

CHAPTER IV

VASCULAR PLANTS OF DOI PHU KHA NATIONAL PARK

METHODOLOGY

Botanical surveys and collections of vascular plants on Doi Phu Kha National Park were undertaken between 1998-2003. Voucher and material specimens collected were investigated and identified to the specific level and also re-checked by comparison with the materials deposited at the herbaria in Thailand and abroad. Description including their vernacular and uses (if applicable), ecological, phenological and distribution information are provided. Photographs and line drawing illustrations of some taxa are included. Occurrence species are enumerated. Keys to the families, genera and species of vascular plants on Doi Phu Kha National Park are constructed.

1. Collection

1.1. Vascular plant specimens (flower or fruit materials) had been collected throughout the park at all seasons of the year from June 1998 through December 2003. Surveys based on geographical data taken from topographic map scale 1:50,000. Attempts were made to visit all habitats and areas so as to cover all species distributions, focusing on evergreen forests.

1.2. Herbarium specimens were processed as indicated in Bridson & Forman (1992). In addition, spirit materials in 70% ethyl alcohol were made for the materials which were difficult to study when dried such as in Araceae, Balsaminaceae, Begoniaceae, Commelinaceae, Cucurbitaceae, Gesneriaceae, Marantaceae, Orchidaceae, Urticaceae, Zingiberaceae, etc. Some carpological materials were collected as supplementary such as in Aristolochiaceae, Fabaceae, Fagaceae, Juglandaceae, Sterculiaceae, etc.

1.3. Plant information: habit, colour of flower, special character, abundance, phenology, plant community, elevation when collecting and date of collection were observed and noted.

1.4. Uses and vernacular were obtained by interviewing local people in the park.

1.5. Photographs were taken.

1.6. Voucher specimens were collected at least 3 sets and deposited at:

1.6.1. Queen Sirikit Botanic Garden Herbarium, Chiang Mai (QBG) (main set)

1.6.2. Ethnobotanical Research Section, Chiang Mai University, Chiang Mai

1.6.3. Forest Herbarium, Bangkok (BKF) and other herbaria which are

working on the Flora of Thailand for further taxonomic references.

1.7. Some plants, in particular rare and useful species, were collected for growing and propagating at Queen Sirikit Botanic Garden, Chiang Mai.

2. Identification

2.1. Morphological characters of vascular plants were observed and examined.

2.2. Plant identifications were made using the following floras and publications: Flora of Thailand, Flora of British India, Forest Flora of British Burma, Flore Générale de L'Indo-Chine, Flore du Cambodge, du Laos et du Viêt Nam, Flora of China, Flora of Bhutan, Flora Malesiana and relevant taxonomic revision available.

2.3. Previous collections from Doi Phu Kha (if available) from the following herbaria were investigated:

- Ethnobotanical Research Section, Chiang Mai University, Chiang Mai
- Department of Agriculture, Bangkok (BK)
- Forest Herbarium, Bangkok (BKF)
- Chiang Mai University Herbarium, Chiang Mai (CMU) and
- Queen Sirikit Botanic Garden Herbarium, Chiang Mai (QBG)

2.4. Specimens were re-checked by comparison with the materials deposited at the following herbaria:

- Department of Systematic Botany, University of Aarhus, Aarhus (AAU), Denmark
- Department of Agriculture, Bangkok (BK)
- Forest Herbarium, Bangkok (BKF)
- Chiang Mai University Herbarium, Chiang Mai (CMU)
- Royal Botanic Gardens, Kew, London (K), United Kingdom
- Kunming Institute of Botany, Kunming (KUN), China
- Laboratoire de Phanérogamie, Muséum National d' Histoire Naturelle, Paris (P), France
- Xishuangbanna Tropical Botanical Garden Herbarium, Xishuangbanna (XTBG), China and
- Queen Sirikit Botanic Garden Herbarium, Chiang Mai (QBG)

2.5. Classification follows Mabberley (1997), of which in general followed K. Kubitzki (ed.)'s *The Families and Genera of Vascular Plants* (1990-). The arrangement for Pteridophyta and Gymnospermae as well as part of Angiospermae follows the published works.

3 Description

3.1. Description of the species (except pteridophytes, gymnosperms, some angiosperm families, some cultivated plants, and any taxa that have been seen but not actually been collected) were provided.

3.2. Taxonomic literature were quoted. Author abbreviations are as suggested in Brummitt & Powell (1992).

3.3. Occurrence in Thailand and their distribution taken from literature were cited.

3.4. Ecological and phenological information of each species mostly observed from Doi Phu Kha were informed, if not, from literature were added.

3.5. Voucher specimens were quoted.

3.6. Vernaculars and usages at Doi Phu Kha were informed, if not, vernacular in northern Thailand from Smitinand (2001) (if applicable) were added.

3.7. Photograph and line drawing of some taxa were illustrated.

4. Enumeration of species

4.1. Occurrence species were enumerated according to their taxonomic hierarchy. The families were arranged alphabetically under class or subclass heading with the genera within the families and the species within the genera also arranged alphabetically.

4.2. Keys to the families, genera and species of vascular plants (except some families) on Doi Phu Kha National Park were constructed.

RESULTS

A total of 2,500 specimens of vascular plants were collected and identified. There are 1,058 species belonging to 576 genera and 165 families. Thirty species could not be identified to the family due to insufficient materials.

No attempts were made to compare the number of species in each forest type because this study was focused on evergreen forest. Many species have been seen but did not include in this chapter due to lacking voucher specimens, especially common species and cultivated plants, some are appear in Chapter III.

The number of genera and species in each family are summarized below.

PTERIDOPHYTA (17: 33: 53)

Lycopsida

Lycopodiaceae	2: 2
Selaginellaceae	1: 6

Equisetopsida

Equisetaceae	1: 2
--------------	------

Filicopsida

Aspleniaceae	1: 5	Blechnaceae	1: 1
Cyatheaceae	1: 1	Davalliaceae	3: 3
Dennstaedtiaceae	2: 2	Dryopteridaceae	4: 4
Gleicheniaceae	1: 1	Hymenophyllaceae	2: 2
Lomariopsidaceae	1: 1	Ophioglossaceae	1: 1
Polypodiaceae	6: 13	Pteridaceae	3: 5
Schizaeaceae	1: 1	Vittariaceae	2: 3

GYMNOSPERMAE (3: 3: 3)

Family	Genera: Species
Cycadaceae	1: 1
Gnetaceae	1: 1
Pinaceae	1: 1

ANGIOSPERMAE**Dicotyledonae (Magnoliopsida) (118: 432: 801)**

Acanthaceae	13: 33	Aceraceae	1: 3
Actinidiaceae	1: 2	Alangiaceae	1: 3
Amaranthaceae	4: 4	Anacardiaceae	5: 5
Annonaceae	10: 16	Apiaceae (Umbelliferae)	3: 5
Apocynaceae	9: 10	Aquifoliaceae	1: 1
Araliaceae	3: 8	Aristolochiaceae	1: 3
Asclepiadaceae	6: 9	Asteraceae (Compositae)	21: 44
Balanophoraceae	1: 2	Balsaminaceae	1: 6
Begoniaceae	1: 9	Berberidaceae	1: 1
Betulaceae	2: 2	Bignoniaceae	3: 3
Boraginaceae	4: 5	Brassicaceae (Cruciferae)	1: 1
Bretschneideraceae	1: 1	Buddlejaceae	1: 2
Burseraeae	3: 4	Buxaceae	1: 1
Campanulaceae	3: 7	Capparaceae	2: 7
Caprifoliaceae	5: 7	Cardiopteridaceae	1: 1
Caryophyllaceae	3: 3	Cecropiaceae	1: 1
Celastraceae	3: 5	Chloranthaceae	2: 3
Clusiaceae (Guttiferae)	3: 6	Combretaceae	2: 3
Convolvulaceae	3: 6	Cornaceae	3: 3
Crassulaceae	2: 2	Cucurbitaceae	7: 10
Dilleniaceae	1: 1	Ebenaceae	1: 3
Elaeagnaceae	1: 1	Elaeocarpaceae	2: 7
Ericaceae	5: 7	Euphorbiaceae	21: 28
Fabaceae (Leguminosae)	19: 43	Fagaceae	3: 15
Flacourtiaceae	2: 2	Fumariaceae	1: 1
Gelsemiaceae	1: 1	Gentianaceae	4: 6
Gesneriaceae	10: 22	Hamamelidaceae	1: 1
Hydrangeaceae	1: 1	Icacinaceae	6: 7
Juglandaceae	1: 2, 2 var.	Lamiaceae (Labiatae)	23: 37
Lauraceae	4: 10	Leeaceae	1: 1
Lentibulariaceae	1: 1	Linaceae	1: 1
Loranthaceae	4: 6	Lythraceae	1: 1
Magnoliaceae	2: 3	Malphighiaceae	2: 2
Malvaceae	5: 7, 2 var.	Melastomataceae	6: 12
Meliaceae	5: 5	Menispermaceae	5: 8
Moraceae	3: 10	Myricaceae	1: 1
Myrsinaceae	3: 17, 2 var.	Myrtaceae	3: 4
Olacaceae	2: 2	Oleaceae	4: 15
Onagraceae	1: 1	Opiliaceae	1: 1
Orobanchaceae	1: 1	Oxalidaceae	1: 1
Passifloraceae	2: 2	Piperaceae	2: 8
Pittosporaceae	1: 2	Plantaginaceae	1: 1
Polygalaceae	2: 4	Polygonaceae	1: 3, 3 var.
Primulaceae	1: 3	Proteaceae	1: 3

Rafflesiaceae	1: 1	Ranunculaceae	2: 6
Rhamnaceae	6: 7	Rhizophoraceae	1: 1
Rosaceae	4: 12	Rubiaceae	36: 80
Rutaceae	10: 13	Sabiaceae	2: 3
Santalaceae	1: 1	Sapindaceae	3: 3
Sapotaceae	2: 3	Scrophulariaceae	9: 21
Simaroubaceae	2: 2	Solanaceae	2: 5
Sonneratiaceae	1: 1	Staphyleaceae	1: 1
Sterculiaceae	6: 9, 2 var.	Strychnaceae	2: 3
Styracaceae	1: 2	Symplocaceae	1: 7, 2 ssp.
Theaceae	6: 9	Thymelaeaceae	2: 4
Tiliaceae	3: 5	Ulmaceae	4: 4
Urticaceae	5: 14	Valerianaceae	1: 1
Verbenaceae	3: 3	Violaceae	1: 4
Viscaceae	1: 1	Vitaceae	3: 7

Monocotyledonae (Liliopsida) (27: 108: 201)

Acoraceae	1: 1	Alliaceae	1: 2
Anthericaceae	1: 2	Araceae	7: 13
Arecaceae (Palmae)	4: 6	Asparagaceae	1: 1
Burmaniaceae	1: 1	Colchicaceae	1: 1
Commelinaceae	9: 15	Convallariaceae	5: 8
Costaceae	1: 3	Cyperaceae	3: 7
Dioscoreaceae	1: 4	Dracaenaceae	1: 2
Eriocaulaceae	1: 1	Hypoxidaceae	1: 2
Liliaceae	1: 1	Marantaceae	2: 3
Melanthiaceae	1: 1	Musaceae	1: 2
Orchidaceae	31: 51	Pandanaceae	1: 1
Poaceae (Gramineae)	21: 30	Smilacaceae	1: 5
Trilliaceae	1: 2	Xyridaceae	1: 1
Zingiberaceae	8: 35		

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

Copyright © by Chiang Mai University

All rights reserved

Key to the Principal Groups of Vascular Plants of Doi Phu Kha National Park

1. Plants bearing seeds **Spermatophyta**
2. Seeds covered with ovary wall (ovules enclosed in an ovary). Flowers bisexual or unisexual **Angiospermae**
3. Embryo with two cotyledons. Vascular bundles of the stem usually arranged in a circle or circles (except in a few genera of the more primitive herbaceous families which have scattered bundles). Leaves typically net-veined, alternate or opposite, sometimes with stipules. Flowers usually 4-5-merous **Dicotyledonae (Magnoliopsida)**
3. Embryo with a single cotyledon. Vascular bundles of the stem closed and scattered (not in regular circles). Leaves typically parallel-veined, alternate, without stipules. Flowers usually 3-merous **Monocotyledonae (Liliopsida)**
2. Seeds not covered with ovary wall (ovules naked, not enclosed by an ovary). Flowers unisexual **Gymnospermae**
1. Plants not bearing seed **Pteridophyta**

PTERIDOPHYTA

There are 38 families with about 232 genera and 9,800 species worldwide (Kramer & Green, 1990; Mabberley, 1997). Thirty-three families, 140 genera and 672 species in Thailand (Tagawa & Iwatsuki, 1979; 1985; 1988; 1989; Boonkerd & Pollawatn, 2000; Lindsay, Suddee, Middleton & Pooma, 2003). Seventeen families, 33 genera and 53 species recorded from Doi Phu Kha National Park.

Artificial Key to the Families on Doi Phu Kha National Park

1. Leaves microphyllous, single-veined
2. Stem not articulate, without differentiation into nodes and internodes. Sporangia borne singly in the axil or on the base of a sporophyll
3. Spores of one kind **Lycopodiaceae**
3. Spores of two kinds **Selaginellaceae (*Selaginella*)**
2. Stem articulate, differentiated into nodes and internodes, bearing whorled leaves at nodes. Sporangia borne several together on sporophylls aggregated in strobili **Equisetaceae (*Equisetum*)**
1. Leaves macrophyllous, several-veined
4. Vernation erect: leaves not coiled in bud **Ophioglossaceae (*Botrychium*)**

4. Vernation circinate: leaves coiled in bud
5. Lamina of one cell layers; epidermis and stomata lacking **Hymenophyllaceae**
5. Lamina of more than one cell layers; epidermis differentiated, with stomata
6. Plants with aerial erect stem, tree-like. Leaves bipinnately compound
Cyatheaceae (*Cyathea*)
6. Plants not as above
7. Annulus of sporangia transverse; sporangia solitary or maturing simultaneously in a sorus
8. Annulus medial; sporangia a few in each sorus, without indusia
Gleicheniaceae (*Dicranopteris*)
8. Annulus apical; sporangium solitary, subtended by an outgrowth (pseudindusium)
Schizaeaceae (*Lygodium*)
7. Annulus of sporangia oblique or longitudinal; sporangia in a sorus, or on fertile leaves in acrostichoid condition, maturing not simultaneously but basipetally pr without any regular order
9. Sori rounded or oblong
10. Stipes and/or pinnae articulate
11. Leaves tripinnate. Sori with indusia **Davalliaceae**
11. Leaves simple, pinnatifid or pinnate. Sori without indusia
Polypodiaceae
10. Neither stipes nor pinnae articulate
12. Venation without free included veinlets. Sori marginal
Dennstaedtiaceae
12. Venation reticulate with free included veinlets. Sori mostly dorsal
Dryopteridaceae
9. Sori not rounded, or sporangia in coenosori
13. Sporangia protected by reflexed margin **Pteridaceae**
13. Sporangia not protected by reflexed margin
14. Sporangia in elongated sori
15. Sori with indusia
16. Sori oblique to costa **Aspleniaceae (*Asplenium*)**
16. Sori parallel to costa **Blechnaceae (*Woodwardia*)**
15. Sori without indusia
17. Sori immersed in grooves, with paraphyses; spicular idioblasts present among epidermis **Vittariaceae**
17. Sori oblique to costa, without paraphyses; no spicular idioblasts among epidermis
Polypodiaceae (*Loxogramme*)
14. Sporangia in coenosori
18. Pinnae not articulate at base **Lomariopsidaceae (*Bolbitis*)**
18. Pinnae articulate at base **Polypodiaceae**

Annotated Checklist of Pteridophytes

The following checklist includes Pteridophytes collected from this study between 1998 and 2003. The families are arranged alphabetically under class headings as well as for the genera within the families and the species within the genera. Families and genera classification follows Kramer & Green (1990). Identification uses Flora of Thailand (Tagawa & Iwatsuki, 1979; 1985; 1988; 1989) and relevant taxonomic revision available. Voucher specimens were also compared with the materials deposited at QBG.

Annotations accompanying each taxon are arranged in the following sequence: Scientific names. Basionym or most cited synonym in Thailand (if applicable). Occurrence in Thailand. Distribution. Ecological information in Doi Phu Kha National Park. Uses (if applicable). Vernacular (if applicable). Voucher specimens. References. Notes.

LYCOPSIDA

LYCOPODIACEAE

Huperzia hamiltonii (Spr.) Trevis.

Basionym.— *Lycopodium hamiltonii* Spr.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan, Phitsanulok; North-eastern: Loei; South-eastern: Chanthaburi; Central: Nakhon Nayok; South-western: Kanchanaburi; Peninsular: Nakhon Si Thammarat.

Distribution.— Himalayas (type), S China, S Japan, Taiwan, Continental SE Asia.

Ecology.— Lower montane forest, on mossy tree-trunk, on mossy rock, alt. 1,650-1,870 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 906, 1748, 2354; *P. Srisanga* & *C. Maknoi* 2047.

References.— Alston (1951); Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

Lycopodiella cernua (L.) Pic. Serm.

Basionym.— *Lycopodium cernuum* L.

Thailand.— Northern: Almost throughout; North-eastern: Loei; Central: Nakhon Nayok; South-western: Kanchanaburi; Peninsular: Almost throughout.

Distribution.— Tropical and subtropical regions throughout the world (India-type).

Ecology.— Lower montane forest, on mountain slopes, open places, by roadsides, alt. 1,250-1,500 m (Doi Phu Kha).

Vernacular.— สามร้อยยอด Sam roi yot (General).

Voucher specimens.— *P. Srisanga* 1730, 2720; *P. Srisanga et al.* 2490.

References.— Alston (1951); Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

SELAGINELLACEAE

Selaginella helferi Warb.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Phitsanulok, Tak; North-eastern: Loei; South-eastern: Chon Buri; Central: Saraburi.

Distribution.— India (Assam), S China, Myanmar (type), Vietnam, Laos.

Ecology.— Lower montane forest, alt. 1,100-1,300 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 2226.

References.— Alston (1951); Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

Selaginella involvens (Sw.) Spring

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Phitsanulok, Tak; Eastern: Chaiyaphum; South-eastern: Chanthaburi, Trat; Central: Nakhon Nayok; Peninsular: Trang.

Distribution.— India, Sri Lanka, China, Taiwan, S Korea, Japan (type), Myanmar, Laos, Vietnam, Malesia.

Ecology.— Dry evergreen forest, by streams and lower montane scrub, on rock in open places, alt. 800-1,760 m (Doi Phu Wae, Sapan Waterfall).

Voucher specimens.— *P. Srisanga* 426; 1584.

References.— Alston (1951); Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

Selaginella lindhardii Hieron.

Thailand.— Northern: Chiang Rai, Nan, Tak (type); Central: Bangkok; South-western: Ratchaburi.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane scrub, open places, alt. 1,700 m (Doi Phu Wae).

Voucher specimens.— *P. Srisanga* 2669.

References.— Alston (1951); Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

Selaginella siamensis Hieron.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Nan, Phitsanulok; North-eastern: Loei; South-eastern: Trat (Ko Chang-type); Central: Nakhon Nayok; South-western: Kanchanaburi; Peninsular: Satun.

Distribution.— Vietnam, Cambodia.

Ecology.— Lower montane forest, on rock in open areas, alt. 1,800 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 1490.

References.— Alston (1951); Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

***Selaginella tamariscina* (Beauv.) Spring**

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, China, Japan, Vietnam, Malesia.

Ecology.— Lower montane scrub, in crevices of limestone rocks, alt. 1,700-1,760 m (Doi Phu Wae).

Vernacular.— ดอกหิน Dok hin (General).

Voucher specimens.— *P. Srisanga* 425; *P. Suksathan* 1792.

References.— Alston (1951); Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand, and few localities known.

***Selaginella wallichii* (Hook. & Grev.) Spring**

Thailand.— Northern: Chiang Rai, Nan; Peninsular: Ranong, Surat Thani, Nakhon Si Thammarat, Yala.

Distribution.— Myanmar, Laos, Vietnam, Cambodia, Malaysia (type), Indonesia (Sumatra), Borneo.

Ecology.— Dry evergreen and lower montane forest, alt. 870-1,680 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 2728; *P. Srisanga* & *S. Watthana* 697.

References.— Alston (1951); Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

EQUISETOPSIDA

EQUISETACEAE

***Equisetum debile* Roxb. ex Vauch.**

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lampang, Nan; North-eastern: Phetchabun; Eastern: Chaiyaphum; South-eastern: Chanthaburi, Trat; South-western: Kanchanaburi.

Distribution.— India (type), S China, Taiwan, SE Asia, Malesia, Polynesia.

Ecology.— Deciduous dipterocarp forest, along streams, alt. 450 m (Wiang Peian Waterfall).

Vernacular.— หญ้าดอกปล้อง Ya thot plong (General).

Voucher specimens.— *P. Srisanga* 2287.

References.— Tardieu-Blot & Christensen (1951); Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

***Equisetum diffusum* D. Don**

Thailand.— Northern: Nan.

Distribution.— Nepal (type), S China, N Vietnam, Laos, Malaysia, Philippines.

Ecology.— Dry evergreen and lower montane forest, along streams, by roadsides in wet and shaded areas, alt. 600-1,650 m (Doi Phu Kha).

Vernacular.— หญ้าดอกปล้องน้อย Ya thot plong noi (General).

Voucher specimens.— *P. Srisanga* 349, 489, 2610; *P. Srisanga & C. Puff* 1100.

References.— Tardieu-Blot & Christensen (1941b); Nanakorn (1998); Boonkerd & Pollawatn (2000).

FILICOPSIDA

ASPLENIACEAE

***Asplenium ensiforme* Wall. ex Hook. & Grev.**

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— India (type), Sri Lanka, China, Japan, Vietnam.

Ecology.— Lower montane forest, on mossy tree-trunk, on mossy rock, alt. 1,600-1,800 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 1530; *P. Srisanga & S. Watthana* 633, 687.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

***Asplenium interjectum* Christ**

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— China (type), N Vietnam (Tonkin).

Ecology.— Lower montane forest, on rock, alt. 1,000-1,100 m (Doi Phu Wae).

Voucher specimens.— *P. Srisanga et al.* 839.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

***Asplenium normale* D. Don**

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan; North-eastern: Phetchabun, Loei; South-eastern: Chanthaburi; Central: Nakhon Nayok; Peninsular: Krabi, Nakhon Si Thammarat, Songkhla.

Distribution.— Throughout tropical Old World, Himalayas (type), Japan.

Ecology.— Lower montane forest, on mossy rock, alt. 1,650-1,800 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 1149.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

***Asplenium obscurum* Bl.**

Thailand.— Northern: Chiang Mai, Chiang Rai, Lamphun, Nan.

Distribution.— E Himalayas, Sri Lanka, S China, Taiwan, Vietnam, Malesia (Java-type), Madagascar.

Ecology.— Lower montane forest, on ground or on moist rock, alt. 1,300-1,500 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* & *S. Watthana* 676.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

***Asplenium phyllitidis* D. Don**

Thailand.— Northern: Lampang, Nan, Tak.

Distribution.— Himalayas (type).

Ecology.— Lower montane forest, on mossy tree-trunk, on moist rock, alt. 1,100-1,200 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 2208.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

BLECHNACEAE***Woodwardia japonica* (L.f.) Sm.**

Synonym.— *Woodwardia cochinchinensis* Ching

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; North-eastern: Loei.

Distribution.— Korea, Japan, S China, Taiwan, Laos, Vietnam.

Ecology.— Lower montane forest, on ground, alt. 1,100-1,200 m (Doi Phu Kha, Nan Watershed).

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2078.

References.— Tagawa & Iwatsuki (1988); Boonkerd & Pollawatn (2000; 2004).

CYATHEACEAE

Cyathea chinensis Copel.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— E Himalayas, S China (Yunnan-type), Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Vernacular.— กูดตัน Kut ton (Northern).

Voucher specimens.— *P. Srisanga et al.* 822.

References.— Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

DAVALLIACEAE

Araiostegia pulchra (D. Don) Copel.

Thailand.— Northern: Almost throughout; North-eastern: Loei; South-western: Kanchanaburi.

Distribution.— Himalayas (Nepal-type), S China (Yunnan), Laos, Vietnam.

Ecology.— Lower montane forest, on mossy tree-trunk, on mossy rock, alt. 1,600-1,700 m (Doi Phu Kha).

Vernacular.— กูดยุง Kut yung (Chiang Mai).

Voucher specimens.— *P. Srisanga et al.* 756.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

Davallodes membranulosum (Wall. ex Hook.) Copel.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Tak.

Distribution.— Himalayas (type), S China (Yunnan), Vietnam (Tonkin).

Ecology.— Lower montane forest, on mossy tree-trunk, alt. 1,600-1,700 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 958; *P. Srisanga et al.* 758.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

Leucostegia immersa (Wall. ex Hook.) Presl

Thailand.— Northern: Chiang Mai, Chiang Rai, Lamphun, Nan, Phitsanulok, Tak; North-eastern: Loei; South-western: Kanchanaburi; Peninsular: Surat Thani.

Distribution.— Himalayas (type), China, Taiwan, SE Asia.

Ecology.— Lower montane forest, on ground, alt. 1,700-1,800 m (Doi Phu Kha).

Vernacular.— กูดหมัก Kut mak (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1521, 1529.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

DENNSTAEDTIACEAE

According to Kramer (1990), Lindsaeaceae is included within Dennstaedtiaceae.

Odontosoria chinensis (L.) J. Smith

Synonym.— *Sphenomeris chinensis* (L.) Maxon

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; North-eastern: Loei, Phetchabun; South-eastern: Trat; Peninsular: Nakhon Si Thammarat, Surat Thani.

Distribution.— Tropical and subtropical regions of the Old World (China-type).

Ecology.— Lower montane forest, on ground or on rock, alt. 1,400-1,500 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga et al.* 780.

References.— Tagawa & Iwatsuki (1985); Kramer (1990); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

Pteridium aquilinum (L.) Kuhn var. *wightianum* (J. Agardh) R.M. Tryon

Thailand.— Northern: Chiang Mai, Chiang Rai, Lamphun, Lampang, Nan, Phitsanulok; North-eastern: Phetchabun, Loei.

Distribution.— Himalayas eastwards to Taiwan and southwards to Malaysia.

Ecology.— Secondary forest, in disturbed areas, open places, edges of the forest, alt. 1,200-1,400 m (Doi Phu Kha).

Vernacular.— กูดเกียะ Kut kia (Chiang Mai).

Voucher specimens.— *P. Srisanga* 2311.

References.— Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

DRYOPTERIDACEAE

According to Kramer et al. (1990), Athyriaceae and Woodsiaceae are included within Dryopteridaceae.

Arachniodes spectabilis (Ching) Ching

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lampang, Nan, Phitsanulok; South-eastern: Chanthaburi; South-western: Kanchanaburi.

Distribution.— E Himalayas, S China (Yunnan-type).

Ecology.— Lower montane forest, on ground, alt. 1,600-1,700 m (Doi Phu Wae).

Voucher specimens.— *P. Srisanga & S. Watthana* 631, 689.

References.— Tagawa & Iwatsuki (1988); Boonkerd & Pollawatn (2000).

***Diacalpe aspidioides* Bl.**

Synonym.— *Peranema aspidioides* (Bl.) Mett.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan; North-eastern: Loei; South-eastern: Chanthaburi; Central: Nakhon Nayok; Peninsular: Chumphon, Ranong, Krabi, Nakhon Si Thammarat.

Distribution.— Sri Lanka, N India, S China, Laos, Vietnam, Malesia (Java-type).

Ecology.— Lower montane forest, on ground, alt. 1,700-1,800 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 1528, 2347.

References.— Tardieu-Blot & Christensen (1941a); Tagawa & Iwatsuki (1988); Boonkerd & Pollawatn (2000).

***Hypodematium crenatum* (Forssk.) Kuhn**

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Nan; South-western: Kanchanaburi.

Distribution.— Throughout the warmer parts of the Old World: S & E Africa, Mauritius, Arabia (type), N India, China, Taiwan, Japan, N Vietnam, Philippines, Malaysia, Pacific Islands.

Ecology.— Lower montane scrub, in crevice of limestone rock, alt. 1,700-1,800 m (Doi Phu Wae).

Voucher specimens.— *P. Srisanga* 1847, 2666; *P. Srisanga et al.* 2417.

References.— Tagawa & Iwatsuki (1988); Boonkerd & Pollawatn (2000).

***Tectaria polymorpha* (Wall. ex Hook.) Copel.**

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Tak, Phitsanulok, Nakhon Sawan; North-eastern: Loei; South-eastern: Chanthaburi; Central: Nakhon Nayok; South-western: Kanchanaburi; Peninsular: Chumphon, Surat Thani, Nakhon Si Thammarat, Trang, Yala.

Distribution.— Sri Lanka, E Himalayas (type), S China, Taiwan, Vietnam, Cambodia, Malaysia.

Ecology.— Dry evergreen forest, on ground, alt. 800 m (Doi Phu Kha, Huay Pong).

Vernacular.— กูดเค็ม Kut taem (Northern).

Voucher specimens.— *P. Srisanga* 2592.

References.— Tagawa & Iwatsuki (1988); Boonkerd & Pollawatn (2000).

GLEICHENIACEAE***Dicranopteris linearis* (Burm.f.) Underw.**

Thailand.— Northern: Almost throughout; North-eastern: Loei; South-eastern: Prachin Buri, Chanthaburi, Trat; Peninsular: Almost throughout.

Distribution.— Tropical and subtropical regions of the Old World (Sri Lanka-type).

Ecology.— Lower montane forest, secondary forest, in open areas, edges of the forest, on mountain slopes, by roadsides, alt. 1,200-1,500 m (Doi Phu Kha).

Vernacular.— ไทร Chon (General).

Voucher specimens.— *P. Srisanga* 2719.

References.— Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

Notes.— There are several varieties in this species. Four varieties are known from Thailand. Doi Phu Kha specimens belongs to the variety *linearis*.

HYMENOPHYLLACEAE

Crepidomanes pallidum (Bl.) K. Iwats.

Basionym.— *Trichomanes pallidum* Bl.

Synonym.— *Pleuromanens pallidum* (Bl.) Presl

Thailand.— Northern: Nan; North-eastern: Loei; Peninsular: Krabi, Surat Thani, Nakhon Si Thammarat, Trang, Yala.

Distribution.— Sri Lanka, Vietnam, Taiwan, Malesia (Java-type), Polynesia.

Ecology.— Dry evergreen forest, on rock by stream, alt. 700 m (Doi Phu Kha, Tham Pha Kong).

Voucher specimens.— *P. Srisanga* 2521.

References.— Tagawa & Iwatsuki (1979; 1989); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

Hymenophyllum badium Hook. & Grev.

Synonym.— *Mecodium badium* (Hook. & Grev.) Copel.

Thailand.— Northern: Chiang Mai, Nan, Phitsanulok; North-eastern: Loei; South-eastern: Chanthaburi; Peninsular: Krabi, Nakhon Si Thammarat, Phatthalung.

Distribution.— E Himalayas (Nepal-type), S China, Vietnam, S Japan, and southwards to Malesia.

Ecology.— Lower montane forest, on mossy tree-trunk, on mossy rock, alt. 1,600-1,700 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 1995.

References.— Tagawa & Iwatsuki (1979; 1989); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

LOMARIOPSIDACEAE

Bolbitis sinensis (Baker) K. Iwats.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lamphun, Lampang, Nan; North-eastern: Phetchabun, Loei; South-eastern: Chanthaburi.

Distribution.— N India, S China (type), Myanmar, Vietnam (Tonkin).

Ecology.— Lower montane forest, on ground, on rock, alt. 1,400-1,700 m (Doi Phu Kha).

Vernacular.— กูดบั้ง Kut bong (Northern).

Voucher specimens.— *P. Srisanga* 1221, 2294; *P. Srisanga et al.* 802.

References.— Tagawa & Iwatsuki (1988); Boonkerd & Pollawatn (2000).

OPHIOGLOSSACEAE

Botrychium lanuginosum Wall. ex Hook. & Grev.

Synonym.— *Japanobotrychium lanuginosum* (Wall. ex Hook. & Grev.) Nishida ex Tagawa

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Tak.

Distribution.— India, Sri Lanka, Nepal (type), China, Taiwan, Vietnam, Philippines, Indonesia (Sumatra, Java).

Ecology.— Lower montane scrub, in open areas on limestone rock, alt. 1,700-1,800 m (Doi Phu Wae).

Voucher specimens.— *P. Srisanga* 2153; *P. Srisanga et al.* 859.

References.— Tardieu-Blot & Christensen (1939); Tagawa & Iwatsuki (1979; 1989); Boonkerd & Pollawatn (2000).

POLYPODIACEAE

Belvisia henryi (Hieron. ex C. Chr.) Tagawa

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan, Tak, Phitsanulok; North-eastern: Loei; Eastern: Nakhon Ratchasima.

Distribution.— E Himalayas, S China (Yunnan-type), N Vietnam.

Ecology.— Lower montane forest, on mossy tree-trunk, alt. 1,400-1,700 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 953, 1395; *P. Srisanga & S. Watthana* 632; *P. Srisanga et al.* 775.

References.— Tagawa & Iwatsuki (1989); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

Lepisorus nudus (Hook.) Ching

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Tak; North-eastern: Loei; South-eastern: Chanthaburi.

Distribution.— Sri Lanka, India, Himalayas (type), S China (Yunnan), Myanmar, Indonesia (Sumatra).

Ecology.— Lower montane scrub, creeping on limestone rock, alt. 1,700-1,760 m (Doi Phu Wae).

Voucher specimens.— *P. Srisanga* 434, 2650.

References.— Tagawa & Iwatsuki (1989); Boonkerd & Pollawatn (2000).

Lepisorus scolopendrium (Buch.-Ham. ex D. Don) Mehra & Bir

Thailand.— Northern: Chiang Mai, Chiang Rai, Lamphun, Nan, Phitsanulok; North-eastern: Loei; South-eastern: Chanthaburi; Peninsular Surat Thani.

Distribution.— Tibet, Himalayas (type), S China, Myanmar, Laos, Vietnam.

Ecology.— Lower montane forest, on mossy tree-trunk, on mossy rock, alt. 1,500-1,700 m (Doi Phu Kha).

Vernacular.— กูดจ๊กเข็บ Kut chak khep (Northern).

Voucher specimens.— *P. Srisanga* 2257; *P. Srisanga et al.* 799, 801.

References.— Tagawa & Iwatsuki (1989); Boonkerd & Pollawatn (2000).

Lepisorus subconfluens Ching

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— Bhutan, S China (Yunnan).

Ecology.— Lower montane forest, on mossy tree-trunk, alt. 1,350-1,500 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 2248, 2339.

References.— Tagawa & Iwatsuki (1989); Boonkerd & Pollawatn (2000).

Leptochilus decurrens Bl.

Thailand.— Northern: Almost throughout; North-eastern: Phetchabun; South-eastern: Chanthaburi; South-western: Uthai Thani, Kanchanaburi; Peninsular Nakhon Si Thammarat.

Distribution.— E Himalayas, S China, Taiwan, Laos, Vietnam, Malesia (Java-type), Polynesia.

Ecology.— Lower montane forest, on ground, alt. 1,600-1,700 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 959.

References.— Tagawa & Iwatsuki (1989); Nooteboom (1997); Boonkerd & Pollawatn (2000).

Loxogramme chinensis Ching

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— India (Assam), Bhutan, S China (type), Myanmar, N Vietnam.

Ecology.— Lower montane forest, on mossy tree-trunk, on mossy rock, alt. 1,400-1,500 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 2321, 2325.

References.— Tagawa & Iwatsuki (1989); Boonkerd & Pollawatn (2000).

***Loxogramme duclouxii* Christ**

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Phetchabun, Loei.

Distribution.— Tibet, India, S China (type), Korea, Japan, Taiwan.

Ecology.— Lower montane forest, on mossy rock, alt. 1,400-1,500 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 2320.

References.— Tagawa & Iwatsuki (1989); Boonkerd & Pollawatn (2000).

***Microsorium membranaceum* (D. Don) Ching**

Thailand.— Northern: Almost throughout.

Distribution.— Sri Lanka, E Himalayas (Nepal-type), S China, Taiwan, Myanmar, Laos, N Vietnam, Philippines.

Ecology.— Lower montane forest, on rock, alt. 1,600-1,700 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga et al.* 800.

References.— Tagawa & Iwatsuki (1989); Bosman (1991); Nooteboom (1997); Boonkerd & Pollawatn (2000).

***Microsorium pteropus* (Bl.) Copel.**

Thailand.— Almost throughout the country.

Distribution.— India, Nepal, Sikkim, China, Taiwan, Japan, Myanmar, Laos, Vietnam, Malaysia, Indonesia (Java-type), Philippines, New Guinea.

Ecology.— Dry evergreen forest, on rock by stream, alt. 800-900 m (Doi Phu Kha, Sapan Waterfall).

Voucher specimens.— *P. Srisanga* 2574.

References.— Tagawa & Iwatsuki (1989); Bosman (1991); Nooteboom (1997); Boonkerd & Pollawatn (2000).

***Microsorium superficiale* (Bl.) Ching**

Synonym.— *Neocheiropteris superficialis* (Bl.) Bosman

Thailand.— Northern: Chiang Mai, Nan, Phitsanulok; North-eastern: Loei.

Distribution.— India, Nepal, China, Japan, Myanmar, Laos, Vietnam, Malaysia, Indonesia (Java-type).

Ecology.— Lower montane forest, climbing on mossy tree-trunk, alt. 1,600-1,700 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 546, 550; *P. Srisanga* & *S. Watthana* 708.

References.— Tagawa & Iwatsuki (1989); Bosman (1991); Nooteboom (1997); Boonkerd & Pollawatn (2000).

***Pyrrrosia flocculosa* (D. Don) Ching**

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Himalayas (Nepal-type), Myanmar, Vietnam.

Ecology.— Dry evergreen and lower montane forest, on mossy tree-trunk, alt. 1,000 m (Tham Pha Kaow).

Voucher specimens.— *P. Srisanga* 1926, 2557.

References.— Hovenkamp (1986); Tagawa & Iwatsuki (1989); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

***Pyrrrosia lingua* (Thunb.) Farw. var. *heteractis* (Mett. ex Kuhn) Hovenk.**

Synonym.— *Pyrrrosia heteractis* (Mett. ex Kuhn) Ching; *P. eberhardtii* (Christ) Ching

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Tak, Phitsanulok; North-eastern: Loei; South-eastern: Chanthaburi, Trat; Central: Nakhon Nayok; South-western: Kanchanaburi; Peninsular: Nakhon Si Thammarat, Phangnga, Trang.

Distribution.— Himalayas (Assam-type), China, Myanmar, Laos, Vietnam.

Ecology.— Lower montane forest, on mossy tree-trunk, alt. 1,300-1,700 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 2307, 2356.

References.— Hovenkamp (1986); Tagawa & Iwatsuki (1989); Boonkerd & Pollawatn (2000).

***Pyrrrosia mollis* (Kunze) Ching**

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Nan; North-eastern: Loei; South-eastern: Trat.

Distribution.— Sri Lanka, Himalayas, China, Myanmar, Laos, Vietnam.

Ecology.— Lower montane scrub, on limestone rock, alt. 1,700-1,800 m (Doi Phu Wae).

Vernacular.— กูดหมาก Kut mak (Northern).

Voucher specimens.— *P. Srisanga et al.* 867; *P. Suksathan* 1793.

References.— Hovenkamp (1986); Tagawa & Iwatsuki (1989); Boonkerd & Pollawatn (2000).

PTERIDACEAE

According to Tryon et al. (1990), Adiantaceae and Parkeriaceae are included within Pteridaceae.

***Adiantum zollingeri* Mett. ex Kuhn**

Thailand.— Northern: Almost throughout; North-eastern: Phetchabun, Loei; Eastern: Nakhon Ratchasima; Central: Nakhon Nayok; South-western: Almost throughout; Peninsular: Almost throughout.

Distribution.— Himalayas east and southwards to W Malesia (Java-type).

Ecology.— Dry evergreen forest, on ground, alt. 800-900 m (Doi Phu Kha, Tham Pha Khong).

Voucher specimens.— *P. Srisanga* 2606.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

***Cheilanthes pseudofarinosa* (Ching & S.K. Wu) K. Iwats.**

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, China (Yunnan-type), Philippines.

Ecology.— Lower montane scrub, in open places on limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Vernacular.— กูดเงิน Kut ngoen (Northern).

Voucher specimens.— *P. Srisanga* 2660; *P. Suksathan* 1787.

References.— Tagawa & Iwatsuki (1985; 1989); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

***Cheilanthes rufa* D. Don**

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— E Himalayas (Nepal-type).

Ecology.— Dry evergreen and lower montane forest, lower montane scrub, usually in open places on limestone rocks, alt. 1,000-1,800 m (Doi Phu Kha, Doi Phu Wae, Tham Pha Kaow).

Voucher specimens.— *P. Srisanga* 427, 1479, 1848, 2556; *P. Srisanga et al.* 868.

References.— Tagawa & Iwatsuki (1985; 1989); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

***Onychium contiguum* Hope**

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— N India (type), S China, Taiwan.

Ecology.— Lower montane scrub, in open areas and in crevices of limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Voucher specimens.— *P. Srisanga* 2663; *P. Srisanga et al.* 883.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

Notes.— New locality recorded from Nan, in Thailand.

***Onychium siliculosum* (Desv.) C. Chr.**

Thailand.— Northern: Mae Hong Son, Chiang Mai, Lamphun, Nan; North-eastern: Phetchabun; South-eastern: Trat; South-western: Kanchanaburi.

Distribution.— India, S China (Yunnan), Taiwan, Laos, Vietnam, Malesia, Polynesia.

Ecology.— Dry evergreen forest, on ground, alt. 800-900 m (Doi Phu Kha, Tham Pha Khong).

Voucher specimens.— *P. Srisanga* 2399.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

SCHIZAEACEAE***Lygodium flexuosum* (L.) Sw.**

Thailand.— Almost throughout the country.

Distribution.— India, Sri Lanka (type), China, Taiwan, SE Asia, Malesia, Melanesia, Australia (Queensland).

Ecology.— Deciduous and dry evergreen forest, alt. 800-900 m (Doi Phu Kha, Tham Pha Khong).

Vernacular.— กูดคอย Kut doi, กูดเควหรือ Kut khrua (Northern).

Voucher specimens.— *P. Srisanga* 574, 2398.

References.— Tagawa & Iwatsuki (1979); Boonkerd & Pollawatn (2000).

VITTARIACEAE***Antrophyum callifolium* Bl.**

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Tak; North-eastern: Nong Khai, Loei; South-eastern: Chanthaburi, Trat; Central: Nakhon Nayok; South-western: Kanchanaburi; Peninsular: Almost throughout.

Distribution.— Widely distributed in tropical Old World (Java-type).

Ecology.— Lower montane forest, on mossy tree-trunk, alt. 1,500-1,600 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 1655.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

***Vittaria elongata* Sw.**

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Tak, Phitsanulok; North-eastern: Nong Khai, Loei; Eastern: Nakhon Ratchasima; South-eastern: Trat; Central: Nakhon Nayok; South-western: Kanchanaburi; Peninsular: Almost throughout.

Distribution.— Tropical Old World.

Ecology.— Dry evergreen forest, by stream, on tree-trunk, alt. 900-1,000 m (Doi Phu Kha, Thon Thong Waterfall).

Voucher specimens.— *P. Srisanga & C. Maknoi* 2093.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

Vittaria flexuosa Fee

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Nan, Tak; North-eastern: Phetchabun, Loei; South-eastern: Chanthaburi, Trat; Central: Nakhon Nayok; Peninsular: Nakhon Si Thammarat.

Distribution.— E Himalayas (type), China, Japan, Laos, Cambodia, Vietnam, Malaysia.

Ecology.— Lower montane forest, on tree-trunk, on rock, alt. 1,600-1,700 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 1178.

References.— Tagawa & Iwatsuki (1985); Boonkerd & Pollawatn (2000).

GYMNOSPERMAE

There are 17 families with about 86 genera and 840 species worldwide (Kramer & Green, 1990; Mabberley, 1997). Six families, 7 genera and 25 species in Thailand (Smitinand, 1972; Phengklai, 1972; 1975). Only 3 families, 3 genera and 3 species recorded from Doi Phu Kha National Park.

Artificial Key to the Families on Doi Phu Kha National Park

1. Leaves pinnately compound, frond-like, crowded at the top of the stem. Plants palm-like **Cycadaceae (*Cycas*)**
1. Leaves simple, scattered along the branches of the stem
 2. Erect trees. Leaves in cluster, needle-like. **Pinaceae (*Pinus*)**
 2. Erect trees or woody climbers. Leaves normal, opposite **Gnetaceae (*Gnetum*)**

Annotated Checklist of Gymnosperms

The following checklist includes Gymnosperms collected from this study between 1998 and 2003. The families are arranged alphabetically under class headings as well as for the genera within the families and the species within the genera. Families and genera classification follows Kramer & Green (1990). Identification uses Flora of Thailand (Smitinand, 1972; Phengklai, 1972; 1975). Voucher specimens were also compared with the materials deposited at QBG.

Annotations accompanying each taxon are arranged in the following sequence: Scientific names. Occurrence in Thailand. Distribution. Ecological information in Doi Phu Kha National Park. Uses (if applicable). Vernacular (if applicable). Voucher specimens. References.

CYCADOPSIDA

CYCADACEAE

Cycas pectinata Griff.

Thailand.— Almost throughout the country.

Distribution.— E Himalayas (Assam-type), S China, SE Asia.

Ecology.— Lower montane forest, sometimes in open areas and on limestone mountain, alt. 1,300-1,500 m (Doi Phu Kha, Doi Phu Wae).

Vernacular.— ประดู่ Prong khao (General).

Voucher specimens.— *P. Srisanga* 1876, 2632.

References.— Smitinand (1972).

GNETOPSIDA**GNETACEAE**

Gnetum latifolium Bl. var. ***funiculare*** (Bl.) Markgraf

Thailand.— Northern: Nan; Eastern: Surin; South-eastern: Chon Buri; Peninsular: Phuket, Nakhon Si Thammarat, Satun.

Distribution.— Malaysia, Indonesia (Java-type).

Ecology.— Lower montane forest, alt. 1,700 m (Doi Phu Kha).

Voucher specimens.— *P. Srisanga* 1443.

References.— Phengklai (1975).

PINOPSIDA**PINACEAE**

Pinus merkusii Jungh. & De Vriese

Thailand.— Common in Northern, North-eastern and Eastern regions; Central: Suphan Buri; South-western: Kanchanaburi, Phetchaburi.

Distribution.— SE Asia (Sumatra-type).

Ecology.— Pine forest, alt. 700-1,000 m (Doi Phu Huat).

Uses.— Wood used for construction and fuel.

Vernacular.— จ้าง Chuang (Lua-Nan); เกี้ยะ Kia (Northern); สนสองใบ Son song bai (General).

Voucher specimens.— *P. Srisanga* s.n.

References.— Phengklai (1972); Santisuk (1997).

DICOTYLEDONAE (MAGNOLIOPSIDA)

One hundred and eighteen families, 432 genera and 801 species recorded from Doi Phu Kha National Park.

ACANTHACEAE

Herbs, shrubs or climbers, rarely small trees. **Leaves** simple, opposite, exstipulate. **Inflorescence** terminal or axillary, cymes, racemes or panicles; bracts and bracteoles usually present. **Flowers** bisexual, zygomorphic, usually 2-lipped. **Sepals** (4-)5(-6), rarely many up to 16, connate, at least at base. **Petals** 4-5, connate into distinct tube. **Stamens** 2 or 4, rarely 5, epipetalous. Staminodes often present. **Ovary** superior, 2-locular, axile placentation; ovules 2-many in each loculus; stigmas 2-lobed. **Fruit** a loculicudal capsule, 2-valved, often elastically dehiscent from the apex downwards, usually with seeds in hook-like funicular jaculators.

About 229 genera and 3,450 species, mainly in tropical and subtropical regions (Mabberley, 1997). About 40 genera and 250 species in Thailand. Thirteen genera and 33 species recorded from Doi Phu Kha National Park (Table 7).

Annotated Checklist of Acanthaceae

The following checklist includes Acanthaceae collected from this study between 1998 and 2003. The genera are arranged alphabetically as well as for the species within the genera. Voucher specimens were also compared with the materials deposited at BKF, KUN and QBG.

Table 7. Checklist of Acanthaceae of Doi Phu Kha National Park.

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	Notes
<i>Asystasia salicifolia</i> Craib	Khok ma taek	DEF, by streams	800	Aug-Sep	Oct-Dec	PS 1592	
<i>Asystasiella neesiana</i> (Wall.) Lindau	Phak kut	LMF	1,500-1,700	Aug-Nov	Nov-Dec	PS 282, 1202, 1620, 1784; PS & C. Maknoi 2024; PS & C. Puff 1082	Fig. 84
<i>Barleria cristata</i> L.	Ang kap	DDF	500	Oct-Nov	Nov-Jan	PS 2279	Fig. 85
<i>Eranthemum tetragonum</i> Wall. ex Nees		DEF	850	Jan-Feb		PS 2395	
<i>Justicia procumbens</i> L.		LMF, open places	1,600-1,700	Oct-Jan		PS 1153, 2667	
<i>Justicia</i> sp.		LMF	1,650	Nov-Jan		PS 1199, 1268, 2360	
<i>Lepidagathis incurva</i> Buch.-Ham. ex D. Don	Ya khon kai	LMF	1,500	Jan-Mar	Mar-May	PS 2335; PS et al. 2471	
<i>Ophiorrhizophyllum macrobotryum</i> Kurz		LMF	1,600-1,700	Jan-Feb	Apr-May	PS 476, 1270	
<i>Phlogacanthus curviflorus</i> (Wall.) Nees	Hom chang	LMF	1,600-1,700	Nov-Jan	Feb-Apr	PS 1197	
<i>Pseuderanthemum parishii</i> (T. Ander.) Lindau	Dok dai	DEF	850	Jan-Feb		PS 2393	
<i>Pseuderanthemum tonkinense</i> R. Ben.		LMF	1,500-1,600	Sep-Oct		PS 281, 1622	
<i>Rungia parviflora</i> (Retz.) Nees var. <i>ciliata</i> Brem.		DEF, by streams	700-1,000	Nov-Apr		PS 597, 1243	
<i>Staurogyne brachystachya</i> R. Ben.		DEF, LMF	850-1,300	Jan-Feb	Apr-May	PS 1948, 2261	
<i>Strobilanthes alatairamosa</i> Lo & D. Fang		LMF	1,250-1,500	Sep-Dec		PS 1616, 1912, 2255	
<i>Strobilanthes anfractuosus</i> C.B. Clarke ex Hoss.		LMF	1,600-1,700	Sep-Dec		PS 1735	
<i>Strobilanthes auriculatus</i> Nees	Cha hom	DDF	800	Oct-Dec		PS 1802	
<i>Strobilanthes consors</i> C.B. Clarke ex Hoss.		DEF, LMF	780-1,700	May-Sep	Oct-Dec	PS 1445, 1587, 1758	

Table 7. Checklist of Acanthaceae of Doi Phu Kha National Park.

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	Notes
<i>Asystasia salicifolia</i> Craib	Khok ma taek	DEF, by streams	800	Aug-Sep	Oct-Dec	PS 1592	
<i>Asystasiella neesiana</i> (Wall.) Lindau	Phak kut	LMF	1,500-1,700	Aug-Nov	Nov-Dec	PS 282, 1202, 1620, 1784; PS & C. Maknoi 2024; PS & C. Puff 1082	Fig. 84
<i>Barleria cristata</i> L.	Ang kap	DDF	500	Oct-Nov	Nov-Jan	PS 2279	Fig. 85
<i>Eranthemum tetragonum</i> Wall. ex Nees		DEF	850	Jan-Feb		PS 2395	
<i>Justicia procumbens</i> L.		LMF, open places	1,600-1,700	Oct-Jan		PS 1153, 2667	
<i>Justicia</i> sp.		LMF	1,650	Nov-Jan		PS 1199, 1268, 2360	
<i>Lepidagathis incurva</i> Buch.-Ham. ex D. Don	Ya khon kai	LMF	1,500	Jan-Mar	Mar-May	PS 2335; PS et al. 2471	
<i>Ophiorrhizophyllum macrobotryum</i> Kurz		LMF	1,600-1,700	Jan-Feb	Apr-May	PS 476, 1270	
<i>Phlogacanthus curviflorus</i> (Wall.) Nees	Hom chang	LMF	1,600-1,700	Nov-Jan	Feb-Apr	PS 1197	
<i>Pseuderanthemum parishii</i> (T. Ander.) Lindau	Dok dai	DEF	850	Jan-Feb		PS 2393	
<i>Pseuderanthemum tonkinense</i> R. Ben.		LMF	1,500-1,600	Sep-Oct		PS 281, 1622	
<i>Rungia parviflora</i> (Retz.) Nees var. <i>ciliata</i> Brem.		DEF, by streams	700-1,000	Nov-Apr		PS 597, 1243	
<i>Staurogyne brachystachya</i> R. Ben.		DEF, LMF	850-1,300	Jan-Feb	Apr-May	PS 1948, 2261	
<i>Strobilanthes alatairamosa</i> Lo & D. Fang		LMF	1,250-1,500	Sep-Dec		PS 1616, 1912, 2255	
<i>Strobilanthes anfractuosus</i> C.B. Clarke ex Hoss.		LMF	1,600-1,700	Sep-Dec		PS 1735	
<i>Strobilanthes auriculatus</i> Nees	Cha hom	DDF	800	Oct-Dec		PS 1802	
<i>Strobilanthes consors</i> C.B. Clarke ex Hoss.		DEF, LMF	780-1,700	May-Sep	Oct-Dec	PS 1445, 1587, 1758	

ACERACEAE

Trees or shrubs with perulate buds. **Leaves** simple, frequently palmately lobed or at least veined, pinnately or palmately compound, opposite; stipules absent. **Inflorescence** axillary or terminal, fascicles, racemes or corymbs. **Flowers** bisexual or unisexual, actinomorphic; vestige of ovary often present in the male flowers. **Sepals** 4-5. **Petals** 4-5(-6), rarely absent, often similar to sepals. **Stamens** (4-)8(-12); filaments free; anthers opening by longitudinal slits. Disk present or rarely absent, sometimes reduced to teeth. **Ovary** superior, 2-locular, compressed contrary to the septum; styles 2, free or connate; ovules usually 2 in each loculus, attached to the central axis. **Fruit** a winged schizocarp, often a double samara. **Seed** usually solitary.

Two genera: *Acer* L. with about 111-124 species mainly in N temperate Hemisphere and tropical mountains and *Dipteronia* Oliv. with 2 species in China (Gelderen et al., 1994; Mabberley, 1997). One genus and 6 species in Thailand (Santisuk, 1998a). Three species recorded from Doi Phu Kha National Park.

ACER L.

Sp. Pl.: 1054. 1753; Gelderen, Jong & Oterdoom, Maples of the World: 99. 1994.

Trees or shrubs, usually deciduous, rarely evergreen. **Leaves** simple, frequently palmately lobed or at least veined, palmately compound or rarely pinnately compound, opposite. **Inflorescence** axillary or terminal, fascicles, racemes or corymbs. **Flowers** bisexual or unisexual. **Sepals** 4-5. **Petals** 4-5(-6), rarely absent, often similar to sepals. **Stamens** (4-)8(-12). Disk present or rarely absent, sometimes reduced to teeth. **Ovary** superior, compressed contrary to the septum; styles free or connate; ovules usually 2 in each loculus, attached to the central axis. **Fruit** winged schizocarp, a double samara, sometimes with only 1 well-developed samara; wing terminal. **Seed** solitary.

KEY TO THE SPECIES

1. Leaves palmately lobed
 2. Leaves all 3-lobed, with 2 lateral lobes below the middle, basally 3-nerved, fallen leaves red. Petioles 1.5-4.6 cm long. Inflorescence 2.4-5.6 cm long. Infructescence ascending with few fruits, usually with 1 well-developed samara; wing reddish **1. *A. calcaratum***
 2. Leaves normally 3-lobed, above the middle, juvenile ones 3-5-lobed, basally 5-nerved, fallen leaves yellow to yellowish brown. Petioles 4-6.4 cm long. Inflorescence 10-23 cm long. Infructescence drooping with many fruits, all with 2 developed samara; wing brownish yellow **3. *A. wilsonii***
1. Leaves unlobed **2. *A. laurinum***

1. *Acer calcaratum* Gagnep.

Not. Syst. Paris 13: 192. 1948; Gelderen, Jong & Oterdoom, *Maples of the World*: 125, pl. 15. 1994; Santisuk, *Nat. Hist. Bull. Siam Soc.* 46(1): 102, figs. 1-3, 5. 1998. — *A. craibianum* Delendick, *Brittonia* 30(4): 474, fig. 1. 1978.

Deciduous tree, up to 25 m high. **Leaves** simple, broadly ovate, 3-lobed, 2 lateral lobes below the middle, 4-15 cm long, 3-15 cm wide, 3-plinerved at base, sparsely hairy, becoming glabrous, tuft of hairs present in the axils of leaf base beneath; base obtuse, subtruncate to cordate; apex acuminate; margin entire, new and fallen leaves red; petioles 1.5-4.6 cm long, sparsely hairy, glabrescent, reddish. **Inflorescence** in terminal corymbs, 2.4-5.6 cm long, sparsely puberulous to subglabrous. **Flowers** bisexual; pedicels 4-7 mm long, glabrous. **Sepals** 5, unequal, red, lanceolate, 3.5-6 mm long, united at base, acuminate at apex, sparsely pubescent on both sides. **Petals** 5, white to greenish yellow, obovate, 2-3 mm long, free, undulate along margin, glabrous. **Stamens** (7-)8; filaments 1-1.25 mm long, glabrous; anthers oblong, 1-1.25 mm long, glabrous. Disk thick, glabrous. **Ovary** sparsely pubescent; styles 2.5-3 mm long, connate, sparsely puberulous. **Samaras** reddish, unequal, 3.5-4.5 cm long, 0.8-1.5 cm wide, including wings, glabrous, usually with 1 well-developed samara.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— Myanmar, Vietnam (type).

Ecology.— Lower montane forest, alt. 1,600-1,800 m (Doi Phu Kha).

Phenology.— Flowering: December-January; fruiting: January-August; leaves: December-November.

Vernacular.— กววมแดง Kuam daeng (Northern).

Voucher specimens.— *P. Srisanga* 375, 2362, 2364, 2707; *P. Srisanga & C. Maknoi* 2009.

2. *Acer laurinum* Hassk.

Tijdr. Nat. Gesch. Phys. 10: 138. 1843; Steenis in *Fl. Mal.* I(4): 592. 1954; Gelderen, Jong & Oterdoom, *Maples of the World*: 239, pl. 121. 1994; Santisuk, *Nat. Hist. Bull. Siam Soc.* 46(1): 94, fig. 8. 1998. — *A. garrettii* Craib, *Kew Bull.* 1920: 301. 1920; in *Fl. Siam. Enum.* 1: 337. 1926; Maxwell, *Nat. Hist. Bull. Siam Soc.* 39(1): 72, fig. 1. 1991.

Evergreen dioecious tree, up to 30 m high. **Leaves** simple, unlobed, lanceolate to elliptic, 6.5-15 cm long, 2.5-7 cm wide, 3- to slightly 5-plinerved at base, glabrous on both surfaces, glaucous, whitish or light blue-grey beneath; base rounded to broadly cuneate; apex acute to acuminate; margin entire; petioles 2.5-5 cm long, glabrous. **Inflorescence** in axillary simple or compound racemes, 2-10 cm long, pubescent. **Flowers** unisexual, greenish to pale yellowish; pedicels 2.5-3.5 mm long, pubescent. **Sepals** and **petals** similar, each 5, free, lanceolate, 1.5-3 mm long, puberulous. **Stamens** 8; filaments 2.5-3 mm long, glabrous; anthers subglobose to

ovoid, 0.5-0.75 mm long, glabrous. Disk thick, sparsely puberulous. **Ovary** puberulous; styles 1-1.5 mm long, puberulous. **Samaras** yellowish brown, unequal, 4-7 cm long, 1.2-2.3 cm wide, including wings, puberulous outside; nutlet-locule glabrous inside except puberulous at apex. **Seed** ovoid, rough, sparsely puberulous, 8-11 mm long, 5-6 mm wide (Fig. 87).

Thailand.— Northern: Mae Hong Son, Chiang Mai (type of *A. garrettii*), Nan; North-eastern: Loei; South-western: Kanchanaburi; Peninsular: Phangnga.

Distribution.— Nepal, India (Assam), China, SE Asia (Java-type).

Ecology.— Lower montane forest, alt. 1,600-1,800 m (Doi Phu Kha).

Phenology.— Flowering: January-February; fruiting: November-January.

Vernacular.— กำแพงหิน Kuam khao (Northern).

Voucher specimens.— *P. Srisanga* 376, 2365.

3. *Acer wilsonii* Rehd.

In Sargent, Trees and Shrubs 1: 157, fig. 74: 1-4. 1905; Santisuk, Nat. Hist. Bull. Siam Soc. 46(1): 103, figs. 4-6. 1998. — *A. campbelli* Hook.f. & Thomson ex Hiern subsp. *wilsonii* (Rehd.) de Jong in Gelderen, Jong & Oterdoom, Maples of the World: 129, pl. 18. 1994 — *A. angustilobum* H.H. Hu, J. Arn. Arb. 12: 154. 1931.

Deciduous tree, 10-15 m high. **Leaves** simple, broadly ovate, normally 3-lobed, above the middle, juvenile ones 3-5-lobed, 9-15 cm long, 7-15 cm wide, 5-plinerved at base, glabrous, except tuft of hairs at the insertion of petiole; base obtuse, subtruncate to cordate; apex acuminate; margin entire or remotely serrate, fallen leaves yellow to yellowish brown; petioles 4-6.4 cm long, glabrous. **Inflorescence** in terminal panicle, 10-23 cm long, glabrous. **Flowers** andromonoecious. **Sepals** 5, lanceolate, 1-2 mm long, glabrous. **Petals** 5, white, glabrous. **Stamens** 8, 3-4 mm long, glabrous. Disk thick, glabrous. **Ovary** sparsely pubescent. **Samaras** brownish yellow, 3-4 cm long, 0.8-1.3 cm wide, including wings, glabrous, all with 2 developed samaras.

Thailand.— Northern: Nan.

Distribution.— China (type).

Ecology.— Lower montane forest, alt. 1,100-1,700 m (Doi Phu Kha).

Phenology.— Flowering: November; fruiting: May; leaves: December-November.

Vernacular.— กำแพงหิน Kuam phu kha (Nan).

Voucher specimens.— *P. Srisanga* s.n. (14 Jan. 2002).

ACTINIDIACEAE

Trees, shrubs or climbers. **Leaves** simple, alternate, petiolate; stipules absent or minute. **Inflorescence** terminal or axillary, cymose, fascicles or panicles, or

sometimes flower solitary. **Flowers** bisexual or unisexual. **Calyx** (4-)5(-7), imbricate, persistent. **Corolla** (4-)5(-7), imbricate. **Stamens** mostly numerous, rarely 10 or 15, often in 5 clusters, opposite to the petals; anthers dorsifixed or versatile, opening by terminal pores or rarely by longitudinal slits. **Ovary** superior, 3-30-locular, axile placentation; ovules 2 to many in each loculus; styles 3-5(-7). **Fruit** a berry or rarely capsule. **Seeds** small, numerous.

Three genera: *Actinidia* Lindl. with about 40 species in E and SE Asia; *Clematoclethra scandens* (Franch.) Maxim. in China and *Saurauia* Willd. with about 300 species in tropical and temperate regions (Mabberley, 1997). Two genera and 6 indigenous species excluded *Sladenia celastrifolia* Kurz (Sladeniaceae or Theaceae) formerly included in Actinidiaceae in Thailand (Keng, 1972a; 1972b). One genus with 2 species recorded from Doi Phu Kha National Park.

SAURAUIA Willd.

Ges. Naturf. Freunde Berlin Neue Schr. 3: 407. 1801; Keng in Fl. Thailand 2(2): 109. 1972; Dressler & Bayer in Fam. Gen. Vasc. Pl. 6: 18. 2004.

Trees or shrubs; branches often hollow. **Leaves** usually serrate, with prominent parallel veins. **Inflorescence** axillary or on old branches or trunks. **Flowers** bisexual or unisexual. **Calyx** 5, imbricate, persistent. **Corolla** 5, imbricate, shortly connate at base. **Stamens** many to numerous, rarely 15, mostly adnate to the base of the corolla; anthers versatile, opening by apical pores. **Ovary** mostly 3-5-locular; styles 3-5(-6), usually free. **Fruit** a berry or rarely leathery capsule eventually bursting open irregularly from the top. **Seeds** small, numerous, immersed in pulp.

Four species in Thailand (Keng, 1972a).

KEY TO THE SPECIES

- | | |
|--|---------------------------------|
| 1. Inflorescence in axillary long peduncled panicles | 1. <i>S. nepaulensis</i> |
| 1. Inflorescence in axillary small fascicles | 2. <i>S. roxburghii</i> |

1. *Saurauia nepaulensis* DC.

Mém. Soc. Phys. Hist. Nat. Genève 1: 421. 1822; Craib in Fl. Siam. Enum. 1: 128. 1925; Keng in Fl. Thailand 2(2): 109. 1972.

Tree, 4-10 m high; young branches, petioles and peduncles covered with scurfy tomentum mixed with brown hairs and minute scales. **Leaves** oblong to elliptic, chartaceous, (13-)20-35 cm long, (5-)7.5-9(-12) cm wide, glabrescent above, thinly ferruginous tomentose beneath; base cuneate to rounded; apex obtuse, acute to acuminate; margin serrulate, wavy; primary veins 18-28 pairs; secondary veins scalariform; petioles (1.5-)2.5-5 cm long. **Inflorescence** in axillary peduncled panicles, (15-)20-35 cm long, including the peduncle. **Sepals** orbicular-ovate, 3-5 mm long and wide, puberulous on both sides, glabrescent outside, ciliate at margin. **Petals**

pink, orbicular-ovate, 6-8 mm long and wide, erect and recurved outward at apex, fimbriate at margin. **Stamens** numerous. **Ovary** 5-locular, glabrous; styles 5. **Berry** globose, 5-ridged, 6-8 mm long and wide, with persistent calyx and styles.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— E India, Nepal (type), Myanmar, SW China, Malaysia.

Ecology.— Lower montane forest, open places and by roadsides, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-September.

Vernacular.— ช้างสาม Cha san (Northern).

Voucher specimens.— *P. Srisanga* 982; *P. Srisanga* & *C. Maknoi* 2041.

2. *Saurauia roxburghii* Wall.

Pl. As. Rar. 2: 40. 1829; Craib in Fl. Siam. Enum. 1: 128. 1925; Keng in Fl. Thailand 2(2): 111. 1972. – *S. thorelii* auct. non Finet & Gagnep.: Craib in Fl. Siam. Enum. 1: 128. 1925.

Shrub or small tree, up to 6 m high; young branches, petioles and undersurface of leaves covered with short ferruginous tomentose hairs mixed with minute scales. **Leaves** oblong, lanceolate to elliptic, chartaceous, (10-)15-35 cm long, 4-6(-10) cm wide, glabrescent above; base cuneate; apex acute to shortly acuminate; margin obtusely or finely serrulate; primary veins 10-15 pairs; petioles 1.5-2.5 cm long. **Inflorescence** in axillary small fascicles, arising from the axils of fallen leaves, thinly tomentose. **Sepals** orbicular-ovate, 3-4 mm long and wide, sparsely puberulous outside. **Petals** pink, orbicular-ovate, 4-6 mm long and wide, erect and recurved outward at apex. **Stamens** 35-50. **Ovary** 5-locular, glabrescent; styles 5, connate below. **Berry** globose, 4-6 mm long and wide, with persistent calyx and styles.

Thailand.— Northern: Chiang Mai, Chiang Rai, Phrae, Nan; South-eastern: Chanthaburi; South-western: Kanchanaburi.

Distribution.— E India (type), Myanmar, Cambodia, Vietnam.

Ecology.— Dry evergreen and lower montane forest, in wet places and by roadsides, alt. 900-1,100 m (Doi Phu Kha, Tham Pha Kaow).

Phenology.— Flowering and fruiting: May-August.

Vernacular.— ส้านเห็บ San hep (Northern).

Voucher specimens.— *P. Srisanga* 2554.

ALANGIACEAE

Monogeneric family. Description as in the genus. Alangiaceae is frequently considered as the member of Cornaceae (Kubitzki, 2004).

ALANGIUM Lam.

Enc. Méth. Bot. 1: 174. 1783; Bloembergen, Blumea 1(2): 241. 1935; Bull. Jard. Bot. Buitenzorg sér. III 16: 140. 1939 (revision); Tardieu-Blot in Fl. C.L.V. 8: 36. 1968; Kubitzki in Fam. Gen. Vasc. Pl. 6: 89. 2004. – *Stylidium* Lour., Fl. Cochinch.: 220. 1790. – *Marlea* Roxb., Pl. Corom. 3: 80, t. 283. 1819. – *Diacicarpium* Bl., Bijdr. 13: 657. 1825. – *Karangolum* O. Kuntze, Rev. Gen.: 272. 1891.

Trees or shrubs, sometimes spiny. **Leaves** simple, alternate; stipules absent. **Inflorescence** in axillary cymes. **Flowers** bisexual, actinomorphic. **Calyx** tube adnate to the ovary; lobes 4-10 or truncate. **Petals** 4-10, free or connate at base, mostly linear, valvate. **Stamens** the same number as and alternate with the petals or 2-4 times as many, free or slightly connate at base; filaments more or less villous inside; anthers 2-locular, linear, opening by longitudinal slits. **Ovary** inferior, 1-2-locular; style simple, clavate or 2-3-lobed; ovule 1 in each loculus, pendulous or 1 locule absent. Disk present. **Fruit** a drupe crowned by calyx and disk. **Seed** 1.

About 18 species in tropical old world, temperate E Asia and E Australia (Bloembergen, 1939). Six species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Young shoots and leaves beneath brown to golden brown hirsute or sparsely puberulous
 2. Corolla 6-11 mm long. Filaments 1.5-3.5 mm long, bearded with 2-3 mm long stiff hairs at the apex inside, glabrous or short hairy outside; anthers 4-7 mm long, glabrous. Style 4-9 mm long, glabrous. Disk in fruiting state not exerted **1. *A. barbatum***
 2. Corolla 8-19 mm long. Filaments 2.5-6.5 mm long, bearded at the apex inside, pilose outside; anthers 5-10 mm long, glabrous. Style 7-16 mm long, pilose. Disk in fruiting state exerted about 1-1.5 mm high **2. *A. chinense***
1. Young shoots and leaves beneath densely golden brown softly tomentose. Corolla 15-30 mm long. Filaments 4-8 mm long, pilose on both sides; anthers 9-16 mm long, pilose inside. Style 12-24 mm long, glabrous. Disk in fruiting state exerted about 0.5-2 mm high **3. *A. kurzii***

1. *Alangium barbatum* (R. Br.) Baill.

Adans. 5: 195. 1864-65; Harms in Engler & Prantl, Nat. Pflanzenfam. 3(8): 262. 1898; Tardieu-Blot in Fl. C.L.V. 8: 45. 1968. – *Marlea barbata* R. Br., Names and Notes Ind. Pl. 1828-1849, in Brown Misc. Bot. Works 2: 534. 1867. – *Karangolum barbatum* O. Kuntze, Rev. Gen.: 273. 1891. – *Alangium kingianum* Prain, J. As. Soc. Beng. 67(2): 294. 1898. – *A. barbatum* (C.B. Clarke) Harms subsp. *typicum* Bloembergen, Bull. Jard. Bot. Buitenzorg sér. III 16: 191, fig. 4: 10a; 5: o-q. 1939.

Shrub or small tree, up to 6 m high; young shoots brown to golden brown hirsute. **Leaves** variable in size and shape, oblong, lanceolate, elliptic, oblanceolate, obovate to narrowly ovate, chartaceous, 7-21 cm long, 2.5-10 cm wide; base broadly cuneate to subtruncate, more or less oblique; apex acuminate to shortly caudate, hirsute on both surfaces, glabrescent except on midrib and nerves on both sides, 3-5-plinerved at base; primary veins 4-10 pairs; petioles 5-20 mm long, brown to golden brown hirsute. **Inflorescence** brown to golden brown hirsute, 1.5-3.5 cm long, 3-23-flowered. **Flowers** (5-)6(-7)-merous; pedicels 2-10 mm long, brown to golden brown hirsute. **Calyx** brown to golden brown hirsute; tube infundibuliform to campanulate, 0.8-2 mm long; lobes triangular, 0.25-0.5 mm long. **Corolla** creamy yellow or creamy white, in mature bud subcylindrical, somewhat swollen above the base and in the upper half, 6-11 mm long, short hirsute outside, glabrous inside. **Stamens** as many as petals, yellow; filaments 1.5-3.5 mm long, bearded with 2-3 mm long stiff hairs at the apex inside, glabrous or short hairy outside; anthers 4-7 mm long, glabrous. **Ovary** 1-locular; style 4-9 mm long, glabrous; stigma capitate. Disk subglobose, 4-7-ribbed, 0.75-1.5 mm high. **Drupe** ellipsoidal, 8-12 mm long, 4-6.5 mm wide, dark violet, glabrous or sparsely hairy; disk not exerted.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Nakhon Phanom.

Distribution.— India (Assam-type), China, Laos, Vietnam.

Ecology.— Dry evergreen and lower montane forest, alt. 900-1,700 m (Doi Phu Kha).

Phenology.— Flowering: April-June; fruiting: June-September.

Voucher specimens.— *P. Srisanga* 728, 1397, 1413, 1552, 1682; *P. Srisanga* & *C. Puff* 1094; *P. Srisanga* & *S. Watthana* 639.

Notes.— New locality recorded from Nan, in Thailand. *A. decipiens* Evrard is possibly conspecific with this species.

2. *Alangium chinense* (Lour.) Harms

Ber. Deut. Bot. Gesel. 15: 24. 1897; Craib in Fl. Siam. Enum. 1: 805. 1931; Bloembergen, Blumea 1(2): 255, fig 2: a-c. 1935; Bull. Jard. Bot. Buitenzorg sér. III 16: 169, fig. 4: 6; 5: f-h. 1939; Tardieu-Blot in Fl. C.L.V. 8: 43, pl. IV: 6-10. 1968. — *Stylidium chinense* Lour., Fl. Cochinch.: 221. 1790. — *Marlea begoniaefolia* Roxb., Pl. Corom. 3: 80, t. 283. 1819. — *Alangium begoniaefolium* Baill., Hist. Pl.: 270, pl. 6. 1877. — *Karangolum chinense* O. Kuntze, Rev. Gen.: 273. 1891.

Tree or shrub, up to 15 m high; young shoots brown hirsute, sometimes glabrescent. **Leaves** broadly ovate to ovate-triangular, chartaceous, 6-25 cm long, 4-20 cm wide; base broadly cuneate, subtruncate, rounded to subcordate, distinctly oblique; apex acuminate to caudate, sometimes with 3-5 acuminate lobed, sparsely puberulous on both surfaces, glabrescent except on midrib and nerves on both sides, usually with tufts of hairs in the axils of the nerves below, 3-7-plinerved at base; primary veins 3-6 pairs; petioles 1.5-6 cm long, brown hirsute. **Inflorescence** brown hirsute, 3-9 cm long, 3-23-flowered. **Flowers** (5-)7(-8)-merous; pedicels 2-20 mm long, brown hirsute. **Calyx** brown hirsute; tube infundibuliform to campanulate, 1-3 mm long; lobes triangular, 0.5-1 mm long. **Corolla** white, in mature bud

subcylindrical, somewhat swollen above the base, 8-19 mm long, short hirsute outside, glabrous inside. **Stamens** as many as petals, yellow; filaments 2.5-6.5 mm long, bearded at the apex inside, pilose outside; anthers 5-10 mm long, glabrous. **Ovary** 2-locular, sometimes one of the cells more or less reduced; style 7-16 mm long, pilose; stigma capitate. Disk subglobose, slightly angular, 0.75-1.75 mm high. **Drupe** ellipsoidal, 5.5-13 mm long, 4-7 mm wide, black or dark violet, sparsely hairy; disk exerted about 1-1.5 mm high.

Thailand.— Northern: Chiang Mai, Lamphun, Phrae, Nan.

Distribution.— Tropical Africa, India, China, Japan, SE Asia (Cochinchina-type).

Ecology.— Deciduous, dry evergreen and lower montane forest, sometimes by streams, alt. 400-1,700 m (Doi Phu Kha).

Phenology.— Flowering: April-May; fruiting: June-August.

Vernacular.— ขี้วุ้น Khao yen (Northern).

Voucher specimens.— *P. Srisanga* 1527.

3. *Alangium kurzii* Craib

Kew Bull. 1911: 60. 1911; in Fl. Siam. Enum. 1: 806. 1931; Bloembergen, Blumea 1 (2): 262, fig 2: g-i. 1935; Bull. Jard. Bot. Buitenzorg sér. III 16: 169, fig. 4: 9; 5: l-n. 1939; Tardieu-Blot in Fl. C.L.V. 8: 41, pl. IV: 11-14. 1968. — *Diacarpium tomentosum* Bl., Bijdr. 13: 657. 1825. — *Marlea tomentosa* Hassk., Flora 27: 605. 1844. — *Alangium chinense* var. *tomentosum* Melchior, Notizbl. Bot. Gart. Berl. 10: 827. 1929.

Tree, up to 20 m high; young shoots densely golden brown softly tomentose. **Leaves** broadly ovate, chartaceous, 8-22 cm long, 4-12 cm wide; base rounded to subcordate, distinctly oblique; apex acuminate to caudate, densely golden brown softly tomentose below, sparsely puberulous above, except golden brown softly tomentose on midrib and nerves, 5-7-plinerved at base; primary veins 4-7 pairs; petioles 1.5-5 cm long, golden brown softly tomentose. **Inflorescence** golden brown softly tomentose, 3-9 cm long, 3-18-flowered. **Flowers** (5-)9(-10)-merous; pedicels 2-20 mm long, golden brown softly tomentose. **Calyx** golden brown tomentose; tube infundibuliform, campanulate or cylindrical, 1-2.5 mm long; lobes triangular, up to 0.5 mm long. **Corolla** creamy white or yellow, in mature bud subcylindrical, somewhat swollen above the base, 15-30 mm long, short tomentose outside, glabrous inside except hairy in the lower portion above the base. **Stamens** as many as petals, yellow; filaments 4-8 mm long, pilose on both sides; anthers 9-16 mm long, pilose inside. **Ovary** 2-locular, sometimes one of the cells more or less reduced; style 12-24 mm long, glabrous; stigma capitate. Disk subglobose, 1-2 mm high. **Drupe** ellipsoidal, 8-14 mm long, 5-8 mm wide, black or dark violet, glabrous to thinly tomentose; disk exerted about 0.5-2 mm high.

Thailand.— Almost throughout the country.

Distribution.— Myanmar, China, Laos, Vietnam, Malaysia, Indonesia (Java-type).

Ecology.— Lower montane forest, open areas, alt. 1,200-1,300 m (Doi Phu Kha).

Phenology.— Flowering: April-May; fruiting: July-September.

Vernacular.— สลึงคอง Salik dong (Chiang Mai).

Voucher specimens.— *P. Srisanga & S. Watthana* 641.

AMARANTHACEAE

Herbs or shrubs, rarely woody climbers. **Leaves** simple, alternate or opposite, exstipulate, entire or nearly so. **Inflorescence** usually compound, often dense, spike-like or capitulate, basically cymose. Bracts and bracteoles almost present. **Flowers** unisexual or bisexual; sterile flowers forming hooks or bristles often present. **Tepals** (1-)3-5 or absent, usually scarious or membranous. **Stamens** as many as tepals and opposite to them, rarely fewer; filaments often connate at base into a tube or staminal cup, often producing teeth or lobes alternating with the stamens (pseudo-staminodes); anthers opening by longitudinal slits. Disc often present inside the staminal cup. **Ovary** superior, 1-locular; stigmas capitate or up to 2-3(-6)-lobed; ovule usually solitary and basal from a free central placenta, rarely several. **Fruit** an irregularly rupturing capsule with thin membranous walls (utricle), nut or circumscissile capsule, rarely berry, 1 to rarely few-seeded, often surrounded by the persistent tepals.

Sixty-nine genera and over 1,000 species, distributed all over the world particularly in the tropics and subtropics (Townsend, 1993). The family contains many weedy species but several species are widely cultivated as garden ornamental plants and few are used as vegetables. Fifteen genera and 31 species, indigenous or naturalized in Thailand (Larsen, 1992a, 1994; Mekanawakul, 1996). Four genera and 4 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Scandent shrub. Leaves spirally arranged. Pseudo-staminodes absent 4. *Deeringia*
1. Herb or undershrub. Leaves opposite, at least in the lower part.
 - Pseudo-staminodes present
 2. Flowers surrounded by fascicled hooks 3. *Cyathula*
 2. Flowers not surrounded by fascicled hooks
 3. Tepals pilose 2. *Aerva*
 3. Tepals glabrous 1. *Achyranthes*

1. *ACHYRANTHES* L.

Sp. Pl.: 204. 1753; Larsen in Fl. Thailand 5(4): 394. 1992; Townsend in Fam. Gen. Vasc. Pl. 2: 87. 1993.

Perennial herbs, sometimes with woody base. **Leaves** opposite, entire, petiolate. **Inflorescence** in terminal spikes, dense at first, later elongating with remote flowers and fruits. **Flowers** bisexual, supported by persistent bract; bracteoles 2. **Tepals** 4-5, subequal, membranous, one- or few-nerved, pungent in fruit. **Stamens** 2-5; filaments connate at base into a short staminal cup; pseudo-staminodes 5, denticulate and sometimes accompanied by a large fimbriate scale; anthers oblong or ovate. **Ovary** with 1 ovule; style filiform, longer than the stamens; stigma minute, capitate. **Fruit** an utricle with a glabrous, fragile pericarp.

Ten species, in tropical and subtropical regions of the Old World. Three species in Thailand (Larsen, 1992a). One species recorded from Doi Phu Kha National Park.

Achyranthes bidentata Bl.

Bijdr.: 545. 1826; Larsen in Fl. Thailand 5(4): 395, fig. 88: 8-12. 1992.

Perennial, erect or ascending herb, up to 2 m high; branches slightly quadrangular with longitudinal furrows, hairy. **Leaves** elliptic to broadly lanceolate, 5-10(-25) cm long, 2-8(-11) cm wide; base acute or obtuse; apex acuminate, hairy on both surfaces, often reddish; petioles 1-3 cm long. **Inflorescence** up to 45 cm long; peduncle up to 15 cm long; rachis rather thin often somewhat tortuous, hairy. Bract ovate, subulate, ca. 3 mm long; bracteoles spinose, 3-5 mm long, shorter than perianth, the limb reduced to 2 membranous lobes inserted at the thickened base of the spine. **Tepals** glabrous, lanceolate, subulate, acuminate, 4-7 mm long. **Stamens** 5; staminal cup ca. 2 mm high; pseudo-staminodes truncate. **Ovary** ovoid; style 1-2 mm long. **Utricle** glabrous, obovoid, brown, ca. 2 mm long. **Seed** cylindrical, smooth, small.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lamphun, Nan, Phitsanulok; North-eastern: Loei; Eastern: Chaiyaphum, Nakhon Ratchasima; South-western: Kanchanaburi.

Distribution.— Throughout palaeotropical region (Java-type).

Ecology.— Dry evergreen and lower montane forest, often in shaded and moist areas or by streams, alt. 600-1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: September-March.

Vernacular.— พันธุ์น้อย Phan ngu noi (Northern).

Voucher specimens.— *P. Srisanga* 276, 584, 2608; *P. Srisanga et al.* 234.

2. *AERVA* Forssk.

Fl. Aegypt.-Arab.: 170. 1775, nom. cons.; Larsen in Fl. Thailand 5(4): 389. 1992; Townsend in Fam. Gen. Vasc. Pl. 2: 85. 1993.

Herbs or undershrubs, often densely hairy. **Leaves** alternate or opposite, entire. **Inflorescence** terminal or axillary of dense, cylindrical or spherical, spikes or

pseudo-spikes. **Flowers** bisexual or unisexual, supported by persistent bract; bracteoles 2. **Tepals** 4-5, often lanate. **Stamens** 4-5; filaments connate at base into a short staminal cup; pseudo-staminodes 5, subulate. **Ovary** compressed, glabrous; style short; stigma capitate or bifid; ovule 1. **Fruit** an utricle. **Seed** reniform.

Ten species, in tropical and subtropical regions of the Old World outside Europe (Townsend, 1993). Two species in Thailand (Larsen, 1992a; Mekanawakul, 1996). One species recorded from Doi Phu Kha National Park.

Aerva sanguinolenta (L.) Bl.

Bijdr.: 547. 1826; Larsen in Fl. Thailand 5(4): 389, fig. 86: 1-6. 1992. – *Achyranthes sanguinolenta* L., Sp. Pl. ed. 2: 294. 1762. – *A. scandens* Roxb., Fl. Ind. ed. Carey 2: 509. 1824. – *Aerva scandens* Wall. ex Moq.-Tand. in DC., Prodr. 13: 302. 1849.

Perennial herb, sometimes woody at base, up to 1.5 m high, erect or scrambling; stem terete, velutinous. **Leaves** lanceolate to elliptic, 1.5-8 cm long, 0.5-5 cm wide; base attenuate; apex acute, mucronate, hairy on both surfaces; petioles up to 1 cm long. **Inflorescence** solitary or fascicles, white to pale purplish, up to 5 cm long. **Flowers** very densely packed together, bisexual or female flowers. Bract and bracteoles membranous, ovate, mucronate, pilose, ca. 1 mm long. **Tepals** 5, membranous, oblong, ca. 3 mm long, acute at apex, pilose. **Stamens** half length of the tepals; staminal cup short; pseudo-staminodes filiform, shorter than the filaments. **Ovary** ovoid; stigma entire or somewhat bifid. **Utricle** irregularly dehiscent, ca. 1 mm in diam. **Seed** shining, reticulate, brownish black.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Nan; North-eastern: Loei, Sakon Nakhon, Khon Kaen; South-eastern: Chon Buri, Rayong, Trat; Central: Saraburi, Ayutthaya, Bangkok; South-western: Kanchanaburi, Phetchaburi, Prachuap Khiri Khan; Peninsular: Chumphon.

Distribution.— India, S China, SE Asia.

Ecology.— Lower montane forest, open areas, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: November-December.

Vernacular.— เครือข้าวตอก Khruea khao tok (Northern).

Voucher specimens.— P. Srisanga 2260.

3. CYATHULA Bl.

Bijdr.: 548. 1826, nom. cons.; Larsen in Fl. Thailand 5(4): 393. 1992; Townsend in Fam. Gen. Vasc. Pl. 2: 84. 1993.

Annual or perennial herbs or undershrubs. **Leaves** opposite, entire. **Inflorescence** cylindrical or spherical pseudo-spikes with flowers clustered on the axis in glomerules. **Flowers** bisexual, few together accompanied by bracts and sterile flowers transformed to fascicled hooks; bracteoles often also hooked. **Tepals** 5.

Stamens 5; staminal cup short; pseudo-staminodes 5, dentate or lacerate. **Ovary** ovoid; style filiform; stigma capitate; ovule 1. **Fruit** a dry, indehiscent utricle.

About 20 species in tropical region, especially Africa. Only 1 species in Thailand (Larsen, 1992a).

***Cyathula prostrata* (L.) Bl.**

Bijdr. 549. 1826; Larsen in Fl. Thailand 5(4): 393, fig. 86: 7-13. 1992. – *Achyranthes prostrata* L., Sp. Pl. ed. 2: 296. 1762. – *Cyathula geniculata* auct. non Lour.: Miq., Fl. Ind. Bat. 1(1): 1045. 1858.

Herb, up to 80 cm high, erect or procumbent, branched; stems puberulous with thin spreading or ascending whitish hairs. **Leaves** broadly elliptic to rhombic, 1-6(-10) cm long, 1-4 cm wide, sparsely puberulous; base rounded to cuneate; apex obtuse to acute; petioles short or sessile. **Inflorescence** terminal and axillary, up to 25 cm long, elongating in fruit; peduncle 2-5 cm long. Glomerules often 3, 1 fertile and 2 lateral sterile reduced to bracteoles and narrow tepals; bract falcate, ca 1 mm long. **Tepals** scarious, lanceolate, 2-3 mm long, velutinous on the dorsal side. Pseudo-staminodes obtuse, emarginate or even dentate. **Ovary** ovoid, 1-2 mm long. **Utricle** ovoid, 1-2 mm long, inconspicuously operculate, enclosed within the stiff persisting perianth parts. **Seed** flattened, ellipsoid, ca. 1 mm long, shining, smooth, brown.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Phrae, Nan, Phitsanulok, Tak; North-eastern: Loei; South-eastern: Chanthaburi; Central: Nakhon Nayok, Bangkok; South-western: Uthai Thani, Kanchanaburi; Peninsular: throughout.

Distribution.— Throughout palaeotropic region, introduced to Central and S America.

Ecology.— Deciduous, dry evergreen and lower montane forest, often in disturbed areas and along streams, alt. 700-1,700 m (Doi Phu Kha, Nan Watershed).

Phenology.— Flowering and fruiting: August-March.

Vernacular.— หญ้าพันงูเล็ก Ya phan ngu lek (Eastern).

Voucher specimens.— *P. Srisanga* 320, 585, 1209; *P. Srisanga & C. Maknoi* 2085.

4. DEERINGIA R. Br.

Prodr.: 413. 1810; Larsen in Fl. Thailand 5(4): 376. 1992; Townsend in Fam. Gen. Vasc. Pl. 2: 79. 1993. – *Lestibudesia* Pet.-Thou., Hist. Veg. II. Austr. Afr.: 53. 1806. – *Cladostachys* D. Don, Prodr. Fl. Nepal.: 76. 1825.

Erect or scandent herbs or shrubs. **Leaves** alternate, petiolate. **Inflorescence** terminal or lateral panicles composed of racemes or spikes. **Flowers** bisexual or unisexual, subtended by bract; bracteoles 2. **Tepals** (4-)5(-6), glabrous with scarious margin. **Stamens** the same number as tepals; filaments united at base to a staminal cup or nearly free; pseudo-staminodes absent. **Ovary** sessile or shortly stipitate; style

short; stigma (2-)3(-4)-lobed. **Fruit** baccate, thin-walled, spherical-obovoid, surrounded by the persistent tepals.

Seven species in tropical and subtropical regions of the Old World. Two species in Thailand (Larsen, 1992a). One species recorded from Doi Phu Kha National Park.

***Deeringia amaranthoides* (Lam.) Merr.**

Int. Rumph.: 211. 1917; Larsen in Fl. Thailand 5(4): 377, fig. 83: 1-5. 1992. – *Achyranthes amaranthoides* Lam., Enc. 1: 548. 1785. – *Celosia baccata* Retz., Obs. 5: 23. 1789. – *Deeringia celosioides* R. Br., Prodr.: 413. 1810. – *Cladostachys baccata* (Retz.) O. Kuntze, Rev. Gen. 2: 541. 1891.

Scandent or scrambling shrub, up to 7 m high; branches pendulous; young twigs pubescent, later glabrous. **Leaves** ovate to broadly lanceolate, 4-10(-13) cm long, 2-6 cm wide, finely pubescent when young, later glabrous; base truncate, slightly cordate, oblique; apex acuminate, mucronate; petioles 1-5 cm long. **Inflorescence** terminal, up to 100 cm long; individual racemes with short or long peduncles, 5-30 cm long; the racemes in the lower part of the inflorescence subtended by leaves similar to those on vegetative shoots; rachis pubescent. **Flowers** white or green, foetid; bract tiny, narrowly triangular, 1-2 mm long; pedicels 1-2 mm long. **Tepals** 5, suborbicular-ovate, 1-2 mm long, patent, later reflexed. **Stamens** free or joined at base. **Ovary** spherical with 3 subsessile stigmas. **Fruit** red, spherical, 4-6 mm in diam. **Seeds** 2-5(-9), circular, reticulate, ca. 1 mm in diam., shining, black.

Thailand.— Northern: Chiang Mai, Lampang, Nan: North-eastern: Loei; South-western: Kanchanaburi, Prachuap Khiri Khan; Peninsular: Surat Thani.

Distribution.— India (type), S China, Taiwan, SE Asia, N Australia.

Ecology.— Dry evergreen and lower montane forest, alt. 750-1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-November.

Vernacular.— เครือข่าง Khruea yang (North-eastern).

Voucher specimens.— *P. Srisanga* 344, 1128.

ANACARDIACEAE

Trees, shrubs or climbers, often with resinous bark, sometimes with white latex. **Leaves** simple or compound, alternate, rarely opposite; stipules mostly absent. Inflorescence axillary or terminal, panicles. **Flowers** bisexual or unisexual, actinomorphic. **Sepals** 3-5, imbricate or valvate, usually connate basally. **Petals** 3-7 or absent, free or rarely connate and adnate to the torus. **Stamens** equal or twice number of the petals, rarely more than twice; filaments free; anthers 2-locular, opening by longitudinal slits. Disk present. **Ovary** superior, rarely inferior (*Drimycarpus* Hook.f.), 1-5-locular or rarely carpels free, then only one fertile; styles

1-5, often widely separated; ovule solitary, pendulous from the apex or adnate to the ovary wall or pendulous from a basal funicle. **Fruit** mostly drupaceous, sometimes with resinous mesocarp.

About 70 genera and 875 species mainly in tropical and subtropical regions (Mabberley, 1997). A family contains many important fruits and ornamentals. Eighteen genera and 58 species in Thailand (Chayamarit, 1994). Five genera and 5 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Leaves simple
 2. Leaves crispate and with a distinct marginal vein. Ovary inferior **1. *Drimycarpus***
 2. Leaves not crispate and without a marginal vein. Ovary superior **4. *Semecarpus***
1. Leaves compound
 3. Climbers or scandent shrubs. Stamens twice the number as the petals **2. *Pegia***
 3. Erect trees or shrubs
 4. Leaves without a distinct, continuous, intra-marginal veins. Stamens the same number as the petals **3. *Rhus***
 4. Leaves with a distinct, continuous, intra-marginal veins. Stamens twice the number as the petals **5. *Spondias***

1. *DRIMYCARPUS* Hook.f.

In Gen. Pl. 1: 424. 1862; Tardieu-Blot in Fl. C.L.V. 2: 179. 1962; Hou in Fl. Mal. I(8): 520. 1978.

Evergreen trees, dioecious or polygamous, with white latex. **Leaves** simple, alternate, entire, with a rather thick, distinct marginal veins. **Inflorescence** axillary or terminal, paniculate. **Flowers** unisexual or rarely bisexual. **Calyx** (4-)5-lobed. **Petals** (4-)5(-6), free, imbricate. **Stamens** (4-)5, alternipetalous; filaments subulate, glabrous; anthers dorsifixed, imperfect or abortive in female flowers. Disk intrastaminal, (4-)5-notched, glabrous. **Ovary** inferior, 1-locular; ovule solitary, attached to the side of ovary wall and pendulous; style short, cylindrical; stigmas 3, capitate. **Drupe** crowned with remaining floral parts.

About 2 species in India, Sikkim, Bhutan, S China, Myanmar, N Vietnam and Malesia. One species in Thailand (Chayamarit, 1994).

Drimycarpus racemosus (Roxb.) Hook.f.

In Gen. Pl. 1: 424. 1862; in Fl. Br. Ind. 2: 36. 1876; Tardieu-Blot in Fl. C.L.V. 2: 179. 1962; Grierson in Fl. Bhutan 2(1): 59, fig. 7: a-c. 1991; Chayamarit, Thai For. Bull. (Bot.) 22: 12. 1994. – *Holigarna racemosa* Roxb, Fl. Ind. 2: 82. 1832.

Small tree, 5-8 m high. **Leaves** oblong, lanceolate to narrowly elliptic, subcoriaceous, 12-23 cm long, 3.5-7.5 cm wide, glabrous, slightly glaucous below;

base cuneate; apex acuminate to caudate; margin crispate; primary veins 16-20 pairs, more prominent and raised below; petioles 1-1.8 cm long, glabrous. **Inflorescence** 3-10 cm long, puberulous, glabrescent. **Flowers** yellowish red to red. **Calyx** lobes triangular, 0.5-1 mm long, glabrous. **Petals** ovate to ovate-oblong, 1.5-2 mm long, glabrous. **Stamens** 1.5-2.5 mm long. **Drupe** transverse-oblong, 1.5-2.3 cm long, 2.3-2.8 cm wide (Fig. 88).

Thailand.— Northern: Chiang Mai, Nan; Peninsular: Phangnga, Nakhon Si Thammarat.

Distribution.— India (Assam-type), Sikkim, Bhutan, Myanmar, S China, N Vietnam.

Ecology.— Lower montane forest, sometimes along streams, alt. 1,100-1,700 m (Doi Phu Kha).

Phenology.— Flowering: September-October; fruiting: March-April.

Vernacular.— ลูกดำ Luk dam (Northern).

Voucher specimens.— *P. Srisanga* 268, 544, 1700.

Notes.— Latex irritation. New locality recorded from Nan, in Thailand.

2. *PEGIA* Colebr.

Trans. Linn. Soc. 15: 364. 1827; Tardieu-Blot in Fl. C.L.V. 2: 153. 1962; Hou in Fl. Mal. I(8): 488. 1978. – *Phlebochiton* Wall., Trans. Med. Phys. Soc. Calcutta 7: 230. 1835.

Climbers or scandent shrubs. **Leaves** alternate, imparipinnate, petiolate; leaflets opposite or alternate, entire or serrate. **Inflorescence** axillary or terminal, paniculate. **Flowers** unisexual or bisexual (polygamous). **Calyx** (4-)5-lobed. **Petals** (4-)5, free, imbricate or subvalvate. **Stamens** (8-)10, 5 opposite calyx lobes and 5 opposite petals, abortive in female flowers; filaments filiform, glabrous; anthers subglobose. Disk intrastaminal, annular, flat, slightly notched, glabrous. **Ovary** superior, immersed in the disk, 3-5-locular, usually only 1 fertile; ovule 1 in fertile locule; style (4-)5; stigmas capitate. **Drupe** ovoid to ellipsoid.

About 3 species in India, Sikkim, Bhutan, S China and SE Asia. One species in Thailand (Chayamarit, 1994).

Pegia nitida Colebr.

Trans. Linn. Soc. 15: 364. 1827; Craib in Fl. Siam. Enum. 1: 351. 1926; Grierson in Fl. Bhutan 2(1): 58. 1991; Chayamarit, Thai For. Bull. (Bot.) 22: 18. 1994. – *Tapiria hirsuta* Hook.f. in Fl. Br. Ind. 2: 28. 1876.

Climber or scandent shrub. **Leaves** 10-25 cm long; leaflets 4-7 pairs, oblong, lanceolate to ovate, chartaceous, 4-8 cm long, 2-4.5 cm wide, sparsely puberulous, glabrescent, with distinctly tuft domatia in nerve axils; base rounded to cuneate, oblique; apex acute to acuminate; margin coarsely serrate; primary veins 6-9 pairs,

prominent and raised on both surfaces, especially below; veins distinct; petiolules 2-10 mm long, puberulous. **Inflorescence** 10-30 cm long, puberulous. **Flowers** creamy yellow. **Calyx** lobes triangular, ca. 0.5 mm long, glabrous. **Petals** ovate, 1.5-2 mm long, glabrous. **Stamens** 1-1.5 mm long. **Ovary** subglobose, 1-1.5 mm long. **Drupe** ellipsoid, 1-1.2 cm long, 5-6 cm wide (Fig. 28).

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— India (Assam-type), Sikkim, Bhutan, S China, Myanmar.

Ecology.— Lower montane forest, sometimes along streams and disturbed areas, alt. 1,100-1,300 m (Doi Phu Kha).

Phenology.— Flowering: February-April; fruiting: April-May.

Voucher specimens.— *P. Srisanga* 1334.

Vernacular.— กระชายเขา Kra chai khao (Chiang Rai).

Notes.— New locality recorded from Nan, in Thailand.

3. *RHUS* L.

Sp. Pl. 1: 265. 1753; Tardieu-Blot in Fl. C.L.V. 2: 181. 1962; Hou in Fl. Mal. I(8): 534. 1978. – *Toxicodendron* Miller, Gard. Dict. ed. 4. 1754.

Erect trees or shrubs, dioecious or polygamous. **Leaves** alternate, imparipinnate, trifoliolate or unifoliolate; leaflets opposite or subopposite, entire, crenate or serrate, with or without domatia in the nerve axils. **Inflorescence** axillary or terminal, paniculate. **Flowers** unisexual or bisexual. **Calyx** 5-lobed. **Petals** 5, free, imbricate. **Stamens** 5, alternipetalous, imperfect or abortive in female flowers; filaments subulate, glabrous; anthers dorsifixed. Disk intrastaminal, discoid, shortly cupular, or round. **Ovary** superior, 1-locular; ovule solitary; style short, distinct or obscure; stigmas 3, free or united. **Drupe** subglobose, ovoid to ellipsoid.

About 200 species in tropical and temperate regions (Mabberley, 1997). Two species in Thailand (Chayamarit, 1994). One species recorded from Doi Phu Kha National Park.

Rhus chinensis Miller

Gard. Dict. ed. 8. sub n. 7. 1768; Tardieu-Blot in Fl. C.L.V. 2: 182. 1962; Hou in Fl. Mal. I(8): 537. 1978; Grierson in Fl. Bhutan 2(1): 55. 1991; Chayamarit, Thai For. Bull. (Bot.) 22: 19. 1994. – *R. semialata* Murray, Comm. Soc. Goett. 5: 27, t. 3. 1784. – *R. javanica* (non L.) Thunb., Fl. Jap.: 121. 1785; Craib in Fl. Siam. Enum. 1: 342. 1926.

Small tree or shrub, 4-10 m high, with white latex and then black when oxidation. **Leaves** imparipinnate; rachis 10-30 cm long, tomentose, winged; leaflets 4-6 pairs, oblong, lanceolate to ovate, chartaceous to subcoriaceous, 5-15 cm long, 2.5-7.5 cm wide, tomentose on lower surface, sparsely puberulous on upper surface except tomentose midrib, without domatia in nerve axils; base rounded to cuneate,

oblique; apex acute to acuminate; margin crenate-dentate; primary veins 11-18 pairs, prominent and raised below; veins reticulate-scalariform; lateral petiolules very short or absent; terminal petiolules 2-4 cm long. **Inflorescence** terminal, 20-40 cm long, tomentose. **Flowers** white or creamy yellow. **Calyx** lobes triangular, 0.5-0.75 mm long, puberulous. **Petals** oblong to elliptic, 1.5-2 mm long, sparsely pilose inside, glabrous outside, ciliolate. **Stamens** 1.5-2 mm long. Disk discoid or shortly cupular. **Ovary** ovoid, 1-1.5 mm long, pubescent. **Drupe** subglobose, 4-5 mm long and wide, reddish, pubescent.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan; North-eastern: Loei.

Distribution.— Widely distributed in temperate, subtropical Asia and SE Asia.

Ecology.— Lower montane forest, along roadsides and disturbed areas, alt. 1,100-1,400 m (Doi Phu Kha).

Phenology.— Flowering: September-November; fruiting: January-February.

Uses.— Fruit edible, sour taste.

Vernacular.— ส้มผด Som phot (Northern).

Voucher specimens.— *P. Srisanga* 1710.

4. *SEMECARPUS* L.f.

Suppl. 25: 282. 1781; Tardieu-Blot in Fl. C.L.V. 2: 156. 1962; Hou in Fl. Mal. I(8): 499. 1978.

Trees or shrubs, dioecious or polygamous. **Leaves** simple, alternate, sometimes subverticillate, entire, often papillose on the lower surface. **Inflorescence** axillary or terminal, rarely cauliflorous, paniculate; pedicels articulated, sometimes at the base. **Flowers** unisexual, rarely bisexual. **Calyx** (4-)5-lobed. **Petals** (4-)5, free, imbricate, rarely valvate. **Stamens** (4-)5, imperfect or abortive in female flowers; filaments subulate, glabrous; anthers dorsifixed. Disk intrastaminal, shortly cupular, round, flat, often (4-)5-notched. **Ovary** superior, 1-locular, usually hairy; ovule solitary; styles 3, terminal, divergent. **Drupe** often laterally compressed, seated on a distinct, flesh hypocarp which is sometimes cupular whereby the fruit is seemingly slightly half-inferior; exocarp and mesocarp fleshy; endocarp crustaceous.

About 60 species in S and SE Asia to New Caledonia and Fiji (Hou, 1978; Mabberley, 1997). Three species in Thailand (Chayamarit, 1994). One species recorded from Doi Phu Kha National Park.

Semecarpus sp.

Tree, up to 20 m high. **Leaves** oblanceolate to obovate, subcoriaceous, 10-20 cm long, 4-11 cm wide, glabrous or glabrescent on upper surface, sparsely puberulous on lower surface; base cuneate or attenuate; apex obtuse, sometimes slightly emarginate or acute; primary veins 9-16 pairs; veins distinct on both surfaces,

especially below; petioles 1-2 cm long, puberulous. **Inflorescence** in terminal panicles, up to 35 cm long, brown tomentose. Mature flowers and fruit not known.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, alt. 900-1,000 m (Doi Phu Kha, Nan Watershed).

Phenology.— Flowering: November.

Voucher specimens.— *P. Srisanga* 300.

Notes.— Possibly belong to *S. cochinchinensis* Engl. Due to lacking the mature flower materials, the affinity is uncertain.

5. *SPONDIAS* L.

Sp. Pl. 1: 371. 1753; Tardieu-Blot in Fl. C.L.V. 2: 133. 1962; Hou in Fl. Mal. I(8): 479. 1978.

Trees, sometimes deciduous, dioecious or polygamous. **Leaves** alternate, imparipinnate, rarely bipinnate; leaflets opposite, subopposite or alternate, entire, crenate or serrate, with a distinct, continuous, intra-marginal veins, without domatia in the nerve axils. **Inflorescence** axillary or terminal, paniculate. **Flowers** unisexual or bisexual. **Calyx** (4-)5-lobed. **Petals** (4-)5, valvate, glabrous. **Stamens** (8)10; filaments subulate, filiform, glabrous or papillose; anthers dorsifixed. Disk intrastaminal, shortly cupular, or round and flat, crenulate, glabrous or papillose. **Ovary** superior, (4-)5-locular, glabrous; styles (4-)5 and free or 1. **Drupe** (4-)5 or 1-celled; endocarp woody, hard.

About 10 species in S & SE Asia and tropical America (Hou, 1978; Mabberley, 1997). Five species in Thailand (Chayamarit, 1994). One species recorded from Doi Phu Kha National Park.

Spondias pinnata (L.f.) Kurz

Rep. Pegu App. A. 44 & B. 42. 1875; Craib in Fl. Siam. Enum. 1: 356. 1926; Tardieu-Blot in Fl. C.L.V. 2: 133, Pl. VIII: 1-7. 1962; Hou in Fl. Mal. I(8): 483, fig. 39: a-c, 40. 1978; Grierson in Fl. Bhutan 2(1): 60. 1991; Chayamarit, Thai For. Bull. (Bot.) 22: 20. 1994. — *Mangifera pinnata* L.f., Suppl.: 156. 1781. — *Spondias mangifera* Willd, Sp. Pl. 2: 751. 1799. — *S. acuminata* Roxb., Fl. Ind. ed. 2: 453. 1832; Craib in Fl. Siam. Enum. 1: 355. 1926.

Deciduous tree, 10-20 m high, sometimes with buttresses. **Leaves** imparipinnate, reddish when young; rachis 10-20 cm long, glabrous; leaflets 4-6(-8) pairs, oblong, lanceolate to elliptic, chartaceous to subcoriaceous, 4-10 cm long, 1.7-4.5 cm wide, glabrous; base rounded to cuneate, oblique; apex acuminate; margin entire; primary veins 12-23 pairs, parallel; petiolules short, up to 4 mm long. **Inflorescence** terminal, rarely axillary, 20-40 cm long, glabrous, appearing before the leaves or accompanied by the young ones. **Flowers** white or creamy yellow, sessile or subsessile. **Calyx** lobes triangular, ca. 0.5 mm long, glabrous. **Petals** oblong-ovate,

2-3 mm long, glabrous. **Stamens** ca. 1.5 mm long. Disk shortly cupular. **Ovary** subglobose, glabrous. **Drupe** ellipsoid to ovoid, 3-5 mm long, 2.5-3.5 mm wide, yellowish brown.

Thailand.— Throughout the country.

Distribution.— Widely distributed in S & SE Asia (India-type).

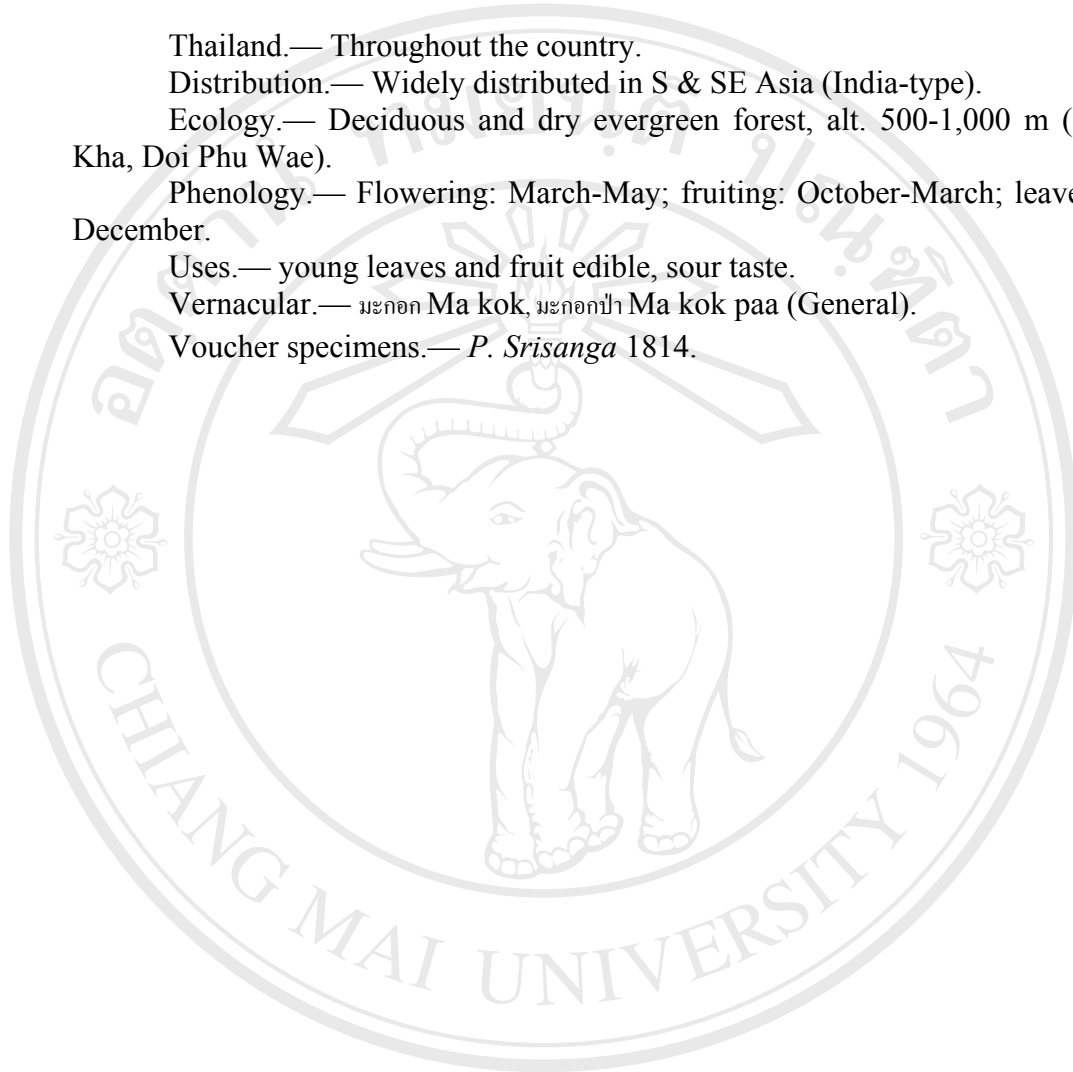
Ecology.— Deciduous and dry evergreen forest, alt. 500-1,000 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: March-May; fruiting: October-March; leaves: May-December.

Uses.— young leaves and fruit edible, sour taste.

Vernacular.— มะกอก Ma kok, มะกอกป่า Ma kok paa (General).

Voucher specimens.— *P. Srisanga* 1814.



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
 Copyright © by Chiang Mai University
 All rights reserved



Figure 28. *Pegia nitida* Colebr.

A. flowering branch; B. flower. All from *P. Srisanga* 1334.

ANNONACEAE

Trees, shrubs or climbers, usually aromatic. **Leaves** simple, alternate, entire, exstipulate. **Inflorescence** terminal or axillary, frequently cauliflorous, basically cymose or flower solitary, paired or fasciated. **Flowers** mostly bisexual, rarely unisexual, usually 3-merous. **Sepals** mostly 3, rarely 2 or 4, free or partly united, slightly imbricate or valvate. **Petals** often 6, in 2 whorls, rarely 2-4, or up to 12, free or rarely connate at base, imbricate or valvate in each whorl. **Stamens** few to numerous, spirally arranged; filaments short; anthers 2-locular, opening lengthwise, often overtopped by the truncate enlarged connective. **Ovary** superior; carpels few or numerous, free or rarely united into a 1-locular ovary; ovules 1-many, basal or parietal; styles free or united, mostly shortly terete; stigma capitate. **Fruit** aggregate, in 1-several monocarps, rarely syncarpous, dry or fleshy, rarely dehiscent, sessile or stipitate. **Seeds** often arillate, with copious and markedly ruminant endosperm and minute embryo.

A pantropical family with about 128 genera and 2,300 species (Kessler, 1993). About 41 genera and 195 species in Thailand. Ten genera and 16 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Woody climbers or scrambling shrubs
 2. Petals subequal
 3. Inner petals shortly clawed. Monocarps globose, oblong to ovoid, not moniliform **2. *Cyathostemma***
 3. Inner petals not clawed. Monocarps moniliform **3. *Desmos***
 2. Inner petals slightly shorter than outer ones **4. *Fissistigma***
1. Trees or shrubs
 4. Petals subequal or inner petals shorter than outer ones
 5. Petals subequal or inner petals slightly shorter than outer ones
 6. Connective with a short prolonged apex. Ovules 10-19 in each carpel **1. *Alphonsea***
 6. Connective with a truncate dilated apex. Ovules 1-2 in each carpel **9. *Polyalthia***
 5. Inner petals much shorter than outer ones or clawed and forming mitriform, cohering about the reproductive organs
 7. Flowers axillary or cauliflorous **5. *Goniothalamus***
 7. Flowers leaf-opposed **8. *Mitrephora***
 4. Inner petals longer than outer ones
 8. Outer petals and sepals similar in size and shape; inner petals saccate at the base, neither clawed nor forming mitriform, cohering about the reproductive organs **6. *Milium***
 8. Outer petals and sepals different in size and shape; inner petals not saccate at the base, but clawed and forming mitriform, cohering about the reproductive organs
 9. Stamens 3, 6, 9 or 12; connective without a prolonged apex; staminodes present or absent **8. *Orophea***

9. Stamens numerous; connective with a truncate dilated apex;
staminodes absent

10. *Pseuduvaria*

1. *ALPHONSEA* Hook.f. & Thomson

Fl. Ind. 1: 152. 1855; Sincl., Gard. Bull. Singapore 14: 381. 1955; Heusden, Blumea, Suppl. 7: 130. 1992; Kessler in Fam. Gen. Vasc. Pl. 2: 122. 1993.

Trees or shrubs. **Flowers** bisexual, solitary or in fascicles, leaf-opposed or supra-axillary. **Sepals** 3, valvate. **Petals** 6, in 2 whorls, valvate, subequal or inner whorl slightly shorter than outer ones, saccate at the base, tips reflexed at anthesis. **Stamens** few to numerous; connective with a shortly prolonged apex. **Carpels** 1-15, free; ovules 10-19, lateral, biseriate. **Monocarps** globose to cylindrical, sessile or stipitate.

About 30 species in India, Sri Lanka and SE Asia (Kessler, 1993). About 8 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Alphonsea tonkinensis* A. DC.**

Bull. Herb. Boiss. Ser. 2(4): 1071. 1904 '*tonquinensis*'; Finet & Gagnep., Bull. Soc. Bot. France 53: 163. 1906.

Tree, 8-13 m high; young branchlets sparsely puberulous, glabrescent. **Leaves** oblong, lanceolate to narrowly elliptic, subcoriaceous, 13-18 cm long, 3-6 cm wide, glabrous on both surfaces, or sparsely puberulous on midrib below, glabrescent; base cuneate; apex acute to acuminate; midrib impressed above, raised and prominent below; primary veins 9-12 pairs, prominent on lower surfaces; petioles 3-6 mm long, sparsely puberulous. **Inflorescence** in leaf-opposed, 2-3-flowered fascicles or flower solitary; pedicels 3-6 mm long, puberulous. **Sepals** green, triangular, 1.5-2.5 mm long, puberulous, acute at apex. **Petals** creamy yellow, elliptic to ovate, 10-12 mm long, 5-7 mm wide, thick, obtuse at apex, inner whorl slightly shorter than outer ones. **Stamens** numerous; anthers glabrous, ca. 1.5 mm long. **Carpels** oblong, 2-3 mm long, pilose. **Monocarps** 1-2, cylindrical, 5-9 cm long, 3-5 cm wide, yellow, glabrous, stipitate. **Seeds** 12-14 (Fig. 89).

Thailand.— Northern: Nan.

Distribution.— Laos, Vietnam (type).

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: July-September; fruiting: February-July.

Voucher specimens.— *P. Srisanga* 555, 931, 935, 1512, 1911.

Notes.— Rare species.

2. *CYATHOSTEMMA* Griff.

Not. Pl. As. 4: 707. 1845; Sincl., Gard. Bull. Singapore 14: 219. 1955; Heusden, Blumea, Suppl. 7: 144. 1992; Kessler in Fam. Gen. Vasc. Pl. 2: 114. 1993; Utteridge, Blumea 45(2): 381. 2000.

Woody climbers. **Flowers** bisexual or rarely unisexual, in axillary fascicles or cauliflorous. **Sepals** 3, valvate, connate at base. **Petals** 6, in 2 whorls, valvate at base, imbricate at apex, subequal; inner petals shortly clawed. **Stamens** numerous; connective with an oblique incurved apex. **Carpels** numerous, free; ovules 4-8, lateral, biseriolate. **Monocarps** globose, oblong to ovoid, stipitate.

About 10 species in SE Asia. About 6 species in Thailand. One species recorded from Doi Phu Kha National Park.

Cyathostemma sp.

Woody climber; young branchlets puberulous, glabrescent. **Leaves** oblong-lanceolate, subcoriaceous, 15-20 cm long, 4.5-6 cm wide, sparsely pubescent on both surfaces, glabrescent; base broadly cuneate; apex acute to shortly acuminate; midrib impressed above, raised and prominent below; primary veins 13-16 pairs, prominent on lower surfaces; petioles 10-17 mm long, puberulous, sometimes glabrescent. **Flowers** not known. **Monocarps** 6-7, subglobose to ovoid, 1.5-2 cm in diam., pubescent, glabrescent, stipitate. **Seeds** 4-5, 10-15 mm long, flatten, glabrous, shiny.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, by streams, alt. 850 m (Doi Phu Kha).

Phenology.— Fruiting: March.

Voucher specimens.— *P. Srisanga* 1326.

Notes.— Due to lacking flower materials. The affinity is uncertain.

3. *DESMOS* Lour.

Fl. Cochinch.: 352. 1790; Sincl., Gard. Bull. Singapore 14: 261. 1955, as sect. *Eudesmos*; Heusden, Blumea, Suppl. 7: 69. 1992; Kessler in Fam. Gen. Vasc. Pl. 2: 114. 1993.

Woody climbers or scrambling shrub. **Flowers** bisexual, solitary or paired, leaf-opposed or supra-axillary. **Sepals** 3, valvate, connate at base. **Petals** 6, in 2 whorls, valvate, subequal. **Stamens** numerous; connective with a truncate dilated or subglobose apex. **Carpels** numerous, free; ovules 2-7, lateral, uniseriate. **Monocarps** moniliform, with 1-8 segments, shortly stipitate.

Between 25-30 species in India and SE Asia (Kessler, 1993). About 6 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves subglabrous to sparsely hairy and glaucous beneath **1. *D. chinensis***
 1. Leaves tomentose, not glaucous beneath **2. *D. dumosus***

1. *Desmos chinensis* Lour.

Fl. Cochinch.: 352. 1790; Craib in Fl. Siam. Enum. 1: 37. 1925; Sincl., Gard. Bull. Singapore 14: 266. 1955. – *Unona discolor* Vahl, Symb. Bot. 2: 63, t. 36. 1791; Hook.f. & Thomson in Fl. Br. Ind. 1: 59. 1872.

Scrambling shrubs; young branchlets pubescent, glabrescent, lenticellate. **Leaves** oblong-elliptic, chartaceous, 11-15 cm long, 4-5.5 cm wide, subglabrous to sparsely hairy and glaucous on lower surface, glabrous on upper surface; base rounded to truncate, sometimes emarginated; apex acute to shortly caudate; midrib impressed above, raised and prominent below; primary veins 8-12 pairs, prominent on lower surface; petioles 5-11 mm long, grooved, pubescent. **Flower** solitary, leaf-opposed, fragrant; pedicels 2-4 cm long, subglabrous to sparsely hairy. **Sepals** green, lanceolate-ovate, 5-10 mm long, subglabrous, acute at apex. **Petals** yellow to orange-yellow, narrowly lanceolate, 4-8 cm long, 0.5-2 cm wide, leathery, adpressed pubescent, spreading and curving inwards, acute at apex, clawed at base, inner whorl slightly smaller than outer ones. **Stamens** numerous; anthers oblong, ca. 1 mm long. **Carpels** oblong, ca. 2 mm long, pilose. **Monocarps** 8-13, moniliform, 2.5-4 cm long, 0.5-0.7 cm wide, stipitate, with 2-6 segments, black, pubescent; fruiting stalk 4-5 cm long.

Thailand.— Almost throughout the country.

Distribution.— India, China (type), SE Asia.

Ecology.— Dry evergreen forest, alt. 800-900 m (Doi Phu Kha, Tham Pha Khong).

Phenology.— Flowering: April-July; fruiting: September-January.

Uses.— Cultivated as ornamentals.

Vernacular.— สายหยุด Sai yut (General).

Voucher specimens.— *P. Srisanga* 2401.

2. *Desmos dumosus* (Roxb.) Saff.

Bull. Torrey Bot. Club 39: 506. 1912; Craib in Fl. Siam. Enum. 1: 39. 1925; Sincl., Gard. Bull. Singapore 14: 268. 1955. – *Unona dumosa* Roxb. in Fl. Ind. ed. Carey 2: 670. 1832; Hook.f. & Thomson in Fl. Br. Ind. 1: 59. 1872.

Scrambling shrubs; young branchlets pubescent, lenticellate. **Leaves** oblong-elliptic, chartaceous, 9-12 cm long, 3.5-4.5 cm wide, tomentose on lower surface, glabrous except tomentose along midrib on upper surface; base rounded to truncate; apex acuminate to caudate; midrib raised on both surfaces but more prominent below;

primary veins 8-11 pairs, prominent on lower surface; petioles 5-8 mm long, tomentose. **Flower** solitary, leaf-opposed, fragrant; pedicels 1.5-2.5 cm long, tomentose. **Sepals** green, lanceolate-ovate, 7-12 mm long, pubescent, acute at apex. **Petals** yellow, narrowly lanceolate, 4.5-7 cm long, 0.8-2 cm wide, leathery, adpressed pubescent, spreading and curving inwards, acute at apex, clawed at base, inner whorl smaller than outer ones. **Stamens** numerous; anthers oblong, ca. 1 mm long. **Carpels** oblong, ca. 2 mm long, pilose. **Monocarps** 8-13, moniliform, 1.5-4 cm long, 0.5-0.7 cm wide, stipitate, with 1-4 segments, black, pubescent; fruiting stalk 3-5 cm long.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— India (Assam-type), China (Yunnan), Vietnam, Malaysia, Singapore.

Ecology.— Lower montane forest, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering: April-July; fruiting: September-January.

Vernacular.— ตีนตั้ง Tin tang (Loei).

Voucher specimens.— *P. Srisanga* 1249.

4. *FISSISTIGMA* Griff.

Not. Pl. As. 4: 706. 1854; Sincl., Gard. Bull. Singapore 14: 349. 1955; Heusden, Blumea, Suppl. 7: 69. 1992; Kessler in Fam. Gen. Vasc. Pl. 2: 121. 1993.

Woody climbers. **Flowers** bisexual, in few-flowered fascicles, leaf-opposed. **Sepals** 3, valvate, connate at base. **Petals** 6, in 2 whorls, valvate, inner whorl slightly shorter than outer ones, triquetrous, concave at the base. **Stamens** numerous; connective with a tongue-shaped apex. **Carpels** numerous, free; ovules 2-20, lateral, biseriate. **Monocarps** stipitate.

About 60 species in E India and SE Asia to NE Australia (Kessler, 1993). About 10 species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|---------------------------------|
| 1. Leaves pubescent, not glaucous beneath | 1. <i>F. minuticalyx</i> |
| 2. Petals brown pubescent | 2. <i>F. sp. 1</i> |
| 2. Petals densely golden brown pubescent | 3. <i>F. sp. 2</i> |
| 1. Leaves glabrous, slightly glaucous beneath | |

1. *Fissistigma minuticalyx* (Mac Gregor & W.W. Sm.) Chatterjee

Kew Bull. 1948: 58. 1948. – *Melodorum minuticalyx* Mac Gregor & W.W. Sm., Rec. Bot. Surv. India 4: 274. 1911.

Woody climbers; young branchlets densely brown pubescent, lenticellate. **Leaves** oblong to oblong-elliptic, chartaceous, 4-20 cm long, 1.5-7 cm wide, densely brown pubescent on both surfaces, glabrescent on upper surface; base obtuse, rounded to broadly cuneate; apex obtuse to acute; midrib impressed above, raised and prominent below; primary veins 5-22 pairs, more or less parallel, prominent on lower surface; secondary veins parallel, distinct on lower surface; petioles 6-15 mm long, pubescent. **Flowers** in few-flowered fascicles, leaf-opposed; pedicels up to 2 cm long, pubescent. **Sepals** green, triangular-ovate, 3-4 mm long, pubescent, acute at apex. **Petals** creamy yellow, reddish at base inside, lanceolate, thick, pubescent, obtuse at apex; outer petals 13-17 mm long, 4-6 mm wide; inner petals 10-13 mm long, 3-4 mm wide. **Stamens** numerous; anthers oblong, ca. 1 mm long. **Carpels** oblong, ca. 2 mm long, pilose. **Monocarps** 10-20, subglobose, 1.8-2.5 cm in diam., densely brown pubescent; stipe 3.5-5.5 cm long, densely brown pubescent; fruiting stalk 1.5-2.5 cm long.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— Myanmar (type), S China (Yunnan).

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: November-January; fruiting: June-September.

Vernacular.— นมควาย Nom khwai (Chiang Rai).

Voucher specimens.— *P. Srisanga* 1888, 2382.

2. *Fissistigma* sp. 1

Woody climbers; young branchlets densely dark brown or blackish pubescent, lenticellate. **Leaves** oblong to oblong-elliptic, chartaceous, 4-9 cm long, 1.5-3 cm wide, brown pubescent on both surfaces, glabrescent on upper surface; base obtuse, rounded to broadly cuneate; apex acute; midrib impressed above, raised and prominent below; primary veins 8-14 pairs, more or less parallel, prominent on lower surface; secondary veins parallel, distinct on lower surface; petioles 6-11 mm long, pubescent. **Flowers** in 2-6-flowered fascicles, leaf-opposed; pedicels up to 8 mm long, densely brown pubescent. **Sepals** green, triangular-ovate, 4-5 mm long, pubescent, acute at apex. **Petals** brown, lanceolate, 10-12 mm long, 4-5 mm wide, thick, densely golden brown pubescent, inner whorl slightly smaller than outer ones. **Stamens** numerous; anthers oblong, ca. 1 mm long. **Carpels** oblong, 2-3 mm long, pilose. **Fruit** not known.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,700 m (Doi Phu Kha).

Phenology.— Flowering: February-March.

Voucher specimens.— *P. Srisanga* 468.

3. *Fissistigma* sp. 2

Woody climbers; young branchlets sparsely puberulous, glabrescent. **Leaves** oblong, oblong-elliptic to narrowly obovate, chartaceous, 7-19 cm long, 3-7.5 cm wide, glabrous on both surfaces, slightly glaucous beneath; base obtuse, rounded to broadly cuneate; apex obtuse and emarginate; midrib impressed above, raised and prominent below; primary veins 10-14 pairs, prominent on lower surface; petioles 4-10 mm long, glabrous or subglabrous. **Flowers** in few-flowered fascicles, leaf-opposed; pedicels up to 10 mm long, brown pubescent. **Sepals** yellowish orange, triangular-ovate, ca. 1 mm long, pubescent, acute at apex. **Petals** yellowish orange, reddish at base inside, lanceolate, 4-5 mm long, ca. 3 mm wide, thick, densely brown pubescent, inner whorl slightly smaller than outer ones. **Stamens** dark red, numerous. **Carpels** oblong, ca. 2 mm long, pilose. **Fruit** not known.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, alt. 850 m (Sapan Waterfall).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 1945.

5. *GONIOTHALAMUS* Hook.f. & Thomson

Fl. Ind. 1: 105. 1855; Sincl., Gard. Bull. Singapore 14: 423. 1955; Heusden, Blumea, Suppl. 7: 163. 1992; Kessler in Fam. Gen. Vasc. Pl. 2: 119. 1993.

Small trees or shrubs. **Flowers** bisexual, solitary or in few-flowered fascicles, axillary or cauliflorous. **Sepals** 3, valvate, free or connate. **Petals** 6, in 2 whorls, valvate, free, inner petals much shorter than outer ones, shortly clawed, cohering above the reproductive organs. **Stamens** numerous; connective with a truncate dilated or conical apex. **Carpels** numerous, free; ovules 1-6, basal or lateral, uniseriate. **Monocarps** globose to oblong, sessile or stipitate.

About 50-115 species in India and SE Asia to New Guinea (Kessler, 1993). About 23 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves 50-75 cm long, 16-22 cm wide, brown pubescent on both surfaces. Flowers strongly fragrant. Outer petals elliptic to ovate, 6-8 cm long, 3-4 cm wide. Monocarps (6-)10-15, oblong-cylindric, 4.5-10 cm long **1. *G. cheliensis***
1. Leaves 20-30 cm long, 4-8 cm wide, glabrous on both surfaces. Flowers not fragrant. Outer petals lanceolate, 4-5 cm long, 0.7-1.2 cm wide. Monocarps 4-10, ellipsoid to ovoid, 1-1.5 cm long **2. *G. griffithii***

1. *Goniothalamus cheliensis* Hu

Bull. Fan. Mem. Inst. Biol. 10: 122. 1940.

Small tree, 5-7 m high; terminal buds and young branchlets densely dark brown pubescent. **Leaves** oblanceolate, thin coriaceous, 50-75 cm long, 16-22 cm wide, brown pubescent on both surfaces, glabrescent above except along the midrib; base obtuse to broadly cuneate; apex acuminate-caudate; midrib slightly impressed above, raised and prominent below; primary veins 26-33 pairs; petioles 2-3 cm long, densely dark brown pubescent. **Inflorescence** cauliflorous, 2-4-flowered fascicles. **Flowers** strongly fragrant; pedicels 1-1.5 cm long, brown pubescent. **Sepals** green, broadly ovate, 2.5-3 cm long and wide, pubescent, thick, acuminate at apex. **Petals** green, thick, pubescent; outer petals elliptic to ovate, 6-8 cm long, 3-4 cm wide; inner petals ovate, 3-3.5 cm long, 2-2.5 cm wide. **Monocarps** (6-)10-15, oblong-cylindric, apiculate at apex, 4.5-10 cm long, including stipe, 1.5-2 cm wide, brown pubescent. **Seeds** 1-6, oblong-cylindric, 2-3 cm long, 1-1.5 cm wide, brown, glabrous; fruiting stalk 1-2 cm long, brown pubescent (Fig. 91).

Thailand.— Northern: Nan.

Distribution.— S China (Yunnan).

Ecology.— Lower montane forest, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering: March-May; fruiting: September-January.

Voucher specimens.— *P. Srisanga* 1139, 2346.

Notes.— Rare species.

2. *Goniothalamus griffithii* Hook.f. & Thomson

Fl. Ind. 1: 110. 1855; in Fl. Br. Ind. 1: 73. 1872; Craib in Fl. Siam. Enum. 1: 50. 1925.

Shrub or small tree, 2-5 m high; young branchlets glabrous or nearly so. **Leaves** oblong to lanceolate, coriaceous, 20-30 cm long, 4-8 cm wide, glabrous on both surfaces; base cuneate; apex acute to acuminate; midrib impressed above, raised and prominent below; primary veins 15-20 pairs; petioles 7-10 mm long, grooved, glabrous. **Flowers** in axillary or cauliflorous, solitary or in 2-flowered fascicles, not fragrant; pedicels 8-12 mm long, puberulous. **Sepals** green, ovate, 1.3-2.2 cm long, 1-1.4 cm wide, shortly puberulous along margin, thick, obtuse at apex. **Petals** green or yellowish green, thick; outer petals lanceolate, 4-5 cm long, 0.7-1.2 cm wide, shortly puberulous along margin; inner petals lanceolate, 2-2.5 cm long, 0.3-0.4 cm wide, sparsely puberulous. **Monocarps** 4-10, ellipsoid to ovoid, 1-1.5 cm long. **Seed** 1; fruiting stalk 1-1.5 cm long.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Myanmar (type).

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha, Sapan Waterfall, Tham Phan Kong).

Phenology.— Flowering: May-July; fruiting: September-November.

Vernacular.— สะบันงาป่า Saban nga pa (Northern).

Voucher specimens.— *P. Srisanga* 1452, 1958, 2548.

6. *MILIUSA* Leschen. ex A. DC.

Mém. Soc. Phys. Hist. Nat. Genève 5: 213. 1832; Sincl., Gard. Bull. Singapore 14: 377. 1955; Heusden, Blumea, Suppl. 7: 106. 1992; Kessler in Fam. Gen. Vasc. Pl. 2: 122. 1993. – *Saccopetalum* Benn., Pl. Rar. Jav. 2: 165. 1840.

Small trees or shrubs. **Flowers** bisexual, sometimes unisexual, solitary or in few-flowered fascicles, axillary. **Sepals** 3, valvate, free or connate. **Petals** 6, in 2 whorls, valvate; outer petals and sepals similar in size and shape; inner petals much longer than outer ones, free or connate, saccate at the base. **Stamens** few to numerous; connective without a prolonged apex. **Carpels** numerous, free; ovules 1-10, lateral, uniseriate. **Monocarps** globose to oblong, stipitate.

About 40 species in India and SE Asia to Australia (Kessler, 1993). About 11 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|------------------------------|
| 1. Flowers bisexual. Leaves (3-)9-14 cm long, (1.5-)3-4.5 cm wide | 1. <i>M. cuneata</i> |
| 1. Flowers unisexual. Leaves (13-)17-25 cm long, 6-9 cm wide | 2. <i>M. thorelii</i> |

1. *Miliusa cuneata* Craib

Kew Bull. 1912: 145. 1912; in Fl. Siam. Enum 1: 58. 1925.

Shrub, up to 3 m high; young branchlets densely puberulous. **Leaves** oblong-lanceolate to elliptic, (3-)9-14 cm long, (1.5-)3-4.5 cm wide, puberulous along midrib on both surfaces, glabrescent; base cuneate; apex acute to acuminate; midrib impressed above, raised and prominent below; primary veins 9-13 pairs; petioles 1-5 mm long, puberulous. **Inflorescence** in axillary, 1-3-flowered fascicles. **Flowers** bisexual, green, not fragrant; pedicels 1-2 cm long, pubescent. **Sepals** and **outer petals** linear, 2-4 mm long, pubescent. **Inner petals** elliptic, 1.2-1.7 cm long, 0.3-0.5 cm wide, sparsely hairy, connate one third to about half way from the base. **Monocarps** 8-15, globose, 8-10 mm in diam., black. **Seed** 1; stipe 5-10 mm long; fruiting stalk 2-3.5 cm long (Fig. 90).

Thailand.— Northern: Chiang Mai (type), Nan.

Distribution.— S China (Yunnan).

Ecology.— Dry evergreen and lower montane forest, sometimes by streams, alt. 800-1,700 m (Doi Phu Kha, Tham Pha Khaw).

Phenology.— Flowering: February-April; fruiting: June-November.

Voucher specimens.— *P. Srisanga* 497, 1322, 1629, 1927, 2225; *P. Srisanga* & *C. Puff* 1083; *P. Srisanga* & *S. Watthana* 664; *P. Srisanga et al.* 777.

Notes.— Rare species.

2. *Milium thorelii* Finet & Gagnep.

Bull. Soc. Bot. France 54: 89. 1907; Craib in Fl. Siam. Enum 1: 59. 1931.

Shrub or small tree, 2-4 m high; young branchlets glabrous or nearly so. **Leaves** elliptic, (13-)17-25 cm long, 6-9 cm wide, glabrous on both surfaces or sparsely puberulous beneath; base obtuse to broadly cuneate; apex acute to acuminate; midrib flattened or slightly impressed above, raised and prominent below; primary veins 9-13 pairs; petioles 5-8 mm long, puberulous. **Inflorescence** in axillary or cauliflorous, 3-9-flowered fascicles. **Flowers** unisexual, green or creamy yellow, not fragrant; pedicels 5-7 cm long, pubescent. **Sepals** and **outer petals** linear, 2-4 mm long. **Inner petals** elliptic, 1.2-1.7 cm long, 0.7-1 cm wide, connate one third to about half way from the base. **Monocarps** 10-15, globose, 8-10 mm in diam., black. **Seed** 1; stipe 13-16 mm long; fruiting stalk 13-16 mm long.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Lampang, Nan.

Distribution.— Laos (type).

Ecology.— Dry evergreen forest, sometimes by streams, alt. 700-800 m (Doi Phu Kha, Tham Pha Kong).

Phenology.— Flowering: March-April; fruiting: June-August.

Vernacular.— กากฟ้าง Ka fae paa (Nan)

Voucher specimens.— *P. Srisanga* 2526; *P. Srisanga* & *C. Maknoi* 2062.

7. *MITREPHORA* (Bl.) Hook.f. & Thomson

Fl. Ind. 1: 112. 1855; Sincl., Gard. Bull. Singapore 14: 463. 1955; Heusden, Blumea, Suppl. 7: 109. 1992; Kessler in Fam. Gen. Vasc. Pl. 2: 119. 1993. — *Uvaria* sect. *Mitrephorae* Bl., Fl. Jav.: 13. 1830.

Trees or shrubs. **Flowers** bisexual, solitary or in few-flowered fascicles, leaf-opposed. **Sepals** 3, valvate, free or connate. **Petals** 6, in 2 whorls, valvate, free; outer petals longer than inner ones; inner petals clawed, mitriform, first cohering about the reproductive organs, later spreading. **Stamens** numerous; connective with a truncate dilated apex. **Carpels** few to numerous, free; ovules 2-several, lateral, biseriate. **Monocarps** ovoid to globose, stipitate.

About 40 species in India and SE Asia (Kessler, 1993). About 8 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Mitrephora* sp.**

Tree, ca. 15 m high; young branchlets densely pubescent. **Leaves** oblong-elliptic, 15-20 cm long, 4.5-8 cm wide, subglabrous except puberulous along midrib and nerves above; base cuneate; apex acute; midrib flattened or slightly impressed above, raised and prominent below; primary veins 7-10 pairs; petioles 5-8 mm long, puberulous. **Flowers** not known. **Monocarps** ca. 8, subglobose, 1.5-2 cm in diam., brown, densely puberulous. **Seeds** 4-6, 13-15 mm long, 6-7 mm wide; stipe 6-10 mm long, densely puberulous; fruiting stalk ca. 2.5 cm long, sparsely pubescent.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, alt. 700 m (Tham Pha Kong).

Phenology.— Fruiting: June-July.

Voucher specimens.— *P. Srisanga* 2513.

Notes.— Possibly conspecific with *M. teysmannii* Scheff. Due to lacking flower materials. The affinity is uncertain.

8. OROPHEA Bl.

Bijdr.: 18. 1825; Sincl., Gard. Bull. Singapore 14: 390. 1955; Kessler, Blumea 33(1): 31. 1988 (revision); Heusden, Blumea, Suppl. 7: 111. 1992; Kessler in Fam. Gen. Vasc. Pl. 2: 122. 1993.

Small trees. **Flowers** bisexual, in few-many-flowered fascicles, axillary or supra-axillary. **Sepals** 3, valvate, free or connate. **Petals** 6, in 2 whorls, valvate, free; inner petals longer than outer ones, clawed, mitriform, cohering about the reproductive organs. **Stamens** 3, 6, 9 or 12; connective without a prolonged apex; staminodes present or absent. **Carpels** 3, 6, 9 or 12, free; ovules 1-several, lateral, biseriate. **Monocarps** globose (subgenus *Sphaerocarpon*) or cylindrical (subgenus *Orophea*), then weakly constricted between the seeds, shortly stipitate or sessile.

About 41 species in India, Sri Lanka, China and SE Asia (Kessler, 1993). About 7 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Orophea polycarpa* A. DC.**

Mém. Anon.: 39. 1832; Craib in Fl. Siam. Enum 1: 60. 1925; Sincl., Gard. Bull. Singapore 14: 395. 1955; Kessler, Blumea 33(1): 58. 1988 (see also for complete synonymy).

Small tree, 7-10 m high; young branchlets pubescent. **Leaves** lanceolate, 7-11 cm long, 2-3 cm wide, glabrous or subglabrous on both surfaces; base cuneate; apex acute to bluntly acuminate; midrib impressed above, raised and prominent below; primary veins 7-9 pairs; petioles 1-3 mm long, puberulous. **Inflorescence** in axillary, 1-2-flowered fascicles. **Flowers** greenish white, not fragrant; pedicels 8-12 mm long, sparsely hairy. **Sepals** broadly ovate, ca. 1 mm long and wide, pubescent, acute at apex. **Outer petals** orbicular, ca. 3 mm long and wide, pubescent; inner petals deltoid

and with distinctly clawed, 5-6 mm long, ca. 4 mm wide, pubescent. **Stamens** 6. **Carpels** 12, oblong, glabrous. **Monocarps** 1-5, globose, 8-10 mm in diam., black, glabrous, stipitate. **Seed** 1.

Thailand.— Northern: Chiang Mai, Phrae, Nan, Uttaradit, Kamphaeng Phet; North-eastern: Phetchabun, Nong Khai; South-eastern: Chon Buri; Central: Saraburi; South-western: Prachuap Khiri Khan.

Distribution.— Sri Lanka, Andaman Islands, Myanmar (type), China (Hainan), Laos, Cambodia, Vietnam, Malaysia, Lesser Sunda Islands (Flores, Sumba).

Ecology.— Deciduous and dry evergreen forest, alt. 700-800 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: June-August.

Vernacular.— เถลืออง Lueang (Northern).

Voucher specimens.— *P. Srisanga* 558.

9. *POLYALTHIA* Bl.

Fl. Javae: 68. 1830; Sincl., Gard. Bull. Singapore 14: 279. 1955; Heusden, Blumea, Suppl. 7: 125. 1992; Kessler in Fam. Gen. Vasc. Pl. 2: 114. 1993.

Trees or shrubs. **Flowers** bisexual, solitary or in fascicles, axillary, supra-axillary or leaf-opposed. **Sepals** 3, valvate, free or connate at base. **Petals** 6, in 2 whorls, valvate, free, subequal. **Stamens** numerous; connective with a truncate dilated apex. **Carpels** several, free; ovules 1 and basal or 2 and lateral. **Monocarps** globose to ovoid, stipitate.

About 100 species in India and SE Asia to Australia (Kessler, 1993). About 30 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves elliptic to ovate, 16-23 cm long, 9-10 cm wide

1. *P. viridis*

1. Leaves oblong-lanceolate, 10-23 cm long, 2.5-5 cm wide

2. *P. sp.*

1. *Polyalthia viridis* Craib

Kew Bull. 1914: 1. 1914; Kew Bull. 1922: 226. 1922; in Fl. Siam. Enum. 1: 45. 1925.

Tree, 13-15 m high; young branchlets puberulous. **Leaves** elliptic to ovate, chartaceous to subcoriaceous, 16-23 cm long, 9-10 cm wide, glabrous on both surfaces, except sparsely puberulous on midrib and veins; base obtuse to rounded; apex obtuse to shortly acute; midrib impressed above, raised and prominent below; primary veins 16-20 pairs, prominent on lower surfaces; petioles 6-10 mm long, puberulous. **Inflorescence** 3-6-flowered fascicles, on branches; pedicels 1.5-4 cm long, puberulous. **Sepals** green, suborbicular, 3-4 mm long and wide, puberulous,

rounded at apex. **Petals** green, oblong-lanceolate, 16-25 mm long, 3-4.5 mm wide, thick, obtuse at apex, inner whorl slightly shorter than outer ones. **Stamens** numerous; anthers ca. 1 mm long, glabrous. **Carpels** oblong, 1-1.5 mm long, pubescent. **Monocarps** 25-35, ellipsoid, 2.5-3 cm long, 1.5-2 cm wide, orange-red. **Seed** 1; stipe 3-4.5 cm long; fruiting stalk 2.5-4 cm long.

Thailand.— Northern: Mae Hong Son, Chiang Mai (type), Chiang Rai, Nan.

Distribution.— S China (Yunnan).

Ecology.— Dry evergreen forest, alt. 700-800 m (Doi Phu Kha).

Phenology.— Flowering: June-July; fruiting: October-December.

Vernacular.— ยางโตน Yang on (Northern).

Voucher specimens.— *P. Srisanga* 2593.

2. *Polyalthia* sp.

Tree, ca. 25 m high; young branchlets densely puberulous. **Leaves** oblong-lanceolate, chartaceous, 10-23 cm long, 2.5-5 cm wide, glabrous on both surfaces, except sparsely puberulous on midrib and veins; base obtuse to rounded; apex acuminate; midrib impressed above, raised and prominent below; primary veins 13-15 pairs, prominent on lower surfaces; petioles 5-8 mm long, puberulous. **Flowers** not known. **Monocarps** 13-50, ellipsoid, 2.5-3 cm long, 1.3-1.8 cm wide, orange-red. **Seed** 1; stipe 3-4.5 cm long; fruiting stalk 2.5-4.5 cm long.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, alt. 900-1,000 m (Doi Phu Kha, Nan Watershed).

Phenology.— Fruiting: October-December.

Voucher specimens.— *P. Srisanga* 299.

Notes.— Due to lacking flower materials. The affinity is uncertain.

10. *PSEUDUVARIA* Miq.

Fl. Ind. Bat. 1(2): 32. 1858; Sincl., Gard. Bull. Singapore 14: 401. 1955; Heusden, Blumea, Suppl. 7: 113. 1992; Kessler in Fam. Gen. Vasc. Pl. 2: 119. 1993.

Trees or shrubs. **Flowers** unisexual or bisexual, in few-flowered fascicles, axillary. **Sepals** 3, valvate, free. **Petals** 6, in 2 whorls, valvate, free; inner petals much longer than outer ones, clawed, mitriform, cohering about the reproductive organs. **Stamens** numerous; connective with a truncate dilated apex; staminodes absent. **Carpels** several, free; ovules 2-5, lateral, uni- or biseriate. **Monocarps** globose or ellipsoid, stipitate or sessile.

About 35 species in India, SE Asia to Australia (Kessler, 1993). About 6 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Pseuduvaria rugosa* (Bl.) Merr.**

Philipp. J. Sci. 10: 255. 1915; Sincl., Gard. Bull. Singapore 14: 412. 1955. – *Uvaria rugosa* Bl., Bijdr.: 12. 1825.

Tree, 10-20 m high; young branchlets pubescent. **Leaves** oblong-lanceolate, 7-15 cm long, 3-4.5 cm wide, glabrous or subglabrous on both surfaces, except pubescent along midrib and veins; base cuneate; apex acute to bluntly acuminate; midrib slightly impressed above, raised and prominent below; primary veins 8-12 pairs; petioles 3-5 mm long, pubescent. **Inflorescence** 3-8-flowered fascicles, on branches. **Flowers** unisexual, yellowish green, not fragrant; pedicels 1.5-2 cm long, puberulous. **Sepals** triangular-ovate, 1-2 mm long and wide, densely puberulous. **Outer petals** ovate, 1.5-2.5 mm long and wide, puberulous; inner petals deltoid and with distinctly clawed, 6-8 mm long, 3-4 mm wide, puberulous. **Stamens** numerous. **Carpels** 6-13, oblong, 1.5-2 mm long, densely puberulous; staminodes 4-6. **Monocarps** 2-7, globose, 1-2 cm in diam., brown, rugose; stipe 6-10 mm long; fruiting stalk 6-10 mm long.

Thailand.— Northern: Lampang, Nan; South-eastern: Chanthaburi; South-western: Prachuap Khiri Khan; Peninsular: throughout.

Distribution.— Myanmar, Malaysia, Indonesia (Java-type).

Ecology.— Deciduous and dry evergreen forest, alt. 700-800 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: June-August.

Voucher specimens.— *P. Srisanga* 561.

APIACEAE (UMBELLIFERAE)

Annual or perennial herbs, rarely shrubs or trees. **Leaves** alternate, simple, ternately or pinnately compound; stipules present or absent. **Inflorescence** of simple or compound umbels. Bracts and bracteoles present or absent. **Flowers** mostly bisexual, 5-merous, small. **Sepals** present or absent, minute. **Petals** white, yellow or purple. **Stamens** alternate with the petals; anthers dehiscent by longitudinal slits. **Ovary** inferior, 2-locular; ovule 1 in each loculus. **Fruit** a schizocarp of 2 dorsally or laterally compressed or hemispherical mericarps, separated by a narrow or broad commissure; mericarps with 5 primary ridges, sometimes conspicuous or winged.

A cosmopolitan family, particularly in N temperate region, with more than 400 genera and 3,500 species. A family contains many important foods, herbs, spices, flavorings, medicines, perfumes and ornamentals. About 16 genera and 23 species, native or introduced in Thailand (Hedge & Lamond, 1992; Suksathan, 2001b). Three genera and 5 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|--|------------------------------|
| 1. Leaves simple | |
| 2. Erect herbs | 1. <i>Bupleurum</i> |
| 2. Prostrate or creeping herbs, often rooting at the nodes | 2. <i>Hydrocotyle</i> |
| 1. Leaves ternately or pinnately compound | 3. <i>Peucedanum</i> |

1. *BUPLEURUM* L.

Sp. Pl. 1: 236. 1753; Hiroe, Umbell. Asia 1: 75. 1958; Hedge & Lamond in Fl. Thailand 5(4): 451. 1992.

Annual or perennial erect herbs, all parts glabrous. **Leaves** simple, entire, often perfoliate or amplexicaul. **Umbels** compound. Bracts present or absent. Bracteoles present. Umbellules few to many-flowered. **Sepals** absent. **Petals** yellow or yellowish-white, with an inflexed apical lobe adnate to limb of petal. **Fruit** ellipsoid to ovoid, terete, with 5 prominent ridges, winged or not.

About 100 species, mainly in Europe; only 1 species in Thailand (Hedge & Lamond, 1992).

Bupleurum tenue Buch.-Ham. ex D. Don

Prodr. Fl. Nepal.: 182. 1825 non *B. tenue* Salisb. (1796) nom. illeg.; Craib in Fl. Siam. Enum. 1: 788. 1931; Hiroe, Umbell. Asia 1: 89. 1958; Hedge & Lamond in Fl. Thailand 5(4): 451, fig. 98: 9. 1992.

Herb, 30-50 cm high, much branched. **Leaves** oblong to oblanceolate, 2.5-6 cm long, 0.5-1 cm wide; base cuneate; apex acute, mucronulate, subsessile. **Umbels** numerous, mostly lateral; peduncles up to 4 cm long; rays 3-5, subequal or unequal, filiform. Bracts and bracteoles ovate to lanceolate, thin, herbaceous, prominently veined, cuspidate, 1-2 mm long. **Petals** yellow, 0.5-1 mm long; pedicels 0.5-1 mm long. **Fruit** oblong, 2-4 mm long, 1-2 mm wide, smooth with filiform ribs (Fig. 92).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal (type), Sikkim Bhutan, Pakistan, Myanmar, SW China, Vietnam.

Ecology.— Lower montane scrub, open ground among limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: October-December.

Voucher specimens.— *P. Srisanga* 1808.

Notes.— Rare species.

2. *HYDROCOTYLE* L.

Sp. Pl. 1: 234. 1753; Hiroe, Umbell. Asia 1: 8. 1958; Hedge & Lamond in Fl. Thailand 5(4): 443. 1992.

Annual or perennial, prostrate or creeping herbs, often rooting at the nodes, glabrous or sparsely pilose. **Leaves** simple, cordate or hastate, variously lobed, crenate to serrulate, petiolate; small scarious stipules usually present. **Umbels** leaf-opposed, simple or few, often globose. Bracts and bracteoles present. **Sepals** minute or obsolete. **Petals** white or greenish, inconspicuous. **Fruit** laterally compressed with usually narrow commissures at right angles to the width of the fruit, ovoid to oblate, 5-ribbed.

About 100 species, mainly in the tropical and warm temperate regions of S Hemisphere. Four species in Thailand (Hedge & Lamond, 1992). Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves broadly triangular ovate with 5-lobed. Pedicels 5-8 mm long **2. *H. siamica***
 1. Leaves broadly ovate to suborbicular. Pedicels less than 5 mm long
 2. Delicate plants with filiform stems. Leaves 0.5-2 cm wide **3. *H. sibthorpioides***
 2. Robust plants. Leaves 3-9 cm wide **1. *H. javanica***

1. *Hydrocotyle javanica* J. P. Pontén ex Thunb.

Dissert. Hydrocot. p.p. 3 (no. 17), fig 6, 8-9. 1798; Craib in Fl. Siam. Enum. 1: 786. 1931; Hiroe, Umbell. Asia 1: 8. 1958; Dansk Bot. Ark. 20: 193. 1963; Acta Phytotax. Geobot. 22: 141. 1967; Hedge & Lamond in Fl. Thailand 5(4): 444, fig. 97: 3. 1992.

Prostrate herb, fleshy, with ascending or scrambling branches, 15-40 cm high, glabrous to densely tomentose. **Leaves** broadly ovate, usually broader than long, 3-9 cm long and wide, with 5-8 crenate or serrate lobes, glabrous or hairy mainly on the veins on both surfaces; stipules prominent; petiole up to 17 cm long, hairy. **Umbels** 15-many-flowered; peduncles 2-7 cm long; pedicels up to 2 mm long or absent. **Petals** greenish-yellow, lanceolate, ca. 1 mm long. **Fruit** suborbicular to oblate, 1-1.5 mm long, 1.5-2 mm wide, dark green to reddish-brown, glabrous.

Thailand.— Throughout the country.

Distribution.— Widespread in tropical Asia, Australia.

Ecology.— Lower montane forest, moist areas, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: September-December.

Vernacular.— ผักหนอกช้าง Phak nok chang, ผักหนอกคอก Phak nok doi (Northern).

Voucher specimens.— *P. Srisanga* 1217; *W. Nanakorn et al.* 4262.

2. *Hydrocotyle siamica* Craib

Kew Bull. 1911: 58. 1911; Craib in Fl. Siam. Enum. 1: 787. 1931; Hiroe, Dansk Bot. Ark. 20: 193. 1963; Acta Phytotax. Geobot. 22: 141. 1967; Konta, Acta Phytotax. Geobot. 35: 38. 1984; Hedge & Lamond in Fl. Thailand 5(4): 445, fig. 97: 5. 1992. – *H. javanica* Thunb. var. *siamica* (Craib) Hosseus, Beih. Bot. Centralbl. 28(2): 420. 1911. – *H. siamensis* H. Wolff, Feddes Rep. Sp. Nov. 17: 155. 1921.

Prostrate herb, fleshy, with ascending or scrambling branches, 30-60 cm high, angular, glabrous to tomentose. **Leaves** broadly triangular-ovate, 5-lobed, with a prominent basal sinus, 3.5-10 cm long, 5-11 cm wide, crenulate or serrulate, almost glabrous or with scattered hairs on both surfaces; petiole 5-20 cm long, glabrous to densely tomentose. **Umbels** in globose head, simple, 15-20 mm in diam., up to 50-flowered; peduncle 7-17 cm long; pedicels 5-8 mm long. **Petals** yellowish-green, oblong, ca. 1 mm long. **Fruit** suborbicular to reniform, 1-2 mm long, 2-3 mm wide, with prominent indumentum of setulose-like hairs; ribs distinct, raised.

Thailand.— Northern: Chiang Mai (type of *H. siamica* Craib: *Kerr* 670, *Hosseus* 192 and *H. siamensis* H. Wolff: *Hosseus* 192), Chiang Rai, Nan.

Distribution.— Myanmar, SW China.

Ecology.— Lower montane forest, alt. 1,400-1,600 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: September-November.

Vernacular.— ผักหนอก Phak nok (Northern).

Voucher specimens.— *P. Srisanga* 1649.

3. *Hydrocotyle sibthorpioides* Lam.

Enc. 3: 153. 1789; Craib in Fl. Siam. Enum. 1: 787. 1931; Hiroe, Umbell. Asia 1: 10. 1958; Hedge & Lamond in Fl. Thailand 5(4): 446, fig. 97: 1. 1992.

Prostrate herb, fleshy; stems slender to filiform, 7-30 cm high, glabrous or with few pilose hairs. Stipules membranous, entire or fringed. **Leaves** broadly ovate to suborbicular, 0.5-2 cm long and wide, with 3-5 crenate lobes, glabrous or pilose; petiole 1.5-6 cm long. **Umbels** 3-10-flowered, condensed; peduncles 0.5-3 cm long, filiform; pedicels very short or obsolete. **Petals** greenish-white, up to 1 mm long. **Fruit** suborbicular or oblate, ca. 1 mm long and wide, brownish, glabrous or short pilose; ribs distinct, raised.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Phrae, Nan, Tak; Eastern: Ubon Ratchathani; Central: Bangkok.

Distribution.— Tropical Africa (type), tropical Asia, Australia.

Ecology.— Lower montane scrub, crevices of limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: September-December.

Vernacular.— หูช้ำกเล็ก็ดหอย Ya klet hoi (Central).

Voucher specimens.— *P. Srisanga* 415, 1844, 2120.

3. PEUCEDANUM L.

Sp. Pl. 1: 245. 1753; Hiroe, Umbell. Asia 1: 173. 1958; Hedge & Lamond in Fl. Thailand 5(4): 464. 1992.

Perennial herbs. **Leaves** ternately or pinnately compound. **Umbels** compound. Bracts and bracteoles present or absent. **Sepals** present or absent. **Petals** white, yellow, emarginate at apex. **Fruit** ellipsoid or oblong, strongly compressed dorsally, glabrous or pilose; dorsal ridges prominent, but not winged; lateral ridges clearly winged.

About 100-120 species mainly in temperate region. Three species in Thailand (Hedge & Lamond, 1992). One species recorded from Doi Phu Kha National Park.

Peucedanum siamicum Craib

Kew Bull. 1930: 419. 1930; in Fl. Siam. Enum. 1: 791. 1931; Hiroe, Dansk Bot. Ark. 20: 195. 1962; Hiroe, Acta Phytotax. Geobot. 22: 144. 1967; Hedge & Lamond in Fl. Thailand 5(4): 467, fig. 100. 1992. – *P. siamicum* Craib var. *payapicum* Hiroe, Acta Phytotax. Geobot. 22: 144, fig. 1. 1967.

Perennial herb; stems erect, branched, 40-60 cm high, terete, sulcate, glabrous or with scattered retrorse eglandular papillae. **Basal and lower cauline leaves** ternate or pinnate; leaflets broad ovate, rhomboid, (1.5-)3-5 cm long and wide; base truncate, broadly cordate; apex acute; margin serrate, hairy especially on lower surface; petioles 7-15 cm long. Upper cauline leaves with shorter petiole. **Umbels** lateral and terminal; rays 8-14, 2-3 cm long. Bracts and bracteoles present, lanceolate, 3-6 mm long. **Sepals** absent. **Petals** white, ca. 1 mm long and wide. **Fruit** strongly compressed, 5-7 mm long, 3-4 mm wide, glabrous or with scattered papillae; ridges distinct, raised.

Thailand.— Northern: Chiang Mai (type: *Put* 359: K), Nan.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane scrub, open ground, crevices of limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: September-November.

Vernacular.— ฟักฉี่เป่า Phak i-pau (Northern).

Voucher specimens.— *P. Srisanga* 1855, 2143.

Notes.— Rare species.

APOCYNACEAE

Trees, shrubs or woody climbers, rarely herbs, latex present. **Leaves** simple, opposite, verticillate or spirally arranged. **Inflorescence** terminal or axillary, cymose, rarely fasciculate or flower solitary. **Flowers** bisexual, (4-)5-merous, actinomorphic

or very rarely slightly zygomorphic. **Sepals** often with colleters inside. **Corolla** sympetalous, salverform, infundibuliform, urceolate or rotate; lobes overlapping to the left or right, more rarely valvate. **Stamens** inserted on the inside of the corolla tube, completely included or exserted; anthers sagittate or ovate, free or adnate to the pistil head, sometimes with the base and apex sterile. Disk present or absent. **Ovary** superior or rarely half-inferior, of 2 separate carpels united into a common style, a single bilocular ovary or a unilocular ovary; pistil head with a stigmatic base and a 2-cleft apex. **Fruit** a drupe, berry, capsule or follicle. **Seeds** often arillate, winged, with a ciliate margin or with an apical and/or basal coma.

About 155 genera and 1,700 species mainly in tropical and subtropical regions. Forty-two genera (6 introduced) and 126 species (10 introduced) in Thailand (Middleton, 1999; 2002). — A family contains many important medicines and ornamentals. Nine genera and 10 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Climbers or scramblers
 2. Corolla lobes overlapping to the left in bud
 3. Secondary leaf veins ascending, usually with domatia in axils. **7. *Parameria***
 3. Secondary leaf veins more or less straight, without domatia in axils.
 - Stamens adnate to the pistil
 4. Ovary of 2 separate carpels united into a common style **1. *Alyxia***
 4. Ovary syncarpous
 5. Corona absent; disk present; ovary 1-celled **3. *Bousigonia***
 5. Corona present; disk absent; ovary 2-celled **6. *Melodinus***
 2. Corolla lobes overlapping to the right in bud
 6. Corolla infundibuliform. Pericarp very thick, corky and warty **2. *Amalocalyx***
 6. Corolla salverform. Pericarp not thick and warty **4. *Chonemorpha***
1. Trees or shrubs
 7. Corolla lobes overlapping to the left in bud. Fruit a drupe or paired follicle
 8. Leaves in whorls of 3-5, rarely opposite. Disk present. Fruit a drupe **8. *Rauvolfia***
 8. Leaves always opposite. Disk absent. Fruit a paired follicle **9. *Tabernaemontana***
 7. Corolla lobes overlapping to the right in bud. Fruit a drupe **5. *Kopsia***

1. *ALYXIA* R. Br.

Prodr.: 470. 1810 nom. cons.; Middleton in Fl. Thailand 7(1): 55. 1999. — *Gynopogon* Forst., Char. Gen.: 35. 1776.

Climbers; branchlets often strongly angled when young. **Leaves** verticillate or more rarely opposite, often with an intramarginal nerve; usually with few glands in the axils. **Inflorescence** axillary or terminal cymes, sometimes forming panicles. **Sepals** without colleters inside. **Corolla** lobes overlapping to the left in bud; mature corolla

salverform. **Stamens** free from the pistil head, inserted in top half of corolla tube, completely included in tube; filaments thin and short; anthers ovate, base cordate, fertile entire length. Disk absent. **Ovary** of 2 separate carpels united into a common style, pubescent all over or only at base; style filiform. **Fruit** a drupe, usually moniliform with one or more subglobose articles, frequently reduced to one in mature fruit, stipitate, one-seeded per article. **Seeds** ovoid; with a horny and deeply ruminate endosperm.

About 70-90 species in E Asia, Australia and the Pacific regions. Four species in Thailand (Middleton, 1999). Only 1 species recorded from Doi Phu Kha National Park.

Alyxia siamensis Craib

Kew Bull. 1911: 412. 1911; Kerr in Fl. Siam. Enum. 2: 433. 1939; Middleton in Fl. Thailand 7(1): 58, fig. 19. 1999. – *A. balansae* Pitard in Fl. Gén. I.-C. 3: 1120. 1933. – *Alyxia* sp.: Kerr in Fl. Siam. Enum. 2: 434. 1939.

Woody climber; branchlets puberulent or glabrous when young, glabrous and lenticellate when old. **Leaves** opposite or in whorls of 3, elliptic, oblong or obovate, coriaceous, 5-18 cm long, 2-6 cm wide, glabrous; base cuneate to obtuse; apex acuminate to caudate; primary veins 20-50 pairs; petioles 0.5-1.2 cm long. **Inflorescence** 2.5-7 cm long, axillary and terminal forming a panicle, densely puberulent; pedicels 1-2 mm long. **Sepals** ovate, 1-2 mm long, apex acuminate to acute, puberulent. **Corolla** white or creamy yellow; tube 4-6 mm long; lobes 1.5-2.5 mm long, elliptic, obtuse or rounded at apex, few hairs on top of tube or base of lobes outside, pubescent inside on top half of tube. **Stamens** inserted at 3-4 mm from corolla base; filaments ca. 0.5 mm long; anthers ca. 1 mm long. **Ovary** 0.5-1 mm long, pubescent; style and pistil head 2.5-4 mm long. **Fruit** 1.3-3 cm long, 1-1.5 cm wide, glabrous.

Thailand.— Northern: Chiang Mai (type: *Kerr* 783: K), Nan, Tak; North-eastern: Nong Khai; Eastern: Chaiyaphum; South-eastern: Trat.

Distribution.— China, Laos.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: July-August; fruiting: September-January.

Voucher specimens.— *P. Srisanga* 951.

Vernacular.— เครื่องเขินหมาก Kruea khao muak (Chiang Mai).

Notes.— New locality recorded from Nan, in Thailand.

2. AMALOCALYX Pierre ex Spire

Contr. Apocyn.: 93. 1905; Middleton in Fl. Thailand 7(1): 125. 1999.

Climbers. **Leaves** opposite; glands present in axils. **Inflorescence** axillary and terminal. **Sepals** with colleters inside. **Corolla** lobes overlapping to the right in

bud; tube infundibuliform; lobes short. **Stamens** inserted slightly below middle of corolla tube, subsessile; anthers narrowly triangular, sagittate at base, with sterile area, adnate to the pistil head. Disk annular, higher than the ovary. **Ovary** of two separate carpels united into a common style; ovules numerous; pistil head collared at base, columnar at top. **Fruit** a paired follicle, parallel, connate at base and apex; pericarp very thick, corky and warty, pubescent. **Seeds** unbeaked; ellipsoid, flattened, glabrous, with an apical coma.

A monotypic genus distributed in China and SE Asia.

Amalocalyx microlobus Pierre ex Spire

Contr. Apocyn.: 93. 1905; Kerr in Fl. Siam. Enum. 2: 475. 1939; Middleton in Fl. Thailand 7(1): 125, fig. 39. 1999.

Climbing herb; branchlets densely tomentose and hispid; branches often with large corky tubercles. **Leaves** obovate, papery, 5-24 cm long, 3-18 cm wide, pubescent; base cordate, rarely rounded; apex acuminate to caudate; primary veins 5-9 pairs; petioles 0.8-4 cm long. **Inflorescence** 9-25 cm long, flowers usually clustered at end; puberulent. **Sepals** white or pink, linear to narrowly elliptic, 4-10 mm long, 1-4 mm wide, acute to rounded at apex, puberulent. **Corolla** white or pink outside and white, red or purple inside; tube 2.3-3 cm long, widening slightly above stamen insertion; lobes 3-6 mm long, somewhat asymmetrical, puberulent outside, especially towards apex, rarely glabrous, puberulent in 5 lines below stamens inside. **Stamens** inserted at 1.2-1.4 cm from corolla base; anthers 4-6 mm long. Disk 1.5-2 mm long. **Ovary** ca. 1 mm long; style and pistil head 1.5-2.2 cm long. **Fruit** 6-9 cm long, each follicle 1.5-1.8 cm wide. **Seeds** 7-10 mm long, 5-6 mm wide; coma 4-5 cm long.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Phrae, Nan, Tak; North-eastern: Loei, Sakon Nakhon, Udon Thani; South-eastern: Chon Buri; South-western: Kanchanaburi, Prachuap Khiri Khan; Central: Bangkok.

Distribution.— Myanmar, China, Laos, Vietnam (type).

Ecology.— Deciduous forest, dry evergreen forest and lower montane scrub, often in disturbed places, alt. 800-1,750 m (Tham Pha Khaw, Doi Phu Kha, Doi Phu Wae)

Phenology.— Flowering: June-July; fruiting: November-February.

Vernacular.— ห้างสมุทร Yang samut (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1922; *P. Srisanga et al.* 873.

3. *BOUSIGONIA* Pierre

Bull. Linn. Soc. Paris 2(1): 35. 1898; Middleton in Fl. Thailand 7(1): 22. 1999.

Woody climbers. **Leaves** opposite, with a clear ridge joining the petioles across the stem; no glands in the axils. **Inflorescence** of axillary cymes. **Sepals** with

a row of colleters inside. **Corolla** lobes overlapping to the left in bud, open corolla salverform; lobes ovate, rounded. Corona absent. **Stamens** free from the pistil head; completely included in the corolla tube; filaments short and narrow; anthers oblong, base sagittate, apex rounded and apiculate, fertile entire length. Disk closely adnate to the ovary, annular. **Ovary** syncarpous and unilocular; 2 parietal placentas with 2 ovules per placenta; style filiform. **Fruit** a berry; 3-4-seeded.

Two species in Continental SE Asia and S China. One species in Thailand (Middleton, 1999).

Bousigonia angustifolia Pierre ex Spire

Contr. Apocyn.: 129. 1905; Kerr in Fl. Siam. Enum. 2: 426. 1939; Middleton in Fl. Thailand 7(1): 22, fig. 8. 1999.

Branchlets sparsely puberulent or glabrous; branches with small lenticels. **Leaves** oblong to narrowly elliptic, subcoriaceous, 5-13 cm long, 1.5-3.5 cm wide, glabrous, punctate beneath; base acute to cuneate; apex caudate; primary veins 17-24 pairs, straight, anastomosing into an intramarginal nerve; petioles 8-20 mm long. **Inflorescence** 2-6 cm long. **Flowers** glabrous or very sparsely puberulent, slightly fragrant; pedicels 3.5-9 mm long. **Sepals** ovate, 2-3 mm long, 1-2 mm wide, glabrous, rounded at apex. **Corolla** white; tube 5-7 mm long; lobes ca. 3 mm long, glabrous. **Stamens** inserted at 2-4 mm from corolla base; filaments ca. 0.5 mm long; anthers ca. 3 mm long. Disk 0.5-1 mm long. **Ovary** ca. 2 mm long; style and pistil head ca. 2 mm long. **Fruit** ovoid, 1.5-3 cm long and wide.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— China, Laos (type), Vietnam.

Ecology.— Lower montane forest, alt. 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering: February-March.

Voucher specimens.— *P. Srisanga* 551.

4. CHONEMORPHA G. Don

Gen. Syst. 4: 76. 1837 nom. cons.; Chatterjee, Kew Bull. 1947: 47. 1947; Middleton in Fl. Thailand 7(1): 121. 1999. – *Rhyncospermum* A. DC., Prodr. 8: 431. 1844 non Reinw. – *Cerocoma* Miq., Fl. Ind. Bat. 2: 445. 1857 non Wall. – *Triadenia* Miq., Fl. Ind. Bat. 2: 458. 1857 non Spach. – *Rhynchodia* Benth. in Gen. Pl. 2: 719. 1876.

Climbers. **Leaves** opposite; glands in the axils. **Inflorescence** a terminal panicle. **Sepals** with colleters inside. **Corolla** lobes overlapping to the right and twisted to the left in bud; lobes obovate, slightly asymmetrical, salverform in mature flower. **Stamens** inserted near the base of corolla tube; anthers sessile, sagittate, with sterile area, adnate to the pistil head. Disk entire, 5-dentate, shorter than the ovary, glabrous. **Ovary** of two separate carpels united into a common style, glabrous; ovules numerous. **Fruit** a paired follicle. **Seeds** with a long beak topped with a coma directed towards the fruit apex.

About 10 species from India and China to Indonesia. Four species in Thailand (Middleton, 1999). Only 1 species recorded from Doi Phu Kha National Park.

Chonemorpha griffithii Hook.f.

In Fl. Br. Ind. 3: 662. 1882; Middleton in Fl. Thailand 7(1): 122. 1999. – *C. macrantha* Pitard in Fl. Gén. I.-C. 3: 1247. 1933; Kerr in Fl. Siam. Enum. 2: 474. 1939. – *C. valvata* Chatterjee, Kew Bull. 1947: 51. 1947.

Woody climber; branchlets strongly angled or flattened when dry, tomentose to glabrate; branches lenticellate. **Leaves** broadly obovate to elliptic, papery to subcoriaceous, 12-26 cm long, 8-30 cm wide, sparsely hairy; base cordate to rounded; apex acuminate; primary veins 9-14 pairs; petioles 1.7-6 cm long. **Inflorescence** 2-4 cm long, sparsely tomentose. **Flowers** fragrant. **Calyx** dark red, deeply divided, often to the base; lobes linear, 8-14 mm long, densely puberulent. **Corolla** yellow or creamy white with yellow patch at the mouth inside; tube 2.8-4.3 cm long; lobes 3.5-6.5 cm long, glabrous or sparsely puberulent outside, densely pubescent inside. **Anthers** 9-10 mm long. **Ovary** 2-3 mm long; style and pistil head 10-11 mm long. **Fruit** glabrous, 20-25 cm long, 1-1.5 cm wide. **Seeds** 11-15 mm long, 2-3 mm wide; coma 5-6 cm long (Fig. 29).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India (type), China, Laos, Cambodia, Vietnam.

Ecology.— Lower montane forest, alt. 1,300-1,700 m (Doi Phu Kha).

Phenology.— Flowering: May-July.

Vernacular.— โมกคดอย Mok doi (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1423.

Notes.— New locality recorded from Nan, in Thailand.

5. KOPSIA Bl.

Catalogus: 12. 1823 nom. cons.; Middleton in Fl. Thailand 7(1): 60. 1999.

Shrubs or trees. **Leaves** opposite, with a large interpetiolar ridge and glands in the axils. **Inflorescence** cymose. **Sepals** without colleters inside. **Corolla** lobes overlapping to the right in bud, mature corolla salverform; lobes oblong or obovate, acute to rounded at apex. **Stamens** free from the pistil head; completely included in the corolla tube; filaments short and narrow; anthers narrowly ovate, base cordate, apex acute, fertile entire length. Disk of 2 narrow lobes. **Ovary** of 2 separate carpels united into a common style, glabrous or pubescent; ovules 2 in each carpel; style filiform with a collared style head. **Fruit** a drupe, solitary or paired. **Seeds** ovoid; flattened.

About 20 species from Myanmar and China to northern Australia. Five species in Thailand (Middleton, 1999). Only 1 species recorded from Doi Phu Kha National Park.

***Kopsia arborea* Bl.**

Catalogus: 13. 1823; Middleton in Fl. Thailand 7(1): 61, fig. 20. 1999. – *K. jasminiflora* Pitard in Fl. Gén. I.-C. 3: 1136. 1933; Kerr in Fl. Siam. Enum. 2: 438. 1939. – *K. lancibracteolata* Merr., Philipp. J. Sci. 23: 262. 1923.

Shrub or small tree up to 6 m high; branchlets minutely puberulent or glabrous. **Leaves** oblong to elliptic, coriaceous to subcoriaceous, 7-22 cm long, 1.5-6 cm wide, glabrous; base cuneate; apex acuminate; primary veins 15-18 pairs; petioles 4-8 mm long. **Inflorescence** a lax cyme, 6.5-9 cm long, glabrous or puberulent; pedicels 1.5-2.5 mm long. **Sepals** lanceolate, 2-3 mm long, acuminate or acute at apex, glabrous or puberulent. **Corolla** white with red patch at mouth; tube 28-35 mm long; lobes 14-20 mm long, lanceolate, glabrous outside or with ciliate lobes, pubescent in mouth and beneath stamens inside. **Stamens** inserted at 25-30 mm from corolla base; filaments ca. 1 mm long; anthers 1.5-2 mm long. Disk 1.5-2 mm long. **Ovary** ca. 1 mm long, pubescent or glabrous; style and pistil head ca. 2.5 cm long. **Fruit** black-purplish, ellipsoid, 2.5-4 cm long, 1-2.3 cm wide.

Thailand.— Northern: Chiang Mai, Nan; Eastern: Chaiyaphum; Peninsular: Nakhon Si Thammarat

Distribution.— China, Vietnam, Malaysia, Indonesia (Java-type), Philippines, Australia (Queensland).

Ecology.— Deciduous and dry evergreen forest, alt. 700-900 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering and fruiting: almost throughout the year.

Vernacular.— มะดีควาย Ma dee kwai (Northern).

Voucher specimens.— *P. Srisanga* 575, 1598.

6. MELODINUS Forst.

Char. Gen.: 37. 1776; Middleton in Fl. Thailand 7(1): 14. 1999.

Woody climbers. **Leaves** opposite; venation often raised; veins anastomosing before margin forming an intramarginal nerve, with few glands in the axils or absent. **Inflorescence** a cyme, axillary or terminal, often forming a terminal panicle. **Corolla** lobes overlapping to the left in bud, open corolla infundibuliform or salverform; with a corona at the mouth of the corolla. **Stamens** completely included in the corolla tube; anthers narrowly elliptic or lanceolate, base very short bluntly sagittate, fertile entire length; filaments short, filiform. Disk absent. **Ovary** syncarpous, bilocular, with numerous ovules, glabrous; style slender. **Fruit** a hard-walled solitary berry. **Seeds** ellipsoid, flattened.

About 45 species from India to the Pacific regions. Three species in Thailand (Middleton, 1999). One species recorded from Doi Phu Kha National Park.

***Melodinus cochinchinensis* (Lour.) Merr.**

Trans. Amer. Phil. Soc. n.s. 24: 315. 1935; Middleton in Fl. Thailand 7(1): 16, fig. 6. 1999. – *Oncinus cochinchinensis* Lour., Fl. Cochinch.: 123. 1790. – *Melodinus henryi* Craib, Kew Bull. 1911: 411. 1911; Kerr in Fl. Siam. Enum. 2: 426. 1939. – *M. crassipetalus* Kerr, Kew Bull. 1937: 40. 1937; in Fl. Siam. Enum. 2: 426. 1939. – *M. oblongus* auct. non Pierre ex Spire: Kerr in Fl. Siam. Enum. 2: 427. 1939.

Branchlets glabrous, puberulent around nodes or rarely puberulent all over when very young. **Leaves** oblong, elliptic to narrowly ovate, subcoriaceous, 3-20 cm long, 1-7 cm wide, glabrous; base rounded to cuneate; apex acuminate; primary veins 10-23 pairs; petioles 5-11 mm long, glabrous or sparsely puberulent when very young. **Inflorescence** axillary and terminal panicle, up to 7 cm long, puberulent. **Flowers** fragrant. **Sepals** pale green, strongly imbricate, ovate, 1.5-3 mm long, obtuse to rounded at apex; puberulent or glabrous, ciliate. **Corolla** white or yellow; tube 5-8 mm long, puberulent outside, densely pubescent inside; lobes 3-5 mm long, obovate, about as long as wide, puberulent or glabrous. Corona fleshy, 1-2 mm long, 2-lobed, pubescent. **Stamens** inserted at 2-4 mm from corolla base; anthers 1.5-2 mm long. **Ovary** 1-1.5 mm long; style 1-2 mm long; pistil head 1-2 mm long. **Fruit** oblong, ovoid to globose, 3.5-10 cm long, 2-5.5 cm wide. **Seeds** 10-17 mm long, 7-10 mm wide, ca. 2 mm thick.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei; Eastern: Nakhon Ratchasima; South-western: Kanchanaburi; Peninsular: Surat Thani.

Distribution.— Myanmar, China, Vietnam (type).

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: March-May; fruiting: January-April.

Vernacular.— นาโต๊ะเจ Na toe chae (Karen-Chiang Mai).

Voucher specimens.— *P. Srisanga* 2682; *P. Srisanga* & *S. Watthana* 656, 671.

7. PARAMERIA Benth.

Gen. Pl. 2: 715. 1876; Middleton, Blumea 41(1): 74. 1996; in Fl. Thailand 7(1): 150. 1999. – *Parameriopsis* Pichon, Bull. Mus. Nat. Hist. Nat. sér. 2, 20: 299. 1948; Mem. Mus. Nat. Hist. Nat. sér. B, Bot. 1: 85. 1950.

Climbers; branches pubescent or glabrous, lenticellate or not. **Leaves** opposite or very rarely in whorls of 3; primary veins strongly ascending; glands in the axils. **Inflorescence** axillary and terminal cymes, often forming a panicle; bracts small, ovate. **Flowers** often distinctly 5-angled, fragrant. **Sepals** ovate, acute or acuminate at apex, with numerous colleters inside. **Corolla** lobes overlapping to the left in bud; lobes asymmetrical, slanting to the left as viewed from the inside; tube cylindrical, mature corolla salverform. **Stamens** inserted near the base of corolla tube; filaments short; anthers sagittate, with sterile area, adnate to the pistil head. Disk of 5 separate lobes or deeply 5-lobed. **Ovary** of two separate carpels united into a common style;

ovules numerous. **Fruit** a paired follicle, long, narrow and strongly torulose with thin connections between bulges containing seeds. **Seeds** with an apical coma.

Three species in SE Asia and Malesia. Two species in Thailand (Middleton, 1999). Only 1 species recorded from Doi Phu Kha National Park.

Parameria laevigata (Juss.) Moldenke

Rev. Sudamer. Bot. 6: 176. 1940; Middleton, Blumea 41(1): 76. 1996; in Fl. Thailand 7(1): 151. 1999. – *Aegiphila laevigata* Juss., Ann. Mus. Hist. Nat. Paris 7: 76. 1805. – *Parsonsia barbata* Bl., Bijdr.: 1042. 1826. – *Ecdysanthera barbata* (Bl.) Miq., Fl. Ind. Bat. 2: 451. 1857. – *Parameria barbata* (Bl.) K. Schum., Nat. Pflanzenfam. 4 (2): 162. 1895; Kerr in Fl. Siam. Enum. 2: 464. 1939. – *Echites glandulifera* Wall. ex G. Don, Gen. Syst. 4: 75. 1837. – *Ecdysanthera glandulifera* (Wall. ex G. Don) A. DC. in Prodr. 8: 443. 1844. – *Parameria glandulifera* (Wall. ex G. Don) Benth. ex Kurz, Fl. Burm. 2: 189. 1877. – *Ecdysanthera glandulifera* var. *pierrei* Heim ex Spire, Apocyn. I.-C. 40. 1905. – *Parameria glandulifera* var. *pierrei* (Heim ex Spire) Pitard in Fl. Gén. I.-C. 3: 1201. 1933. – *P. barbata* var. *pierrei* (Heim ex Spire) Kerr in Fl. Siam. Enum. 2: 464. 1939.

Woody climber; branches pubescent or glabrous. **Leaves** elliptic to ovate, papery, 2-14 cm long, 1-5.5 cm wide; base cuneate; apex acute to acuminate; primary veins 3-6 pairs; petioles 1-5 mm long. **Inflorescence** forming a terminal panicle or having shorter cymes scattered along stem, many-flowered, 2-16 cm long, puberulent. **Sepals** 0.5-1 mm long; pubescent to glabrous. **Corolla** white or pink; tube 1.5-2.5 mm long; lobes 1.5-4 mm long, glabrous or pubescent on tube outside, glabrous inside. **Anthers** 1-1.5 mm long, apex long acuminate. Disk of 5 separate lobes. **Ovary** ca. 0.5 mm long, pubescent on top; style and pistil head ca. 1 mm long. **Fruit** 12-27 cm long, ca. 0.5 cm wide, glabrous. **Seeds** elliptic, brown, hirsute, inrolled, 5-12 mm long, 1-4 mm wide; coma 1.5-3 mm long (Fig. 30).

Thailand.— Almost throughout the country.

Distribution.— Myanmar, China, Cambodia, Vietnam, Malaysia, Indonesia, Philippines.

Ecology.— Dry evergreen forest, often by streams, alt. 700-850 m (Span Waterfall, Doi Phu Kha).

Phenology.— Flowering: August-October; fruiting: January-March.

Vernacular.— เครื่องหมากขาว Kruea khao muak khao, ตังตู้เครือ Tang tu kruea (Northern).

Voucher specimens.— *P. Srisanga* 1596.

8. RAUVOLFIA L.

Sp. Pl.: 208. 1753; Middleton in Fl. Thailand 7(1): 50. 1999. – *Ophioxylon* L., Sp. Pl.: 1043. 1753. – *Dissolena* Lour., Fl. Cochinch.: 137. 1790.

Shrubs or small trees. **Leaves** in whorls of 3-5, rarely opposite, usually with glands in the axils. **Inflorescence** a terminal or axillary cyme or whorl of cymes. **Sepals** without colleters inside or only at the sepal corners. **Corolla** lobes overlapping to the left in bud; open corolla salverform; lobes subsymmetrical, ovate or elliptic, obtuse to rounded at apex. **Stamens** free from the pistil head; completely included in the corolla tube; filaments short and narrow; anthers ovate to lanceolate, base cordate, apex acute to obtuse, fertile entire length. Disk annular, shorter than the ovary. **Ovary** syncarpous and bilocular, of 2 carpels connate at base or of 2 free carpels, in each case united into a common style, glabrous; 2 ovules in each carpel; style filiform with a collared style head. **Fruit** a drupe. **Seeds** ovoid, flattened.

About 60 species, pantropical. Five species in Thailand (Middleton, 1999). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Inflorescence solitary, axillary or more rarely terminal; peduncle robust.
Fruit dark blue and glaucous **1. *R. cambodiana***
1. Inflorescence in a terminal whorl; peduncles not robust. Fruit red
2. *R. verticillata*

1. *Rauvolfia cambodiana* Pierre ex Pitard

In Fl. Gén. I.-C. 3: 1117. 1933; Kerr in Fl. Siam. Enum. 2: 428. 1939; Middleton in Fl. Thailand 7(1): 51, fig. 17. 1999.

Shrub up to 2 m high; branchlets glabrous, strongly angled when young. **Leaves** elliptic to oblanceolate, papery to subcoriaceous, 12-30 cm long, 4-10 cm wide, glabrous; base cuneate; apex acute to acuminate; primary veins 12-25 pairs; petioles 1-3.5 cm long. **Inflorescence** solitary, axillary or more rarely terminal, robust, 3-10 cm long; peduncle 1.5-4.5 cm long, glabrous; pedicels 2-7 mm long. **Sepals** ovate or lanceolate, 1.5-2.5 mm long, 0.5-1.5 mm wide, acute to acuminate at apex, glabrous, minutely ciliate or not. **Corolla** tube reddish or purplish, 9-16 mm long; lobes white, 2-4 mm long, glabrous outside, pubescent in mouth and inside to just beneath the stamens. **Stamens** inserted at 8-10 mm from corolla base; filaments ca. 0.5 mm long; anthers 1-2 mm long. Disk 0.5-1 mm long. **Ovary** 1-2 mm long; carpels free up to the single style; style and pistil head 6-8 mm long. **Fruit** paired, free from each other, ovoid, dark blue, glaucous, 7-11 mm long, 4-6 mm wide. **Seeds** 6-7 mm long, 2-4 mm wide.

Thailand.— Northern: Chiang Rai, Lampang, Nan; North-eastern: Phetchabun; Eastern: Chaiyaphum, Nakhon Ratchasima; South-eastern: Chon Buri, Chanthaburi, Trat; South-western: Kanchanaburi.

Distribution.— Vietnam, Cambodia (type).

Ecology.— Dry evergreen forest, alt. 600-800 m (Doi Phu Kha).

Phenology.— Flowering: February-April; fruiting: May-July.

Vernacular.— ขะย้อมหลวง Kha yom luang (Northern).

Voucher specimens.— *P. Srisanga* 2588.

2. *Rauvolfia verticillata* (Lour.) Baillon

Bull. Linn. Soc. Paris 1: 768. 1888; Middleton in Fl. Thailand 7(1): 54. 1999. – *Dissolena verticillata* Lour., Fl. Cochinch.: 138. 1790. – *Tabernaemontana densiflora* Wall., Bot. Reg.: t. 1273. 1829. – *Rauvolfia densiflora* (Wall.) Benth. ex Hook.f. in Fl. Br. Ind. 3: 633. 1882; Kerr in Fl. Siam. Enum. 2: 429. 1939. – *Tabernaemontana ophiorrhizoides* Kurz, J. As. Soc. Beng. 42: 89. 1873. – *Rauvolfia ophiorrhizoides* (Kurz) Kerr in Fl. Siam. Enum. 2: 429. 1939. – *R. peguana* Hook.f. in Fl. Br. Ind. 3: 632. 1882. – *R. perakensis* King & Gamble, J. As. Soc. Beng. 74(2): 424. 1907; Kerr in Fl. Siam. Enum. 2: 430. 1939.

Shrub up to 2 m high; branchlets glabrous, often angled. **Leaves** elliptic, obovate to oblanceolate, papery, 3-30 cm long, 1-10 cm wide, glabrous; base cuneate; apex acute to acuminate; primary veins 9-18 pairs; petioles 0.5-1 cm long. **Inflorescence** in a terminal whorl, 2-12 cm long; peduncle up to 10 cm long, glabrous; pedicels 3-7 mm long. **Sepals** ovate or lanceolate, 1.5-2.5 mm long, 0.5-1 mm wide, acute to acuminate at apex, glabrous, minutely ciliate or not. **Corolla** white or white and reddish; tube 9-18 mm long; lobes 2-4 mm long, glabrous outside, pubescent in mouth and inside to just beneath stamens. **Stamens** inserted at 5-10 mm from corolla base; filaments 0.5-1 mm long; anthers 1-1.5 mm long. Disk 0.5-1 mm long. **Ovary** 1-2 mm long; carpels free up to the single style; style and pistil head 4-10 mm long. **Fruit** paired, free from each other or solitary, ovoid, red, 8-14 mm long, 4-6 mm wide. **Seeds** ca. 7.5 mm long, 3.5-4.5 mm wide.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Nan; North-eastern: Loei; South-eastern: Chanthaburi; South-western: Kanchanaburi; Peninsular: Chumphon, Ranong, Surat Thani, Phangnga, Trang, Songkhla, Pattani, Narathiwat.

Distribution.— Bhutan, India, Sri Lanka, Myanmar, China, Vietnam (type), Cambodia, Laos, Malaysia, Indonesia, Philippines.

Ecology.— Dry evergreen forest, lower montane forest and lower montane scrub, by streams or open ground among limestone rocks, alt. 800-1,760 m (Sapan Waterfall, Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: December-January; fruiting: July-August.

Vernacular.— ยาแก้ชักขม Ya kae hak khom (Chiang Mai).

Voucher specimens.— *P. Srisanga* 448, 1962; *P. Srisanga et al.* 856.

9. *TABERNAEMONTANA* L.

Sp. Pl.: 210. 1753; A. DC., Prodr. 8: 361. 1844; Leeuwenberg, Rev. Tabernaemontana 1: 1. 1991; Middleton in Fl. Thailand 7(1): 27. 1999. – *Tabernaemontana* sect.

Ervatamia A. DC., Prodr. 8: 373. 1844. – *Ervatamia* (A. DC.) Stapf, Fl. Trop. Afr. 4, 1: 126. 1902. – *Pagiantha* Markgr., Notizbl. Bot. Gart. Mus. Berl. 12: 549. 1935.

Shrubs or small trees; branchlets glabrous or sparsely pubescent. **Leaves** opposite, often a pair unequal in size; distinct stipule-like ochrea in the axils. **Inflorescence** a cyme or flower solitary, lax, 2 inflorescences at each ramification, occasionally with one missing. **Flowers** usually fragrant. **Sepals** often with colleters inside. **Corolla** in mature bud with a narrow tube and globose to ovoid head; corolla lobes overlapping to the left in bud, open corolla salverform. **Stamens** subsessile or with short filaments, completely included in tube; anthers narrowly triangular to oblong, base cordate, apex acute, fertile entire length, free from the pistil. Disk absent. **Ovary** of two separate carpels united into a common style; style filiform; pistil head short. **Fruit** a paired follicle, obliquely ellipsoid to somewhat elongated, ridged or smooth, sometimes torulose. **Seeds** covered in a fleshy aril, obliquely ellipsoid.

Ninety-nine species, circumtropical. Nine species in Thailand (Middleton, 1999). Only 1 species recorded from Doi Phu Kha National Park.

***Tabernaemontana corymbosa* Wall.**

Bot. Reg. 15: sub t. 1273. 1829; Leeuwenberg, Rev. Tabernaemontana 1: 138, fig.41, map 21. 1991; Middleton in Fl. Thailand 7(1): 31. 1999. – *Ervatamia corymbosa* (Wall.) King & Gamble, J. As. Soc. Beng. 74(2): 448. 1907. – *Pagiantha peninsularis* Kerr, Kew Bull. 1937: 43. 1937; in Fl. Siam. Enum. 2: 441. 1939. – *P. peninsularis* var. *brevituba* Kerr in Fl. Siam. Enum. 2: 442. 1939.

Shrub up to 4 m high; branches lenticellate, glabrous. **Leaves** elliptic, obovate to oblanceolate, papery, 7-30 cm long, 3-13 cm wide, glabrous; base cuneate, decurrent into the petiole; apex acuminate to caudate; primary veins 6-15 pairs; petioles 2-15 mm long. **Inflorescence** 5-12 cm long, lax-flowered; peduncle 2-6 cm long, glabrous; pedicels 4-10 mm long, glabrous. **Flowers** fragrant. **Sepals** green, ovate, connate for up to half of length, 2-5 mm long, obtuse to broadly acute at apex, ciliate at margin. **Corolla** white, 1.7-3.5 cm long, in mature bud with broadly ovoid to subglobose head, glabrous outside; tube 1.5-2.8 cm long, twist; lobes obliquely elliptic, 9-15 mm long, 4-7 mm wide, rounded at apex, puberulous inside, ciliate at margin. **Stamens** inserted in the upper half of the corolla tube, with apex 1-4 mm below mouth; filaments 0.5-1 mm long; anthers 2-5 mm long. **Ovary** 1.5-2 mm long; style 10-16 mm long. **Fruit** yellowish orange, obliquely ellipsoid, 2-4.5 cm long, 0.5-2.5 cm wide, sometime ridges, acuminate to rounded at apex, mostly recurved. **Seeds** 5-15, 9-13 mm long, 5-10 mm wide; arils orange-red. (Fig. 31).

Thailand.— Northern: Chiang Mai, Nan; Peninsular: Surat Thani, Phuket.

Distribution.— Myanmar, S China, Vietnam, Laos, Malaysia (type), Singapore.

Ecology.— Lower montane forest, alt. 1,400-1,700 m (Doi Phu Kha).

Phenology.— Flowering: April-June; fruiting: September-April.

Voucher specimens.— *P. Srisanga* 266, 1183, 1439; *P. Srisanga* & *S. Watthana* 623, 659.

Notes.— New locality recorded from Nan, in Thailand.



Figure 29. *Chonemorpha griffithii* Hook.f.

A. flowering branch; B. stamens; C. ovary. All from *P. Srisanga* 1423.

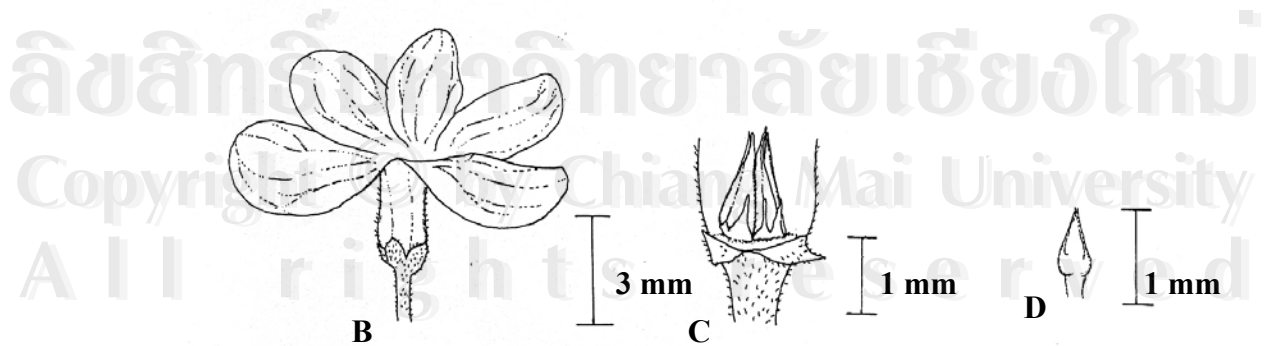


Figure 30. *Parameria laevigata* (Juss.) Moldenke

A. flowering branch; B. flower; C. stamens; D. ovary. All from *P. Srisanga* 1596.

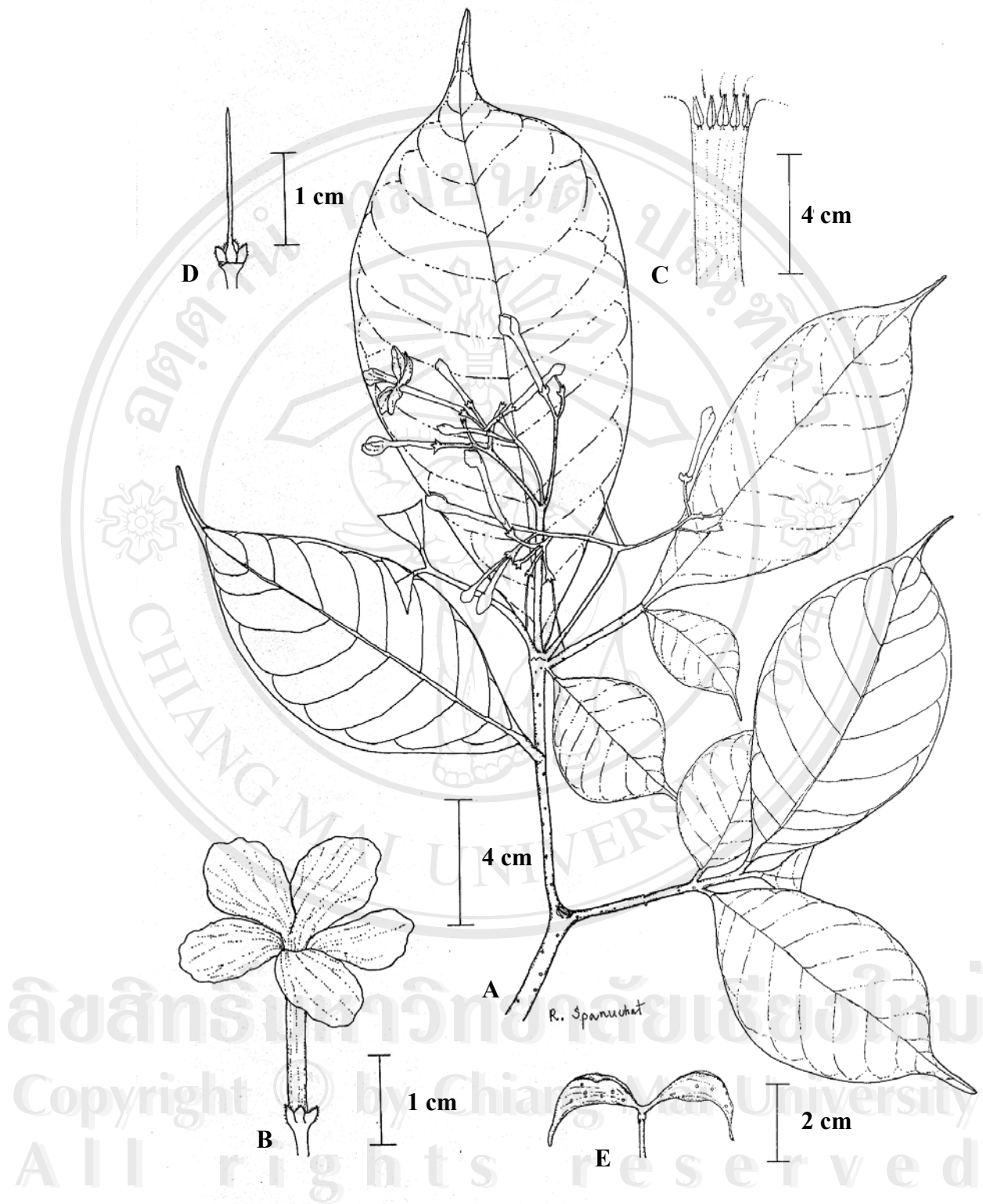


Figure 31. *Tabernaemontana corymbosa* Wall.

A. flowering branch; B. flower; C. stamens; D. pistil; E. fruit.

AQUIFOLIACEAE

Trees or shrubs, usually evergreen. **Leaves** simple, alternate, rarely in pseudowhorls or opposite; stipules absent or very small. **Inflorescence** axillary or terminal, cymose, racemose, umbellate or fasciculate. **Flowers** bisexual or unisexual, actinomorphic, small. **Sepals** 4(-8), imbricate. **Petals** 4(-8), mostly greenish white or white, connate at base, imbricate or valvate. **Stamens** usually the same number and alternate with the petals, often adnate to the base of petals; anther 2-locular, opening by longitudinal slits. **Ovary** superior, (2-)4-6(-24)-locular, axile placentation; style terminal or absent; ovules 1(-2) in each loculus, pendulous from the apex. **Fruit** drupaceous of 2-10-seeded pyrenes.

An almost cosmopolitan family with 4 genera and about 420 species (Mabberley, 1997). One genus and about 5 species in Thailand. One species recorded from Doi Phu Kha National Park.

ILEX L.

Sp. Pl.: 125. 1753; Hook.f. in Fl. Br. Ind. 1: 598. 1875; Philcox in Fl. Ceylon 13: 4. 1999.

Dioecious trees or shrubs. **Leaves** simple, alternate; stipules usually early caducous. **Inflorescence** axillary, cymose, umbellate or fasciculate. **Flowers** unisexual. **Sepals** 4(-8), persistent. **Petals** 4(-8), imbricate. **Stamens** usually the same number and alternate with the petals. **Ovary** (2-)3-6(-12)-locular; style absent; ovules 1(-2) in each loculus. **Fruit** drupaceous of 2-10-seeded pyrenes, mostly globose.

About 400 species, cosmopolitan, especially in tropical and temperate Asia and America (Mabberley, 1997).

Ilex umbellulata (Wall.) Loes.

Pflanzenfam. I: 218. 1897; Craib in Fl. Siam. Enum. 1: 277. 1926. – *Ehretia umbellulata* Wall. in Fl. Ind. ed. Carey 2: 344. 1824. – *Ilex sulcata* Wall. ex Hook.f. in Fl. Br. Ind. 1: 604. 1875.

Tree up to 20 m high. **Leaves** broadly lanceolate, elliptic to ovate, subcoriaceous, 4-11 cm long, 2-5.5 cm wide, glabrous on both surfaces; base cuneate to rounded; apex acute; margin entire; midrib impressed above, raised and prominent below; petioles 6-10 mm long, puberulous, glabrescent. **Inflorescence** in axillary umbellate, dense-flowered; peduncle 1.5-2.5 cm long, puberulous. **Flowers** creamy white; pedicels 3-4 mm long, puberulous. **Sepals** 4, ovate, ca. 1 mm long, sparsely puberulous. **Petals** 4, oblong, ca. 3 mm long, 1.5 mm wide, obtuse at apex, puberulous. **Stamens** 4; filaments ca. 1.5 mm long; anthers ca. 1 mm long. **Fruit** globose, 5-8 mm long and wide, red, glabrous. **Seeds** 4-8.

Thailand.— Northern: Chiang Mai, Lampang, Phrae, Nan, Sukhothai.

Distribution.— India (Assam-type), Myanmar, S China (Yunnan).

Ecology.— Dry evergreen forest, alt. 700-1,000 m (Doi Phu Kha, Tham Pha Khong).

Phenology.— Flowering: October-March; fruiting: July-October.

Uses.— Wood for indoor construction.

Vernacular.— ไม้ตัง Mai tong (Lua-Nan).

Voucher specimens.— *P. Srisanga* 2403.

ARALIACEAE

Trees or shrubs, sometimes climbing by means of aerial roots. **Leaves** simple, palmately or pinnately compound, alternate or rarely opposite; stipules either adnate to and scarcely distinguished from the base of the petiole, or intrapetiolar, rarely absent. **Inflorescence** terminal rarely axillary, head or umbellate. **Flowers** bisexual or unisexual, actinomorphic. **Calyx** tube adnate to the ovary; lobes 3-5, small teeth or absent. **Petals** (3-)5(-12), free or rarely connate at base, imbricate or valvate. **Stamens** the same number as and alternate with the petals or numerous; anther 2-ocular, opening by longitudinal slits. Disk present. **Ovary** inferior, (1-)2-5(-10)-locular; styles free or connate; ovules solitary in each loculus, pendulous from the apex. **Fruit** a berry or drupe, rarely schizocarp.

Forty-seven genera and about 1,325 species mainly in tropical and subtropical regions (Mabberley, 1997). About 14 genera and 50 species in Thailand. Three genera and 8 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|---|-------------------------------|
| 1. Leaves tri-foliolate or 1-3 pinnately compound | 1. <i>Aralia</i> |
| 1. Leaves simple or palmately compound | |
| 2. Stems armed | 2. <i>Brassaiopsis</i> |
| 2. Stems unarmed | 3. <i>Macropanax</i> |

1. *ARALIA* L.

Sp. Pl.: 273. 1753; Grierson in Fl. Bhutan 2(1): 333. 1991.

Shrubs or small trees, armed or unarmed. **Leaves** tri-foliolate or 1-3 pinnately compound. **Inflorescence** basically umbels arranged in racemes or panicles. **Flowers** bisexual or unisexual; pedicels usually articulated at base of ovary. **Calyx** minutely 5-lobed. **Petals** 5, imbricate. **Ovary** 5-locular; styles 5, free or shortly connate. **Fruit** 5-lobed, subglobose. **Seeds** 5, compressed.

Over 50 species in N America, E and SE Asia and Malesia. About 7 species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|------------------------|
| 1. Leaves 3 pinnately compound | 1. <i>A. thomsonii</i> |
| 1. Leaves tri-foliolate or 1 pinnately compound | |
| 2. Leaves densely floccose tomentose beneath | 2. <i>A. sp. 1</i> |
| 2. Leaves glabrous beneath | 3. <i>A. sp. 2</i> |

1. *Aralia thomsonii* Seem.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).
 Phenology.— Flowering and fruiting: June-August.
 Voucher specimens.— *P. Srisanga et al.* 835.

2. *Aralia sp. 1*

Ecology.— Lower montane scrub, open places on limestone mountain, alt. 1,700-1,800 m (Doi Phu Wae).
 Phenology.— Flowering and fruiting: November-December.
 Voucher specimens.— *P. Srisanga* 441, 1849.

3. *Aralia sp. 2*

Ecology.— Lower montane forest, alt. 1,700 m (Doi Phu Kha).
 Phenology.— Flowering: November-December.
 Voucher specimens.— *P. Srisanga* 384.

2. *BRASSAIOPSIS* Decne. & Planch.

Rev. Hort. ser. 4, 3: 106. 1854; Grierson in Fl. Bhutan 2(1): 342. 1991.

Shrubs or small trees, armed. **Leaves** simple, palmately lobed or palmately compound. **Inflorescence** basically umbels arranged in racemes or panicles. **Flowers** bisexual or unisexual; pedicels not articulated at base of ovary. **Calyx** minutely 5-lobed. **Petals** 5, valvate. **Ovary** 2-locular; styles 2, connate to apex. **Fruit** globose. **Seeds** 2, scarcely compressed.

About 20 species in India, China and SE Asia. About 7 species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|-----------------------------------|----------------------|
| 1. Leaves simple, palmately lobed | 1. <i>B. ciliata</i> |
| 2. Base of leaf webbed | |
| 2. Base of leaf not webbed | 3. <i>B. sp.</i> |

1. Leaves palmately compound

2. *B. glomerulata*

1. ***Brassaiopsis ciliata*** Decne.

Ecology.— Lower montane forest, alt. 1,600-1,800 m (Doi Phu Kha).

Phenology.— Flowering: March-June; fruiting: June-August.

Vernacular.— ต้างขน Tang khon (General).

Voucher specimens.— *P. Srisanga* 903, 1379; *P. Srisanga & S. Watthana* 694; *P. Srisanga et al.* 765, 809.

2. ***Brassaiopsis glomerulata*** (Bl.) Regel

Ecology.— Lower montane forest, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering: June-July.

Vernacular.— ต้างผา Tang pha (Northern).

Voucher specimens.— *P. Srisanga* 742.

3. ***Brassaiopsis* sp.**

Ecology.— Lower montane forest, alt. 1,700 m (Doi Phu Kha).

Phenology.— Fruiting: February-March.

Voucher specimens.— *P. Srisanga* 484.

3. **MACROPANAX** Miq.

Fl. Ind. Bat. 1(1): 763. 1856; Grierson in Fl. Bhutan 2(1): 343. 1991.

Shrubs or small trees, unarmed. **Leaves** palmately compound, 3-5-foliolate. **Inflorescence** basically umbels arranged in panicles. **Flowers** bisexual; pedicels articulated at base of ovary. **Calyx** minutely 5-lobed. **Petals** 5, valvate. **Ovary** 2(-3)-locular; styles connate to apex. **Fruit** globose or ellipsoid. **Seeds** 2(-3), compressed.

About 14 species in E Himalayas to W Malesia (Mabberley, 1997). About 3 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaflets serrate. Inflorescence minutely brown tomentose

1. *M. dispermus*

1. Leaflets entire or minutely serrate. Inflorescence glabrous

2. *M. undulatus*

1. *Macropanax dispermus* (Bl.) Kuntze

Ecology.— Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: November-December.

Vernacular.— เขี้ยวฟัน Phia fan (Chiang Mai).

Voucher specimens.— *P. Srisanga* 898, 1889.

2. *Macropanax undulatus* (Wall. ex G. Don) Seem.

Ecology.— Dry evergreen and lower montane forest, sometimes by streams, alt. 900-1,400 m (Doi Phu Kha, Nan Watershed).

Phenology.— Flowering: September-November; fruiting: November-January.

Vernacular.— ครุฑกนก Krut kanok (General).

Voucher specimens.— *P. Srisanga* 303, 1172, 1567, 1661, 2305, 2327, 2596.

ARISTOLOCHIACEAE

Perennial herbs, often woody at the base, undershrubs, scrambling or woody climbers. **Leaves** simple, alternate; stipules mostly absent (in some *Aristolochia* L. cultivated in Thailand with pseudo-stipules). **Inflorescence** terminal or axillary, racemose, cymose, panicles or flower solitary. **Flowers** bisexual, actinomorphic or zygomorphic. **Calyx** synsepalous, petaloid. **Corolla** absent. **Stamens** 6-many, usually united with the stylar column into a gynostemium; anthers extrorse. **Ovary** inferior, 4-6-locular; ovules many in each loculus; styles 3-6-lobed. **Fruit** a septical capsule or irregularly dehiscent, usually angles. **Seeds** many.

Twelve genera and about 475 species, mainly in tropical region. Two genera and about 18 species in Thailand (Phuphathanaphong, 1987; Hansen & Phuphathanaphong, 1999). One genus and 3 species recorded from Doi Phu Kha National Park.

ARISTOLOCHIA L.

Sp. Pl.: 960. 1753; Phuphathanaphong in Fl. Thailand 5(1): 1. 1987; Huber in Fam. Gen. Vasc. Pl. 2: 137. 1993.

Prostrate, scrambling or climbing herb or woody climber. **Leaves** entire or 3-lobed, palmately or pinnately nerved. **Inflorescence** racemose or paniculate or flower solitary. **Flowers** zygomorphic; perianth basally expanded into the utricle, then contracted into a slender tube; limb 1-2-lipped. **Stamens** 6, adnate to the style to form a gynostemium. **Ovary** 6-locular, slightly 6-angular; stigmatic lobes 3 or 6. **Capsule** septical, dehiscent from base upwards, 6-valved. **Seeds** flatten, winged or not, verrucose.

About 400 species widely distributed chiefly in tropical and subtropical regions, some in the warm temperate region. About 14 species (included 2 cultivated) in Thailand (Phuphathanaphong, 1987; Hansen & Phuphathanaphong, 1999).

KEY TO THE SPECIES

1. Leaves longer than broad
 2. Leaves glabrous on both surfaces or at most pubescent on nerves **1. *A. acuminata***
 2. Leaves puberulous beneath **2. *A. kerrii***
1. Leaves as long as broad **3. *A. longeracemosa***

1. *Aristolochia acuminata* Lam.

Enc. Méth. 1: 254. 1783; Bosser, *Adansonia* 19(1): 169. 1997. – *A. tagala* Cham., *Linnaea* 7: 207, tab. 5, fig. 3. 1832; Phuphathanaphong in *Fl. Thailand* 5(1): 15, figs. 1: C, 2: C-D, 10, pl. I: 1. 1987. – *A. roxburghiana* Klotzsch, *Monatsber. Königl. Preuss. Akad. Wiss. Berlin*: 596. 1859.

Climbing herb; young stem ridged, pubescent, glabrescent. **Leaves** ovate to lanceolate, 9-20 cm long, 5-9.5 cm wide, glabrous on both surfaces or at most pubescent on nerves; base deeply cordate; apex acuminate; margin entire; palmately 3-nerved, pinnately 3-4-nerved along the midrib; venation reticulate; petioles 3-6 cm long, grooved, pubescent. **Inflorescence** axillary, racemose or paniculate, 3.5-10 cm long, pubescent to nearly glabrous; bract ovate, 1.5-3 mm long, 1-1.5 mm wide, cuneate at base, acute at apex, puberulous; pedicels 5-8 mm long. **Perianth** greenish, dark purple hairy inside, laxly hairy outside, 3.6-5 cm long; utricle globular, 5-7 mm long and wide; tube 0.5-1 mm long; limb linear-lanceolate, 1.6-3.5 cm long, 0.6-0.8 cm wide. **Anthers** ellipsoid, ca. 1 mm long. **Ovary** 5-10 mm long; gynostemium 3-4 mm long; stigmatic lobes 6, long conical, obtuse at apex. **Capsule** ovoid, 3.3-5.5 cm long; fruiting pedicels 3-6 cm long. **Seeds** broadly obovate to obcordate, 5-10 mm long and wide, winged, laxly verrucose on one side, the other side nearly smooth, light brown.

Thailand.— Northern: Chiang Mai, Nan, Tak; South-eastern: Chanthaburi; South-western: Kanchanaburi; Peninsular: Surat Thani, Phuket, Nakhon Si Thammarat, Trang.

Distribution.— India (type cult. ex Jardin du Roi, Isle de France), Sri Lanka, Bangladesh, Myanmar, China, Vietnam, Cambodia, Malaysia, Indonesia, Philippines, Australia.

Ecology.— Dry evergreen forest, open placed and disturbed areas, alt. 800-900 m (Tham Pha Kong, Doi Phu Kha).

Phenology.— Flowering: June-July; fruiting: January-March.

Vernacular.— ปุ่ลิ่ง Pu ling (Chiang Mai).

Voucher specimens.— *P. Srisanga* 2537; *P. Srisanga* s.n. (19 March 2000).

2. *Aristolochia kerrii* Craib

Kew Bull. 1911: 450. 1911; Phuphathanaphong in Fl. Thailand 5(1): 18, figs. 1: G, 2: M-N, 12, pl. I: 2. 1987.

Climbing herb; stem glabrous. **Leaves** ovate, triangular-ovate to ovate-lanceolate, 8-15 cm long, 7-11 cm wide, glabrous above, puberulous beneath, gland-dotted on both surfaces; base truncate to deeply cordate; apex acute to acuminate; margin entire; palmately 5-nerved; venation reticulate; petioles 3-5.5 cm long, glabrous. **Inflorescence** axillary, fascicle racemes, 1.5-3 cm long, puberulous; bract lanceolate, 5-12 mm long, 2-5 mm wide, densely gland-dotted; pedicels 8-14 mm long. **Perianth** dark purple, cream inside, 1.3-2 cm long; utricle spherical or ovoid, 2.5-4.5 mm long and wide; tube 3-7.5 mm long, curved; limb sagittate, 0.7-1.4 cm long, 0.4-1.2 cm wide. **Anthers** ellipsoid, ca. 0.5 mm long. **Ovary** 2-3 mm long; gynostemium 0.8-1.8 mm long; stigmatic lobes 6, short, obtuse at apex. **Capsule** ovoid, 1.8-2.2 cm long; fruiting pedicels 1.8-2.2 cm long. **Seeds** obovate, 4-4.5 mm long, 2.3-2.6 mm wide, not winged, verrucose on both sides (Fig. 93).

Thailand.— Northern: Mae Hong Son, Chiang Mai (type: *Kerr* 627: K), Phayao, Nan, Tak; North-eastern: Khon Kaen; Eastern: Chaiyaphum; South-western: Kanchanaburi; Peninsular: Surat Thani.

Distribution.— Endemic to Thailand.

Ecology.— Dry evergreen and lower montane forest, alt. 900-1,500 m (Tham Pha Kaow, Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: June-July; fruiting: July-September.

Vernacular.— กระเช้าปากเขียด Krachao pak ped (Northern).

Voucher specimens.— *P. Srisanga* 2555; *P. Srisanga et al.* 843.

3. *Aristolochia longeracemosa* B. Hansen & Phuphathanaphong

Nord. J. Bot. 19(5): 577, fig. 2. 1999.

Climbing herb; stem glabrous, slightly angular. **Leaves** broadly ovate, 10.5-14 cm long and wide, glabrous above, densely pubescent beneath; base deeply cordate; apex acute to acuminate; margin entire; palmately 7-9-nerved; venation reticulate; petioles 6-11 cm long, glabrous. **Inflorescence** axillary, fascicle racemes, 1-2 in the axils of present leaves, 3.5 cm long, 6-7-flowered; bract ovate, 6 mm long, 4.4 mm wide, acuminate at apex; pedicels 3 mm long, glabrous. **Perianth** dark purple, slightly curved, glabrous outside, pubescent inside; utricle globose to ovoid, 6 mm long and wide; tube 6 mm long, curved; limb 1-lipped, 20 mm long, from a broad base ca. 8 mm wide tapering into a narrow apical part 0.5-1 mm wide, retuse at apex. **Anthers** ca. 0.6 mm long. **Ovary** 5 mm long, 6-ridged, glabrous; gynostemium 1.8 mm long; stigmatic lobes 6, triangular, obtuse at apex. **Capsule** only known in young state, 5 cm long, 1 cm wide.

Thailand.— Northern: Nan (Doi Phu Kha-type: *Bänziger* 667: C, herb. Bänziger).

Distribution.— Endemic to Doi Phu Kha.

Ecology.— Lower montane forest, alt. 1,100 m.

Phenology.— Flowering and fruiting: April-May.

Notes.— Possibly endangered. Only known from the type collections. Closely allied to *A. kerri* Craib. The species could not be traced. Description is based on Hansen & Phuphathanaphong (1999).

ASCLEPIADACEAE

Herbs or climbers, rarely shrubs or trees, with milky latex, sometimes succulent or with fleshy underground parts. **Leaves** simple, opposite, verticillate or rarely spirally arranged, mostly entire. **Inflorescence** terminal or axillary, cymose, often umbelliform. **Flowers** bisexual, 5-merous, actinomorphic. **Sepals** imbricate or valvate, usually connate at base. **Corolla** sympetalous, variously connate. Corona usually present, inserted on corolla or stamens or both. **Stamens** epipetalous, usually inserted at base of corolla tube and adhering to stigma head to form gynostegium; filaments usually connate to form a tube enclosing ovary; anthers 2- or 4-celled, often with a membranous apical appendage; pollen tetrads contained loosely on a spatulate translator with a basal corpusculum, or pollen united into waxy pollinia, each attached through a caudicle (stalk) to the retinaculum (gland) between adjacent anthers to form a pollinarium; pollinia 2 or 4 per pollinarium. **Ovary** superior, of 2 separate carpels united only by stigma head; ovules (1-)numerous on marginal placentas, pendulous. **Fruit** of 2 distinct follicles, sometimes only one developed. **Seeds** numerous, mostly flattened, with terminal coma.

About 315 genera and 2,900 species, mainly in tropical and subtropical regions, especially Africa (Mabberley, 1997). About 45 genera and 150 species in Thailand. Six genera and 9 species recorded from Doi Phu Kha National Park.

Dischidia major (Vahl) Merr.

Synonym.— *Dischidia rafflesiana* Wall.

Ecology.— Epiphyte, Deciduous dipterocarp forest, alt. 750 m (Wiang Peian Waterfall).

Phenology.— Flowering: March-April; fruiting: May-June.

Vernacular.— จุกโรหิณี Chuk rohini, พุงปลาช่อน Phung pla chon (Central).

Voucher specimens.— *P. Srisanga* 2274.

References.— Rintz (1980).

Dischidia obcordata (N.E. Br.) Maxwell & R. Donk.

Basionym.— *Micholitzia obcordata* N.E. Br.

Ecology.— Epiphyte, Lower montane forest, alt. 1,300 m (Doi Phu Wae).
 Phenology.— Flowering: August-September.
 Voucher specimens.— *P. Srisanga* 2169.
 References.— Maxwell (1991); Li et al. (1995).

***Heterostemma* sp.**

Ecology.— Climber, Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).
 Phenology.— Flowering: May-June; fruiting: July-October.
 Voucher specimens.— *P. Srisanga* 1438; *P. Srisanga* & *C. Puff* 1092; *P. Srisanga et al.* 813.

***Hoya longifolia* Wall. ex Wight**

Ecology.— Epiphyte, Lower montane forest, alt. 1,700 m (Doi Phu Kha).
 Phenology.— Flowering: May-June.
 Voucher specimens.— *P. Srisanga* 1440.
 References.— Li et al. (1995).

***Hoya thailandica* Thaithong**

Distribution.— Endemic to northern Thailand (Fig. 95).
 Ecology.— Epiphyte, Lower montane forest, alt. 1,650 m (Doi Phu Kha).
 Phenology.— Flowering: May-July.
 Voucher specimens.— *P. Srisanga* 1406; *P. Srisanga et al.* 752.
 References.— Thaithong (2001).

***Marsdenia eriocaulis* Kerr**

Ecology.— Climber, Dry evergreen forest, by streams, alt. 850 m (Doi Phu Kha).
 Phenology.— Flowering: March.
 Voucher specimens.— *P. Srisanga* 1320.

***Marsdenia tinctoria* R. Br.**

Ecology.— Climber, Lower montane forest, alt. 1,650 m (Doi Phu Kha).
 Phenology.— Flowering: May-July.
 Vernacular.— เถือก Boek (Chiang Mai).
 Voucher specimens.— *P. Srisanga* 1384.
 References.— Li et al. (1995).

***Periploca calophylla* (Wight) Falconer**

Ecology.— Climber, Lower montane scrub, open places, alt. 1,750 m (Doi Phu Wae).

Phenology.— Flowering: February-March.

Voucher specimens.— *P. Srisanga et al.* 2421.

References.— Li et al. (1995).

***Raphistemma pulchellum* (Roxb.) Wall.**

Ecology.— Climber, Lower montane forest, edge of the forest, by roadsides, alt. 1,330 m (Doi Phu Kha) (Fig. 94).

Phenology.— Flowering: September-October.

Vernacular.— ข้าวสาร Khao san (General); มะโอเครือ Ma O khrua, เครือเขานัง Khrua khao nang (Northern).

Voucher specimens.— *P. Srisanga* 1635.

References.— Li et al. (1995).

ASTERACEAE (COMPOSITAE)

Trees, shrubs, herbs or rarely climbers, laticifers or not. **Leaves** simple, or compound, usually alternate, rarely opposite or whorled, exstipulate. **Inflorescence** basically in head (capitula), with 1-numerous sessile flowers on receptacle, almost subtended by an involucre of 1-several series of bracts. Heads homogamous (all the individual florets of each head having the same form and function) or heterogamous (i.e. the disc florets bisexual, either fertile or functionally male, while the marginal (ray) florets being female or neuter and different in form from the disc ones). **Flowers** bisexual or unisexual, actinomorphic or zygomorphic. **Calyx** reduced or transformed to hairy or bristly pappus in fruit. **Corolla** tubular, strap-shaped (ligulate) or 2-lipped (bilabiate), (3-)5-lobed. **Stamens** as many as corolla lobes, alternipetalous, inserted in corolla tubes; anthers dehiscent by longitudinal slits. **Ovary** inferior, 1-locular; style 1, bifid; ovule 1, basal, erect. **Fruit** an achene.

About 1,528 genera and 22,750 species worldwide (Mabberley, 1997). About 67 genera and 210 species in Thailand. At least 21 genera and 44 species (3 unidentified to genera) recorded from Doi Phu Kha National Park (Table 8).

Annotated Checklist of Asteraceae

The following checklist includes Asteraceae collected from this study between 1998 and 2003. The genera are arranged alphabetically as well as for the species within the genera. Voucher specimens were also compared with the materials deposited at BK, BKF and QBG.

Table 8. Checklist of Asteraceae of Doi Phu Kha National Park.

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	Notes
<i>Ageratum conyzoides</i> L.	Sap raeng sap ka	Disturbed areas	800	Oct-Jan	Oct-Jan	PS 2600	
<i>Anaphalis adnata</i> DC.	Nat khao	LMF, roadsides	1,200	Oct-Dec		PS 2222	
<i>Anaphalis margaritacea</i> (L.) Benth. & Hook.f.	Nat doi	LMF, roadsides	1,700	Nov-Dec		PS 401	
<i>Artemisia roxburghiana</i> Bess.	Ya khi thut	Disturbed areas	1,700	Feb-Mar	Feb-Mar	PS et al. 2444	
<i>Bidens pilosa</i> L.	Puen nok sai	LMF, roadsides	1,600-1,700	Jan-Feb	Jan-Feb	PS 2376	
<i>Blumea aromatica</i> DC.	Nat hom	LMF, roadsides	1,300-1,400	Feb-Mar		PS et al. 2489	
<i>Blumea densiflora</i> DC.	Nat dok	LMF, roadsides	1,500-1,600	Feb-Mar		PS 459; PS et al. 2446	
<i>Blumea laciniata</i> (Roxb.) DC.		Disturbed areas	1,300	Feb-Mar		PS et al. 2454	
<i>Blumea</i> sp. 1		Disturbed areas	1,300	Feb-Mar		PS et al. 2456	
<i>Blumea</i> sp. 2		DDF	800	Feb-Mar		PS et al. 2461	
<i>Blumea</i> sp. 3		LMF, roadsides	1,300-1,400	Feb-Mar		PS et al. 2496	
<i>Blumeopsis flava</i> (DC.) Gagnep.	Phak kat khok	MDF	900	Nov-Dec	Nov-Dec	PS 2616	
<i>Chromolaena odoratum</i> (L.) R.M. King & H. Rob.	Sap suea, Ya mueang wai	Disturbed areas	800	Dec-Jan	Dec-Jan	PS 2603	
<i>Elephantopus scaber</i> L.	Do mai ru lom	MDF	900	Nov-Dec	Nov-Dec	PS 2618	
<i>Ethulia megacephala</i> Sch.-Bip.		LMF	1,300-1,400	Jul-Nov	Jul-Nov	PS 949, 1125	
<i>Gnaphalium affine</i> D. Don		LMF, roadsides	1,300-1,400	Sep-Oct		PS 1607	
<i>Gnaphalium hypoleucum</i> DC.		DDF, MDF, LMS	800-1,700	Nov-Mar		PS 414; PS et al. 2460	
<i>Gynura longifolia</i> Kerr		LMF	1,400-1,500	Jan-Mar	Jan-Mar	PS 492, 2700, 2702; PS et al. 2485	

(continued)

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	Notes
<i>Gynura</i> sp.		LMF	1,400-1,500	Nov-Feb	Nov-Feb	PS 462, 2242	
<i>Imula cappa</i> (Buch.-Ham. ex D. Don) DC.	Nat kham, Nat doi	LMF, open places	1,700	Nov-Mar	Nov-Mar	PS 438, PS et al. 2443	
<i>Imula nervosa</i> Wall. ex DC.	Di la mon	LMS	1,700	Nov-Dec	Nov-Dec	PS 437, 2652	
<i>Lactuca</i> sp. 1		LMF, roadsides	1,400-1,700	Jan-Mar	Jan-Mar	PS 477; PS et al. 2484, 2488	
<i>Lactuca</i> sp. 2		LMF, roadsides	1,100-1,200	Nov-Dec		PS 2213	
<i>Laggera pterodonta</i> (DC.) Sch.-Bip. ex Oliv.	Nat doi	Disturbed areas	1,300	Feb-Mar	Feb-Mar	PS et al. 2455	
<i>Ligularia hodgsonii</i> Hook.f.		LMS	1,700-1,800	Aug-Nov	Aug-Nov	PS 1856, 2124	Fig. 96
<i>Microglossa pyrifolia</i> (Lam.) O. Kuntze	Tong hung	DEF, LMF	1,000-1,100	Feb-Mar	Feb-Mar	PS et al. 2458	
<i>Pentanema indica</i> (L.) Ling		DDF, MDF	800	Feb-Mar		PS et al. 2459	
<i>Pluchea polygonata</i> (DC.) Gagnep.	Nat	DDF	700-800	Nov-Dec		PS 2272	
<i>Saussurea deltoidea</i> (DC.) C.B. Clarke		LMF, open places	1,600-1,800	Oct-Feb	Oct-Feb	PS 1158, 2377	
<i>Synotis cappa</i> (Buch.-Ham. ex D. Don) C. Jeffrey & Y.L. Chen var. <i>parishii</i> (Hook.f.) H. Koyama		LMF, open places	1,700	Jan-Feb		PS 2349	
<i>Synotis nagensium</i> (C.B. Clarke) C. Jeffrey & Y.L. Chen	Khang hang lek	LMS, open places	1,700-1,750	Nov-Mar	Nov-Mar	PS 435; PS et al. 2420	
<i>Vernonia megacephala</i> Sch.-Bip.		LMF, open places	1,400-1,500	Feb-Mar		PS et al. 2486	
<i>Vernonia parishii</i> Hook.f.	Khang hang lek	DEF, LMF	1,000-1,100	Feb-Mar		PS et al. 2457	
<i>Vernonia solanifolia</i> Benth.	Cha khruua	MDF, DEF	800-900	Feb-Mar		PS 572	
<i>Vernonia squarrosa</i> (D. Don) Less.	Nat dam	DEF, LMF	800-1,300	Jan-Mar		PS 2392; PS et al. 2452	
<i>Vernonia sutepensis</i> Kerr		LMF	1,400-1,500	Feb-Mar		PS et al. 2483	

(continued)

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	Notes
<i>Vernonia volkameriifolia</i> Wall. ex DC.	Ya kae	LMF	1,500-1,700	Nov-Feb	Nov-Feb	PS 458, 1229, 2681	
<i>Vernonia</i> sp. 1		DEF, by streams	800-900	Mar		PS 1315	
<i>Vernonia</i> sp. 2		MDF	900	Dec		PS 2621	
<i>Vernonia</i> sp. 3		LMF	1,100	Dec		PS 2623	
<i>Vernonia</i> sp. 4		LMF	1,500-1,600	Feb-Mar		PS et al. 2447	
Unidentified 1		LMF	1,700	Aug-Sep		PS 1516	
Unidentified 2		LMF	1,500	Jan-Feb		PS 2686	
Unidentified 3		LMS	1,600-1,700	Jun-Jul		PS et al. 872	

BALANOPHORACEAE

Annual or perennial, dioecious or monoecious, fleshy parasitic herbs on roots, chlorophyll less, no stomata; underground parts apparently modified root, tuber-like. **Leaves** simple, alternate, opposite or whorled, scale-like or absent. **Inflorescence** terminal, spicate, racemose or spadix-like. **Flowers** unisexual, very rarely bisexual. **Male flowers**: perianth 3-4(-8) or absent, valvate; anthers 1-2 when perianth absent or as many as the tepals. **Female flowers** very reduced: perianth absent or very minute; ovary superior or inferior, 1-3-celled; styles 1-3; ovule 1 in each cell. **Fruit** indehiscent, nut-like. **Seed** 1.

Eighteen genera and 44 species in tropical and subtropical regions (Mabberley, 1997). Only 1 genus with 5 species in Thailand (Hansen, 1972b). Two species recorded from Doi Phu Kha National Park.

BALANOPHORA J. R. & G. Forst.

Char. Gen. Pl.: 99. t. 50. 1776; Hansen, Dansk Bot. Ark. 28: 84. 1972 (revision); in Fl. Thailand 2(2): 177. 1972.

Dioecious or monoecious, fleshy, red, brown or yellow root parasitic herbs. Stems appear from basal tubers. **Leaves** alternate, opposite or spirally arranged. **Inflorescence** spadix-like, terminating the stem. **Flowers** unisexual. **Male flowers** small, many to numerous, subtended by bracts or not; perianth 3-6, actinomorphic or zygomorphic; tepals ovate or lanceolate, acute or truncate at apex; stamens without filament; anthers 3-5, united into a synandrium. **Female flowers** very small, numerous, without a perianth, consisting of an ovary and a style, situated on the main axis of the inflorescence as well as on the lower part of the spadices; ovule 1, pendulous. **Fruit** indehiscent, nut-like, small.

Fifteen species in temperate to tropical Asia, Pacific Islands, tropical Australia, tropical Africa and Madagascar (Hansen, 1972a).

KEY TO THE SPECIES

1. Leaves spirally arranged. Male flowers actinomorphic; tepals normally 4-5, lanceolate, acute at apex **1. *B. fungosa* subsp. *indica***
1. Leaves opposite, decussate or distichous. Male flowers zygomorphic; tepals normally 6, with 2 median ones almost square with truncate at apex and 4 lateral ones lanceolate with acute at apex **2. *B. laxiflora***

1. *Balanophora fungosa* J. R. & G. Forst. subsp. *indica* (Arn.) B. Hansen

Dansk Bot. Ark. 28: 100. 1972 (see also for complete synonymy); in Fl. Thailand 2 (2): 179. 1972. – *Langsdorffia indica* Arn., Ann. Nat. Hist. 2: 37. 1838. – *Balanophora indica* (Arn.) Griff., Trans. Linn. Soc. London 20: 95. 1846; Hansen, Dansk Bot. Ark. 27: 27. 1969. – *B. thwaitesii* Eichl. in DC., Prodr. 17: 146. 1873. – *B.*

bonii Tiegh., Ann. Sci. Nat. Bot. Sér. 9. 6: 150. 1907. – *B. pierrei* Tiegh., Ann. Sci. Nat. Bot. Sér. 9. 6: 150. 1907. – *B. latipes* Tiegh., Ann. Sci. Nat. Bot. Sér. 9. 6: 150. 1907. – *B. gracilis* Tiegh., Ann. Sci. Nat. Bot. Sér. 9. 6: 151. 1907. – *Balaniella sphaerica* Tiegh., Ann. Sci. Nat. Bot. Sér. 9. 6: 184. 1907. – *Balanophora sphaerica* (Tiegh.) Lec. in Fl. Gén. I.-C. 5: 227. 1915. – *B. pierrei* var. *tonkinense* Lec. in Fl. Gén. I.-C. 5: 225. 1915. – *B. annamensis* Moore in Baker et al., J. Nat. Hist. Soc. Siam 4: 157. 1921. – *B. globosa* auct. non Jungh.: Ridl., Fl. Mal. Pen. 3: 174. 1924.

Dioecious plants, yellow to orange-yellow, pink or red; length from fusion with host root to top of inflorescence 5-25 cm high. **Tubers** single or in a mass more or less branched from the base; single tubers subspherical, 0.5-5.5 cm wide; surface of tuber coarsely tessellate to fine granular with stellate warts. Stem more or less elongated. **Leaves** 10-20, spirally arranged, imbricate, 2-3 cm long, 1-2 cm wide, obtuse, slightly cucullate. **Male inflorescence** red, ovoid-ellipsoid, 2-12 cm long, 2-7 cm wide, with expanded flowers; bracts truncate, almost square, ca. 5 mm long, 4 mm wide. **Male flowers** actinomorphic; tepals red, normally 4-5, lanceolate, 3-7 mm long, 1-2.5 mm wide, acute at apex; pedicels 7-10 mm long. Synandrium on a short torus, slightly compressed and obconical, 2.5-5 mm long; anthers (3-)4-5(-6), horseshoe-shaped. **Female inflorescence** red, depressed ellipsoid, subspherical or obovoid, 1-7 cm long, 1-5 cm wide. **Female flowers** on the main axis of the inflorescence as well as on the lower part of the spadices, very small, numerous.

Thailand.— All over the country.

Distribution.— India (type), Sri Lanka, Myanmar, S China (Yunnan), Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, Pacific Islands, Australia (Queenland).

Ecology.— Lower montane forest, alt. 1,400-1,700 m (Doi Phu Kha).

Phenology.— Flowering: December-February.

Vernacular.— ขนุนดิน Khanun din, ดอกดิน Dok din (Lua-Nan, General).

Voucher specimens.— *P. Srisanga* 1272, 2332.

Notes.— According to Hansen (1972a), *Balanophora fungosa* J. R. & G. Forst. subsp. *indica* (Arn.) B. Hansen comprises of 3 varieties: var. *indica* which widely distribution in India, Sri Lanka, S China (Yunnan), SE Asia, Pacific Islands and Australia (Queenland); var. *globosa* (Jungh.) B. Hansen which restrict distribution in Indonesia (Java only) and var. *minor* (Eichl.) B. Hansen which very rare specimens collected, only 3 times from India (Nilghiris) and N Thailand (Mae Hong Son). Specimens from Doi Phu Kha National Park belong to var. *indica*.

2. *Balanophora laxiflora* Hemsl.

In Forb. & Hemsl., J. Linn. Soc. Bot. 26: 410, pl. 9. 1894; Dansk Bot. Ark. 28: 148. 1972 (see also for complete synonymy); in Fl. Thailand 2(2): 181. 1972. – *Polyplethia hexamera* Tiegh., Ann. Sci. Nat. Bot. Sér. 9. 6: 195. 1907. – *Balanophora hexamera* (Tiegh.) Lec., Bull. Soc. Bot. France 62: 212. 1915. *Acroblastum hexamerum* (Tiegh.) Setch., Univ. Calif. Publ. Bot. 19: 146. 1935. – *Balanophora indica* auct. non (Arn.) Griff.: Hance, J. Bot. 21: 356. 1883.

Dioecious plants, deep crimson to dark red; length from fusion with host root to top of inflorescence 7-20 cm high. **Tubers** in a mass branched from the base; single tubers subspherical or slightly longer than wide, 1-3 cm long and wide; surface of tuber fine granular with stellate warts. Stem more or less elongated. **Leaves** opposite, decussate, 2-7 pairs or distichous, 2-2.5 cm long, 1-1.5 cm wide, obtuse, slightly cucullate. **Male inflorescence** red, oblong-lanceolate, 6-12 cm long, 1-2 cm wide; bracts absent or each bract reduced to 2 short, blunt bodies below the flower. **Male flowers** zygomorphic; tepals red, normally 6, with 2 median tepals, almost square with truncate at apex and 4 lateral tepals, lanceolate with acute at apex, 2-3 mm long, 1-1.5 mm wide, subequal or the 2 median one slightly wider than the 4 lateral ones; pedicels absent or extremely short, less than 1 mm long. Synandrium much depressed, low domeshaped, subcircular or slightly elliptic, being lateral elongated; anther cells often divided into small locelli about 2 times longer than wide. **Female inflorescence** red, oblong-lanceolate to narrowly ellipsoid, 3-6 cm long, 1.5-3 cm wide. **Female flowers** on the main axis of the inflorescence as well as on the lower part of the spadices, very small, numerous.

Thailand.— Northern: Nan; Peninsular: Nakhon Si Thammarat.

Distribution.— Tibet, China (type), Taiwan, Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,400-1,700 m (Doi Phu Kha).

Phenology.— Flowering: July-February.

Vernacular.— ขนุนดิน Khanun din, ดอกดิน Dok din (Lua-Nan, General).

Voucher specimens.— *P. Srisanga* 2350; *P. Srisanga* & *C. Maknoi* 1992.

Notes.— New locality recorded from Nan, in Thailand.

BALSAMINACEAE

Annual or perennial herbs, rarely subshrubs, sometimes with tubers or rhizomes; stems succulent, rarely woody at base, more or less translucent, often rooting at the lower nodes; stipules absent. **Leaves** simple, alternate, opposite or verticillate, fleshy; margin crenate, dentate or serrate. **Inflorescence** axillary, cymose, racemose, pseudoumbellate or flowers solitary or in pairs. **Flowers** bisexual, zygomorphic, mostly resupinate, usually brightly coloured. **Sepals** 3 or 5, imbricate, free, unequal, the lowermost usually elongated into a tubular spur. **Petals** 5, dorsal petal free, flat or cucullate, often crested dorsally, lower 4 petals free (*Hydrocera* Bl.) or united into two lateral pairs (*Impatiens* L.). **Stamens** 5, connate into a ring surrounding ovary and stigma, ripening and usually falling off in one piece before the maturity of the stigma; anthers 2-locular. **Ovary** superior, 5-locular, axile placentation; style 1, very short or absent; stigmas 1-5; ovules 1 (*Hydrocera*) or numerous (*Impatiens*) in each loculus. **Fruit** a berry-like drupe (*Hydrocera*) or loculicidal fleshy explosive capsule and opening elastically into 5 twisted valves (*Impatiens*).

Two genera and about 1,000 species mainly in tropical and subtropical regions especially Asia and Africa. *Hydrocera* is a monotypic genus: *H. triflora* (L.) Wight &

Arn. Two genera and about 40 species in Thailand. One genus and 6 species recorded from Doi Phu Kha National Park.

***IMPATIENS* L.**

Sp. Pl.: 937. 1753; Fischer in Fam. Gen. Vasc. Pl. 6: 24. 2004.

Terrestrial or epiphytic annual or perennial herbs, rarely subshrubs; stems erect, ascending or decumbent. **Leaves** alternate, opposite or verticillate, petiolate. **Lateral sepals** 2, rarely 4, much smaller than petals; lower sepal with short or long, broad or filiform spur, or spur reduced and lacking. **Lateral petals** 4, united into two pairs. **Fruit** loculicidal fleshy explosive capsule and opening elastically into 5 twisted valves. **Seeds** few to numerous.

About 1,000 species in Europe, N and C America, Asia, tropical Africa and Madagascar (Fischer, 2004). Many species are cultivated as ornamentals.

KEY TO THE SPECIES

1. Flowers in racemes with conspicuous peduncles
 2. Lower sepal saccate with incurved spur
 3. Leaves congested on the top of stem, oblanceolate to obovate. Flowers white with red stripe and yellow patch on lower lateral petals **1. *I. claviger***
 3. Leaves not congested on the top of stem, lanceolate, elliptic to ovate. Flowers yellow with dark red dots on dorsal petal inside **2. *I. jurpia***
 2. Lower sepal narrowly trumpet-shaped with slender, slightly upcurved spur. Lower petals elongate **3. *I. longiloba***
1. Flowers solitary or in pairs
 4. Flower pink to violet
 5. Leaves alternate, distributed along stem; petioles distinct, up to 3 cm long, usually spinulose glandular. Lower sepal with 25-40 mm long incurved spur. Dorsal petal broadly obcordate, 10-12 mm long **4. *I. violaeiflora***
 5. Leaves congested on the top of shoot; petioles up to 5 mm long or absent. Lower sepal with 11-15 mm long incurved spur. Dorsal petal orbicular, ca. 5 mm long **5. *I. sp. 1***
 4. Flower yellow **6. *I. sp. 2***

1. *Impatiens claviger* Hook.f.

Hook. Ic. Pl. 29: t. 2863. 1908; in Fl. Gén. I.-C. 1: 627. 1911; Craib in Fl. Siam. Enum. 1: 210. 1926; Shimizu, SE Asian Studies 8(2): 215. 1970.

Erect herb, up to 1 m high, glabrous. **Leaves** alternate, congested on the top of stem, oblanceolate to obovate, 5-20 cm long, 3-8 cm wide, glabrous on both surfaces; base cuneate, attenuate onto the petiole; apex caudate; margin crenate, stipitate glandular at each sinus; primary veins 5-7 pairs; petioles up to 2 cm long.

Inflorescence in axillary racemes; peduncle up to 15 cm long. **Flowers** white with red stripe and yellow patch on lower lateral petals; pedicels up to 2 cm long, glabrous; bracts ovate, 8-12 mm long, caducous. **Lateral sepals** 4; the 2 outer ones broadly ovate to suborbicular, 13-16 mm long, mucronate at apex; the 2 inner ones linear, 16-20 mm long; lower sepal saccate, 20-25 mm long, with 10-12 mm long incurved spur, 18-20 mm across at mouth. **Dorsal petal** obovate, 17-20 mm long, emarginate at apex, costa gibbose on the upper part. **Capsule** clavate, 10-15 mm long, glabrous. **Seeds** numerous.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Vietnam (Tonkin-type).

Ecology.— Lower montane forest, alt. 1,400-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: June-December.

Voucher specimens.— *P. Srisanga* 736, 1737, 2297; *P. Srisanga et al.* 760; *W. Nanakorn* 8296.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

2. *Impatiens jurpia* Ham. ex Hook.f. & Thomson

J. Linn. Soc. London 4: 140. 1860; Hook.f. in Fl. Br. Ind. 1: 471. 1875; Craib in Fl. Siam. Enum. 1: 210. 1926; Shimizu, SE Asian Studies 8(2): 213. 1970; Grey-Wilson in Fl. Bhutan 2(1): 90, fig. 11: i. 1991.

Erect herb, up to 1 m high, glabrous or pubescent. **Leaves** alternate, lanceolate, elliptic to ovate, 5-23 cm long, 3-8 cm wide, sparsely hairy on upper surface, glabrous or pubescent along nerves on lower surface; base cuneate, attenuate onto the petiole; apex acuminate to caudate; margin crenate, stipitate glandular at each sinus; primary veins (5-)7-9 pairs; petioles up to 6 cm long. **Inflorescence** in axillary racemes, 3-8-flowered; peduncle up to 7 cm long. **Flowers** yellow with dark red dots on dorsal petal inside; pedicels up to 2 cm long, glabrous; bracts ovate, 2-3 mm long, caducous. **Lateral sepals** 4; the 2 outer ones obliquely lanceolate to broadly ovate or suborbicular, 2.5-7 mm long, mucronate at apex; the 2 inner ones minute; lower sepal saccate, 23-26 mm long, with 10-15 mm long incurved spur, 18-20 mm across at mouth. **Dorsal petal** orbicular-cucullate, 16-18 mm long, with 6-9 mm long spurred near apex behind; lateral united petals 24-32 mm long, lower petals oblong, 14-18 mm long, upper petals suborbicular, 10-15 mm long. **Capsule** clavate, 2-3 cm long, glabrous. **Seeds** numerous (Fig. 97).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Nepal (type), Bhutan, Myanmar.

Ecology.— Lower montane forest, alt. 1,280-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: June-November.

Vernacular.— เทียนจาบ Thian chap (General).

Voucher specimens.— *P. Srisanga* 270, 960, 1138, 1621, 1902, 2308; *P. Srisanga et al.* 770.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

3. *Impatiens longiloba* Craib

Kew Bull. 1926: 161. 1926; in Fl. Siam. Enum. 1: 211. 1926; Shimizu, SE Asian Studies 8(2): 213. 1970.

Herb, up to 1 m high, glabrous. **Leaves** alternate, broadly lanceolate to elliptic, 6-13 cm long, 3.5-5 cm wide, glabrous on both surfaces; base cuneate, attenuate onto the petiole; apex acuminate; margin crenate, stipitate glandular at each sinus; primary veins 7-10 pairs; petioles up to 6 cm long. **Inflorescence** in axillary racemes, 2-5-flowered; peduncle up to 3 cm long. **Flowers** yellow with red blotches along spur; pedicels 1-1.5 cm long, glabrous; bracts ovate, 3-4 mm long, caducous. **Lateral sepals** 4; the 2 outer ones ovate or suborbicular, 4-6 mm long, mucronate at apex; the 2 inner ones subulate, 4-5 mm long; lower sepal narrowly trumpet-shaped with oblique mouth, 25-30 mm long including slender, slightly upcurved spur, 7-9 mm across at mouth. **Dorsal petal** ovate, 10-13 mm long, rounded at apex, costa narrowly winged; lateral united petals 20-25 mm long, lower petals elongate, 10-15 mm long, upper petals ovate-reniform, 6-9 mm long. **Capsule** linear-clavate, 2-3 cm long, glabrous. **Seeds** numerous.

Thailand.— Northern: Chiang Mai (type), Chiang Rai, Nan.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, sometimes by streams, alt. 1,400 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: June-August.

Vernacular.— เทียนหาง Thian hang (General).

Voucher specimens.— *P. Srisanga et al.* 844.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

4. *Impatiens violaeiflora* Hook.f.

In Fl. Br. Ind. 1: 457. 1874; Craib in Fl. Siam. Enum. 1: 214. 1926; Shimizu, SE Asian Studies 8(2): 198. 1970.

Erect herb, up to 50 cm high, glabrous or puberulous on the upper part. **Leaves** alternate, lanceolate, elliptic to ovate, (1-)4.5-10 cm long, (0.5-)1.5-3.5 cm wide, sparsely hairy on upper surface, glabrous or rarely pubescent on lower surface; base cuneate, attenuate onto the petiole; apex acuminate; margin crenate-serrate, stipitate glandular at each sinus, usually conspicuous on the lower half; primary veins 5-10 pairs; petioles up to 3 cm long, usually spinulose glandular. **Flowers** solitary or in pairs, axillary, pink to violet, with two yellow spots at the centre; pedicels 1-3.5 cm long, glabrous or sparsely hairy; bracts caducous. **Lateral sepals** 2, lanceolate to ovate, 1-3 mm long, glabrous or puberulous outside; lower sepal funnel-shaped or trumpet-shaped, 5-7 mm long, with 25-40 mm long, slender, incurved spur, 5-7 mm across at mouth. **Dorsal petal** broadly obcordate, 10-12 mm long, costa narrowly winged, slightly pubescent, horned at apex; lateral united petals deeply bilobed, 15-18

mm long, lower petals suborbicular, slightly larger than upper petals. **Capsule** ellipsoid, 10-15 cm long, hirsute. **Seeds** ovoid, numerous, hairy.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Nan; North-eastern: Phetchabun, Loei.

Distribution.— Myanmar (type).

Ecology.— Dry evergreen and lower montane forest, along streams, open places, sometimes on limestone rocks, alt. 900-1,650 m (Doi Phu Kha, Tham Pha Khaw).

Phenology.— Flowering and fruiting: June-December.

Vernacular.— เทียนดอย Thian doi, เทียนป่า Thian pa (Chiang Mai).

Voucher specimens.— *P. Srisanga* 406, 1558, 1570, 1921; *P. Srisanga et al.* 755, 854.

5. *Impatiens* sp. 1

Erect herb, up to 50 cm high, glabrous or puberulous on the upper part. **Leaves** alternate, congested on the top of shoot, lanceolate, elliptic to ovate, 1.5-4.5 cm long, 0.5-2 cm wide, sparsely pubescent on both surfaces; base cuneate, attenuate onto the petiole; apex acute; margin crenate-serrate, stipitate glandular at each sinus; primary veins 5-7 pairs; petioles up to 5 mm long or absent. **Flower** solitary, axillary, pink, without yellow spots at the centre; pedicels up to 11 mm long, puberulous. **Lateral sepals** 2, lanceolate, ca. 1 mm long, puberulous outside; lower sepal funnel-shaped or trumpet-shaped, 5-7 mm long, with 11-15 mm long, slender, incurved spur, 4-5 mm across at mouth. **Dorsal petal** orbicular, ca. 5 mm long, puberulous outside; lateral united petals deeply bilobed, lower petals oblanceolate, 7-8 mm long, rounded at apex, upper petals ovate, ca. 5 mm long. **Capsule** ellipsoid, 9-10 cm long, hirsute. **Seeds** obovoid, compressed, numerous, hairy.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,700-1,80 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-November.

Voucher specimens.— *P. Srisanga* 927, 1140, 1537.

Notes.— Possibly new species.

6. *Impatiens* sp. 2

Herb, up to 25 cm high, glabrous or puberulous on the upper part, lenticellate. **Leaves** alternate, lanceolate to oblanceolate, (1.5-)3-6(-8) cm long, 0.5-1.5 cm wide, glabrous, granular on upper surface, glabrous or sparsely pubescent on nerves on lower surface; base cuneate, attenuate onto the petiole; apex obtuse, bluntly acute to shortly acuminate; margin coarsely crenate, stipitate glandular at each sinus; primary veins 5-6 pairs; petioles obscure, short or absent. **Flower** solitary, axillary, yellow with red stripe inside of lower sepal; pedicels up to 3 cm long, glabrous or sparsely hairy, granular; bracts caducous. **Lateral sepals** ovate, ca. 10 mm long, glabrous;

lower sepal trumpet-shaped, with slender upcurved spur. **Dorsal petal** broadly ovate. **Capsule** not known (Fig. 98).

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, by falls, alt. 700-850 m (Sapan Waterfall).

Phenology.— Flowering: July-November.

Voucher specimens.— *P. Srisanga* 328, 1964.

Notes.— Possibly new species. Due to insufficient materials, the affinity is uncertain.

BEGONIACEAE

Herbs or undershrubs, terrestrial or epiphytic, monoecious or rarely dioecious; stem herbaceous, often succulent, or woody, sometimes acaulescent. **Leaves** simple, sometimes palmately lobed or compound, alternate, often asymmetrical or oblique at base; stipules free, deciduous. **Inflorescence** usually axillary, cymose. **Flowers** unisexual, zygomorphic. **Male flowers: tepals** 2 or (3-)4(-8), free or variously connate, outer tepals usually larger than inner ones; **stamens** mostly numerous; filaments free or connate; anthers 2-locular, continuous with the filaments, opening by longitudinal slits or terminal pores. **Female flowers: tepals** more or less as in male flowers; staminodes absent or very small; **ovary** inferior, 2-3(-6)-locular, axile placentation, mostly angled or winged; styles 2-5, distinct, free or connate at base; stigmas often twisted, papillose nearly all over; ovules numerous. **Fruit** usually loculicidal capsule, often winged, rarely berry. **Seeds** minute, numerous.

Two genera and about 900 species in tropical and temperate regions (Mabberley, 1997). One genus and about 50 species in Thailand. Nine species recorded from Doi Phu Kha National Park.

BEGONIA L.

Sp. Pl.: 1056. 1753; Doorenbos, Sosef & de Wilde, Wag. Agri. Uni. Papers 98-2: 63. 1998.

Description as in the family. Another monotypic genus is *Hillebrandia sandwicensis* Oliver, confine to Hawaii, of which characterizes by 10 tepals in female flowers (Smith et al., 1986; Mabberley, 1997).

About 900 species in tropical and temperate regions (Mabberley, 1997). Many species are cultivated as ornamentals.

KEY TO THE SPECIES

1. Acaulescent herbs or with short stem with indistinct internodes. Leaves not lobed
 2. Leaves elliptic to ovate, cordate at base
 3. Leaf base equal or subequal cordate

4. Leaf base distinctly cordate. Tepals pink
 5. Leaves glabrous or subglabrous. Petioles at least 10 cm long **1. *B. discreta***
 5. Leaves hairy. Petioles less than 8 cm long **8. *B. puttii***
4. Leaf base truncate to cordate. Petioles less than 8 cm long. Tepals white
6. *B. cf. moulmeinensis*
3. Leaf base distinctly oblique cordate
 6. Leaves pubescent along nerves beneath. Petioles less than 12 cm long
2. *B. duclouxii*
6. Leaves glabrous or subglabrous. Petioles more than 20 cm long
7. *B. prostrata*
2. Leaves oblong to lanceolate, rounded, obtuse to broadly cuneate at base
3. *B. hatacoa*
1. Caulescent herbs with distinct internodes. Leaves lobed or not
 7. Leaves oblong to lanceolate, not lobed **4. *B. inflata***
 7. Leaves ovate to broadly ovate, lobed
 8. Leaves deeply lobed; lobes more than halfway to the base **5. *B. cf. macrotoma***
 8. Leaves shallowly lobed; lobes less than halfway to the base **9. *B. villifolia***

1. ***Begonia discreta*** Craib

Kew Bull. 1930: 410. 1930; in Fl. Siam. Enum. 1: 773. 1931; Smith et al., Smiths. Contr. Bot. 60: 159, fig. 8.5. 1986.

Thailand.— Northern: Chiang Mai (type), Nan.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane scrub, on limestone rocks, alt. 1, 700 m (Doi Phu Wae).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 2126.

2. ***Begonia duclouxii*** Gagnep.

Bull. Mus. Hist. Nat. Paris 25: 198. 1919; Smith et al., Smiths. Contr. Bot. 60: 161, fig. 23.5. 1986.

Thailand.— Northern: Nan.

Distribution.— S China (Yunnan-type).

Ecology.— Dry evergreen forest, near falls, alt. 700-800 m (Sapan Waterfall).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 1575.

3. ***Begonia hatacoa*** Buch.-Ham. ex D. Don

Prodr. Fl. Nepal.: 223. 1825; Smith et al., Smiths. Contr. Bot. 60: 176, fig. 16.7. 1986; Grierson in Fl. Bhutan 2(1): 243, fig. 29: k. 1991.

Thailand.— Northern: Nan.

Distribution.— Nepal (type), Bhutan.

Ecology.— Dry evergreen forest, near falls, alt. 700-800 m (Sapan Waterfall).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 2570.

4. *Begonia inflata* C.B. Clarke

In Fl. Br. Ind. 2: 636. 1879; Craib in Fl. Siam. Enum. 1: 774. 1931; Smith et al., Smiths. Contr. Bot. 60: 183, fig. 30.12. 1986; Grierson in Fl. Bhutan 2(1): 242, fig. 29: 1-m. 1991.

Thailand.— Northern: Nan; Peninsular: Surat Thani.

Distribution.— India, Bhutan, Sikkim (type), Myanmar.

Ecology.— Lower montane forest, by streams, alt. 1,200 m (Doi Phu Kha).

Phenology.— Flowering: March-April.

Vernacular.— ส้มกึ่ง Som kung (Nan).

Voucher specimens.— *P. Srisanga* 1330.

5. *Begonia cf. macrotoma* Irmscher

Thailand.— Northern: Nan.

Distribution.— S China (Yunnan-type).

Ecology.— Lower montane forest, by streams, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-November.

Voucher specimens.— *P. Srisanga* 1169.

References.— Smith et al. (1986).

6. *Begonia cf. moulmeinensis* C.B. Clarke

Thailand.— Northern: Nan.

Distribution.— Myanmar.

Ecology.— Dry evergreen forest, on limestone rocks, alt. 1,000 m (Tham Pha Khaw).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 1929.

References.— Smith et al. (1986).

7. *Begonia prostrata* Irmscher

Mitt. Inst. Allg. Bot. Hamburg 10: 516. 1939; Smith et al., Smiths. Contr. Bot. 60: 219, fig. 23.2. 1986.

Thailand.— Northern: Nan.

Distribution.— China (type).

Ecology.— Dry evergreen forest, in shaded and moist areas, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: January-February.

Voucher specimens.— *P. Srisanga* 2731.

8. *Begonia puttii* Craib

Gard. Chron. III. 83: 67. 1928; in Fl. Siam. Enum. 1: 778. 1931; Smith et al., Smiths. Contr. Bot. 60: 221, fig. 8.7. 1986.

Thailand.— Northern: Chiang Mai (type), Nan (Fig. 99).

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, on rocks, alt. 1, 700-1,800 m (Doi Phu Kha).

Phenology.— Flowering: July-September.

Voucher specimens.— *P. Srisanga* 918, 1533.

9. *Begonia villifolia* Irmscher

Notes Roy. Bot. Gard. Edinb. 21: 43. 1951; Smith et al., Smiths. Contr. Bot. 60: 248, fig. 5.34. 1986.

Thailand.— Northern: Nan.

Distribution.— China (type).

Ecology.— Lower montane forest, alt. 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering: September-October.

Voucher specimens.— *P. Srisanga* 269, 1658.

BERBERIDACEAE

Shrubs or perennial herbs, evergreen or deciduous, usually glabrous. **Leaves** simple or compound, alternate; stipules absent or minute. **Inflorescence** axillary or terminal, cymose or racemose. **Flowers** bisexual, (2-)3(-4)-merous, actinomorphic. **Perianth** differentiated into sepals and petals or not. **Sepals** (2-)3(-4)-merous, usually 1 or 2 series, if distinguish sometimes petaloid, free, rarely absent. **Petals** (2-)3(-4)-merous, free, rarely absent. **Stamens** (4-)6(-18), with or without basal nectary glands; anthers 2-locular, usually dehiscent by valves, sometimes by longitudinal slits. **Ovary** superior, 1-locular; ovules 1-many, basal or marginal placentation. **Fruit** usually berry, rarely utricle or follicle. **Seeds** often arillate.

Fifteen genera and about 680 species mainly in N temperate region, sometimes in tropical high mountains (Mabberley, 1997). Many species are cultivated as ornamentals. Only 1 species in Thailand.

MAHONIA Nutt.

Gen. N. Am. Pl. 1: 211. 1818; Loconte in Fam. Gen. Vasc. Pl. 2: 150. 1993.

Evergreen shrubs. **Leaves** trifoliolate or imparipinnate compound; leaflets entire, toothed or spiny. **Inflorescence** terminal, racemes or panicles. **Perianth** not really differentiated into sepals and petals. Outer tepals (sepals) 3-9, petaloid, yellow. Inner tepals (petals) 6, yellow, with basal nectary glands. **Stamens** as many as petals and opposite with them; anthers versatile, dehiscent by valves. **Fruit** a berry. **Seeds** 1-18.

About 100 species from Himalayas to E Asia and in N America (Mabberley, 1997).

Mahonia siamensis Takeda ex Craib

Kew Bull. 1915: 422. 1915; in Fl. Siam. Enum. 1: 73. 1925.

Shrub, 1.5-3 m high; bark rough, corky; wood yellow; stem leafy near apex. **Leaves** imparipinnate, 13-20(-30) cm long; leaflets 4-6(-8) pairs, elliptic to ovate, thick coriaceous, glabrous; base obliquely truncate; apex acute sharply spine; margin coarsely sharply spine, 3-5(-7) teeth on each side; petiolules absent. **Inflorescence** in fascicles of 6-10 racemes, 10-20 cm long; pedicels 3-6 mm long, glabrous; bracts lanceolate, 3-5 mm long, subtended each flower. **Perianth** 15, in 5 whorls, yellow, ovate to obovate, glabrous; outermost whorl smallest, 2.5-3 mm long, 2-2.5 mm wide; others 4 whorls subequal, 4.5-8 mm long, 3-4.5 mm wide; outer 3 whorls broadly acute to obtuse or rounded at apex; inner 2 whorls bilobed or emarginate at apex. **Stamens** 6; filaments flatten, 3.5-4.5 mm long, glabrous. **Ovary** narrowly ellipsoidal, 3.5-4 mm long, glabrous; stigma capitate-peltate. **Berry** ellipsoid to subglobose, 5-8 mm long, bluish-black, glaucous, with persistent style at apex.

Thailand.— Northern: Chiang Mai (type), Nan.

Distribution.— Myanmar.

Ecology.— Lower montane scrub, open areas on limestone mountain, alt. 1,700-1,750 m (Doi Phu Wae).

Phenology.— Flowering: January-March; fruiting: May-June.

Uses.— Wood for relief stomachache.

Vernacular.— ขมิ้นคั้น Khamin ton (General).

Voucher specimens.— *P. Srisanga et al.* 2423.

Notes.— Rare species. New locality recorded from Nan, in Thailand. Possibly conspecific with *M. napaulensis* DC.

BETULACEAE

Monoecious trees or shrubs; branchlets sometimes differentiated into long and short shoots; bark often marked with prominent lenticels. **Leaves** simple, alternate, dentate or serrate; stipules present, deciduous. **Inflorescence** terminal or axillary,

catkin. **Male inflorescence** in more or less pendulous catkin, with numerous overlapping bracts; each bract usually subtending a small dichasium with 1-3 male flowers. **Female inflorescence** in pendulous or erect catkin, short, often woody, with numerous overlapping bracts; each bract usually subtending a small dichasium with 2-3 female flowers. **Flowers** unisexual. **Sepals** 1-6, scale-like or absent. **Petals** absent. **Stamens** same number as sepals and opposite or many, free or united at base; anthers 2-locular, dorsifixed, dehiscing by longitudinal slits. **Ovary** inferior, 2(-3)-locular; styles free; ovules pendulous from near summit of partition, 1-2 in each loculus. **Infructescence** woody or cone-like or consisting of clusters of large subfoliaceous bracts. **Fruit** a nut or 2-winged samara (in Coryloideae subtended or almost enclosed in 2 or 3 leafy bracts). **Seed** usually 1.

Six genera with about 110 species mainly in N temperate and subtropical regions (Mabberley, 1997). Two genera and 3 species in Thailand. Two genera and 2 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Male flowers with scale-like sepals. Female flowers without scale-like sepals.
Infructescence cone-like. Fruit 2-winged samara **1. *Betula***
1. Male flowers without scale-like sepals. Female flowers with scale-like sepals.
Infructescence consisting of clusters of large subfoliaceous bracts. Fruit a nut,
not winged, subtended by a 3-lobed bract **2. *Carpinus***

1. *BETULA* L.

Sp. Pl. 982. 1753; Kubitzki in Fam. Gen. Vasc. Pl. 2: 156. 1993; Li & Skvortsov in Fl. China 4: 304. 1999.

Trees or shrubs, deciduous. **Leaves** often glandular punctate. **Male inflorescence** in elongate, cylindric, pendulous catkin, with numerous overlapping bracts; each bract subtending 2 bracteoles and 3 flowers. **Male flowers** with scale-like, 4-lobed sepals; stamens (1-)2-3(-4). **Female inflorescence** 1-2 or several in spicate, ellipsoid or cylindric, pendulous catkin, with numerous overlapping deciduous bracts; each bract subtending 2-3 flowers. **Female flowers** sessile, without scale-like sepals. Infructescence cone-like. **Fruit** 2-winged samara.

About 50-60 species mostly in temperate and subtropical of N Hemisphere (Li & Skvortsov, 1999). Only 1 species in Thailand.

Betula alnoides Buch.-Ham. ex D. Don

Prodr. Fl. Nepal.: 58. 1825; Hook.f. in Fl. Br. Ind. 5: 599. 1888; Camus in Fl. Gén. I.-C. 5: 1039, fig. 118: 1. 1931; Li & Skvortsov in Fl. China 4: 306. 1999. – *B. acuminata* Wall., Pl. As. Rar. 2: 7, t. 109. 1831.

Tree up to 30 m high; bark and branches grey, prominently with white lenticels. **Leaves** lanceolate to elliptic, papery, (4-)6-10(-12) cm long, 2.5-4.5(-5.5) cm wide, sparsely pubescent on midrib and veins, glabrescent, glandular punctate and with tuft hairs at the leaves axils beneath; base broadly cuneate to rounded, rarely subcordate, slightly oblique; apex acuminate; margin irregular serrate; primary veins 9-13 pairs; petioles 1-1.5(-2) cm long, pubescent, glabrescent. **Female inflorescence** 3-5 in spicate, narrowly cylindrical, pendulous catkin, 5-10 cm long, 0.4-0.6 cm wide, densely brown villous; peduncle 2-3 mm long; bracts oblong, 2-3 mm long, pubescent, ciliolate. **Fruit** obovate, ca. 1 mm long, pubescent at apex, 2-3 mm wide including membranous wings.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan.

Distribution.— India, Nepal (type), Bhutan, Myanmar, China, Vietnam.

Ecology.— Lower montane forest, open places or along roadsides, alt. 1,300-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: December-March; leafless only short period in December-January.

Uses.— Bark is used for making spirit by soaking in local whisky and drink for good health.

Vernacular.— กำลั้งเสือโคร่ง Kamlang suea khrong (Northern).

Voucher specimens.— *P. Srisanga* 480, 2363; *S. Watthana* s.n. (9 March 1997).

Notes.— Strong methyl salicylate smell in crushed leaves and bark.

2. *CARPINUS* L.

Sp. Pl. 998. 1753; Kubitzki in *Fam. Gen. Vasc. Pl.* 2: 156. 1993; Li & Skvortsov in *Fl. China* 4: 289. 1999.

Trees or shrubs, deciduous or evergreen. **Male inflorescence** in elongate, cylindrical, pendulous catkin, with many overlapping bracts; bracteoles absent. **Male flowers** without scale-like sepals; stamens 3-12, inserted at base of bracts; filaments forked at apex. **Female inflorescence** terminal or axillary, spicate. **Female flowers** in paired, with scale-like sepals; bracts subfoliaceous, 2-3-lobed. **Fruit** a nut, not winged, subtended by a persistent bract.

About 50 species mostly in temperate and subtropical of N Hemisphere, especially E Asia (Li & Skvortsov, 1999). Only 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

Carpinus londoniana H. Winkler

Pflanzenr. IV. 61 (Heft 19): 32. 1904; Camus in *Fl. Gén. I.-C.* 5: 1036, fig. 117: 1-2. 1931; Li & Skvortsov in *Fl. China* 4: 293. 1999. – *C. poilanei* Camus, *Bull. Soc. Bot. France* 76: 968. 1929.

Tree up to 15 m high; branches grayish white; branchlets drooping, with white lenticels. **Leaves** lanceolate to narrowly elliptic, chartaceous to subcoriaceous, 5-9(-12) cm long, (2-)2.5-3.5(-4) cm wide, glabrous, with tuft hairs at the leaves axils beneath; base broadly cuneate to rounded, rarely subcordate, slightly oblique; apex acuminate; margin irregular serrate; primary veins 10-13 pairs; petioles 4-7 mm long, black-brown, pubescent. **Female inflorescence** 8-10 cm long, brown villous, glabrescent; peduncle 2-2.5 cm long; bracts 3-lobed, 2-2.5 cm long, glabrous or sparsely hairy, with distinctly veined; median lobe oblong to falcate; margin entire or 1-2 teeth on one side, coarsely serrate on other side; lateral lobes oblong to ovate, 2-3 mm long. **Nut** broadly ovoid, 3-4 mm long, 2.5-3.5 mm wide, with brown resinous glands, prominently ribbed.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan.

Distribution.— Myanmar, China, Laos, Vietnam.

Ecology.— Dry evergreen and lower montane forest, often near streams, alt. 800-1,000 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering: April-June; fruiting: July-August.

Vernacular.— ก่อสร้อย Ko soi (Northern).

Voucher specimens.— *P. Srisanga* 1943, 2581.

BIGNONIACEAE

Trees, shrubs or woody climbers, rarely herbs. **Leaves** opposite, sometimes whorled, rarely spirally arranged, pinnate to 3-pinnate compound, rarely simple or palmately compound, terminal leaflet sometimes transferred into a tendril; stipule absent. **Inflorescence** terminal or axillary, cymose, racemose or flower solitary. **Flowers** bisexual. **Calyx** 5, sometimes bilobed. **Corolla** 5, often 2-lipped, imbricate or rarely valvate. **Stamens** mostly 4, didynamous, epipetalous, rarely 2 or 5; staminodes usually 1, rarely 3 or absent. **Ovary** superior, 1-2-locular, axile or parietal placentation; stigma bilobed; ovules numerous. **Fruit** mostly a bivalved capsule, rarely fleshy. **Seeds** numerous, usually flatten and winged.

About 120 genera and 650 species, mostly in tropical and subtropical with a few genera in warm temperate regions. Many species are cultivated for ornamental in gardens and street trees. Twelve genera and about 24 indigenous species in Thailand (Santisuk, 1987). Three genera and 3 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Leaf rachis winged **1. *Pauldopia***
1. Leaf rachis not winged
 2. Corolla lobes 5, subequal. Capsule terete; body of winged seed flat, without a transverse groove; seed shallow impressed in the septum **2. *Radermachera***
 2. Corolla bilabiate, upper lip 2-lobed, lower lip 3-lobed, rarely 5-lobed, subequal.

Capsule more or less quadrangular; body of winged seed thick, trigonous, wedge-shaped, with a transverse groove; seed embedded in deep notch in the septum

3. *Stereospermum*

1. *PAULDOPIA* Steenis

Acta Bot. Neerl. 18: 425. 1969; Blumea 23(1): 122. 1976; Santisuk in Fl. Thailand 5 (1): 45. 1987; Fischer, Theisen & Lohmann in Fam. Gen. Vasc. Pl. 7: 19. 2004.

Evergreen shrubs or small trees. **Leaves** 2-pinnate with narrowly winged rachis; leaflets entire, subsessile. **Inflorescence** in a lateral thyrse. **Calyx** opened in bud, tubular-campanulate, caducous; lobes 5, short, triangular, caudate. **Corolla** tubular; tube slightly curved; lobes 5, subequal. **Stamens** 4, didynamous; staminode 1. **Fruit** a loculicidal capsule, subcylindric, slightly constricted between the seeds and ending in a long tip, twisted; septum flat, thin. **Seeds** thick woody, wingless.

A monotypic genus in continental SE Asia (Santisuk, 1987).

Pauldopia ghorta (Buch.-Ham. ex G. Don) Steenis

Acta Bot. Neerl. 18: 427, fig. 1. 1969; Blumea 23(1): 122. 1976; Santisuk in Fl. Thailand 5(1): 46. 1987. — *Bignonia ghorta* Buch.-Ham. ex G. Don, Gen. Syst. 4: 222. 1838. — *Stereospermum ghorta* (G. Don) C.B. Clarke in Fl. Br. Ind. 4: 384. 1884. — *Tecoma bipinnata* Coll. & Hemsl., J. Linn. Soc. Bot. 28: 102. 1890. — *Radermachera alata* Dop, Bull. Mus. Hist. Nat. Paris 32: 184. 1926. — *R. bipinnata* (Coll. & Hemsl.) Steenis ex Chatterjee, Bull. Bot. Soc. Beng. 2: 71. 1948.

Shrub or small tree, (2-)4-7 m high. **Leaves** 20-45 cm long, 3-4-jugate; rachis narrowly winged; leaflets thin, papery, ovate, elliptic or ovate-lanceolate, 3-9 cm long, 1.4-3.3 cm wide, usually unequal-sided; base broadly acute, slightly oblique; apex acuminate; margin, midrib and lateral nerves finely hirsute, more hairy below with few scattered glands. **Inflorescence** 8-17 cm long, glabrous. **Calyx** green, 1-2 cm long, membranous, glabrous, with glandular patches towards the base. **Corolla** tube yellow with brown-red lobes and throat; tube 9-15 mm long, slightly widened above, 3.5-6 cm long. **Stamens** included, glandular hairy at insertion. **Capsule** 22-35 cm long, 0.5-0.8 cm wide; septum ca. 4 mm broad. **Seeds** 5-8 mm long and wide.

Thailand.— Northern: Nan, Tak, Phitsanulok, Nakhon Sawan; North-eastern: Loei; South-western: Kanchanaburi.

Distribution.— Myanmar (type), S China, Laos, Vietnam (Tonkin).

Ecology.— Lower montane forest, by streams, alt. 1,200-1,600 m (Doi Phu Kha).

Phenology.— Flowering: March-May; fruiting: June-November.

Vernacular.— ระพังทอง Rakang thong (General).

Voucher specimens.— *P. Srisanga* 262, 1419, 2220; *P. Srisanga* & *S. Watthana* 668; *P. Srisanga et al.* 794.

Notes.— New locality recorded from Nan, in Thailand.

2. *RADERMACHERA* Zoll. & Moritz

In Zoll., Syst. Verz. 3: 53. 1855; Steenis, Blumea 23(1): 121. 1976; Santisuk in Fl. Thailand 5(1): 38. 1987; Fischer, Theisen & Lohmann in Fam. Gen. Vasc. Pl. 7: 20. 2004. – *Mayodendron* Kurz, Rep. Pegu, App. D, Pl. 1-2. 1875; Fl. Burm. 2: 232. 1877.

Evergreen or deciduous trees. **Leaves** 1-3 pinnate; leaflets entire with glandular patches or scattered glands underneath. **Inflorescence** in thyrses or almost reduced to raceme-like fascicles, terminal or ramiflorous. **Calyx** mostly irregularly lobed, usually with glandular patches or scattered crateriform glands, often with microscopic scale-like glands, caducous or persistent. **Corolla** with a mostly short basal tube, widened into salver-, funnel-, or campanulate-shaped upper tube; lobes 5, rounded, subequal. **Stamens** 4, didynamous or free, equal, not exerted or subexserted, glandular hairy or glabrous at insertion; staminode 1. **Fruit** a loculicidal capsule, linear, terete, usually twisted or sometimes straight; septum terete. **Seeds** small, flat, without a transverse groove, with lateral hyaline wing, shallow impressed in the septum.

About 15 species in tropical Asia (Steenis, 1976; Santisuk, 1985). Six species in Thailand (Santisuk, 1987; Srisanga et al., 2003). Only 1 species recorded from Doi Phu Kha National Park.

Radermachera eberhardtii Dop

Bull. Mus. Hist. Nat. Paris 32: 233. 1926; *R. eberhardtii* var. *acuta* Dop, Bull. Mus. Hist. Nat. Paris 32: 234. 1926; Steenis, Blumea 23(1): 125. 1976; Srisanga, Trisonthi & Santisuk, Thai For. Bull. (Bot.) 31: 129, figs. 1-2. 2003. – *R. microcalyx* C.Y. Wu & W.C. Yin in Fl. Yunnan. 2: 711, fig. 197: 1-4. 1979.

Evergreen tree, 7-15 m high. **Leaves** 1-pinnate, 25-30 cm long; leaflets 5-7, chartaceous to subcoriaceous, elliptic to ovate, (10-)14-20(-25) cm long, (3.5-)4.5-6(-11) cm wide, minutely glandular throughout and with sparse medium glands around base on lower surface; base cuneate, oblique; apex acute, acuminate to caudate; midrib raised and prominent below; petiolules 1-2 cm long or up to 6 cm long in terminal leaflet, minutely glandular. **Inflorescence** in terminal panicle, ca. 20 cm long, minutely glandular; pedicels 5-10 mm long. **Calyx** green, 6-7 mm long, minutely glandular, medium glands in groups at middle; lobes ca. 2 mm long, acute at apex. **Corolla** yellow, 3-3.5 cm long, minutely glandular; lobes ovate to orbicular, 0.6-1 cm long, hairy especially outside, margin fimbriate. **Stamens** 4, didynamous, hairy at insertion; filaments glabrous, shorter pair ca. 4 mm long, longer pair 5-6 mm long; anthers glabrous, 1.5-2 mm long. Staminode ca. 2 mm long. **Ovary** cylindrical, 2-2.5 mm long, minutely glandular; style 7-10 mm long, glabrous; stigma bilobed. Disc ca. 0.5 mm high, glabrous. **Capsule** 10-25 cm long, minutely glandular; valves 4-6 mm wide. **Seeds** 8-15 mm long, 1-2 mm wide, included wing (Figs. 32, 100).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— S China, Vietnam (type!).

Ecology.— Dry evergreen forest, by streams, alt.800-900 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: April-December.

Voucher specimens.— *P. Srisanga* 1324, 1450.

Notes.— Rare species, few specimens collected. New recorded for Thailand.

3. *STEREOSPERMUM* Cham.

Linnaea 7: 720. 1832; Santisuk in Fl. Thailand 5(1): 42. 1987; Fischer, Theisen & Lohmann in Fam. Gen. Vasc. Pl. 7: 21. 2004.

Deciduous trees. **Leaves** 1-pinnate with a few pairs of leaflets, usually with flat, plate- or cup-shaped glands or glandular spots beneath. **Inflorescence** in terminal panicles or shortly branched thyrses. **Calyx** smooth or ridged, shortly lobed. **Corolla** with very short or slender cylindrical basal tube, upper part more or less campanulately widened with bilabiate mouth, upper lip 2-lobed, lower lip 3-lobed, or rarely funnel-shaped with 5 subequal rounded, crisped or lacinate lobes. **Stamens** 4, didynamous, not exerted; staminode 1. **Fruit** a loculicidal capsule, more or less quadrangular; septum thick, terete, corky. **Seeds** thick, trigonous, wedge-shaped, with a transverse groove, with membranous wing on both sides, embedded in deep notch in the septum.

Over 12 species, in tropical Africa and Madagascar to SE Asia. Four species in Thailand. (Santisuk, 1987). Only 1 species recorded from Doi Phu Kha National Park.

Stereospermum colais (Buch.-Ham. ex Dillw.) Mabberley

Taxon: 27: 553. 1979; Santisuk in Fl. Thailand 5(1): 44. 1987. – *Bignonia colais* Buch.-Ham. ex Dillw., Rev. Hort. Mal. 6. T. 26: 28. 1839. – *Dipterosperma personatum* Hassk., Flora 25: 28. 1842. – *Stereospermum tetragonum* DC., Prodr. 9: 210. 1845. – *S. personatum* (Hassk.) Chatterjee, Bull. Bot. Soc. Beng. 2: 70. 1948.

Tree, (8-)10-25 m high. **Leaves** 25-45 cm long, 3-4(-6)-jugate; leaflets chartaceous to subcoriaceous, elliptic to elliptic-oblong, 6-13 cm long, 3-6 cm wide, glabrous or puberulous on both surfaces, minutely glandular on lower surface, usually with a few scattered large flat dark glands; base broadly acute to cuneate; apex acuminate to caudate; petiolules 6-17 mm long. **Inflorescence** in terminal panicle, 20-40 cm long, glabrous or finely puberulous to subglabrous. **Flowers** fragrant, diurnal. **Calyx** purple-brown, campanulate, 5-7 mm long, with 3-5 short acute lobes. **Corolla** dingy yellow, cream within, narrow cylindrical basal tube 3-5 mm long, suddenly campanulately widened and curved above, 1.2-1.7 cm long, compressed with the mouth closed and the underside grooved, bilabiate; lobes crisped, the upper 2 strongly recurved, the lower bearded at the mouth, with purplish stripes. **Stamens** hairy at insertion. **Capsule** 20-55 cm long, 1-2 cm wide, curved or twisted, with 4 prominent ridges. **Seeds** ca. 2 cm long, 0.5 cm wide, included wing.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Lampang, Phrae, Nan, Tak, Uttaradit, Nakhon Sawan; Eastern: Chaiyaphum; South-eastern: Chanthaburi; Central: Saraburi; South-western: Kanchanaburi, Ratchaburi; Peninsular: Surat Thani.

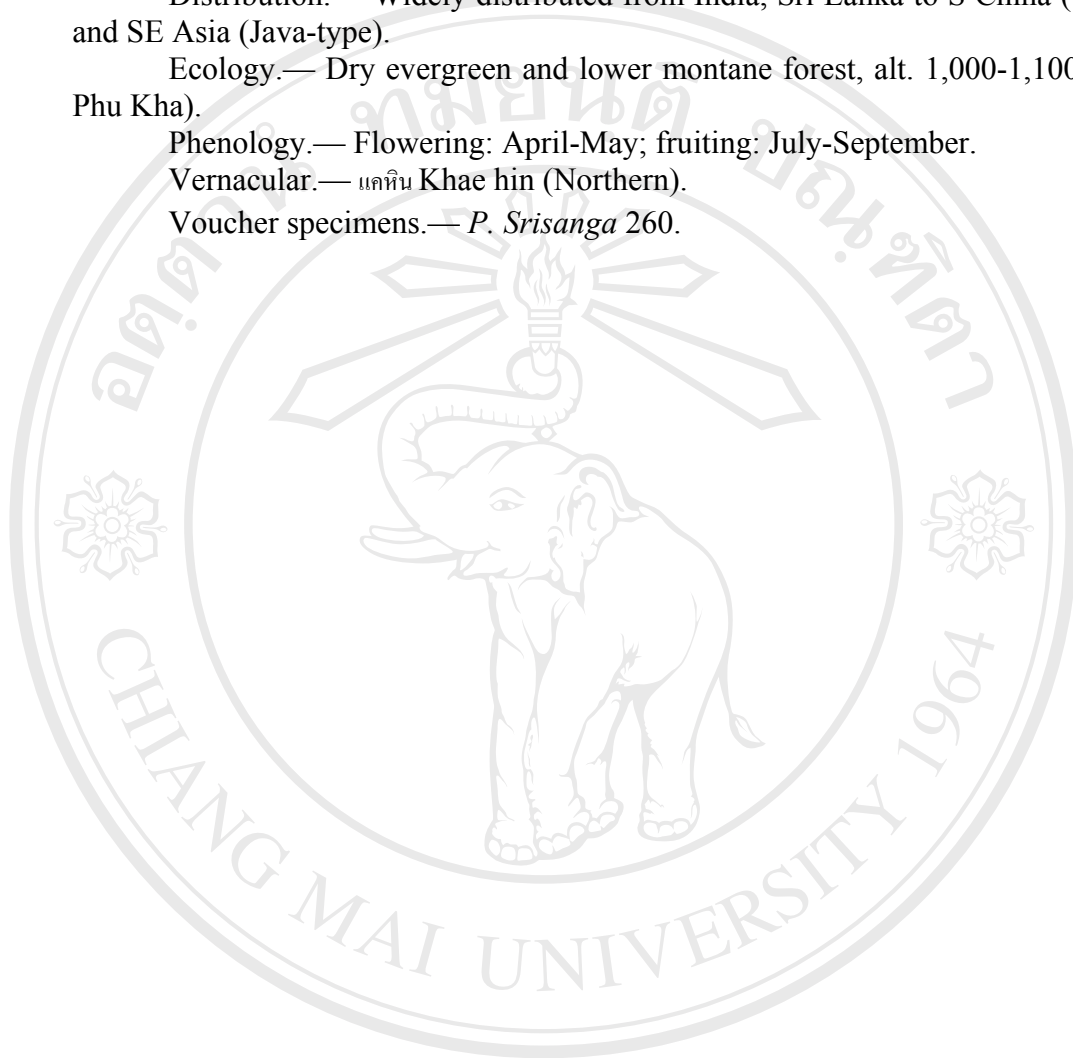
Distribution.— Widely distributed from India, Sri Lanka to S China (Yunnan) and SE Asia (Java-type).

Ecology.— Dry evergreen and lower montane forest, alt. 1,000-1,100 m (Doi Phu Kha).

Phenology.— Flowering: April-May; fruiting: July-September.

Vernacular.— แคะหิน Khae hin (Northern).

Voucher specimens.— *P. Srisanga* 260.



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

Copyright © by Chiang Mai University

All rights reserved



Figure 32. *Radermachera eberhardtii* Dop

A. leaves; B. inflorescence; C. corolla; D. calyx; E. opened corolla; F. stamen; G-H. fruit; I. seed. Scale bars 1 cm in A-C, E, G-H; 1 mm in D, F & I.

BORAGINACEAE

Trees, shrubs or herbs, rarely climbers, mostly with unicellular bristly hairs. **Leaves** simple, alternate, rarely opposite, usually entire; stipules absent. **Inflorescence** terminal, rarely axillary, usually scorpioid or helicoid cymes, rarely flower solitary. **Flowers** usually bisexual, more or less actinomorphic. **Sepals** (4-)5(-8), free or connate, imbricate, rarely valvate, mostly persistent. **Petals** (4-)5(-8), sympetalous; lobes imbricate or convolute, rarely valvate. **Stamens** as many as and alternate with the corolla lobes, inserted on the corolla tube; anthers 2-locular, opening by longitudinal slits. **Ovary** superior, 2-locular with 2 ovules in each loculus or 4-locular with 1 ovule in each loculus; style simple from the middle of the lobes (gynobasic) or terminal on the ovary or 2- or 4-fid or 2 and free; disk usually present; ovule erect, basally or spreading from the central axis, rarely pendulous. **Fruit** a capsule, drupaceous or nutlets.

An almost cosmopolitan family with about 130 genera and 2,300 species (Mabberley, 1997). About 7 genera and 20 species in Thailand. Four genera and 5 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Trees, shrubs or scrambling shrubs, rarely herbs. Style terminal
 2. Inflorescence panicles or corymbs. Styles twice 2-cleft; stigmas 4 **1. *Cordia***
 2. Inflorescence in dense 2-rowed scorpioid cymes. Stigmas entire or 2-cleft **3. *Tournefortia***
1. Herbs or subshrubs. Style gynobasic
 3. Herbs, usually less than 60 cm high. Connective of anthers not subulate, not spirally twisted. Nutlets, ovoid to subglobose, gloccidiate **2. *Cynoglossum***
 3. Subshrubs, usually more than 1 m high. Connective of anthers subulate, awn-like, spirally twisted. Nutlets, enclosed in papery calyx, dorsiventrally compressed, margin of abaxial surface protruding, becoming cupular, dentate **4. *Trichodesma***

1. *CORDIA* L.

Sp. Pl.: 190. 1753; Zhu, Riedl & Kamelin in Fl. China 16: 331. 1995; Riedl in Fl. Mal. I(13): 68. 1997.

Trees or shrubs. **Leaves** alternate, rarely opposite, petiolate. **Inflorescence** terminal or axillary, panicles or corymbs. **Flowers** bisexual, sometimes functionally unisexual and dioecious, frequently heterostylous. **Calyx** tubular or campanulate, enlarged in fruit, persistent; lobes (4-)5(-8), regular or not, usually small. **Corolla** campanulate to funnel-shaped; lobes (4-)5(-8). **Stamens** as many as the corolla lobes, included or exserted; filaments glabrous or pubescent at base. **Ovary** 4-locular; ovule 1 in each loculus; styles twice 2-cleft; stigmas 4. **Fruit** a drupe. **Seeds** 1-4.

About 320 species in tropical region especially America. About 8 species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

Cordia furcans I.M. Johnston

J. Arn. Arb. 32: 5. 1951; Zhu, Riedl & Kamelin in Fl. China 16: 332. 1995.

Tree, 1-2 m high; branchlets shortly pubescent. **Leaves** alternate, elliptic to ovate, 7-20 cm long, 5-15 cm wide, softly and densely pubescent on lower surface, strigose on upper surface; base broadly cuneate, rounded to subcordate; apex obtuse to acute; margin entire or with broadly and shallowly obtuse lobes; petioles 2-6 cm long, pubescent. **Inflorescence** terminal or axillary cymes, branched, 5-6 cm long, pubescent. **Flowers** 4-5-merous, sessile or nearly so. **Calyx** green, narrowly campanulate, 4-5 mm long, puberulous on both sides; lobes irregular, up to 1 mm long. **Corolla** white, 6-8 mm long, glabrous; lobes oblong-lanceolate, recurved, about as long as or slightly longer than the tube. **Filaments** ca. 1 mm long, glabrous; anthers ovoid, ca. 1 mm long. **Ovary** ellipsoid, ca. 2 mm long, glabrous; stigmas recurved, elongated. **Fruit** ovoid, 8-12 mm long and wide, black, glabrous, surrounded by a lobed copular persistent calyx.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Myanmar, S China, Vietnam.

Ecology.— Deciduous and dry evergreen forest, edges of the forest, secondary forest, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: November-December; fruiting: March-May.

Vernacular.— มะเลียง Ma liang (Nan).

Voucher specimens.— *P. Srisanga* 579, 2604.

Notes.— New locality recorded from Nan, in Thailand.

2. CYNOGLOSSUM L.

Sp. Pl.: 134. 1753; Zhu, Riedl & Kamelin in Fl. China 16: 420. 1995; Riedl in Fl. Mal. I(13): 79. 1997.

Herbs. **Leaves** alternate, entire. **Inflorescence** terminal or axillary, cymes, often dichotomously branches. **Calyx** enlarged in fruit, persistent; lobes 5, reflexed or spreading. **Corolla** campanulate, tubular or funnel-shaped, usually blue; tube usually shorter than calyx, with 5 appendages in throat; lobes 5, ovate to orbicular. **Stamens** 5, included. **Ovary** 4-locular; style gynobasic, linear, included; stigma capitate. **Fruit** in 4 nutlets, ovoid to subglobose, glaucous; attachment scar subapical.

About 75 species in tropical and temperate regions. About 3 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Stem softly brown appressed pubescent. Leaves pubescent. Corolla 3.5-5 mm long. Nutlets 2-3 mm long **1. *C. furcatum***
1. Stem densely hispid. Leaves strigose. Corolla 1.5-2 mm long.

Nutlets 1.5-2 mm long

2. *C. lanceolatum*

1. *Cynoglossum furcatum* Wall.

In Fl. Ind. ed. Carey & Wall. 2: 6. 1824; Zhu, Riedl & Kamelin in Fl. China 16: 423. 1995; Riedl in Fl. Mal. I(13): 83. 1997; Mill in Fl. Bhutan 2(2): 908, fig. 83: 1-n. 1999. – *C. zeylanicum* Brand in Pflanzenr., fam. IV.252: 134. 1921, pro parte, non Thunb. ex Lehm. (1817).

Erect herb, 40-60(-100) cm high, with rootstock; stem softly brown appressed pubescent. **Leaves** lanceolate, 15-20 cm long, 3-5 cm wide, sessile, the upper leaves much smaller, pubescent on both surfaces; base attenuate; apex acute; midrib raised and more prominent on lower surface. **Inflorescence** terminal on main stem and lateral branches, mostly paired branches, divaricate, scorpioid in the beginning, straight in fruit, ebracteate, 5-9 cm long, brown pubescent; pedicels 1-2 mm long, pubescent. **Calyx** ovate, 1.5-2.5 mm long, pubescent on both sides, slightly enlarged in fruit. **Corolla** blue, tubular-campanulate, with appendage inside, 3.5-5 mm long, glabrous on both sides; lobes ovate to suborbicular, rounded at apex. **Stamens** sessile; anthers oblong, ca. 1 mm long. **Style** 2-3 mm long, slightly tetragonous, sparsely pubescent; stigma knob-like. **Nutlets** ovoid to subglobose, 2-3 mm long, glaucous all over.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Afghanistan, India, Pakistan, Bhutan, Sikkim, China, Japan, Vietnam, Malaysia, Indonesia, Philippines.

Ecology.— Lower montane forest, open places, alt. 1,600-1,700 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: July-January.

Voucher specimens.— *P. Srisanga et al.* 882; *P. Suksathan* 1790.

2. *Cynoglossum lanceolatum* Forssk.

Fl. Aegypt.-Arab.: 41. 1775; Fletcher & Kerr in Fl. Siam. Enum. 3(1): 88. 1951; Zhu, Riedl & Kamelin in Fl. China 16: 424. 1995; Riedl in Fl. Mal. I(13): 87. 1997; Mill in Fl. Bhutan 2(2): 907. 1999. – *C. micranthum* Desf., Tabl. Ec. Bot.: 220. 1804.

Erect herb, 30-60(-100) cm high, with rootstock; stem densely hispid. **Leaves** lanceolate, 7-13 cm long, 1.5-3.5 cm wide, the upper leaves much smaller, strigose on both surfaces; hairs on upper surface usually with tubercle base; base cuneate, attenuate onto the petiole; apex acute; midrib raised and more prominent on lower surface; petioles up to 3 cm long, usually sessile in upper leaves, strigose. **Inflorescence** terminal on main stem and lateral branches, mostly paired branches, divaricate, scorpioid in the beginning, straight in fruit, ebracteate, 5-10 cm long, strigose; pedicels 1-2 mm long, strigose. **Calyx** ovate, ca. 1 mm long, strigose, slightly enlarged in fruit. **Corolla** white or pale blue, tubular-campanulate, with appendage inside, 1.5-2 mm long, glabrous on both sides; lobes ovate to suborbicular, rounded at apex. **Stamens** sessile; anthers ovate, ca. 0.5 mm long. **Style** ca. 1 mm

long, slightly tetragonous, very sparsely hairy; stigma knob-like. **Nutlets** ovoid to subglobose, 1.5-2 mm long, glaucous all over.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Africa, Arabia (type), Afghanistan, India, Sri Lanka, Pakistan, Nepal, Bhutan, Sikkim, China, Japan, throughout SE Asia.

Ecology.— Lower montane forest, open places, alt. 1,500-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: June-January.

Voucher specimens.— *P. Srisanga et al.* 864; *W. Nanakorn* 8297.

3. *TOURNEFORTIA* L.

Sp. Pl.: 140. 1753; Zhu, Riedl & Kamelin in Fl. China 16: 341. 1995.

Trees, shrubs or scrambling shrubs, rarely herbs. **Leaves** alternate, rarely opposite, entire, petiolate. **Inflorescence** terminal or axillary, in dense 2-rowed scorpioid cymes. **Calyx** 4-5, not enlarged in fruit. **Corolla** usually funnel-shaped, white or pale green; tube pubescent; lobes 4-5, imbricate or valvate. **Filaments** short. **Ovary** 4-locular; ovule 1 in each loculus, pendulous; style terminal; stigmas entire or 2-cleft. **Fruit** a drupe. **Seeds** (1-)4.

About 100 species in tropical and temperate regions. About 4 species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

Tournefortia montana Lour.

Fl. Cochinch. 1: 122. 1790; Zhu, Riedl & Kamelin in Fl. China 16: 341. 1995; Mill in Fl. Bhutan 2(2): 876. 1999.

Scrambling shrub, 1-2 m high; branchlets pubescent. **Leaves** alternate, lanceolate to lanceolate-ovate, 8-14 cm long, 3.5-5.5 cm wide, sparsely strigose on both surfaces; base cuneate to rounded; apex acuminate to caudate; petioles 5-12 mm long, pubescent. **Inflorescence** terminal, branched, 4-8 cm long, substrigose. **Flowers** sessile. **Calyx** green, divided nearly to the base, 1.5-2 mm long, pubescent on both sides; lobes 5, lanceolate. **Corolla** green or greenish yellow, narrowly salver-shaped, 8-12 mm long, sparsely puberulous outside, glabrous inside; lobes 5, broadly ovate, ca. 1 mm long, 1.5-2 mm wide, rounded at apex. **Stamens** 5, included, sessile; anthers oblong-linear, 2.5-3 mm long, inserted 3-4 mm above the corolla base. **Ovary** subcylindric, 1.5-2 mm long, glabrous; stigma sessile. **Fruit** subglobose, 4-5 mm long and wide.

Thailand.— Northern: Nan.

Distribution.— Bhutan, Sikkim, S China, Vietnam.

Ecology.— Lower montane forest, by streams, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: March-May.

Voucher specimens.— *P. Srisanga* 1253, 1340.

Notes.— New recorded for Thailand.

4. *TRICHODESMA* R. Br.

Prodr.: 496. 1810; Zhu, Riedl & Kamelin in Fl. China 16: 415. 1995. – *Lacaitaea* Brand, Fedde Repert. 13: 81. 1914. – *Octosomatium* Gagnep., Not. Syst. Paris 14: 23. 1950.

Perennial herbs or subshrubs. **Leaves** opposite or alternate, entire. **Inflorescence** in terminal cymes, raceme-like or paniculate. **Calyx** 4-5-lobed, enlarged in fruit, persistent. **Corolla** broadly tubular to campanulate, with appendages inside or not; lobes 4-5, triangular-ovate, caudate at apex. **Stamens** 4-5; anthers large; connective of anthers subulate, awn-like, spirally twisted. **Ovary** 4-locular; style gynobasic, filiform, exserted; stigma obscure. **Fruit** in 4 nutlets, enclosed in papery calyx, dorsiventrally compressed, margin of abaxial surface protruding, becoming cupular, dentate. **Seeds** suborbicular.

About 45 species in tropical and temperate regions. About 3 species in Thailand. One species recorded from Doi Phu Kha National Park.

Trichodesma calycosum Coll. & Hemsl.

J. Linn. Soc. Bot. 28: 92. 1890; Johnston, J. Arn. Arb. 33: 75. 1952; Zhu, Riedl & Kamelin in Fl. China 16: 415. 1995; Mill in Fl. Bhutan 2(2): 910, fig. 83: o-r. 1999. – *T. hemsleyana* Lév., Fedde Repert. 9: 327. 1911. – *T. sinicum* Brand, Fedde Repert. 12: 504. 1913. – *T. calcareum* Craib, Kew Bull. 1914: 5. 1914; Fletcher & Kerr in Fl. Siam. Enum. 3(1): 87. 1951. – *Lacaitaea calycosa* (Coll. & Hemsl.) Brand, Fedde Repert. 13: 81. 1914. – *Octosomatium kerrii* Gagnep., Not. Syst. Paris 14: 23. 1950.

Subshrub, 1-3 m high; branchlets quadrangular, pubescent. **Leaves** opposite, lanceolate to elliptic, (12-)15-35 cm long, (2.5-)4-12 cm wide, the upper leaves much smaller, pubescent on lower surface, puberulent and strigose on upper surface; base cuneate, attenuate onto the petiole; apex acuminate; midrib more prominent on lower surface; primary veins 6-8 pairs; petioles up to 2 cm long, sometimes sessile in upper leaves, pubescent. **Inflorescence** in terminal paniculate cymes, up to 20 cm long, pubescent; pedicels 1.5-3 cm long, pubescent, elongated when fruiting, up to 5 cm long. **Calyx** green, 12-15 mm long, pubescent on both sides; tube 4-6 mm long; lobes 4, lanceolate, 7-10 mm long, 3-3.5 mm wide, much enlarged and inflated in fruit. **Corolla** white with green appendage inside, 13-17 mm long, glabrous on both sides, except white woolly villous at the stamens insertion; tube 6-8 mm long; lobes 4, broadly ovate, 7-10 mm long, 7-8 mm wide, acuminate to caudate at apex; appendages 8, gibbose, in the throat, opposite each corolla lobe. **Stamens** 4, exserted, sessile; anthers lanceolate, 9-11 mm long, white woolly villous on the back. **Style** 11-13 mm long, sparsely pubescent. **Nutlets** broadly ovoid, 6-7 mm long and wide, glabrous, margin of abaxial surface leathery, irregularly dentate; enlarged calyx broadly ovate, 2.8-3.5 cm long, 1.3-2.3 cm wide.

Thailand.— Northern: Chiang Mai (type of *T. calcareum*), Nan.

Distribution.— Bhutan, Sikkim, Myanmar (type), S China, Laos (type of *Octosomatium kerrii*).

Ecology.— Lower montane forest, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: March-April.

Voucher specimens.— *P. Srisanga* 1358; *P. Srisanga et al.* 2469.

Notes.— Rare species. In Thailand, only known from Doi Chiang Dao, Chiang Mai, ca. 900 m, in crevices of limestone rocks and this is a new locality recorded from Nan.

BRASSICACEAE (CRUCIFERAE)

Annual or perennial herbs, rarely small shrubs. **Leaves** alternate, simple to variously pinnate, exstipulate, glabrous or hairy. **Inflorescence** racemose or corymbose. **Flowers** bisexual, regular. **Sepals** 4, free. **Petals** 4, free, cruciform, usually differentiated into an upper blade and a lower narrower claw. **Stamens** usually 6, tetradynamous (2 short, 4 long), rarely 2 or 4; filaments free, linear. Nectary glands arranged variously around the base of the filaments. **Ovary** superior, syncarpous of 2 carpels, 2-locular with a false septum formed by 2 lateral outgrowths from the parietal placentas; stigma capitate or bilobed. **Fruit** a capsule, usually dehiscent by 2 valves from below: commonly called a silique (an elongated capsule when 3 or more times longer than wide) or silicle (a capsule when less than 3 times longer than wide), sometimes indehiscent. **Seeds** arranged in 1 or 2 rows within each loculus, without endosperm.

An almost cosmopolitan family, mostly in temperate, with centers in the mediterranean region, SW and central Asia, few species in the tropics, with about 370 genera and 3,000 species. A family contains many important vegetable, fodder and oilseed crops and ornamentals. Only 2 native or naturalized genera and 6 species in Thailand, but several major crop plants in *Brassica* L. are widely cultivated throughout the country (Hedge, 1997). One species recorded from Doi Phu Kha National Park.

CARDAMINE L.

Sp. Pl.: 654. 1753; O.E. Schulz, Bot. Jahrb. 32: 280. 1903; Hedge in Fl. Thailand 6(3): 180. 1997; Appel & Al-Shehbaz in Fam. Gen. Vasc. Pl. 5: 113. 2003.

Annual or perennial herbs. **Leaves** entire to pinnate, petiolate. **Inflorescence** mostly terminal, racemose. **Sepals** with hyaline margin. **Petals** white to lilac, spathulate to claw. **Stamens** 6, rarely 4. **Ovary** cylindrical, sessile; stigma capitate or bilobed. **Fruit** a silique, linear, erect, tapering towards the narrow style; valves more or less flat at maturity, uncoiling abruptly from the base; edge of fruit narrowly thickened. **Seeds** arranged in 1 row in each loculus, oblong, smooth.

An almost cosmopolitan genus, with about 150 species. Only 2 species in Thailand (Hedge, 1997).

***Cardamine hirsuta* L.**

Sp. Pl.: 655. 1753; O.E. Schulz, Bot. Jahrb. 32: 464. 1903; Craib in Fl. Siam. Enum. 1: 76. 1925; Hedge in Fl. Thailand 6(3): 180. 1997.

Annual herb; stem often branched from the base, erect or ascending, 5-30 cm high, glabrous or with scattered hairs. **Leaves** imparipinnate, with a terminal and 2-6 pairs of lateral leaflets, 2-10 cm long; leaflets ovate to rhombic, crenate or lobed, glabrous or with scattered hairs; terminal leaflet 0.3-2 cm long and wide; lateral ones 0.2-1 cm long and wide. **Sepals** oblong, obtuse, ca. 1.5 mm long. **Petals** white, narrowly spatulate, 2-3 mm long, 1-1.5 mm wide. **Stamens** 6, rarely 4. **Silique** 10-20 mm long, ca. 1 mm wide, glabrous. **Seeds** brown, ca. 1 mm long, 0.5 mm wide.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan; North-eastern: Loei.

Distribution.— Europe (type), Asia, widespread as a weed in most parts of the world and probably naturalized in many areas.

Ecology.— Lower montane forest, in moist and open places, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: November-December.

Vernacular.— เต้าท้อ Lao kō (General)

Voucher specimens.— *P. Srisanga* 1214.

BRETSCHNEIDERACEAE

Monotypic family (Santisuk, 1989; Niyomdham, 1991). Description as in the species. Recently, Bretschneideraceae has been included within Akaniaceae, a family of two monotypic genera (Bayer & Appel, 2003).

***Bretschneidera sinensis* Hemsl.**

In Hook. Ic. Pl. 28: tab. 2708. 1901; Santisuk, Nat. Hist. Bull. Siam Soc. 37(2): 173, fig. 1-7. 1989; Niyomdham in Fl Thailand 5(3): 239, pl. XVII: 12. 1991. — *B. yunshanensis* Chun & How, Acta Phytotax. Sin. 7(1): 68, pl. XX. 1958.

Tree, up to 25 m high; bark smooth, greyish; twigs lenticellate; young shoots, leaf rachis and inflorescence axis puberulous to pubescent. **Leaves** alternate, imparipinnate, 30-80 cm long; stipules very early caducous; leaflets 4-8 pairs, opposite or subopposite; membranous, lanceolate-oblong to ovate-lanceolate, 8-15 cm long, 2.5-4(-6) cm wide, glabrous on both surfaces or slightly hairy on midrib, glaucous on lower surface; base cuneate to rounded, oblique, except on the terminal leaflet; apex acute to acuminate; primary veins 10-15 pairs; petiolules 2.5-4 mm long, puberulous. **Inflorescence** a terminal raceme, up to 40 cm long. **Flowers** bisexual, perigynous, zygomorphic, 3.5-4 cm long, 3-4 cm in diam.; pedicels 2-3 cm long, puberulous. **Calyx** greenish white, broadly campanulate, 1.5-2 cm long, pubescent on

both sides; lobes 5, shallowly acute teeth. **Petals** 5, pinkish white outside, pink with purplish streaks inside, free, imbricate, inserted on calyx tube, all similar, except the upper one slightly smaller, broadly obovate to suborbicular, concave, rounded at apex, cuneate and gradually narrowing into the long claw at base, 2-2.5 cm long, 1-1.5 cm wide, glabrous on both sides. **Stamens** 8; filaments 2.5-3 cm long, free, close together, declining towards the upper side of the flower and curved downwards, pubescent; anthers 4-6 mm long, dorsifixed, sparsely hairy, opening by longitudinal slits. **Ovary** superior, ellipsoid, 3-locular, 3-5 mm long, densely pubescent, axile placentation; ovules 2 in each loculus; style 3-4 cm long, pubescent. **Fruit** a loculicidal capsule, 3-valved, obovoid, 3.5-4.5 cm long, verrucose, brown, woody; fruit stalks 2-3 cm long. **Seeds** 1-3, ellipsoid-ovoid, orange, 2-2.5 cm long, 1-1.5 cm wide (Figs. 101-102).

Thailand.— Northern: Nan.

Distribution.— China (Yunnan-type), Vietnam (Tonkin), Taiwan.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: May-October.

Vernacular.— ชมพุกกา Chom phu phu kha (General), ต้นคักกาด Ton phak kard (Lua-Nan).

Voucher specimens.— *P. Srisanga* 1687; *P. Srisanga et al.* 2468; *T. Santisuk* 6915 (BKF).

Notes.— Rare species, in Thailand only known from Doi Phu Kha.

BUDDLEJACEAE

Trees or shrubs, often with glandular, stellate or lepidote indumentum. **Leaves** simple, opposite or verticillate, united at the base by a stipular line. **Inflorescence** axillary or terminal, cymose, racemose, paniculate, capitate or flower solitary. **Flowers** bisexual, sometimes functionally dioecious, 4(-5)-merous. **Calyx** united. **Corolla** united, usually imbricate. **Stamens** inserted in the corolla tube; filaments free; anther 2-locular, opening by longitudinal slits. **Ovary** superior, 2-locular, axile placentation; ovules numerous; style terminal; stigma capitate, entire or shortly 2-lobed. **Fruit** usually septicidal capsule, rarely berry or drupe. **Seeds** often winged.

Eight genera and about 120 species in tropical and warm temperate regions. One genus and 2 native species in Thailand (Opie & Parnell, 2002). Both species also recorded from Doi Phu Kha National Park.

Buddlejaceae, often included in the Loganiaceae *sensu lato* as tribe Buddlejae, is here treated as a distinct family according to Mabberley (1997).

BUDDLEJA Houston ex L.

Sp. Pl.: 112. 1753; Opie & Parnell in Fl. Thailand 7(4): 655. 2002; Oxelman, Kornhall & Norman in Fam. Gen. Vasc. Pl. 7: 42. 2004.

Shrubs, sometimes small trees; branchlets terete to quadrangular, sometimes narrowly winged. **Leaves** petiolate to subsessile, subentire, serrate to dentate. Stipules usually leafy, suborbicular and auriculate or reduced to a transverse line. **Inflorescence** axillary or terminal, thyrsoïd, racemose, clustered cymose or pseudoverticillate, usually many-flowered. **Flowers** 4-merous. **Calyx** cup-shaped or campanulate, persistent. **Corolla** tubular, salverform, funnellform or campanulate; tube usually longer than lobes. **Stamens** epipetalous, usually included; filaments usually short to almost absent. **Fruit** almost septicial capsule, rarely berry. **Seeds** small, numerous, winged.

About 100 species in the tropic and subtropic of America, Africa and Asia (Mabberley, 1997).

KEY TO THE SPECIES

1. Branchlets more or less terete. Stipules reduced to a line. Flower white.
Ovary glabrous or scaly **1. *B. asiatica***
1. Branchlets more or less rectangular. Stipules leafy, suborbicular and auriculate. Flower creamy yellow with pink patch or purple with yellow patch.
Ovary stellate tomentose **2. *B. macrostachya***

1. *Buddleja asiatica* Lour.

Fl. Cochinch.: 72. 1790; Kerr in Fl. Siam. Enum. 3: 53. 1951; Opie & Parnell in Fl. Thailand 7(4): 656, fig. 1, pl. XXIV: 1. 2002.

Shrub, 1-5 m high; most part with fulvous stellate hairs; branchlets more or less terete. **Leaves** opposite, lanceolate to narrowly elliptic, 3-16 cm long, 1-4 cm wide, glabrous or pubescent above, densely tomentose beneath; base cuneate, decurrent or winged; apex acuminate; margin subentire to remotely serrate; petioles 2-7 mm long. Stipules reduced to a line. **Inflorescence** axillary or terminal, thyrsoïd to spiciform, up to 25 cm long, densely tomentose. **Flowers** in crowded, 1-3-flowered cymes, each cyme in the axil of a linear bract, subsessile or short pedicellate, slightly fragrant. **Calyx** campanulate, 2-3.5 mm long, densely tomentose outside, glabrous to puberulent inside; lobes triangular, acuminate. **Corolla** white, densely tomentose outside, glabrous or pubescent inside; tube 3-6 mm long; lobes suborbicular, 1-2 mm long and wide. **Stamens** inserted above middle of corolla tube, included; filaments subsessile; anthers oblong, deeply cordate at base. **Ovary** ovoid to narrowly ovoid, glabrous or scaly, 1-2 mm long, 0.5-1 mm wide; style short; stigma capitate. **Capsule** ellipsoid, 3-5 mm long, 1-3 mm wide, glabrous or sparsely minutely scaly. **Seeds** ellipsoid, short winged at both ends.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lampang, Phrae, Nan, Sukhothai; North-eastern: Loei; Eastern: Chaiyaphum, Ubon Ratchathani; South-western: Kanchanaburi, Phetchaburi; Peninsular: Phangnga, Phuket, Trang.

Distribution.— India, Nepal, Bangladesh, Myanmar, China, Laos, Cambodia, Vietnam (type), Malaysia, Indonesia, Philippines.

Ecology.— Dry evergreen and lower montane forests, often in open areas and forest clearing, alt. 800-1,500 m (Tham Pha Kong, Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting almost throughout the year, especially in November-February.

Vernacular.— ราชวดีป่า Rachawadi pa, ปากน้ำ Puak nam (Chiang Mai).

Voucher specimens.— *P. Srisanga* 451, 2397, 2633.

2. *Buddleja macrostachya* Wall. ex Benth.

Scroph. Ind.: 42. 1835; Kerr in Fl. Siam. Enum. 3: 54. 1951; Opie & Parnell in Fl. Thailand 7(4): 659, fig. 2. 2002. — *B. hosseusiana* Kranzl., Ann. Naturh. Hofmus. Wien. 26: 396. 1912.

Shrub, 1-3 m high; most part with fulvous stellate hairs; branchlets more or less rectangular. **Leaves** opposite, lanceolate to narrowly elliptic, 4-16 cm long, 1-6 cm wide, glabrous or pubescent above, densely tomentose beneath; base cuneate to decurrent; apex acuminate; margin serrate; petioles short to almost sessile. Stipules leafy, suborbicular and auriculate. **Inflorescence** terminal, spiciform, up to 20 cm long, densely tomentose. **Flowers** in crowded, dense, each cyme in the axil of a narrowly lanceolate bract, short pedicellate, slightly fragrant. **Calyx** campanulate, 3-5 mm long, densely tomentose outside, glabrous inside; lobes triangular, acute to acuminate. **Corolla** creamy yellow with pink patch or purple with yellow patch, densely tomentose outside, villous inside; tube 6-10 mm long; lobes suborbicular to ovate, 1.5-3 mm long and wide, glabrous inside. **Stamens** inserted above middle of corolla tube, included; filaments sessile; anthers oblong, deeply cordate at base. **Ovary** ovoid, stellate tomentose, 2-4 mm long, 1.5-2 mm wide; style 1.5-2.5 mm long; stigma clavate. **Capsule** ellipsoid to narrowly ovoid, 7-10 mm long, 3-4 mm wide, stellate tomentose, glabrescent. **Seeds** irregular, winged at both ends.

Thailand.— Northern: Chiang Mai (Doi Chiang Dao – type of *B. hosseusiana*: *Hosseus* 400: holo-W, iso-BM, E, K, L, P!), Chiang Rai, Nan.

Distribution.— India (Assam), Sikkim, Bhutan, Bangladesh (type), Myanmar, S China, Vietnam.

Ecology.— Lower montane scrub, open ground among limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering: December-March; fruiting February-April.

Vernacular.— ราชวดีหลวง Rachawadi luang (Northern).

Voucher specimens.— *P. Srisanga* 2674; *P. Srisanga et al.* 2426.

Notes.— New locality recorded from Nan, in Thailand.

BURSERACEAE

Trees or shrubs with prominent resin ducts in bark. **Leaves** usually imparipinnate, rarely trifoliolate or unifoliolate; leaflets mostly opposite, entire or

serrate; stipules present or absent. **Inflorescence** terminal or axillary, panicle or thyrses. **Flowers** bisexual or unisexual, actinomorphic. **Sepals** 3-5, usually connate basally, imbricate or valvate. **Petals** 3-5, rarely absent, free or connate, imbricate or valvate. **Stamens** the same as or twice number of the petals; filaments free; anthers basifixed or dorsifixed, 2-locular, opening by longitudinal slits. Staminodes often present in the female flowers. Disk present. **Ovary** superior, 2-5-locular; axile placentation; ovules (1-)2 in each loculus. **Fruit** drupaceous with a fleshy pericarp and with woody or crustaceous to papyraceous endocarp (pyrenes).

Eighteen genera and about 550 species widespread in tropical region with a large number in Malesia, S America and Africa. Five genera and 20 species in Thailand (Pooma, 1999). Three genera and 4 species recorded from Doi Phu kha National Park.

KEY TO THE GENERA

- | | |
|--|--------------------|
| 1. Flowers 4-5-merous; stamens 8 or 10 | |
| 2. Leaflets 3-4(-5) pairs; petiolules longer than 3 mm | 3. <i>Protium</i> |
| 2. Leaflets 5 or more pairs; petiolules short, up to 3 mm long or absent | 2. <i>Garuga</i> |
| 1. Flowers 3-merous; stamens 6 | 1. <i>Canarium</i> |

1. *CANARIUM* L.

Amoen. Acad. 4: 121. 1759; Leenh.; Blumea 9(2): 329. 1959 (revision); Pooma, Thai For. Bull. (Bot.) 27: 62. 1999. – *Pimela* Lour., Fl. Cochinch.: 407. 1790. – *Canariopsis* Bl. ex Miq., Fl. Ind. Bat. 1(2): 651. 1859. – *Canariellum* Engl. in Nat. Pflanzenfam. 3(4): 242. 1896.

Trees, rarely shrubs. **Leaves** imparipinnate, very rarely unifoliolate, usually with a pair of stipules near or on the petioles, sometimes absent. **Inflorescence** axillary or terminal, paniculate. **Flowers** unisexual, dioecious; receptacle sometimes slightly concave. **Sepals** 3, connate about halfway, hairy or glabrous outside, nearly always densely sericeous inside, enlarged in fruit. **Petals** 3, free, usually imbricate. **Stamens** 6, epipetalous, free or connate, sometimes adnate to the disk; filaments flattened; anthers dorsifixed. Disk intrastaminal, 6-lobed. **Ovary** ellipsoid to ovoid, 3-locular; style cylindrical; stigmas faintly 3-lobed, capitate. **Fruit** 3-celled, sometimes reduced, 1-3-seeded, mostly blue-black when mature.

About 75 species, mainly in S and SE Asia, Melanesia and W Polynesia, with 2 species in Africa and 3 species in Australia (Leenhouts, 1959). Twelve species in Thailand (Pooma, 1999). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|------------------------|
| 1. Stipules absent. Leaves glabrous | 1. <i>C. euphyllum</i> |
| 1. Stipules present, soon caducous. Leaves pubescent | 2. <i>C. strictum</i> |

1. *Canarium euphyllum* Kurz

J. As. Soc. Beng. 41(2): 295. 1872; Leenh., Blumea 9(2): 417, fig. 28. 1959 (see also for complete synonymy); Pooma, Thai For. Bull. (Bot.) 27: 64, figs. 1b, 2f, 5a, 6b&e. 1999.

Tree, up to 30 m high, with small buttresses; stipules absent. **Leaflets** 4-6(-8) pairs, basal pairs much reduced, oblong to ovate, chartaceous, 10-25 cm long, 5-9 cm wide, glabrous; base rounded to subcordate, oblique; apex acute to acuminate; margin coarsely serrate or dentate, rarely entire; primary veins 12-19 pairs. **Inflorescence** axillary, narrowly thyrsoid, 20-45 cm long, glabrous. **Flowers** creamy white. **Calyx** ca. 4 mm long. **Corolla** ca. 1 cm long, minutely tomentose. **Filaments** connate about halfway, glabrous. Disk annular, 1-2 mm high, fleshy, glabrous. **Ovary** glabrous. **Fruit** ovoid-ellipsoid, rounded triangular in cross section, ca. 2.5 cm long, 1.2-1.4 cm wide, glabrous, verrucose. **Seed** 1.

Thailand.— Northern: Chiang Mai, Nan; Eastern: Chaiyaphum.

Distribution.— Myanmar (type).

Ecology.— Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: April-May; fruiting: February-March.

Vernacular.— မာၣ် Mang (Lawa-Northern).

Voucher specimens.— R. Pooma 1506, 1511.

2. *Canarium strictum* Roxb.

Fl. Ind. 3: 138. 1832; Leenh., Blumea 9(2): 414. 1959 (see also for complete synonymy); Grierson in Fl. Bhutan 2(1): 26. 1991; Pooma, Thai For. Bull. (Bot.) 27: 67, figs. 1c, 2e, 3f, 5d, 6c. 1999. — *Pimela stricta* Bl, Mus. Bot. 1: 226. 1850. — *Canarium sikkimense* King, J. As. Soc. Beng. 62: 187, t. 12. 1893. — *C. resiniferum* Brace ex King, J. As. Soc. Beng. 62: 188, t. 13. 1893.

Tree, up to 40 m high, with buttresses; stipules subulate, ca. 7 mm long, pubescent, soon caducous. **Leaflets** 3-5(-7) pairs, elliptic to ovate, subcoriaceous, 10-15 cm long, 4-6.5 cm wide, glabrous on upper surface, ferruginous pubescent on lower surface; base rounded, subcordate to broadly cuneate, oblique; apex acute to acuminate; margin dentate; primary veins 12-22 pairs. **Inflorescence** axillary, sometimes pseudoterminal, narrowly thyrsoid, 15-40 cm long, ferruginous pubescent. **Flowers** creamy white. **Calyx** 4-5.5 mm long. **Corolla** 7-9 mm long, pubescent to subglabrous. **Filaments** connate about halfway, glabrous. Disk annular, 1-2 mm high, fleshy, pilose. **Ovary** glabrous or sparsely hairy. **Fruit** obovoid-ellipsoid, rounded triangular in cross section, 3-4.5 cm long, 1.7-2.2 cm wide, glabrous. **Seed** 1.

Thailand.— Northern: Chiang Rai, Nan.

Distribution.— India (type), Bhutan, Myanmar.

Ecology.— Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: December-July; fruiting: September-March.

Vernacular.— โฉม Mong (Lawa-Northern).

Voucher specimens.— *R. Pooma* 1534.

2. *GARUGA* Roxb.

Hort. Beng.: 33. 1814; Kalkman, *Blumea* 7(2): 459. 1953 (revision); Pooma, Thai For. Bull. (Bot.) 27: 57. 1999.

Trees or shrubs. **Leaves** imparipinnate; leaflets crenate-serrate; stipules present or absent. **Inflorescence** axillary or terminal, paniculate. **Flowers** bisexual; receptacle globose or cupular, pubescent. **Sepals** 5, free. **Petals** 5, free. **Stamens** 10, free, inserted at margin of receptacle, usually more or less didynamous; filaments usually tomentose at base; anthers dorsifixed. Disk adnate to receptacle, glabrous, with 10 nectarial lobes between stamens. **Ovary** on short gynophore, 5-locular; style cylindrical; stigmas 5-lobed. **Fruit** 1-5-seeded.

Four species in S and SE Asia, Malesia, N Australia and W Pacific (Kalkman, 1953). One species in Thailand (Pooma, 1999).

Garuga pinnata Roxb.

Hort. Beng.: 33. 1814; Craib in Fl. Siam. Enum. 1: 246. 1926; Kalkman, *Blumea* 7(2): 468, fig. 3d. 1953 (see also for complete synonymy); Grierson in Fl. Bhutan 2(1): 27, fig. 2k-n. 1991; Pooma, Thai For. Bull. (Bot.) 27: 57, figs. 2a, 3c, 4c-d, 5e. 1999.

Deciduous tree, up to 15 m high; young shoots pubescent; stipules spatulate to linear, 0.5-1 cm long, caducous. **Leaflets** (5-)7-11 pairs, oblong, lanceolate to elliptic, 5.5-13 cm long, 2-4.5 cm wide, pubescent, glabrescent; base rounded to cuneate, oblique; apex acuminate; margin crenate-serrate; primary veins 10-15 pairs, sessile or subsessile. **Inflorescence** axillary or terminal, paniculate, 7.5-19 cm long, pubescent, glabrescent; peduncle 2-6 cm long. **Flowers** yellowish; pedicels 1-3 mm long. Receptacle cylindrical, 3-4.5 mm long, pubescent outside. **Sepals** deltoid, 2-3.5 mm long, tomentose on both sides. **Petals** oblong, 4.5-5.5 mm long, tomentose on both side. **Stamens** slightly didynamous, longer ones episealous; filaments 2-3 mm long, hairy at base. **Ovary** subglobose, pubescent. **Fruit** irregularly globose, 1-1.5 cm long and wide, yellowish. **Seeds** 1-5.

Thailand.— Almost throughout the country except in the peninsular.

Distribution.— India (type), Bhutan, Sikkim, E Pakistan, Myanmar, S China, Laos, Cambodia, Vietnam.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: February-April; fruiting: May-August; leaves: April-January.

Vernacular.— หวิด Wit, ค่ำ Kham (Northern).

Voucher specimens.— *P. Srisanga et al.* 846.

3. *PROTIUM* Burm.f.

Fl. Ind.: 88. 1768; Leenh., *Blumea* 7(1): 154. 1952; Pooma, Thai For. Bull. (Bot.) 27: 56. 1999. – *Tingulonga* Rumph., Herb. Amb. 7: 54. 1755. – *Amyris* Willd., Sp. Pl. 2: 337. 1799.

Trees, rarely shrubs. **Leaves** imparipinnate; stipules absent. **Inflorescence** axillary, sometimes pseudoterminal, paniculate. **Flowers** unisexual or bisexual. **Sepals** 4-5, more or less connate. **Petals** 4-5, free. **Stamens** 8 or 10, free, in female flowers slightly reduced, possibly sometimes fertile, inserted at the base of disk. Disk intrastaminal, annular, truncate to undulate, glabrous. **Ovary** ovoid or subglobose, glabrous or pubescent, 1-3-locular; ovules 2 in each cell; stigmas lobed or not. **Fruit** ovoid to subglobose.

About 100 species, mainly in tropical America, with 4 species in Asia. One species in Thailand (Pooma, 1999).

Protium serratum (Wall. ex Colebr.) Engl.

In monogr. Phan. 4: 88. 1883; Craib in Fl. Siam. Enum. 1: 247. 1926; Leenh., *Blumea* 7(1): 155, fig. 1. 1952; Grierson in Fl. Bhutan 2(1): 27. 1991; Pooma, Thai For. Bull. (Bot.) 27: 56, figs. 2c, 4a-b, 5c, 6g. 1999. – *Bursera serrata* Wall. ex Colebr., Trans. Linn. Soc 15: 361. 1827. – *Dracontomelon laoticum* Evrard & Tardieu-Blot, *Adansonia* n.s. 1: 198. 1961; Tardieu-Blot in Fl. C.L.V. 2: 144, fig. 10: 1-6. 1962. – *Santiria yunnanensis* Hu, Bull. Fan Mem. Inst. Bot. ser. 10(3): 129. 1940. – *Protium yunnanense* (Hu) Kalkman, *Blumea* 7(3): 546. 1954.

Deciduous tree, up to 15 m high; young shoots pubescent, glabrescent. **Leaflets** 3-4(-5) pairs, oblong, lanceolate to elliptic, 5-11 cm long, 2-5 cm wide, glabrous except puberulous on midrib and veins; base cuneate, oblique; apex acuminate; margin entire, rarely shallowly serrate; primary veins 8-14 pairs; petiolules 4-7 mm long. **Inflorescence** axillary, paniculate, 10-15 cm long, sparsely puberulous. **Flowers** yellowish red; pedicels 1-2 mm long. **Sepals** deltoid, 1.5-2 mm long, puberulous outside. **Petals** oblong, 2.5-3 mm long, sparsely puberulous outside. **Stamens** subequal; filaments 1.5-2 mm long. **Ovary** pubescent. **Fruit** irregularly globose, 1-1.5 cm long and wide, reddish. **Seeds** 1-3.

Thailand.— Almost throughout the country.

Distribution.— India (type), Myanmar, Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: January-April; fruiting: April-August; leaves: March-January.

Uses.— Fruit edible.

Vernacular.— มะไฟ Ma faen (Northern).

Voucher specimens.— *P. Srisanga* 2336.

Notes.— Fallen leaves reddish.

BUXACEAE

Evergreen trees or shrubs, rarely herbs, monoecious or rarely dioecious. **Leaves** simple, opposite or alternate, entire, penninerved or 3-veined at base, exstipulate. **Inflorescence** in short axillary racemes or clusters. **Flowers** unisexual, actinomorphic, small. **Perianth** 4(6), free. **Male flowers**: stamens 4, opposite to the perianth; anthers dorsifixed, dehiscing by longitudinal slits; rudimentary ovary sometimes present. **Female flowers**: ovary superior; 2-3-locular, axile placentation; styles 2-3, free, usually recurved; ovules 1-2 in each loculus. **Fruit** a capsule or indehiscent and berry-like.

Four genera and about 70 species, subcosmopolitan, mainly in temperate region, absent from Polynesia and Australasia (Mabberley, 1997). Two genera and about 5 species in Thailand. One species recorded from Doi Phu Kha National Park.

SARCOCOCCA Lindl.

Bot. Reg.: t. 1012. 1826; Hutch., Gen. Fl. Pl. 2: 108. 1967.

Shrubs. **Leaves** alternate, penninerved or 3-veined at base, glabrous. **Inflorescence** in short axillary racemes or clusters. Male and female flowers in different axils, each flower subtended by 2 bracts. **Perianth** 4, 2-seriate, imbricate. **Stamens** exerted. **Ovary** 2-3-locular: styles 2-3, persistent; ovules 2 in each loculus. **Fruit** berry-like, indehiscent, ovoid to globose. **Seeds** 1(-2), ellipsoid, pendulous.

About 11 species from Afghanistan through India, China to SE Asia (Mabberley, 1997). About 2 species in Thailand.

Sarcococca wallichii Stapf

Kew Bull. 1916: 37. 1916; Grierson & Long in Fl. Bhutan 2(1): 131. 1991. – *S. pruniformis* auct. non Lindl.: Hook.f. in Fl. Br. Ind. 5: 266. 1887, excl. var.

Shrub, 0.3-1.5 m high; branchlets terete, distinctly longitudinal ridged, glabrous. **Leaves** lanceolate to elliptic, (6-)9-12(-16) cm long, 3-5 cm wide, prominently 3-veined at base; base cuneate, attenuate onto the petiole; apex acuminate to caudate; petioles 5-10 mm long, glabrous. **Inflorescence** in short axillary racemes, ca. 1 cm long, 3-10-flowered. **Flowers** greenish white. **Perianth** elliptic, ca. 2 mm long, ciliate along the margin, outer pair slightly shorter than the inner. **Filaments** ca. 4 mm long, flatten, glabrous; anthers ca. 1 mm long. **Ovary** ovoid, 2-3 mm long, glabrous; styles 2. **Fruit** ovoid, 7-10 mm long, 5-7 mm wide. **Seed** 1, 6-7 mm long, 5-6 mm wide, compressed.

Thailand.— Northern: Nan.

Distribution.— India, Bhutan, Sikkim.

Ecology.— Dry evergreen and lower montane forest, alt. 750-1,400 m (Doi Phu Kha, Huay Pong).

Phenology.— Flowering and fruiting: August-October.

Voucher specimens.— *P. Srisanga* 1672; *P. Srisanga & C. Maknoi* 2061.

CAMPANULACEAE

Herbs, rarely undershrubs or climbings, nearly always with milky juice. **Leaves** simple, alternate or rarely opposite; stipules absent. **Inflorescence** terminal or axillary, racemose, cymose or flower solitary, rarely epiphyllus. **Flowers** bisexual, rarely unisexual, actinomorphic or zygomorphic. **Sepals** (3-)5(-10), connate, imbricate or valvate, usually persistent. **Petals** (3-)5(-10), mostly connate, sometimes free. **Stamens** (3-)5(-10), alternate with the corolla lobes; filaments free or connate; anthers 2-locular, opening by longitudinal slits, free (Campanuloideae) or cohering into a tube around the style (Lobelioideae). **Ovary** inferior or rarely superior, (1-)2-5-locular, axile or rarely parietal placentation; style 1; ovules numerous. **Fruit** a berry or capsule, variously dehiscent, sometimes crowned by the persistent sepals. **Seeds** small, numerous, sometimes winged.

A cosmopolitan family with about 82 genera and 2,000 species (Mabberley, 1997). About 5 genera and 15 species in Thailand. Three genera and 7 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Leaves alternate
 2. Flowers actinomorphic. Corolla campanulate. Anthers free **1. *Campanula***
 2. Flowers zygomorphic. Corolla with a dorsal slit mostly to or near the base.
 - Anthers cohering into a tube around the style **3. *Lobelia***
1. Leaves opposite, at least in the lower part. Flowers actinomorphic **2. *Codonopsis***

1. *CAMPANULA* L.

Sp. Pl.: 167. 1753; C.B. Clarke in Fl. Br. Ind. 3: 438. 1881; Thun in Fl. C.L.V. 9: 18. 1969.

Annual or perennial herbs, erect or decumbent. **Leaves** alternate, sometimes subrosulate. **Inflorescence** terminal or axillary, racemose, cymose or flower solitary. **Flowers** bisexual, actinomorphic. **Calyx** tube adnate to the ovary, turbinate; lobes 5, persistent. **Corolla** campanulate, mostly blue, purple or white; lobes 5. **Stamens** 5, free. **Ovary** inferior, 3-5-locular, axile placentation; stigmas 3-5-lobed. **Fruit** a capsule, obovoid, truncate, dehiscent by small valves at the base or sides below the calyx lobes.

About 300 species mainly in N temperate regions. About 3 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Campanula cana* Wall.**

In Fl. Ind. ed. Carey & Wall. 2: 101. 1824; C.B. Clarke in Fl. Br. Ind. 3: 440. 1881.

Perennial decumbent herb, woody at base, up to 40 cm long; stem hirsute. **Leaves** elliptic to ovate, sessile, 7-18 mm long, 4-12 mm wide, white tomentose on lower surface, scabrous-hirsute on upper surface; base broadly cuneate to obtuse; apex obtuse to broadly acute; margin coarsely dentate. **Flower** solitary; pedicels 3-10 mm long, hirsute. **Calyx** green, campanulate, 7-10 mm long, hirsute on both sides; tube 3-4 mm long; lobes lanceolate, with coarsely tooth, 4-6 mm long. **Corolla** blue, 12-14 mm long, sparsely hirsute outside; tube 5-6 mm long; lobes elliptic, 7-8 mm long. **Filaments** flatten, dilated at base, 2-3 mm long, glabrous; anthers lanceolate, 2-3 mm long. **Ovary** obovoid, glabrous; style 5-6 mm long, puberulous in upper half; stigmas 3-lobed. **Capsule** obovoid to obconical, 3-4 mm long, dehiscent by small valves at the base, crowned by the persistent calyx. **Seeds** numerous, ellipsoid, brown, minute (Fig. 103).

Thailand.— Northern: Nan.

Distribution.— India, Nepal.

Ecology.— Lower montane scrub, in crevices of limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: September-January.

Voucher specimens.— *P. Srisanga* 429, 1827, 2133; *P. Suksathan* 1795.

Notes.— New recorded for Thailand.

2. *CODONOPSIS* Wall.

In Fl. Ind. ed. Carey & Wall. 2: 103. 1824; Moeliono in Fl. Mal. I(6): 118. 1960; Thuan in Fl. C.L.V. 9: 7. 1969. – *Glosocomia* D. Don, Prodr. Fl. Nepal.: 158. 1825. – *Campanumoea* Bl., Bijdr.: 726. 1826. – *Cyclocodon* Griff., Not. Pl. As. 4: 279. 1854.

Perennial herbs, erect or climbing, with tuberous roots. **Leaves** opposite, at least in the lower part. **Inflorescence** in terminal and axillary cymes or flower solitary and axillary. **Flowers** bisexual, actinomorphic. **Calyx** tube adnate to the ovary; lobes 4-6(-7), spreading, persistent. **Corolla** campanulate, white, greenish or creamy yellow, sometimes with purplish tinged, the base adherent to the ovary; lobes 4-6(-7). **Stamens** 4-6(-7), free, inserted near the base of the corolla tube on the ovary. **Ovary** inferior, 4-6(-7)-locular, axile placentation; stigmas 4-6(-7)-lobed. **Fruit** a berry or capsule dehiscent by apical valves, subglobose or cylindrical.

About 30 species in C, E and SE Asia. About 3 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|--------------------------------|
| 1. Climbing herbs. Leaves with cordate at base | 1. <i>C. javanica</i> |
| 1. Erect herbs. Leaves with rounded to broadly cuneate at base | 2. <i>C. lancifolia</i> |

1. *Codonopsis javanica* (Bl.) Hook.f.

Ill. Him. Pl.: 116, t. 16B. 1855; Moeliono in Fl. Mal. I(6): 119, fig. 7. 1960; Thuan in Fl. C.L.V. 9: 8, Pl. I: 1-2. 1969. – *Campanumoea javanica* Bl., Bijdr.: 727. 1826; C.B. Clarke in Fl. Br. Ind. 3: 435. 1881; Kerr in Fl. Siam. Enum. 2(3): 307. 1936. – *C. cordata* Miq., Sum.: 599. 1862; Maxim., Bull. Ac. Imp. Sc. Petersb. 12: 68. 1868. – *C. japonica* Maxim., Bull. Ac. Imp. Sc. Petersb. 12: 67. 1868, non Sieb. & Morren (1863).

Climbing herb; stem glabrous. **Leaves** elliptic to ovate, 2.5-8 cm long, 1.5-5 cm wide, glabrous to puberulous on both surfaces; base cordate; apex obtuse to acute; margin coarsely crenate; petioles 1.5-6 cm long, glabrous to puberulous. **Flower** solitary, axillary; pedicels 1-3 cm long, glabrous. **Calyx** green; lobes 5, lanceolate, entire, 13-18 mm long, 3-4 mm wide, glabrous or hairy outside. **Corolla** creamy yellow with dark purplish veined inside, 2-3 cm long, glabrous, sometimes sparsely puberulous; lobes 5, elliptic to ovate, acute to shortly acuminate at apex. **Stamens** 5; filaments linear, 5-8 mm long, glabrous; anthers linear-lanceolate, basifixed, 3-4 mm long. **Ovary** subglobose, glabrous; style 6-10 mm long, glabrous or puberulous; stigmas 4-6-lobed. **Fruit** subglobose, 1.3-2.3 cm long and wide, dehiscent by apical valves, dark purplish, subtended by the persistent calyx lobes at base and crowned by the withered corolla. **Seeds** numerous, ellipsoid, ca. 0.5 mm long, light brown.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Myanmar, China, Japan, Laos, Vietnam, Indonesia (Java-type).

Ecology.— Lower montane forest and lower montane scrub, also on limestone rocks, alt. 1,400-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: September-January.

Voucher specimens.— *P. Srisanga* 273, 1773, 2642.

2. *Codonopsis lancifolia* (Roxb.) Moeliono

In Fl. Mal. I(6): 120. 1960. – *Campanula lancifolia* Roxb. in Fl. Ind. 2: 96. 1824. – *Codonopsis truncata* Wall. ex DC., Mon. Camp.: 122. 1830; Prodr. 7: 423. 1839. – *Cyclocodon albiflora* Griff., Not. Pl. As. 4: 279. 1854. – *C. adnatus* Griff., Not. Pl. As. 4: 278. 1854. – *C. lancifolium* Kurz, Flora 55: 303. 1872; J. As. Soc. Beng. 46(2): 210. 1877.

Erect herb, 1.5-2.5 m high; stem glabrous. **Leaves** lanceolate, elliptic to ovate, 6.5-17 cm long, 2.5-7 cm wide, glabrous on both surfaces; base rounded to broadly cuneate; apex acuminate; margin crenate; petioles 3-8 mm long, glabrous. **Flower** solitary or in cymes of 3, terminal or axillary; pedicels 1-3 cm long, glabrous. **Calyx** green; lobes 5-6(-7), linear, dentate to subpectinate, 8-13 mm long, ca. 1 mm wide, glabrous. **Corolla** white, 7-13 mm long, glabrous; lobes 5-6(-7), elliptic, as long as the corolla tube, acute to acuminate at apex. **Stamens** 5-6(-7); filaments flatten, dilated at base, 2-3 mm long, hairy inside; anthers linear-lanceolate, basifixed, 3-4 mm long. **Ovary** subglobose, 4-5 mm in diam., glabrous; style ca. 3 mm long, glabrous or

scabrid; stigmas 5-6(-7)-lobed. **Fruit** subglobose, 6-8 mm long, 10-13 mm wide, fleshy, black, the persistent calyx adnate about half-way. **Seeds** numerous, ovoid, ca. 0.5 mm long, light brown.

Thailand.— Northern: Chiang Mai, Lampang, Nan.

Distribution.— India (type), China, SE Asia.

Ecology.— Lower montane forest, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-December.

Vernacular.— มะยมแก้ว Mayom kao (Chiang Mai).

Voucher specimens.— *P. Srisanga* 2204, 2206.

3. *LOBELIA* L.

Sp. Pl.: 2: 929. 1753; Moeliono in Fl. Mal. I(6): 121. 1960; Thuan in Fl. C.L.V. 9: 29. 1969. — *Pratia* Gaudich., Ann. Sc. Nat. Bot. 5: 103. 1825.

Annual or perennial herbs, erect or prostrate, sometimes woody at base. **Leaves** alternate. **Inflorescence** in terminal and axillary racemes or panicles or flower solitary. **Flowers** bisexual, rarely unisexual, zygomorphic. **Calyx** tube adnate to the ovary; lobes 5, spreading, persistent. **Corolla** with a dorsal slit mostly to or near the base; lobes 5, with 2 dorsal lobes, mostly diverging from the 3 others which from a trifold consisting of a ventral lobes and 2 lateral lobes. **Stamens** 5, alternate with the corolla lobes, free or adnate to the corolla tube; filaments linear, sometimes broadened at the base; anthers basifixed, cohering into a tube around the style, usually hairy. **Ovary** inferior, 2-locular, axile placentation; stigmas 2-lobed. **Fruit** a berry or capsule dehiscent by apical valves, crowned by the persistent calyx lobes.

About 300 species in tropical and subtropical regions especially America. About 7 species in Thailand. Four species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Prostrate herbs, rooting at the nodes

2. Only 2 anthers bearded at apex. Fruit a berry, purple; seeds ellipsoid

1. *L. angulata*

2. All anthers bearded at apex. Fruit a capsule, green; seeds trigonous

4. *L. zeylanica*

1. Erect herbs

3. Annual herbs, 5-30 cm high; stem 3-angled and winged

2. *L. heyniana*

3. Perennial herbs, 1-3 m high; stem terete

3. *L. nicotianaefolia*

1. *Lobelia angulata* Forst.

Fl. Ins. Aus. Prodr.: 58, n. 309. 1786; Moeliono in Fl. Mal. I(6): 133, figs. 19-20. 1960 (see also for synonymy). — *L. nummularia* Lam., Dict. Bot. 3: 589. 1789. — *L.*

begonifolia Wall., As. Res. 13: 377. 1820. – *L. javanica* Thunb., Fl. Jav.: 9. 1825. – *L. obliqua* Ham. ex D. Don, Prodr. Fl. Nepal.: 158. 1825. – *L. pratiana* Gaudich., Ann. Sc. Nat. Bot. 5: 103. 1825. – *Pratia repens* Gaudich., Ann. Sc. Nat. Bot. 5: 103. 1825. – *P. begonifolia* (Wall.) Lindl., Bot. Reg. 16: t. 1373. 1820; C.B. Clarke in Fl. Br. Ind. 3: 422. 1881; Kerr in Fl. Siam. Enum. 2(3): 302. 1936; Thuan in Fl. C.L.V. 9: 34, Pl. III: 2. 1969. – *P. angulata* (Forst.) Hook.f., Fl. Antarct. 1: 43. 1844. – *P. nummularia* (Lam.) A. Br. & Aschers., Index Sem. Hort. Berol. Append. 6. 1861; Kurz, J. As. Soc. Beng. 46(2): 210. 1877; Haridasan & Mukherjee in Fasc. Fl. Ind. 19: 62. 1988.

Prostrate herbs, rooting at the nodes; stem terete, pubescent. **Leaves** ovate, broadly ovate to suborbicular, 5-25 mm long and wide, puberulous on both surfaces, especially on nerves beneath; base truncate to cordate; apex rounded to acute; margin serrate-dentate; petioles 1-10 mm long, puberulous. **Flower** solitary, axillary; pedicels 1-2 cm long, glabrous. **Calyx** purplish green; lobes linear-lanceolate, entire or minutely tooth, 3-5 mm long, glabrous. **Corolla** bluish white with green tinged at base, 5-8 mm long, glabrous to sparsely puberulous; dorsal lobes falcate, 3-5 mm long; ventral and lateral lobes ovate, 3-4 mm long. **Filaments** 3-4 mm long, basally free for about half-way of the length, glabrous; anthers dark purplish, ca. 1.5 mm long, sparsely hairy, only 2 anterior anthers bearded at apex. **Ovary** ovoid to ellipsoid, glabrous; style 3-4 mm long, glabrous. **Fruit** a berry, purple, ellipsoid to ovoid, 6-10 mm long, 4-7 mm wide, glabrous. **Seeds** numerous, flattened ellipsoid, ca. 0.5 mm long, brown (Fig. 104).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal (type), Bhutan, Bangladesh, Sri Lanka, China, SE Asia to New Zealand.

Ecology.— Dry evergreen and lower montane forest, by streams, open and moist places, alt. 800-1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: throughout the year.

Vernacular.— ผักเบี้ยดิน Phak bia din (Northern).

Voucher specimens.— *P. Srisanga* 1116, 1455.

2. *Lobelia heyniiana* Roth ex Roem. & Schult.

Syst. Veg. 5: 50. 1819; Moeliono in Fl. Mal. I(6): 129, fig. 13, 16d. 1960 (see also for synonymy); Haridasan & Mukherjee in Fasc. Fl. Ind. 19: 51. 1988. – *L. micrantha* Hook., Exot. Fl. 1: t. 44. 1823, non H.B.K. (1818). – *L. trialata* Ham. ex D. Don, Prodr. Fl. Nepal.: 157. 1825; C.B. Clarke in Fl. Br. Ind. 3: 425. 1881; Kerr in Fl. Siam. Enum. 2(3): 306. 1936.

Erect annual herb, 5-30 cm high; stem 3-angled and winged, glabrous. **Leaves** lanceolate, elliptic to broadly ovate, 5-25 mm long, 1-20 mm wide, glabrous to sparsely hairy; base truncate to cuneate, attenuate onto the petiole; apex acute; margin serrate; petioles up to 3 mm long or sessile. **Flower** solitary, axillary; pedicels 4-10 mm long, 3-angled, glabrous. **Calyx** green; lobes subulate, entire or minutely tooth, 2-3 mm long, glabrous. **Corolla** bluish white with purplish patch inside, 4-6 mm

long, glabrous; dorsal lobes linear, 1-2 mm long; ventral and lateral lobes ovate, 1-2 mm long. **Filaments** 2-3 mm long, basally free for up to half-way of the length, glabrous; anthers ca. 1 mm long, sparsely hairy, only 2 anterior anthers bearded at apex. **Ovary** cupular-campanulate, glabrous; style 2-3 mm long, glabrous. **Fruit** a capsule, obconical to narrowly campanulate, 4-5 mm long, ca. 2 mm wide, glabrous. **Seeds** numerous, ellipsoid, ca. 0.5 mm long, brown.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— E Africa, India (type), Sri Lanka, Myanmar, S China, Indonesia, Philippines, New Guinea.

Ecology.— Lower montane forest, open and moist places, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: September-November.

Voucher specimens.— *P. Srisanga* 1123, 1605.

3. *Lobelia nicotianaefolia* Roth ex Roem. & Schult.

Syst. Veg. 5: 47. 1819; C.B. Clarke in Fl. Br. Ind. 3: 427. 1881; Moeliono in Fl. Mal. I (6): 123, fig. 8-10. 1960 (see also for synonymy); Thuan in Fl. C.L.V. 9: 30, Pl. III: 5. 1969; Haridasan & Mukherjee in Fasc. Fl. Ind. 19: 53. 1988. — *L. pyramidalis* Wall., As. Res. 13: 376. 1820; C.B. Clarke in Fl. Br. Ind. 3: 426. 1881; Kerr in Fl. Siam. Enum. 2(3): 304. 1936. — *L. rosea* Wall. in Fl. Ind. ed. Carey & Wall. 2: 115. 1824; C.B. Clarke in Fl. Br. Ind. 3: 427. 1881; Kerr in Fl. Siam. Enum. 2(3): 305. 1936. — *L. excelsa* Lesch. ex Wall. in Fl. Ind. ed. Carey & Wall. 2: 114. 1824, non Bonpl. (1813); C.B. Clarke in Fl. Br. Ind. 3: 427. 1881. — *L. colorata* Wall., Pl. As. Rar. 2: 42. 1831; C.B. Clarke in Fl. Br. Ind. 3: 426. 1881. — *L. erecta* Hook.f. & Thomson, J. Proc. Linn. Soc. Bot. 2: 28. 1858, non de Vriese (1845); C.B. Clarke in Fl. Br. Ind. 3: 426. 1881. — *L. trichandra* Wight, Ic. Pl. Ind. Or. 4: t. 1171. 1853. — *L. leucanthera* Kerr, Kew Bull. 1936: 34. 1936; in Fl. Siam. Enum. 2(3): 304. 1936. — *L. palustris* Kerr, Kew Bull. 1936: 35. 1936; in Fl. Siam. Enum. 2(3): 304. 1936.

Erect perennial herb, 1-3 m high; stem terete, puberulous. **Leaves** oblong to lanceolate, sessile, 5-40 cm long, 1-8 cm wide, puberulous on both surfaces; base broadly cuneate, decurrent; apex acute; margin serrate. **Inflorescence** in terminal and axillary leafy racemes, up to 45 cm long, puberulous; bracts variable in shape and size, lower leaf-like, lanceolate, longer and upper linear, shorter than the flowering pedicels; pedicels 5-10 mm long, puberulous. **Calyx** green; lobes linear to narrowly lanceolate, entire or minutely tooth, 7-13 mm long, ca. 1 mm wide, puberulous. **Corolla** white, 1.5-2.5 cm long, puberulous; dorsal lobes falcate-linear, 1.5-2.5 cm long; ventral and lateral lobes lanceolate, 5-9 mm long. **Filaments** white, 11-15 mm long, basally free for one third of the length, puberulous; anthers dark purplish, 4-5 mm long, hairy. **Ovary** cupular-campanulate, puberulous; style 15-20 mm long, glabrous. **Fruit** a capsule, cupular-campanulate to broadly subglobose, 6-9 mm in diam., puberulous. **Seeds** numerous, ellipsoid, ca. 0.5 mm long, brown.

Thailand.— Northern: Chiang Mai, Nan (Doi Phu Kha-type of *L. leucanthera*: Kerr 4923); North-eastern: Loei.

Distribution.— India (type), Sri Lanka, Myanmar, China, Laos, Vietnam, Indonesia, Philippines.

Ecology.— Deciduous and lower montane forest, open places, grassy slopes, fallow of upland rice fields, alt. 800-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: October-March; fruiting: February-May.

Vernacular.— หางไก่ฟ้า Hang kai fa (Northern).

Voucher specimens.— *P. Srisanga* 1147, 2634; *P. Srisanga et al.* 2462.

4. *Lobelia zeylanica* L.

Sp. Pl. 2: 932. 1753; Moeliono in Fl. Mal. I(6): 128. 1960 (see also for synonymy); Thuan in Fl. C.L.V. 9: 34, Pl. III: 3-4. 1969; Haridasan & Mukherjee in Fasc. Fl. Ind. 19: 58, fig. 12. 1988. — *L. succulenta* Bl., Bijdr. 728. 1826; Kerr in Fl. Siam. Enum. 2 (3): 305. 1936. — *L. affinis* Wall. ex G. Don, Gard. Dict. 3: 709. 1834, non Mirbach (1805); C.B. Clarke in Fl. Br. Ind. 3: 424. 1881, incl. var. *lobbiana*.

Prostrate herbs, sometimes ascending, rooting at the nodes; stem terete, sometimes slightly angular, sparsely hairy. **Leaves** ovate to broadly ovate, 1-4 cm long, 0.7-3.5 cm wide, puberulous on both surfaces, especially on nerves beneath; base truncate to cordate, attenuate onto the petiole; apex acute; margin serrate-dentate; petioles 1-20 mm long, puberulous. **Flower** solitary, axillary; pedicels 1-2 cm long, puberulous. **Calyx** green; lobes linear-lanceolate, entire or minutely tooth, 4-5 mm long, puberulous. **Corolla** bluish white with green tinged, 5-6 mm long, glabrous to sparsely puberulous; dorsal lobes subfalcate, 2-3 mm long; ventral and lateral lobes ovate, 1-2 mm long. **Filaments** 3-4 mm long, basally free for about half-way of the length, hairy at apex; anthers dark purplish, ca. 1.5 mm long, sparsely hairy, all anthers bearded at apex. **Ovary** cupular to obconical, puberulous; style 5-6 mm long, glabrous. **Fruit** a capsule, green, obconical to obovoid, 4-6 mm long, ca. 4 mm wide, puberulous, with distinct nerves and membranous pericarp. **Seeds** numerous, trigonous, ca. 0.5 mm long, brown.

Thailand.— Northern: Chiang Mai, Nan; South-eastern: Chanthaburi; Peninsular: Chumphon, Ranong, Phangnga, Nakhon Si Thammarat, Yala.

Distribution.— India, Bangladesh, Sri Lanka (type), China, SE Asia.

Ecology.— Dry evergreen forest, by streams, alt. 700-900 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering and fruiting: throughout the year.

Voucher specimens.— *P. Srisanga* 331, 1244, 1306, 1463.

CAPPARACEAE

Trees, shrubs, herbs or climbers, often armed with spiny stipules; cataphylls (scale-like bracts) usually present at base of shoots or absent. **Leaves** alternate, simple or palmately, 3-7-foliolate. **Inflorescence** terminal or axillary, racemose,

corymbose, umbellate or in serial or flower solitary. **Flowers** bisexual, zygomorphic. **Sepals** (2-)4(-6), often decussate, mostly free, sometimes connate at base. **Petals** (2-)4(-6), rarely absent, mostly free, sometimes connate at base. **Stamens** 6-numerous, sometimes on a short or elongated androgynophore; filaments free, mostly filiform; anthers 2-locular, dorsifixed or subbasifixed, introrse, opening by longitudinal slits. **Ovary** superior, sessile or on a gynophore, 1(-3)-locular, mostly parietal placentation; ovules few to many; style simple. **Fruit** usually a berry, rarely capsule, drupe or nut, stipitate (from the pedicel and the gynophore together). **Seeds** 1 to many, usually reniform.

About 39 genera and 650 species, mostly in tropical and subtropical regions (Mabberley, 1997). Five genera and 38 species in Thailand (Chayamarit, 1991; Srisanga et al., 2003; Srisanga & Chayamarit, 2004). Two genera and 7 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Sepals 4. Petals 4. Androgynophore absent. Ovary 1-locular; stigma 1 **1. *Capparis***
1. Sepals 6. Petals absent. Androgynophore present. Ovary 3-locular; stigmas 3 **2. *Stixis***

1. *CAPPARIS* L.

Sp. Pl.: 503. 1753; Pax in Pflanzenfam. 3(2): 229. 1894; Jacobs, Blumea 12(3): 405. 1965; Chayamarit in Fl. Thailand 5(3): 241. 1991; Kers in Fam. Gen. Vasc. Pl. 5: 50. 2003.

Trees, shrubs or climbers; branches mostly hairy but soon glabrescent; sometimes cataphylls present at base of shoots; stipular thorns straight or recurved, sometimes wanting. **Leaves** simple, entire; midrib and reticulation usually prominent beneath. **Inflorescence** terminal or axillary, racemose, corymbose, umbellate or in serial or flower solitary. **Sepals** 4, biseriate, free; outer pair mostly boat-shaped. **Petals** 4, imbricate, free, caducous, often obovate and clawed. **Stamens** many to numerous. Gynophore present. **Ovary** 1-locular; ovules numerous; stigma 1. **Fruit** a berry, globose to ellipsoid; pericarp smooth or corky, thin or thick. **Seeds** 1 to many, embedded in pulp.

About 250 species, mostly in tropical and subtropical regions (Jacobs, 1965; Mabberley, 1997). Twenty-eight species in Thailand (Chayamarit, 1991; Srisanga et al., 2003; Srisanga & Chayamarit, 2004). Six species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Erect trees, shrubs or undershrubs
 2. Flowers in terminal racemes **1. *C. assamica***
 2. Flowers (1-)2-6(-8) arranged in serial in leaf axils
 3. Branches and leaves densely ferruginous, glabrescent. Petioles

with narrow undulate wings

2. *C. kerrii*

3. Branches and leaves glabrous or sparsely puberulous. Petioles wingless

3. *C. sabiaefolia*

1. Scandent shrubs or woody climbers

4. Branches and leaves glabrous. Inflorescence in terminal leafy panicles.

Petals white with pink-purplish at base inside

5. *C. trisonthiae*

4. Branches and leaves hairy

5. Branches brown pubescent. Inflorescence in lax corymbs, 2-4-flowered, axillary or on the terminal part of the twig or flower solitary in leaf axils.

Petals creamy yellow

4. *C. sikkimensis* subsp. *yunnanensis*

5. Branches and leaves beneath densely brown tomentose. Inflorescence in terminal corymbs. Petals creamy yellow and turn to purple

6. *C. viburnifolia*

1. *Capparis assamica* Hook.f. & Thomson

In Fl. Br. Ind. 1: 177. 1872; Jacobs, Blumea 12(3): 434. 1965; Chayamarit in Fl. Thailand 5(3): 249. 1991. – *C. gallatyi* King, Ann. Roy. Bot. Gard. Calcutta 5: 118. 1896.

Shrub or undershrub, up to 2 m high; branches sparsely pubescent, glabrescent; shoots with cataphylls at base; thorns straight, small, ca. 1 mm high or wanting. **Leaves** oblong to lanceolate, subcoriaceous, 10-20 cm long, 2-6 cm wide, glabrous; base cuneate; apex acuminate; primary veins 8-12 pairs; midrib deeply grooved above, raised and prominent below; petioles 5-8 mm long. **Inflorescence** in terminal racemes, 12-18 cm long, many-flowered, pendulous; rachis sparsely puberulous; pedicels filiform, 2-3.5 cm long; bracts subulate, ca. 1 mm long. **Sepals** greenish red, elliptic, 3-4 mm long, 2-2.5 mm wide, sparsely pubescent outside. **Petals** white, oblong or ovate, 4-5 mm long, 1.5-2 mm wide, truncate, puberulous towards the base. **Stamens** 16-20, 10-12 mm long. Gynophore 8-11 mm long, glabrous. **Ovary** ovoid, 1-1.5 mm long, acute at apex, glabrous. **Fruit** red, globose, 8-10 mm across. **Seed** 1; stipe slender, 3-3.5 cm long.

Thailand.— Northern: Nan; South-western: Kanchanaburi.

Distribution.— India (E Bengal-type), Myanmar, S China (Yunnan), Laos.

Ecology.— Dry evergreen and lower montane forest; alt. 700-1,400 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: August-September.

Vernacular.— แดงอาสา Daeng asa (General).

Voucher specimens.— *P. Srisanga* & *S. Watthana* 677; *P. Srisanga* & *C. Maknoi* 2069.

Notes.— New locality recorded from Nan, in Thailand.

2. *Capparis kerrii* Craib

Kew Bull. 1922: 232. 1922; in Fl. Siam. Enum. 1: 81. 1925; Chayamarit in Fl. Thailand 5(3): 247. 1991.

Shrub, up to 7 m high; branches densely ferruginous, glabrescent; shoots with few cataphylls at base; thorns straight, small, 1-2(-3) mm high or wanting. **Leaves** oblanceolate, elliptic, ovate to obovate, papery, subcoriaceous when old, 6-9 cm long, (2-) 3-5 cm wide, densely ferruginous, glabrescent; base cuneate; apex acuminate; primary veins 6-8 pairs; midrib impressed above, raised and prominent below; petioles 6-10 mm long, with narrow undulate wings. **Flowers** 2-6(-8) arranged in serial in leaf axils; pedicels 1.5-2.3 cm long, ferruginous, glabrescent. **Sepals** green, oblong to elliptic, 5-6 mm long, 2-2.5 mm wide, ferruginous on both sides. **Petals** pale yellow, oblanceolate, 6-8 mm long, 1.5-2 mm wide, puberulous on both sides. **Stamens** 20-22, 20-25 mm long. Gynophore 17-20 mm long, glabrous. **Ovary** ellipsoidal, 1.5-2 mm long, beaked, glabrous. **Fruit** subglobose to ovoid, 10-16 mm long and wide. **Seeds** 2-4(-6); stipe 5-5.5 cm long.

Thailand.— Northern: Chiang Mai (type: *Kerr* 3568: ABD, BM, K), Nan; South-western: Kanchanaburi.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest; alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: January-February; fruiting: July-August.

Vernacular.— นกกะลิงแดง Nok kaling daeng (General).

Voucher specimens.— *P. Srisanga* 1972, 2701.

Notes.— New locality recorded from Nan, in Thailand.

3. *Capparis sabiaefolia* Hook.f. & Thomson

In Fl. Br. Ind. 1: 179. 1872; Craib in Fl. Siam. Enum. 1: 83. 1925; Chayamarit in Fl. Thailand 5(3): 247. 1991. – *C. acutifolia* Sweet subsp. *sabiaefolia* (Hook.f. & Thoms.) Jacobs, Blumea 12(3): 432. 1965. – *C. vientianensis* Gagnep., Bull. Soc. Bot. France 85: 599. 1939.

Shrub or small tree, up to 5 m high; branches glabrous or sparsely puberulous; shoots with few cataphylls at base or absent; thorns straight, small, 1-2(-3) mm high or wanting. **Leaves** lanceolate, elliptic to ovate, papery, 6-9 cm long, 2-3(-4) cm wide, glabrous; base cuneate; apex long acuminate or caudate; primary veins 6-9 pairs; midrib impressed above, raised and prominent below; petioles 4-6 mm long, glabrous or sparsely puberulous. **Flowers** (1-)2-3 arranged in serial in leaf axils; pedicels 7-9 mm long, puberulous. **Sepals** green, elliptic to ovate, 4-5 mm long, 2-3 mm wide, glabrous outside except tomentose along the margin, tomentose inside. **Petals** white, oblanceolate-spathulate, 6-7 mm long, 1.5-2 mm wide, densely tomentose on both sides. **Stamens** 17-22, 20-23 mm long. Gynophore 18-22 mm long, glabrous. **Ovary** ellipsoidal, 1-1.5 mm long, glabrous. **Fruit** subglobose, 10-14 mm long and wide. **Seeds** 1-3; stipe 2.5-3(-4) cm long.

Thailand.— Northern: Chiang Mai, Phrae, Nan.

Distribution.— India (Assam-type), Myanmar, Laos, Vietnam (Tonkin).

Ecology.— Lower montane forest; alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: August-January.

Vernacular.— ตาชูแม Ta chu mae (Karen-Chiang Mai).

Voucher specimens.— *P. Srisanga* 1187, 2372; *P. Srisanga* & *S. Watthana* 703; *P. Srisanga et al.* 826; *P. Srisanga* & *C. Maknoi* 2035.

4. *Capparis sikkimensis* Kurz subsp. *yunnanensis* (Craib & W.W. Sm.) Jacobs

Blumea 12(3): 496. 1965; Srisanga, Trisonthi & Chayamarit, Thai For. Bull. (Bot.) 31: 123, figs. 1-2. 2003. – *C. yunnanensis* Craib & W.W. Sm., Notes Roy. Bot. Gard. Edinb. 9: 91. 1916. – *C. roxburghii* (non DC.) Dunn, J. Linn. Soc. Lond. Bot. 39: 426. 1911. – *C. bhamoensis* Raizada, Ind. For. Rec. n.s. 3: 127, fig. 4. 1941. – *C. fohaiensis* B.S. Sun, Acta Phytotax. Sin. 9: 114. 1964.

Scandent shrub or woody climbers; branches brown pubescent, glabrescent; shoots not surrounded by cataphylls; thorns slightly recurved, 3-4 mm high. **Leaves** elliptic to ovate, chartaceous, (4.5-)11-13 cm long, (3-)5-6.5 cm wide, pubescent on both surfaces, glabrescent; base rounded to broadly cuneate; apex acute to cuspidate; primary veins 6-8 pairs; midrib impressed above, raised and prominent below; petioles 7-10 mm long, brown pubescent. **Inflorescence** in lax corymbs, 2-4-flowered, axillary or on the terminal part of the twig or flower solitary in leaf axils; peduncles 2-4.5 cm long, brown pubescent. **Flowers** fragrant; pedicels up to 4.5 cm long, brown pubescent. **Sepals** orbicular concave to shallowly saccate, shortly clawed, 13-19 mm long, 11-18 mm wide, inner pairs slightly smaller, brown pubescent on both sides. **Petals** creamy yellow, obovate, 20-25 mm long, 8-12 mm wide, densely tomentose inside, glabrous except for tomentose basal parts outside. **Stamens** 60-80, ca. 3.5 cm long, hairy at base. Gynophore 2.5-4 cm long, hairy at base. **Ovary** ellipsoid, 3-4 mm long, glabrous. **Fruit** ellipsoid, 4-5 cm long, 2.5-3 cm wide; pericarp 2-5 mm thick. **Seeds** 3-4, 15-20 mm long, 10-15 mm wide; stipe 7-8.5 cm long (Fig. 105).

Thailand.— Northern: Nan.

Distribution.— Myanmar, S China (Yunnan-type), Vietnam (Tonkin).

Ecology.— Lower montane forest; alt. 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: September-January.

Voucher specimens.— *P. Srisanga* 1359, 1692, 2337.

Notes.— Rare species, few specimens collected. New recorded for Thailand.

5. *Capparis trisonthiae* Srisanga & Chayamarit

Adansonia, sér. 3. 26(1): 64, fig. 1. 2004.

Woody climbers; branches glabrous, reddish; shoots not surrounded by cataphylls; thorns recurved, 2-4 mm high. **Leaves** elliptic to broadly elliptic, subcoriaceous to coriaceous, (10-)12-18 cm long, (6.5-)8-11 cm wide, glabrous on both surfaces; base cordate; apex mucronulate or retuse; primary veins 6-8 pairs; midrib more or less impressed above at least in the basal part, raised and prominent below; petioles 13-20 mm long, glabrous. **Inflorescence** in terminal leafy panicles of

which the upper part has mostly lost its leaves; peduncle 3-9 cm long, glabrous except for ferruginous puberulous at the upper part; pedicels 2.5-3 cm long, ferruginous puberulous. **Sepals** boat-shaped, 1.8-2.5 cm long, 1.3-2 cm wide, outer pairs slightly smaller, ferruginous puberulous outside, puberulous inside in the marginal parts. **Petals** white with pink-purplish at base inside, oblanceolate-spathulate, 4.5-5 cm long, (1.6-)1.8-2.2 cm wide, crenate to slightly crisped and emarginate at apex, glabrous except for pubescent at base on both sides. **Stamens** 140-170, white, (4-)4.8-5.5 cm long, hairy at base. Gynophore dark purplish, 2-2.5 mm long, glabrous. **Ovary** dark purplish, spindle-shaped, slightly curved, 2-3 mm long, glabrous, with shallowly longitudinal grooves. **Fruit** ellipsoid, 7-10 cm long, 6-8 cm wide; pericarp 7-10 mm thick. **Seeds** 15-40, ovoid-ellipsoid, 17-20 mm long, 13-15 mm wide, embedded in pink-purplish pulp; stipe 8-11 cm long (Figs. 33, 106-107).

Thailand.— Northern: Nan (Doi Phu Kha, Tham Pha Kong – type: *Srisanga* 2550: BKF, P, QBG-holotype).

Distribution.— Endemic to Doi Phu Kha, only known from the type locality.

Ecology.— Dry evergreen forest, by streams; alt. 700 m.

Phenology.— Flowering: June-July; fruiting: December-January.

Voucher specimens.— *P. Srisanga* 2389, 2550, 2611.

6. *Capparis viburnifolia* Gagnep.

Bull. Soc. Bot. France 85: 598. 1939; in Suppl. Fl. Gén. I.-C. 1: 168. 1939; Jacobs, Blumea 12(3): 505. 1965; Chayamarit in Fl. Thailand 5(3): 250. 1991.

Scandent shrub; branches densely brown tomentose; shoots not surrounded by cataphylls; thorns recurved, 2-5 mm high. **Leaves** oblanceolate, lanceolate to narrowly elliptic, 5-8 cm long, 2-3.5 cm wide, subcoriaceous, tomentose above, densely brown tomentose below; base broadly cuneate; apex acuminate; primary veins 4-7 pairs; midrib impressed above, raised and prominent below; petioles 7-10 mm long, densely brown tomentose. **Inflorescence** in terminal corymbs. **Flowers** fragrant; pedicels 1.5-2.2 cm long, densely brown tomentose. **Sepals** ovate to orbicular concave, 10-15 mm long, 6-10 mm wide, inner pair larger with lighter membranous margin, densely brown tomentose outside. **Petals** creamy yellow and turn to purple, obovate, with distinct longitudinal veins, 12-18 mm long, 7-10 mm wide, rounded and crisped at apex, glabrous except for tomentose at basal parts. **Stamens** 50-70, yellow and turn to purple, 2.5-3 cm long, glabrous. Gynophore purple, 3-4.3 cm long, sparsely hairy at base. **Ovary** purple, ovoid to subglobose, 2-3 mm in diam., glabrous. **Fruit** globose, ca. 4 cm in diam., densely brown pubescent; pericarp thick; stipe ca. 7 cm long (Fig. 108).

Thailand.— Northern: Nan, Tak.

Distribution.— S China (Yunnan), Vietnam (Tonkin-type).

Ecology.— Lower montane forest, in open areas, alt. 1,200-1,300 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: July-August.

Vernacular.— สาลีนุ่น Sali num (General).

Voucher specimens.— *P. Srisanga* 505; *P. Srisanga et al.* 898, 2498.

Notes.— Rare species, few specimens collected. New locality recorded from Nan, in Thailand.

2. *STIXIS* Lour.

Fl. Cochinch.: 295. 1790; Jacobs, *Blumea* 12(1): 5. 1963; Chayamarit in Fl. Thailand 5(3): 259. 1991; Kers in *Fam. Gen. Vasc. Pl.* 5: 54. 2003. – *Roydsia* Roxb., *Pl. Corom.* 3: 87. 1819.

Woody climbers; branches lenticellate, unarmed; cataphylls present at base of shoots. **Leaves** simple, entire, with pustules along the midrib. **Inflorescence** terminal or axillary, racemose or paniculate. **Sepals** 6, in 2 whorls of 3, densely tomentose on both sides. **Petals** absent. **Stamens** numerous on a short cylindrical androgynophore; filaments flat; anthers oblong, versatile. **Ovary** 3-locular, axile placentation; ovules 5-8 in each loculus; style short or absent; stigmas 3. **Fruit** a berry, ellipsoid; pericarp thick. **Seed** 1, embedded in pulp.

Seven species in tropical Asia distributed in India, S China, SE Asia southwards to Malaysia and Indonesia (Jacobs, 1963). Two species in Thailand (Chayamarit, 1991). One species recorded from Doi Phu Kha National Park.

Stixis suaveolens (Roxb.) Pierre

Bull. Soc. Linn. Paris 1: 654. 1887; Jacobs, *Blumea* 12(1): 7. 1963; Chayamarit in Fl. Thailand 5(3): 260. 1991. – *Roydsia suaveolens* Roxb., *Pl. Corom.* 3: 87, t. 289. 1819.

Woody climber; branches puberulous, glabrescent. **Leaves** elliptic to oblong, coriaceous, 13-23 cm long, 5-9 cm wide, glabrous, smooth except pustules along the midrib above; base obtuse, rounded to broadly cuneate; apex acute to acuminate; primary veins 7-11 pairs; petioles 1.5-2.5 cm long. **Inflorescence** in axillary racemes, 12-20 cm long; rachis puberulous. **Flowers** yellowish; pedicels 2-4 mm long. **Sepals** elliptic, 4-6 mm long, 2-3 mm wide, obtuse at apex, densely tomentose on both sides. **Stamens** numerous; filaments 4-6 mm long. Gynophore 5-10 mm long, hairy. **Ovary** ellipsoid, ca. 2 mm long, glabrous; style short. **Fruit** ellipsoid, 3-3.5 cm long, 2-2.5 cm wide, woody; pericarp with dry flat papillae; stipe 6-10 mm long.

Thailand.— Northern: Lampang, Nan; North-eastern: Nakhon Phanom.

Distribution.— India (type), Myanmar, China (Yunnan, Hainan), Laos, Cambodia, Vietnam.

Ecology.— Dry evergreen forest, in open areas, alt. 900 m (Doi Phu Kha, Tham Pha Khaw).

Phenology.— Flowering: April-May; fruiting: July-August.

Vernacular.— ขางน้ำข้าว Khang nam khao (Northern).

Voucher specimens.— *P. Srisanga* 1937.

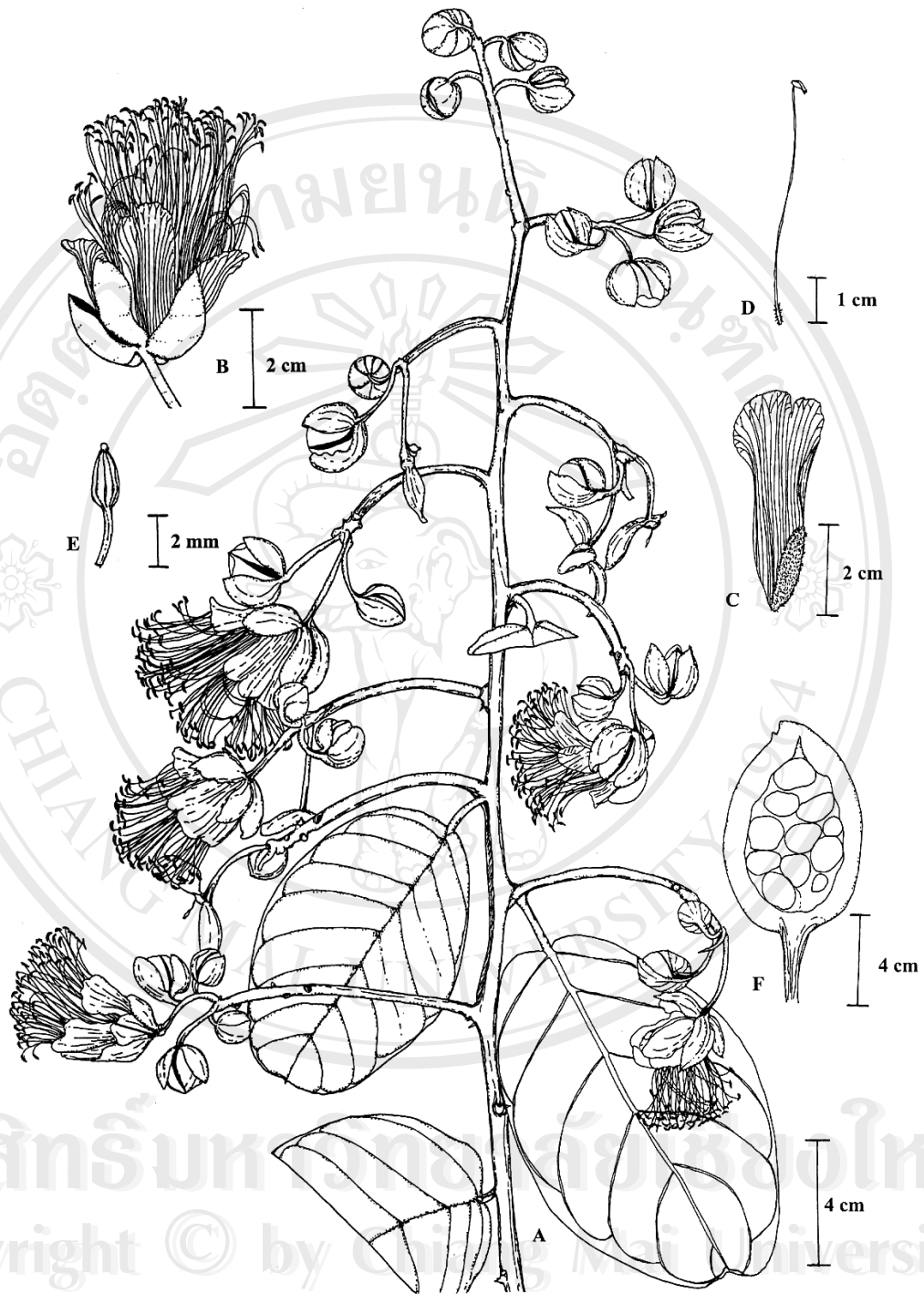


Figure 33. *Capparis trisonthiae* Srisanga & Chayamarit

A. flowering branch; B. flower; C. upper left petal; D. stamen; E. gynophore and ovary; F. longitudinal section of fruit showing seeds. A-E from *P. Srisanga* 2550; F from *P. Srisanga* 2389.

CAPRIFOLIACEAE

Small trees, shrubs, lianas or herbs. **Leaves** simple, rarely pinnately compound (*Sambucus* L.), opposite; stipules absent or very small. **Inflorescence** axillary or terminal, cymose. **Flowers** bisexual, actinomorphic or zygomorphic. **Calyx** tube adnate to the ovary; lobes (4-)5, small, 5-fid or toothed, sometimes accrescent in fruit. **Petals** (4-)5, sometimes 2-lipped; lobes imbricate or valvate. **Stamens** 2, 4 or 5, inserted on the corolla tube; anther 2-locular, opening by longitudinal slits. **Ovary** inferior, 2-5(-8)-locular, usually axile placentation sometimes partition failing to meet in ovary apex or only 1-locular fertile; style terminal; ovules 1 to numerous in each loculus. **Fruit** a capsule, berry or drupe. **Seeds** few to numerous.

Fifteen genera and about 420 species, subcosmopolitan (Mabberley, 1997). *Carlemannia* Benth. and *Silvianthus* Hook.f. are often segregated as their own family (Carlemanniaceae) or included in Rubiaceae. *Sambucus* L. is also sometimes placed in their own monotypic family (Sambucaceae). Five genera and about 25 species in Thailand. Five genera and 7 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|---|------------------------------|
| 1. Leaves simple | |
| 2. Stamens 2. Fruit a capsule | |
| 3. Herbs. Inflorescence terminal, pedunculate. Corolla 4-lobed | 1. <i>Carlemannia</i> |
| 3. Shrubs. Inflorescence axillary, sessile or subsessile. Corolla 5-lobed | 4. <i>Silvianthus</i> |
| 2. Stamens 5. Fruit a berry or drupe | |
| 4. Corolla 2-lipped, at least 12 mm long. Fruit a berry | 2. <i>Lonicera</i> |
| 4. Corolla actinomorphic, at most 10 mm long. Fruit a drupe | 5. <i>Viburnum</i> |
| 1. Leaves pinnately compound | 3. <i>Sambucus</i> |

1. *CARLEMANNIA* Benth.

Hook. J. Bot. 5: 307. 1853; Hook.f. in Fl. Br. Ind. 3: 85. 1880; Kern & Steenis in Fl. Mal. I(4): 192. 1951; Hutchinson, Gen. Fl. Pl. 2: 86. 1967; Thiv in Fam. Gen. Vasc. Pl. 7: 58. 2004.

Perennial herbs. **Leaves** simple, crenate-serrate, petiolate. **Inflorescence** in terminal cymes, pedunculate. **Flowers** pedicellate. **Calyx** tube subglobose, adnate to the ovary; lobes 4(-5), persistent. **Corolla** tubular; imbricate; lobes 4. **Stamens** 2, inserted in the middle of the corolla tube, alternating with the lobes, included; filaments short; anthers dorsifixed. Disk annular-cylindric. **Ovary** 2-locular, axile placentation; style filiform; stigma clavate, 2-fid; ovules numerous. **Fruit** a loculicidal 2-valved, 4-lobed capsule. **Seeds** minute, numerous.

Three species in E Himalayas, S China (Yunnan), Vietnam (Tonkin) and Indonesia (Sumatra) (Thiv, 2004). One species in Thailand.

Carlemannia tetragona Hook.f.

In Fl. Br. Ind. 3: 85. 1880; Kern & Steenis in Fl. Mal. I(4): 193, fig. 1: c. 1951; Nanakorn, Queen Sirikit Bot. Gard. 7: 97. 2004. – *C. tetragona* var. *tonkinensis* Pitard in Fl. Gén. I.-C. 3: 168, fig. 16: 4-7. 1923. – *C. sumatrana* Ridl., J. Str. Br. R. As. Soc. 1: 66. 1923.

Perennial herb, up to 1 m high, rooting at nodes; young shoots pubescent. **Leaves** elliptic to ovate, membranous, (4-)10-16 cm long, (2-)5-9 cm wide, sparsely hairy on both surfaces; base cuneate, oblique; apex acuminate; margin crenate-serrate; petioles (1-)3-5(-6) cm long, sparsely hairy. **Inflorescence** 1-3 cm long, pubescent; pedicels 0.5-1 mm long. **Calyx** puberulous; tube ca. 1 mm long; lobes 4(-5), linear, (2-)3-4 mm long. **Corolla** white or creamy yellow, puberulous; tube 6-8 mm long; lobes ovate, rounded at apex, 1-1.5 mm long. **Filaments** 1-2 mm long; anthers ca. 2 mm long. Disk ca. 0.5 mm long. **Style** 2-3 mm long, glabrous. **Capsule** pyramidal, distinctly 4-lobed, 2.5-3 mm long, 5-6 mm wide, brown, puberulous, with distinctly persistent calyx on the top. **Seeds** ovate, 0.25-0.5 mm long, black, reticulate, aggregated in 2 masses (Fig. 109).

Thailand.— Northern: Nan.

Distribution.— E Himalayas (India-type), S China (Yunnan), Vietnam (Tonkin), Indonesia (Sumatra).

Ecology.— Lower montane forest, in shades or along streams, alt. 1,100-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-November.

Vernacular.— ชาละมุน Khao lamun (General).

Voucher specimens.— *P. Srisanga* 950, 1162, 1623; *P. Srisanga* & *C. Puff* 1081, 1099.

Notes.— Rare species, recently recorded from Thailand.

2. *LONICERA* L.

Sp. Pl.: 173. 1753; Danguy in Fl. Gén. I.-C. 3: 14. 1922; Kern & Steenis in Fl. Mal. I (4): 176. 1951; Hutchinson, Gen. Fl. Pl. 2: 87. 1967. – *Caprifolium* Zinn., Cat. Pl. Gött.: 10. 1757.

Woody climbers or scandent shrubs. **Leaves** simple, entire, rarely lobed. **Inflorescence** axillary or terminal, cymose. **Flowers** usually in pair, each pair subtended by 2 bracts and 2 bracteoles, 5-merous, mostly sessile. **Calyx** tube ovoid to subglobose; lobes small. **Corolla** zygomorphic, 2-lipped, imbricate, showy; upper lip 4-lobed; lower lip 1-lobed. **Stamens** 5, usually exserted; filaments inserted near apex of the corolla tube. **Ovary** 2-3-locular; ovules 3-8 in each loculus, pendulous; style filiform, elongated, usually exserted and longer than stamens; stigma capitate. **Fruit** a berry. **Seeds** few.

About 180 species, mainly in the N hemisphere (Mabberley, 1997). About 10 species indigenous or cultivated for ornamentals in Thailand. One species recorded from Doi Phu Kha National Park.

Lonicera siamensis Gamble

Kew Bull. 1913: 199. 1913; Danguy in Fl. Gén. I.-C. 3: 17. 1922; Craib in Fl. Siam. Enum. 2(1): 5. 1932.

Woody climber; young shoots pale brown tomentose, glabrescent. **Leaves** lanceolate to elliptic, chartaceous, (4-)9-15 cm long, (1.5-)3.5-6.5 cm wide, glabrous and subrugose on upper surface, pale brown tomentose on lower surface; base cuneate to cordate; apex acute to acuminate; primary veins 4-6 pairs; petioles 5-15 mm long, pale brown tomentose. **Inflorescence** axillary or terminal, cymose. **Flowers** in pair, fragrant; bracts linear-lanceolate, ca. 3 mm long; bracteoles ovate, ca. 1 mm long. **Calyx** tube subglobose, ca. 1 mm long, sparsely tomentose; lobes lanceolate, 1-2 mm long, pale brown tomentose. **Corolla** white and turn yellow, pubescent outside, sparsely pubescent inside; tube 2.5-3 cm long; lobes 1.6-2 cm long; lower lip oblong. **Stamens** glabrous; filaments 2-2.4 cm long; anthers oblong, 3.5-5 mm long. **Style** 4.7-5.3 cm long, glabrous. **Fruit** not known (Fig. 110).

Thailand.— Northern: Chiang Mai, Nan (Doi Wao-type: *Kerr* 2457); North-eastern: Loei.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, alt. 1,000-1,400 m (Doi Phu Kha).

Phenology.— Flowering: February-March.

Vernacular.— หญ้าช้างน้อย *Ya chang noi* (Chiang Mai).

Voucher specimens.— *P. Srisanga et al.* 2479; *R. Pooma et al.* 1408 (BKF).

Notes.— Rare species.

3. *SAMBUCUS* L.

Sp. Pl.: 269. 1753; Danguy in Fl. Gén. I.-C. 3: 1. 1922; Kern & Steenis in Fl. Mal. I (4): 190. 1951; Hutchinson, Gen. Fl. Pl. 2: 85. 1967.

Trees or shrubs, rarely erect perennial herbs; nodes often with stipule-like appendage. **Leaves** imparipinnate, opposite; leaflets serrate, opposite, subopposite or alternate. **Inflorescence** in terminal corymbs. **Flowers** 5-merous, actinomorphic. **Calyx** tube short. **Corolla** rotate, valvate or rarely imbricate. **Stamens** inserted on the base of the corolla, alternating with the lobes; filaments filiform, erect; anthers oblong. **Ovary** 3-5-locular; ovule 1 in each loculus, pendulous; stigmas 3 or 5. **Fruit** a berry. **Seeds** 3 or 5.

About 9 species, widely distributed in tropical and temperate regions (Mabberley, 1997). About 3 species indigenous or cultivated for ornamentals in Thailand. One species recorded from Doi Phu Kha National Park.

***Sambucus javanica* Reinw. ex Bl.**

Bijdr.: 657. 1826; Danguy in Fl. Gén. I.-C. 3: 2, fig. 1: 1-2. 1922; Craib in Fl. Siam. Enum. 2(1): 1. 1932; Fukuoka, Acta Phytotax. Geobot. 22: 165. 1967; Kern & Steenis in Fl. Mal. I(4): 191, fig. 1: f. 1951. – *S. chinensis* Lindl., Trans. Hort. Soc. Lond. 6: 297. 1826. – *S. thunbergiana* Bl. ex Miq., Ann. Mus. Lug. Bat. 2: 265. 1866. – *S. formosana* Nakai, Bot. Mag. Tokyo 31: 211. 1917.

Shrub, 2-3 m high; twigs terete with longitudinal furrow, glabrous or subglabrous; nodes between the petioles often with recurved, linear, stipule-like appendage. **Leaves** with (1-)3-7(-9) leaflets; rachis (2.5-)4-17 cm long, sparsely puberulous. Leaflets usually opposite or subopposite, rarely alternate, lanceolate to elliptic, 5-20 cm long, 1.5-7 cm wide, sparsely puberulous especially on midrib and nerves; base rounded to cuneate, oblique; apex acute, acuminate to narrowly caudate; lateral petiolules absent or up to 6 mm long; terminal petiolules 3-16 mm long. **Inflorescence** large, showy, flat-topped, 3-5(-7)-rayed, puberulous; nectaries yellow, obconical, 1-3.5 mm in diam. **Flowers** slightly fragrant; pedicels up to 3 mm long or absent. **Calyx** lobes triangular, ca. 0.5 mm long. **Corolla** white, ovate, acute at apex, 1.5-2 mm long. **Filaments** ca. 0.5 mm long. **Ovary** 3-locular; stigmas 3. **Berry** ovoid to globose, 3-4 mm long and wide, black, glabrous. **Seeds** (2-)3.

Thailand.— Throughout the country.

Distribution.— E & SE Asia (Java-type).

Ecology.— Dry evergreen and lower montane forest, along streams, alt. 800-1,200 m (Doi Phu Kha).

Phenology.— Flowering: August-November; fruiting: October-December.

Vernacular.— สะพานกั้น Sa phan kon (Northern).

Voucher specimens.— *P. Srisanga* 2205, 2214; *P. Srisanga* & *C. Maknoi* 2104.

4. SILVIANTHUS Hook.f.

Hook. Ic. Pl. 11: 36, t. 1048. 1868; Hook.f. in Fl. Br. Ind. 3: 86. 1880; Hutchinson, Gen. Fl. Pl. 2: 86. 1967; Thiv in Fam. Gen. Vasc. Pl. 7: 58. 2004.

Shrubs. **Leaves** simple, minutely dentate, petiolate. **Inflorescence** in dense axillary cymes, sessile or subsessile, resembling globose clusters. **Flowers** pedicellate; bracts lanceolate-oblong. **Calyx** tube obconic, adnate to the ovary; lobes (4-)5, persistent. **Corolla** funnel-shaped; induplicate-valvate; lobes 5. **Stamens** 2, inserted about the middle of the corolla tube, alternating with the lobes, included; filaments short; anthers dorsifixed. Disk conical. **Ovary** 2-locular, axile placentation; style filiform; stigma clavate, 2-fid; ovules many. **Fruit** a 5-valved, fleshy capsule. **Seeds** obliquely oblong.

Two species in Nepal, India (Assam), Myanmar, S China (Yunnan), Vietnam (Tonkin), Laos (Tange, 1998; Thiv, 2004). One species in Thailand.

***Silvianthus tonkinensis* (Gagnep.) Ridsd.**

Blumea 24(1): 42. 1978; Tange, Thai For. Bull. (Bot.) 26: 59, figs. 1-3. 1998. — *Quiducia tonkinensis* Gagnep., Bull. Soc. Bot. France 95: 33. 1948. — *Silvianthus clerodendroides* Airy Shaw, Kew Bull. 19: 507. 1965.

Shrub, 3-4 m high, rooting at nodes; stem glabrous, swollen above the nodes. **Leaves** elliptic to ovate, subcoriaceous, 12-30 cm long, 4-13 cm wide, glabrous on both surfaces; base cuneate to attenuate, oblique; apex acute to acuminate; margin minutely dentate; petioles 1-5(-8) cm long, glabrous. **Inflorescence** in dense axillary cymes, sessile or subsessile, resembling globose clusters, glabrous or with minute glands. **Flowers** heterostylous; pedicels 1-3 mm long. **Calyx** purplish green, glabrous or with minute glands; tube 2-3 mm long; lobes (4-)5, linear, (8-)10-14 mm long. **Corolla** yellow, slightly zygomorphic, glabrous outside, sparsely hairy inside; tube 14-18 mm long; lobes triangular-ovate, broadly acute at apex, 3-4.5 mm long. **Filaments** 0.75-2 mm long; anthers 4-5 mm long. **Style** 5-10 mm long, glabrous; stigma 2-3 mm long. **Capsule** depressed obovate, 7-10 mm long and wide, dehiscent from the apex by 5 valves, pink-purplish, glabrous, with distinctly persistent calyx on the top. **Seeds** obliquely oblong, 2.5-3.5 mm long, 1-1.5 mm wide, black, with longitudinal ridges, aggregated in 2 masses remaining on the central placentas.

Thailand.— Northern: Nan.

Distribution.— S. China (Yunnan), Vietnam (Tonkin-type), Laos.

Ecology.— Lower montane forest, in shades or along streams, alt. 1,100-1,300 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: October-November.

Vernacular.— เพลือกะมูน Lueang lamun (General).

Voucher specimens.— *P. Srisanga* 1161, 1327.

Notes.— Rare species.

5. VIBURNUM L.

Sp. Pl.: 267. 1753; Danguy in Fl. Gén. I.-C. 3: 4. 1922; Kern & Steenis in Fl. Mal. I (4): 180. 1951; Hutchinson, Gen. Fl. Pl. 2: 85. 1967.

Trees or shrubs. **Leaves** simple, entire, serrate or trifold at apex. **Inflorescence** in terminal corymbose or paniculate, rarely axillary. **Flowers** 5-merous, actinomorphic. **Calyx** tube short. **Corolla** white or pink, rotate, campanulate or tubular, imbricate. **Stamens** inserted on the base of the corolla, alternating with the lobes, exserted; filaments filiform; anthers oblong. **Ovary** 1-locular; ovule 1, pendulous from the apex; style short, conical; stigmas 3, connate. **Fruit** a drupe, crowned by persistent calyx and style.

About 150 species widely distributed in Europe, Asia and America (Mabberley, 1997). About 10 species in Thailand (Fukuoka, 1967). Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves entire or only few teeth near apex. Inflorescence in terminal umbellate corymbs
 2. Leaves glabrous. Corolla tubular **1. *V. cylindricum***
 2. Leaves softly tomentose on lower surface. Corolla campanulate
2. *V. sambucinum* var. *tomentosum*
1. Leaves serrate. Inflorescence in axillary paniculate **3. *V. sp.***

1. *Viburnum cylindricum* Ham. ex D. Don

Prodr. Fl. Nepal.: 142. 1825; Craib in Fl. Siam. Enum. 2(1): 1. 1932; Fukuoka, Acta Phytotax. Geobot. 22: 171. 1967. – *V. coriaceum* Bl., Bijdr.: 656. 1826; Danguy in Fl. Gén. I.-C. 3: 8, fig. 2: 8. 1922; Kern & Steenis in Fl. Mal. I(4): 183, fig. 4: a-f. 1951.

Tree or shrub, 4-6, rarely up to 15 m high; young shoots puberulous. **Leaves** lanceolate to elliptic, coriaceous, (5-)10-17 cm long, (1.5-)2.5-6 cm wide, glabrous on both surfaces, usually with glands below, tuft domatia often present in nerve axils; base cuneate, slightly oblique; apex acute to shortly acuminate; margin entire; primary veins (3-)4-5(-6) pairs; petioles 0.4-2.5 cm long, puberulous to glabrous. **Inflorescence** in terminal umbellate corymbs, flat-topped, 5-7-rayed, stellate puberulous, often mixed with glands; peduncle 2-5 cm long. **Flowers** sessile. **Calyx** subtruncate; lobes minute. **Corolla** white, tubular, glabrous or granular; tube 2.5-3 mm long; lobes rounded, 0.5-1 mm long. **Filaments** 4-5 mm long, glabrous; anthers oblong, purplish, ca. 1 mm long. **Ovary** obconic, 1-2 mm long, subglabrous. **Drupe** ovoid, slightly compressed, 3-4 mm long, black, glabrous.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; North-eastern: Loei.

Distribution.— Himalayas (Nepal-type), S China, SE Asia.

Ecology.— Lower montane forest, often in open places, alt. 1,100-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: October-December; fruiting: December-February.

Vernacular.— ฮ่อมช้าง Hom chang (Chiang Mai).

Voucher specimens.— *P. Srisanga* 439, 2624.

2. *Viburnum sambucinum* Bl. var. *tomentosum* Hallier f.

Med. Rijksherb. 14: 36. 1912; Kern & Steenis in Fl. Mal. I(4): 186. 1951. – *V. inopinatum* Craib, Kew Bull. 1911: 385. 1911; Danguy in Fl. Gén. I.-C. 3: 10. 1922; Craib in Fl. Siam. Enum. 2(1): 2. 1932; Fukuoka, Acta Phytotax. Geobot. 22: 173. 1967.

Tree or shrub, 4-6, rarely up to 10 m high; young shoots densely stellate tomentose. **Leaves** lanceolate, elliptic to narrowly ovate, coriaceous, 10-20 cm long, 3.5-7 cm wide, glabrous except puberulous on midrib and nerves on upper surface, stellate tomentose and densely glands on lower surface; base cuneate, slightly oblique;

apex acute, acuminate to caudate; margin entire or only few teeth near apex; primary veins 6-7 pairs; petioles 1-2.5 cm long, puberulous to densely pubescent. **Inflorescence** in terminal umbellate corymbs, flat-topped, 5-7-rayed, densely stellate pubescent; peduncle 3-7 cm long. **Flowers** fragrant, sessile or short pedicellate. **Calyx** lobes minute. **Corolla** white or creamy yellow, campanulate, glabrous; tube 1-1.5 mm long; lobes ovate, rounded, 1-1.5 mm long. **Filaments** 6-7 mm long, glabrous; anthers oblong, 0.5-1 mm long. **Ovary** cylindric, 1-1.5 mm long, densely pubescent. **Drupe** ovoid, compressed, (5-)7-9 mm long, black, hairy, glabrescent.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan.

Distribution.— Myanmar, Laos, Vietnam (Tonkin), Malaysia, Indonesia.

Ecology.— Deciduous, dry evergreen and lower montane forest, often in open places, alt. 700-1,200 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: November-January; fruiting: December-March.

Vernacular.— ดอกข่าว Dok khuang (Lua-Nan); อุ้ม Un (Northern).

Voucher specimens.— *P. Srisanga* 403, 2406, 2614.

3. *Viburnum* sp.

Tree or shrub, 4-5 m high; young shoots sparsely stellate hairy. **Leaves** oblong-elliptic, subcoriaceous, (7-)10-22 cm long, 4-7(-8.5) cm wide, sparsely stellate hairy on both surfaces; base cuneate, sometimes slightly oblique; apex acuminate to shortly caudate; margin serrate; primary veins 6-8 pairs, impressed above, raised and prominent below; petioles 1.3-3 cm long, sparsely stellate hairy, glabrescent, rough. **Inflorescence** in axillary paniculate, 10-13 cm long, stellate hairy. Pedicels 0.5-1 mm long. **Calyx** lobes triangular, ca. 0.5 mm long, sparsely stellate hairy. **Corolla** white, campanulate, sparsely stellate hairy; tube ca. 0.5 mm long; lobes lanceolate-ovate, 2-2.5 mm long. **Filaments** 2-2.5 mm long, glabrous; anthers oblong-lanceolate, 0.75-1 mm long. **Ovary** conical, glabrous; style 2.5-3 mm long, glabrous. **Drupe** (immature) obovoid, compressed, 1-1.5 cm long, 0.8-1.1 cm wide, glabrous.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: September-January.

Voucher specimens.— *P. Srisanga* 1685, 2328.

Notes.— Possibly able to classify as new species. Inflorescence in axillary paniculate is very remarkable.

CARDIOPTERIDACEAE

Monogeneric family. Description as in the genus.

CARDIOPTERIS Wall. ex Royle

Ill. Bot. Himal.: 136, in text. 1834; emed. Bl., Rumphia 3: 205. 1847; Sleum. in Fl. Mal. I(7): 93. 1971; in Fl. Thailand 2(2): 93. 1972. – *Peripterygium* Hassk., Tijdschr. Natuurl. Geschied. Physiol. 10: 142. 1843.

Sinistrorsely twining herbs with white latex. **Leaves** alternate, simple or lobed, cordate, palmatinerved, long-petioled, glabrous, exstipulate. **Flowers** bisexual, or polygamous (andromonoecious), small, subsessile, in unilateral repeatedly forked cincinni. **Calyx** 4-5. **Corolla** 4-5, imbricate. **Stamens** 4-5, inserted on the upper part of the tube, alternate with the lobes; filaments very short; anthers introrse. **Ovary** oblong-ovoid, subquadrangular, rudimentary in male; ovules 2, pendent from apex of cavity; styles 2, one elongated and enlarged in fruit, the other style short-curved and caducous. **Fruit** a samara, obovate-elliptic or suborbicular, compressed, with 2 transversely-veined wings, stramineous colour, emarginate at apex, cuneate at base. **Seed** 1, linear.

Only 2 species, one widely distributed in SE Asia and W Malesia and the second in E. Malesia (Sleumer, 1972).

Cardiopteris quinqueloba (Hassk.) Hassk.

Natuurk. Tijdschr. Ned.-Indie. 10: 64. 1855; Sleum. in Fl. Mal. I(7): 95. 1971; in Fl. Thailand 2(2): 93. 1972. – *Peripterygium quinquelobum* Hassk., Tijdschr. Natuurl. Geschied. Physiol. 10: 142. 1843. – *Cardiopteris javanica* Bl., Rumphia 3: 206. 1847 (or 1849), nom. illeg. – *C. lobata* R. Br. in Benn. & Br., Pl. Jav. Rar.: 246, t. 49. 1852, nom. illeg.; Craib in Fl. Siam. Enum. 1: 276. 1926; Larsen, Dansk Bot. Ark. 23: 71. 1963. – *C. platycarpa* Gagnep., Not. Syst. Paris 1: 198. 1910.

Much branched twining herbs, 2-5(-9) m long. **Leaves** broadly ovate, simple or 3-5(-9)-lobed, herbaceous, (4-)6-12(-17) cm long, (3-)5-7(-16) cm wide; base cordate; apex obtuse, acute to acuminate; main nerves 7-9 from the base. **Inflorescence** 5-10 cm long, glandular-puberulous. **Calyx** lobes elliptic, 1-2 mm long. **Corolla** white, 2-4 mm long. **Samara** 2-3 cm long, 1-2 cm wide.

Thailand.— Northern: Chiang Mai, Lamphun, Nan; North-eastern: Loei, Khon Kaen; Eastern: Nakhon Ratchasima; South-eastern: Chon Buri; Central: Saraburi; South-western: Kanchanaburi; Peninsular: Phuket, Nakhon Si Thammarat.

Distribution.— India (Assam), S China (Yunnan), SE Asia (W Malesia-type).

Ecology.— Dry evergreen forest, alt. 700 m (Sapan Waterfall).

Phenology.— Flowering and fruiting: October-December.

Voucher specimens.— *P. Srisanga* 335.

CARYOPHYLLACEAE

Annual or perennial herbs or low shrubs; stem often swollen at the nodes. **Leaves** opposite, decussate or apparently whorled, simple, entire, with or without stipules. **Inflorescence** mostly dichasial, rarely flower solitary. **Flowers** bisexual, rarely unisexual, actinomorphic. **Sepals** (4-)5, free or connate. **Petals** (4-)5 or absent, free. **Stamens** (2-)5, 8 or 10, free or basally connate; anthers opening by longitudinal slits. **Ovary** superior, mostly unilocular; styles (1-)2-5, usually free; ovules 1-numerous, basal from a free central placenta. **Fruit** usually a capsule, dehiscent from the apex with as many or twice as valves or teeth as carpels.

About 86 genera and ca. 2,200 species, mainly distributed in the temperate regions of the northern hemisphere with a centre in the mediterranean and Irano-Turanean regions (Bittrich, 1993). Many species are cultivated as garden ornamentals. Eight genera and 9 species, native or introduced in Thailand (Larsen, 1992b). Three genera and 3 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|---------------------------------|---------------------------|
| 1. Stipules present | 1. <i>Drymaria</i> |
| 1. Stipules absent | 2. <i>Myosoton</i> |
| 2. Sepals free; styles (4-)5 | 3. <i>Silene</i> |
| 2. Sepals connate; styles 3(-5) | |

1. *DRYMARIA* Willd. ex Schult.

In Roem. & Schult., Syst. Veg. 5: 406. 1819; Duke, Ann. Miss. Bot. Gard. 48: 173. 1961; Larsen in Fl. Thailand 5(4): 413. 1992; Bittrich in Fam. Gen. Vasc. Pl. 2: 220. 1993.

Annual or perennial herbs, procumbent, rarely erect, sometimes rooting at the nodes. **Leaves** opposite or apparently whorled; stipules small, caducous. **Inflorescence** terminal or axillary cymes or flower solitary. **Sepals** 5, herbaceous or with scarios margins. **Petals** 5, bi- or quadrid, or absent. **Stamens** 2-5. **Styles** 3; ovules 2-numerous. **Capsule** (2-)3(-4)-valved.

About 48 species mostly restricted to the New World (Bittrich, 1993). Only 1 species in Thailand (Larsen, 1992b).

Drymaria diandra Bl.

Bijdr.: 62. 1825; Larsen in Fl. Thailand 5(4): 414, fig. 92: 1-8. 1992. – *D. cordata* auct. non Roem. & Schult.: Edgew. & Hook.f. in Fl. Br. Ind. 1: 244. 1874 (excl. syn.: *Ceratium cordifolium* Roxb.); Craib in Fl. Siam. Enum. 1: 108. 1925; Larsen, Dansk Bot. Ark. 23: 61. 1963. – *D. cordata* Willd. ex Roem. & Schult. subsp. *diandra* (Bl.) Duke, Ann. Miss. Bot. Gard. 48: 253, fig. 18. 1961.

Procumbent herb, sparsely branched with adventitious roots at the nodes; stem slender, 30-50 cm long, glabrous. **Leaves** broadly ovate to circular, 0.5-2.5 cm long and wide; base obtuse to truncate, rarely cordate; apex obtuse to acute, glabrous; nerves 3-7 from base; stipules lobed; petioles 1-6 mm long. Peduncle up to 5 cm long, glabrous; pedicels 0.5-3 mm long, pubescent. **Sepals** obovate, 3-nerved, green, 2-4.5 mm long. **Petals** 5, white, 1.5-3 mm long, emarginate, up to half-length; lobes oblong. **Stamens** 5, connate at base. **Ovary** unilocular, spherical. **Capsule** 3-valved, 1.5-2.5 mm long. **Seeds** 1-2.

Thailand.— Northern: Chiang Mai, Nan; Peninsular: Nakhon Si Thammarat.

Distribution.— Pantropical (Java-type).

Ecology.— Lower montane forest, common among grasses in moist areas or along streams, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: June-October.

Vernacular.— หญ้ากึ่งคุดหอย Ya klet hoi (Northern).

Voucher specimens.— *P. Srisanga* 1646.

2. *MYOSOTON* Moench

Meth.: 225. 1794; Larsen in Fl. Thailand 5(4): 422. 1992; Bittrich in Fam. Gen. Vasc. Pl. 2: 227. 1993.

Monotypic genus. Description as in the species.

Myosoton aquaticum (L.) Moench

Meth.: 225. 1794; Larsen in Fl. Thailand 5(4): 423, fig. 94: 1-6. 1992. – *Cerastium aquaticum* L., Sp. Pl.: 439. 1753. – *Stellaria aquatica* (L.) Scop., Fl. Carn. ed. 2. 1: 319. 1772; Craib in Fl. Siam. Enum. 1: 107. 1925. – *Stellaria media* auct. non (L.) Cyr.: Larsen, Dansk Bot. Ark. 23: 61. 1963.

Perennial herb; stems glabrous to sparsely hairy. **Leaves** opposite, lanceolate to ovate, 2-6 cm long, 1-2 cm wide, glabrous; base broadly cordate; apex acute to acuminate; 3-nerved from base; stipules absent; petioles up to 2 cm long or sessile. **Inflorescence** terminal cymes, few-flowered, lax; pedicels fragile, glandular. **Sepals** 5, free, ovate, 3-5 mm long, hairy. **Petals** 5, white, 4-6 mm long, deeply bifid; lobes divided nearly to the base. **Stamens** 10, as long as the petals. **Ovary** unilocular, ovoid; styles (4-)5. **Capsule** ovoid, slightly longer than the sepals, opening with 5 bifid valves. **Seeds** brown, covered with stellately hooked papillae.

Thailand.— Northern: Chiang Mai, Nan, Kamphaeng Phet.

Distribution.— Europe (type) and temperate Asia. Probably introduced with seeds or plants from Europe.

Ecology.— Dry evergreen forest, in damp shady places and along streams, alt. 600-700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: March-April.

Voucher specimens.— *P. Srisanga* 1376.

3. *SILENE* L.

Sp. Pl.: 416. 1753; Larsen in Fl. Thailand 5(4): 418. 1992; Bittrich in Fam. Gen. Vasc. Pl. 2: 233. 1993.

Annual, biennial or perennial herbs. **Inflorescence** dichasial or monochasial cymes or flower solitary. **Flowers** bisexual, monoecious or dioecious. **Calyx** 5, tubular, 10-30(-60)-nerved. **Petals** 5, clawed, entire or deeply lobed; corona present or absent. **Stamens** 10. **Ovary** 3(-5)-locular at base, unilocular towards apex; styles 3(-5). **Capsule** usually opening by twice as many as styles present. **Seeds** many, kidney-shaped or globose.

About 400 species mainly in the temperate and subtropical parts of N Hemisphere. Only 1 species in Thailand (Larsen, 1992b).

Silene burmanica Coll. & Hemsl.

J. Linn. Soc. 28: 23. 1891; Craib in Fl. Siam. Enum. 1: 107. 1925; Larsen, Dansk Bot. Ark. 23: 61. 1963; in Fl. Thailand. 5(4): 418. 1992.

Erect or ascending herb up to 1 m high; stems swollen at the nodes, sparsely glandular hairy. **Leaves** lanceolate to elliptic, 2-4 cm long, 0.7-2 cm wide, sparsely glandular hairy, especially on the nerves and the margin, sessile. Peduncle and pedicels glandular hairy; bracts broadly lanceolate, green, 3-5 mm long, glandular hairy. **Calyx** pale green, 7-14 mm long, glandular hairy; lobes triangular, acute. **Petals** white, sometimes with pink tinge, 10-18 mm long, 4-lobed, 2 lateral lobes small; corona scales present. **Stamens** as long as the petals. **Ovary** unilocular; styles 3, 1.5-2.5 cm long; stigma shortly decurrent. **Capsule** ellipsoid-ovoid, 10-15 mm long, 4-6 mm wide, yellow (Fig. 111).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Myanmar (type), S China (Yunnan).

Ecology.— Lower montane scrub, open areas among grasses on limestone rocks, alt. 1,600-1,800 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: September-December.

Voucher specimens.— *P. Srisanga* 440, 1796, 2139, 2641.

Notes.— Rare species.

CECROPIACEAE

Dioecious trees, shrubs or woody climbers, sometimes epiphytic, with aerial roots or stilt roots, latex absent. Stipules fused, mostly fully amplexicaul. **Leaves**

simple, alternate, entire to deeply palmatifid, petiolate. **Inflorescence** cymose, capitate, spicate to subumbellate; spathe usually present, caducous. **Flowers** unisexual, minute. **Male flowers** with 2-4 tepals, free or fused; stamens 1-4; pistillode usually lacking. **Female flowers** with 2-4 tepals, fused, tubular; ovary superior, 1-locular; ovule basal or subbasal; style 1; stigma ligulate to capitate. **Fruit** a nutlet, sometimes adnate to fleshy accrescent perianth.

Six genera and about 180 species in tropical regions of S America, Africa and Asian-Australasian (Kubitzki, 1993a). The family formerly included within Moraceae or Urticaceae. One genus and about 2 species in Thailand (Chew, 1963). One species recorded from Doi Phu Kha National Park.

***POIKILOSPERMUM* Zipp. ex Miq.**

Ann. Mus. Bot. Lud. Bat. 1: 203. 1864; Chew, Gard. Bull. Singapore 20: 44. 1963 (revision); Kubitzki in Fam. Gen. Vasc. Pl. 2: 245. 1993. – *Conocephalus* Bl., Bijdr: 483. 1825. – *Balansaephytum* Drake, Bull. Soc. Bot. France 43: 83. 1896. – *Conocephalopsis* O. Kuntze, Rev. Gen. 3(2): 136. 1898.

Woody scramblers, sometimes hemi-epiphytic with aerial roots. Stipules intrapetiolar, usually coriaceous, caducous or persistent. **Leaves** entire, usually coriaceous, mostly pinnately veined. **Inflorescence** axillary, cymose, branched once or repeated dichotomously, with capitate clusters of flowers on the ultimate branchlets. **Male flowers** with 2-4 tepals, free or fused, usually strongly incurved at apex; stamens 2-4, inserted around the pistillode, opposite to the tepals; anthers dehiscing by longitudinal slits. **Female flowers** with 4 tepals, fused, tubular; lobes usually decussate, imbricate; ovary superior, ovoid to ellipsoid, 1-locular; ovule basal; stigma subsessile, lingulate to capitate-peltate; staminode absent. **Nutlet** ovoid to ellipsoid, exserted or enclosed within accrescent perianth.

About 20 species from Himalayas to continental SE Asia through Malesia and Bismarck Archipelago (Chew, 1963).

***Poikilospermum suaveolens* (Bl.) Merr.**

Contr. Arn. Arb. 8: 47. 1934, pro parte; Chew, Gard. Bull. Singapore 20: 88, fig. 23. 1963 (see also for complete synonymy). – *Conocephalus suaveolens* Bl., Bijdr: 484. 1825. – *Balansaephytum tonkinense* Drake, Bull. Soc. Bot. France 43: 83, t. 1. 1896. – *Conocephalus sinensis* Wright, J. Linn. Soc. Bot. 26: 471. 1899. – *C. mollis* Gagnep. in Fl. Gén. I.-C. 5: 834. 1929. non Merr.

Woody scrambler; twigs periderm splitting into transverse copper-brown flakes, glabrous. Stipules lanceolate, 1.5-2.5 cm long, sparsely hairy. **Leaves** elliptic to ovate, coriaceous, 10-30 cm long, 6-15 cm wide, glabrous; cystoliths elongate, white, distinct on both surfaces; base cuneate, rounded to subcordate; apex acute to obtuse; primary veins 10-14 pairs, straight, raised and more prominent on lower surface; petioles 5-10 cm long, with periderm splitting into transverse copper-brown flakes, glabrous. **Male inflorescence** (2-)4-6 cm long, branched dichotomously 2-3

times; floral capitula numerous, 4-6 mm in diam. **Female inflorescence** 4-6 cm long, branched dichotomously 1-2 times; floral capitula 2-4, 2.5-5 cm in diam. **Flowers** purplish white. **Male flowers** sessile; tepals (2-)4, 1.5-2 mm long, pubescent; stamens (2-)4, ca. 1.5 mm long; filaments straight; pistillode ca. 1 mm long. **Female flowers** pedicellate; tepals 2-3.5 mm long, sparsely pubescent; ovary 1.5-2 mm long, glabrous; stigma ca. 1 mm long; pedicels 5-8 mm long, glabrous. **Nutlet** ellipsoid, 3-5 mm long, enclosed within accrescent perianth.

Thailand.— Almost throughout the country.

Distribution.— India, S China (Yunnan), SE Asia (Java-type).

Ecology.— Dry evergreen forest, along streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: April-July.

Vernacular.— ขมิ้น Kha man (Chanthaburi).

Voucher specimens.— *P. Srisanga* 1460.

CELASTRACEAE

Trees, shrubs or woody climbers, rarely herbs. **Leaves** simple, alternate, opposite or whorled; stipules absent or small and caducous. **Inflorescence** axillary or terminal, cymose or fasciculate or flower solitary, rarely racemose, paniculate or umbellate. **Flowers** bisexual or rarely unisexual, actinomorphic. **Sepals** (3-)4-5(-6), imbricate, rarely valvate. **Petals** (3-)4-5(-6), free, imbricate or valvate, rarely absent. Disk usually present. **Stamens** (2-)3-5, rarely numerous, alternate with the petals, inserted on or below the margin of the disk; anthers 2-locular, opening by longitudinal slits. **Ovary** superior or half-inferior, (1-)2-5-locular, free or adnate to the disk, axile placentation; style short, more or less 3-lobed; ovules (1-)2-10(-numerous) in each loculus, attach the inner angle of the loculi, rarely pendulous. **Fruit** a berry, capsule, drupe or samara. **Seeds** 1-numerous, with an aril or not, wings, angular or compressed.

A subcosmopolitan family with 98 genera and about 1,211 species, mainly in tropical and subtropical regions (Simmons, 2004). About 12 genera and 60 species in Thailand. Three genera and 5 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Leaves alternate
1. Leaves mostly opposite
 2. Ovules 2(-12) in each loculus
 2. Ovule 1 in each loculus

1. *Celastrus*
2. *Euonymus*
3. *Glyptopetalum*

1. *CELASTRUS* L.

Sp. Pl.: 196. 1753; Simmons in Fam. Gen. Vasc. Pl. 6: 43. 2004.

Scandent shrubs or woody climbers, mostly glabrous. **Leaves** alternate, subentire or serrate. **Inflorescence** axillary or terminal, cymose or thyrsoïd or flower solitary. **Flowers** usually unisexual, 5-merous. Disk membranous or fleshy, annular to cupular, entire or 5-lobed, intrastaminal. **Ovary** superior, 3-locular; ovules erect, 1-2 in each loculus. **Fruit** a loculicidal capsule, coriaceous. **Seeds** 1-6, ellipsoid, with an aril.

Thirty-one species in America, Madagascar, India, SE Asia, Macronesia and Australia (Simmons, 2004). Two species recorded from Doi Phu Kha National Park.

1. *Celastrus monospermus* Roxb.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India (Assam-type), China, Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,800 m (Doi Phu Kha).

Phenology.— Flowering: April-June; fruiting: October-November.

Voucher specimens.— *P. Srisanga* 1142.

2. *Celastrus paniculatus* Willd.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Phrae, Nan; North-eastern: Loei; South-western: Phetchaburi.

Distribution.— India (type), SE Asia.

Ecology.— Lower montane scrub, on limestone mountain, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering: April-June; fruiting: October-December.

Vernacular.— มะแตก Ma taek (Northern).

Voucher specimens.— *P. Srisanga* 447.

2. *EUONYMUS* L.

Sp. Pl.: 197. 1753; Simmons in Fam. Gen. Vasc. Pl. 6: 45. 2004.

Trees, shrubs or sometimes scandent, mostly glabrous. **Leaves** opposite, or rarely alternate or whorled. **Inflorescence** axillary, cymose or rarely fasciculate. **Flowers** bisexual, rarely unisexual and then dioecious, 4-5-merous. Disk fleshy, annular, 4-5-lobed, intrastaminal or stamens on disk. **Ovary** superior, 3-5-locular; ovules erect or pendulous, 2(-12) in each loculus. **Fruit** a loculicidal capsule, subspheroid or obovoid, smooth or echinate, rounded, angular, deeply lobed or laterally winged, coriaceous. **Seeds** 1-several, with an aril.

About 129 species, mainly in tropical and subtropical regions of Old and New World. Two species recorded from Doi Phu Kha National Park.

1. *Euonymus aff. sootepensis* Craib

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Endemic?

Ecology.— Dry evergreen and lower montane forest, sometimes by streams, alt. 800-1,800 m (Doi Phu Kha).

Phenology.— Flowering: March; fruiting: May-November.

Voucher specimens.— *P. Srisanga* 526, 727, 1319, 1396, 1472, 1626, 1877; *P. Srisanga* & *S. Watthana* 667.

Euonymus sp.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen and lower montane forest, sometimes by streams, alt. 750-1,700 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: June-August.

Voucher specimens.— *P. Srisanga* 456, 564, 913, 984, 1444, 1983.

3. *GLYPTOPETALUM* Thwaites

Hooker's J. Bot. 8: 267, t. 7B. 1856; Simmons in Fam. Gen. Vasc. Pl. 6: 46. 2004.

Trees or shrubs, glabrous. **Leaves** opposite, or rarely subopposite. **Inflorescence** axillary, cymose. **Flowers** bisexual, 4-merous. Disk fleshy, annular, 4-lobed or angled, stamens on disk. **Ovary** superior, 4-locular; ovules pendulous, 1 in each loculus. **Fruit** a loculicidal capsule, subspheroid or obovoid, rounded, angular, deeply lobed or laterally winged, coriaceous. **Seeds** 1-4, with an aril.

About 20 species, in India, Sri Lanka, SE Asia and Macronesia (Simmons, 2004). One species recorded from Doi Phu Kha National Park.

Glyptopetalum sclerocarpum (Kurz) Lawson

Thailand.— Northern: Chiang Mai, Lampang, Phrae, Nan; South-western: Prachin Buri.

Distribution.— Myanmar (type), Cambodia.

Ecology.— Dry evergreen forest, alt. 700 m (Tham Pha Kong).

Phenology.— Flowering: February-March; fruiting: June-July.

Vernacular.— ดูดอง Du dong (Chiang Mai), ป็องนง Pong nok (Lampang), มะเดาะ

Mado (Phrae).

Voucher specimens.— *P. Srisanga* 2518.

CHLORANTHACEAE

Trees, shrubs or herbs; stems often swollen at the nodes. **Leaves** simple, opposite, decussate or sometimes in whorled of four, serrate, crenate or dentate, penninerved, petiolate. **Inflorescence** terminal or axillary, spicate, paniculate or capitata. **Flowers** much reduced, bisexual or unisexual with the reduced anther-bearing organ adnate to the side of the ovary. **Perianth** absent or with a 3-lobed calyx; bracts 1-3 or absent. **Male flowers** with 1-3(-5) stamens; anthers linear to oblong, dehiscing by longitudinal slits. **Female flowers** naked or enclosed by a cupular bract; ovary inferior, 1-locular; stigma sessile or style short; ovule solitary. **Fruit** a drupe, small, ovoid or globose. **Seed** subglobose, exarillate.

Four genera and about 75 species mainly in the tropical and subtropical regions (Todzia, 1993a). Two genera and 4 species in Thailand (Verdcourt, 1992). Two genera and 3 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Stamens 3, on a 3-lobed organ. Fruit white, greenish or yellowish **1. *Chloranthus***
 1. Stamen 1, on a discoid organ. Fruit red **2. *Sarcandra***

1. *CHLORANTHUS* Sw.

Phil. Trans. Roy. Soc. 77: 359. 1787; Verdc. in Fl. Thailand 5(4): 425. 1992; Todzia in Fam. Gen. Vasc. Pl. 2: 286. 1993.

Shrubs or perennial erect herbs, glabrous and aromatic; stems swollen at the nodes. **Leaves** opposite, decussate, or sometimes in whorls of four, serrate. **Inflorescence** in terminal spike, slender, sometimes branched. **Flowers** bisexual. **Perianth** absent. **Male** part usually a 3-lobed organ adnate to the ovary and sometimes enveloping it forming a fleshy mass; anthers 1-3; one median with 2 locelli and one on each lateral with 1 locelli, or 2 lateral with 1 locelli and no median one, or 1-3 anthers joined and the lobed organ practically or quite obsolete. **Ovary** naked; stigma subsessile, truncate. **Drupe** white, greenish or yellowish. **Seed** subglobose.

About 20 species in Asia. Three species in Thailand (Verdcourt, 1992). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Branched undershrubs with decussate leaves. Anther-bearing organ shortly 3-lobed or 3-crenate **1. *C. erectus***
 1. Perennial herbs or undershrubs with leaves in whorls of four congested at top of stem. Anther-bearing organ with 3 distinct narrow lobes **2. *C. nervosus***

1. *Chloranthus erectus* (Buch.-Ham.) Verdc.

Kew Bull. 40: 217. 1985; in Fl. Thailand 5(4): 425. 1992. – *Cryphaea erecta* Buch.-Ham., Edinb. J. Sci. 2: 11, t. 2. 1825. – *Chloranthus officinalis* Bl., En. Pl. Jav. 1: 29. 1827. – *Chloranthus elatior* R. Br. ex Sims, Bot. Mag. 48: sub. t. 2190. 1820.

Undershrub, 0.5-3 m high; nodes distinctly swollen. **Leaves** oblong-lanceolate, elliptic, ovate, 8-20(-30) cm long, 3-8(-13) cm wide; base cuneate; apex acuminate; margin glandular-serrate; primary veins 8-11 pairs; petioles 7-15 mm long; stipules minute, subulate. **Inflorescence** with 5-13 spikes, 2.5-7 cm long. **Flowers** white, fragrant. **Anther-bearing organ** shortly 3-lobed or 3-crenate, 1-1.5 mm long; median anther 2 locelli; lateral anthers 1 locelli. **Ovary** enclosed by the male part. **Drupe** white, ovoid to obovoid, glossy, 5-7 mm in diam. **Seed** yellowish white.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Phitsanulok; North-eastern: Loei; Eastern: Chaiyaphum, Nakhon Ratchasima; South-eastern: Chanthaburi; South-western: Kanchanaburi, Prachuap Khiri Khan; Peninsular: throughout.

Distribution.— India (type), Nepal, S China, SE Asia, New Guinea.

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: June-July; fruiting: September-December.

Vernacular.— หอมไค้ Hom kai (Northern).

Voucher specimens.— *P. Srisanga* 383; *P. Srisanga et al.* 828.

2. *Chloranthus nervosus* Coll. & Hemsl.

J. Linn. Soc. 28: 118. 1890; Verdc. in Fl. Thailand 5(4): 427, fig. 95: 1-8. 1992. – *C. kachinensis* King & Prain, J. As. Soc. Beng. 69(2): 173. 1900. – *C. fortunei* var. *holostegius* Hand.-Mazz., Symb. Sin. 7: 156. 1929. – *C. holostegius* (Hand.-Mazz.) Pei & San, Contrib. Biol. Lab. Sc. Soc., China, Bot. Ser. 10: 210. 1938.

Perennial herb or undershrub up to 40 cm high, with few erect stems from a rhizome and with fibrous roots. **Leaves** in whorls of four congested at top of stem, elliptic, ovate, obovate, 4-18 cm long, 2-12 cm wide, serrate; base cuneate; apex acuminate; primary veins 7-10 pairs; petioles up to 2 cm long or sessile. **Inflorescence** with 1-5 spikes, 5-10 cm long; peduncle 2-4 cm long. **Flowers** yellow, fragrant. **Anther-bearing organ** 3-lobed; lobes linear, 5-10 mm long; anthers 1-2 mm long. **Ovary** enclosed by the male part. **Drupe** green, ellipsoid, ca. 4 mm long, 3 mm wide.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan; North-eastern: Phetchabun; Eastern: Chaiyaphum.

Distribution.— India, Myanmar (type), China.

Ecology.— Lower montane forest, limestone mountain, alt. 1,400 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: August-October.

Vernacular.— หอมไค้หลวง Hom kai luaeng (Northern).

Voucher specimens.— *P. Srisanga* 2166.

2. *SARCANDRA* Gardner

Calcutta J. Nat. Hist. 6: 348. 1846; Verdc., Kew Bull. 39: 66. 1984; in Fl. Thailand 5 (4): 429. 1992; Todzia in Fam. Gen. Vasc. Pl. 2: 286. 1993.

Shrubs or shrublets. **Leaves** opposite, decussate or sometimes appearing subverticillate where nodes are congested, usually coarsely serrate. **Inflorescence** in lax terminal spikes. **Flowers** bisexual, sessile; perianth absent. **Male** part reduced to a cup-shaped or discoid organ usually interpreted as a filament and connective of a single stamen bearing 2 locelli. **Ovary** ovoid; stigma sessile, depressed and subcapitate; ovule pendulous. **Drupe** red. **Seed** obovoid, bearing the scar of the fallen male part on its anterior face.

Two species in India, Sri Lanka, Japan, China, SE Asia, New Guinea. One species in Thailand (Verdcourt, 1992).

Sarcandra glabra (Thunb.) Nakai subsp. *brachystachys* (Bl.) Verdc.

Kew Bull. 40: 216. 1985; in Fl. Thailand 5(4): 430. 1992. – *Ascarina serrata* Bl., En. Pl. Jav. 1: 80. 1827. – *Chloranthus brachystachys* Bl., Fl. Jav., Chloranthaceae: 13, t. 2. 1829. – *C. hainanensis* Pei, Sinensia 6: 674. 1935. – *Sarcandra hainanensis* (Pei) Swamy & Bailey, J. Arn. Arb. 31: 128, fig. 4: 15-17. 1950.

Undershrub, 0.5-3 m high; nodes swollen. **Leaves** lanceolate, elliptic, subcoriaceous, (2-)6-20 cm long, 1-8 cm wide; base cuneate; apex acuminate; serrate with thickened teeth; primary veins 5-10 pairs; petioles 4-15 mm long; stipules small, linear-subulate. **Inflorescence** 3-8 cm long. **Flowers** green. **Male** part on a discoid organ; anther cells about as long as the structure itself. **Ovary** bottle-shaped or subglobose, 1-1.5 mm long. **Drupe** at first yellow, becoming red or bright orange, 4-7 mm in diam. **Seed** pale yellowish or cream.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei; South-eastern: Chanthaburi; South-western: Kanchanaburi; Peninsular: Ranong, Phangnga, Krabi, Nakhon Si Thammarat, Phatthalung, Songkhla.

Distribution.— NE India, Bangladesh, Myanmar, S China, N Vietnam and throughout Malesia (Java-type).

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: May-June; fruiting: July-December.

Voucher specimens.— *P. Srisanga* 393, 967, 1422.

CLUSIACEAE (GUTTIFERAE)

Trees, shrubs, or herbs, mostly with yellow resinous sap. **Leaves** simple, opposite or verticillate, usually entire; stipule absent. **Inflorescence** terminal or axillary, cymose, racemose, panicles, rarely flower solitary. **Flowers** bisexual or unisexual, actinomorphic. **Sepals** 2-6, free, imbricate. **Petals** (2-)3-6(-14), free,

contorted or imbricate. **Stamens** mostly numerous, free or various connate in the lower part or into bundles; anthers 2-locular, opening by longitudinal slits. **Ovary** superior, 1-5(-20)-locular, axile or parietal placentation; styles solitary or as many as locules, free or variously united; ovules (1-)2-numerous in each loculus. **Fruit** a berry, drupe or septicidal capsule. **Seeds** often arillate.

About 45 genera and 1,370 species mainly in tropical region except *Hypericum* L. familiarly in N temperate region (Mabberley, 1997). Seven genera and about 55 species in Thailand. Three genera and 6 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Trees
 2. Leaves with numerous, very close, straight, parallel primary veins.
Flowers bisexual. Ovary 1-locular; stigma on elongate style **1. *Calophyllum***
 2. Leaves not as above. Flowers unisexual. Ovary 2-12-locular;
stigma sessile **2. *Garcinia***
1. Herbs or undershrubs. Flowers yellow **3. *Hypericum***

1. *CALOPHYLLUM* L.

Sp. Pl.: 153. 1753; Singh in Fl. Ind. 3: 87. 1993.

Evergreen trees. **Leaves** opposite, decussate, more or less coriaceous, shiny, entire; primary veins numerous, very close, straight, parallel, prominent. **Inflorescence** terminal or axillary, racemose or panicles. **Flowers** bisexual. **Sepals** 4. **Petals** 4. **Stamens** numerous; filaments free or slightly connate at base; anthers basifixed. **Ovary** 1-locular; ovule solitary, basal, erect; style slender; stigma peltate. **Fruit** a drupe, globose, ovoid to ellipsoid.

About 187 species in tropical region, especially Asia. About 17 species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

Calophyllum polyanthum Wall. ex Choisy

Desc. Gutt. Ind. 43: 1849; Anderson in Fl. Br. Ind. 1: 274. 1874; Craib in Fl. Siam. Enum. 1: 121. 1925; Long in Fl. Bhutan 1(2): 370, fig. 30: h-j. 1984; Singh in Fl. Ind. 3: 94, fig. 31. 1993.

Tree, 10-20(-30) m high, with yellow resinous sap; branchlets quadrangular, puberulous, glabrescent. **Leaves** oblong-lanceolate to narrowly elliptic, (8-)10-15(-17) cm long, 3.5-5.5 cm wide, glabrous or sparsely puberulous along the midrib; base cuneate, attenuate onto the petiole; apex acuminate to caudate; margin slightly undulate; midrib impressed above, raised and prominent ridged below; petioles 1-2 cm long, canaliculate, puberulous, glabrescent. **Inflorescence** in terminal and axillary panicles, 10-16 cm long, puberulent; pedicels 5-10 mm long, puberulent. **Sepals**

concave, unequal; outer pair ovate to suborbicular, 2-4 mm long and wide; inner pair obovate, petaloid, 4-5 mm long. **Petals** white, obovate, concave, 6-7 mm long. Filaments filiform, 2.5-4 mm long, connate at base; anthers ellipsoid, 0.5-1 mm long. **Ovary** ovoid, 1.5-2.5 mm long; style 2-3 mm long. **Drupe** ellipsoid to ovoid, 2.5-3.5 cm long, 2-2.5 cm wide, acute at apex.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— India, Sikkim, Bhutan, Myanmar, China.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: May-June; fruiting: July-October.

Vernacular.— มะเหินดอย Ma haen doi (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1725; *P. Srisanga* & *C. Maknoi* 2021; *P. Srisanga et al.* 816.

2. *GARCINIA* L.

Sp. Pl.: 443. 1753; Singh in Fl. Ind. 3: 98. 1993.

Evergreen trees, with yellow resinous sap; branches usually opposite. **Leaves** opposite, coriaceous or membranous, entire, usually glabrous; primary veins close and parallel or distantly spaced. **Inflorescence** usually in axillary cymes or fascicles, rarely flower solitary. **Flowers** unisexual. **Sepals** 4-5, concave, persistent. **Petals** 4-5, imbricate or contorted. **Male flowers**: stamens numerous, forming a globose mass or annular ring around a central rudimentary ovary, or united into 4-5 bundles; anthers sessile or with short filaments. **Female flowers**: staminodes 5-many, free or connate; ovary 2-12-locular, axile placentation; ovule 1 in each loculus; stigma sessile, peltate or deeply lobed. **Fruit** a coriaceous berry, globose, ovoid to ellipsoid. **Seeds** imbedded in whitish, juicy pulp.

About 200 species in tropical Old World, especially Asia and Africa (Mabberley, 1997). About 25 species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Male flowers in axillary, (1-)3-8-flowered fascicles or cymes. Fruit oblong, ovoid to subglobose, less than 4 cm in diam.
 2. Sepals unequal, 4-6 mm long, inner pair larger than the outer pair.
 1. *G. cowa*
 2. *G. merguensis*
 2. Sepals subequal, ca. 1 mm long. Fruit oblong
 1. Male flowers in axillary and terminal panicles. Fruit globose, 7-11 cm in diam.
 3. *G. pedunculata*

1. *Garcinia cowa* Roxb. ex DC.

Prodr. 1:561. 1824; Anderson in Fl. Br. Ind. 1: 262. 1874; Craib in Fl. Siam. Enum. 1: 114. 1925; Gagnep. in Fl. Gén. I.-C. Suppl.: 261. 1943; Long in Fl. Bhutan 1(2): 370. 1984; Singh in Fl. Ind. 3: 108. 1993.

Tree, 10-20 m high; branchlets slightly angular. **Leaves** lanceolate to narrowly elliptic, coriaceous, 8-15 cm long, 3-5 cm wide, glabrous; base cuneate, slightly attenuate onto the petiole; apex acute to acuminate; midrib impressed above, raised and prominent ridged below; petioles 8-15 mm long, canaliculate, glabrous. **Male flowers** in axillary, 3-8-flowered fascicles, glabrous; pedicels 4-7 mm long. **Sepals** 4, unequal, ovate, 4-6 mm long, inner pair larger than the outer pair. **Petals** 4, pale yellow, oblong to obovate, 7-9 mm long. **Stamens** forming a globose mass on fleshy receptacle; filaments short; anthers 2-locular. Rudimentary ovary absent. **Female flowers:** 2-3(-5) in terminal and axillary fascicles, ca. 1.5 cm in diam., yellow; pedicels short. Staminodes in a ring around the ovary. **Ovary** subglobose, 4-8-locular; style absent; stigma 4-8-lobed. **Fruit** ovoid to subglobose, 2-4 cm in diam., yellow. **Seeds** 4-8, oblong, 1.3-2 cm long.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Sikkim, Bangladesh (type), Myanmar, S China (Yunnan).

Ecology.— Lower montane forest, alt. 1,280-1,400 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: April-June.

Uses.— Young leaf and fruit edible, sour taste.

Voucher specimens.— *P. Srisanga* 522; *P. Srisanga & S. Watthana* 618.

2. *Garcinia merguensis* Wight

Icon. Pl. Ind. Orient.: 116. 1839; Anderson in Fl. Br. Ind. 1: 267. 1874; Craib in Fl. Siam. Enum. 1: 114. 1925; Gagnep. in Fl. Gén. I.-C. Suppl.: 258. 1943; Singh in Fl. Ind. 3: 118. 1993.

Tree, 10-20 m high; branchlets slightly angular. **Leaves** oblong, lanceolate to elliptic, coriaceous, 7-12 cm long, 3.5-6 cm wide, glabrous; base cuneate, slightly attenuate onto the petiole; apex acute to shortly acuminate; midrib impressed above, raised and prominent ridged below; petioles 5-13 mm long, canaliculate, glabrous. **Male flowers** (1-3) in axillary cymes, glabrous; pedicels 1-1.5 mm long. **Sepals** 4, subequal, ovate, ca. 1 mm long. **Petals** 4, white, oblong to obovate, 4-5 mm long. **Stamens** united into 4 bundles, each bundle opposite to the petals; filaments short; anthers 2-locular. Rudimentary ovary ca. 2 mm long with conspicuous capitate stigma. **Female flowers** solitary, axillary; pedicels 1-2 cm long. **Sepals** and **petals** as in male flowers. Staminodes scale-like. **Ovary** shallowly obconic, 2-locular; style absent; stigma large, thick, concave. **Fruit** oblong, 1-1.5 cm long. **Seeds** subreniform.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lamphun, Lampang, Nan; South-eastern: Chon Buri, Trat; South-western: Prachuap Khiri Khan; Peninsular: Surat Thani.

Distribution.— India, Bangladesh, Myanmar, Laos, Cambodia, Vietnam, Malaysia.

Ecology.— Dry evergreen forest, by streams, alt. 900 m (Doi Phu Kha).

Phenology.— Flowering: August-September; fruiting: March-May.

Vernacular.— นาน Nuan (Northern).

Voucher specimens.— *P. Srisanga* 1542.

3. *Garcinia pedunculata* Roxb. ex Buch.-Ham.

Edinb. J. Sci. 7: 45, t. 1. 1827; Anderson in Fl. Br. Ind. 1: 264. 1874; Singh in Fl. Ind. 3: 121. 1993.

Tree, 6-10(-15) m high; branchlets slightly angular. **Leaves** lanceolate, elliptic to ovate, coriaceous, 10-20 cm long, 4.5-9 cm wide, glabrous; base cuneate, slightly attenuate onto the petiole; apex acuminate to shortly caudate; midrib raised above, more raised and prominent ridged below; petioles 1.2-2 cm long, canaliculate, glabrous. **Male flowers** in axillary and terminal panicles, glabrous; pedicels 3-4 mm long. **Sepals** 4, unequal, broadly ovate to suborbicular, 3-5 mm long, inner pair larger than the outer pair. **Petals** 4, yellow, obovate, 6-8 mm long. **Stamens** forming a globose mass on fleshy receptacle; filaments short; anthers 2-locular. Rudimentary ovary present. **Female flowers** solitary, terminal; pedicels 2-3 cm long. **Sepals** and **petals** as in male flowers, slightly larger. **Staminodes** in 4 fascicles, connate at base. **Ovary** globose, 8-12-locular; stigma large, peltate. **Fruit** globose, 7-11 cm in diam., orange-yellow. **Seeds** 8-10, reniform.

Thailand.— Northern: Chiang Mai, Chiang Rai, Phayao, Nan.

Distribution.— India, Bangladesh, S China (Yunnan).

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: December-January; fruiting: April-June.

Uses.— Fruit edible, sour taste and used as shampoo.

Voucher specimens.— *P. Srisanga* 1275, 1481.

3. *HYPERICUM* L.

Sp. Pl.: 783. 1753; Robson in Fl. Mal. I(8): 14. 1974; Robson & Long in Fl. Bhutan 1 (2): 372. 1984.

Annual or perennial herbs or undershrubs, glabrous; stems erect, decumbent or prostrate, without sap. **Leaves** opposite, coriaceous or membranous, entire, often pellucid-punctate; petioles short or absent. **Inflorescence** axillary or terminal, cymose or flower solitary. **Flowers** bisexual, actinomorphic. **Sepals** 5, persistent. **Petals** 5, yellow. **Stamens** 5-numerous; filaments free or united into 1 or 3 or 5 bundles;

anthers oblong, dorsifixed. **Ovary** 1-locular with parietal placentation or 3-5-locular with axile placentation; ovules 2-numerous in each loculus; style 3 or 5; stigma capitate or bilobed. **Fruit** a septicidal capsule, 3-5-valved, ellipsoid to ovoid.

About 370 species in N temperate region and tropical mountains. About 6 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|--------------------------------|
| 1. Bracts and sepals with entire margin | 1. <i>H. japonicum</i> |
| 1. Bracts and sepals with glandular-fimbriate margin | 2. <i>H. wightianum</i> |

1. *Hypericum japonicum* Thunb. ex Murray

Syst. Veg.ed. 14: 702. 1784; Craib in Fl. Siam. Enum. 1: 111. 1925; Robson in Fl.Mal. I(8): 27. 1974; Robson & Long in Fl. Bhutan 1(2): 376. 1984.

Herb, suberect or diffuse, sometimes prostrate, 7-25 cm long; stem quadrangular, not or few-branched. **Leaves** oblong-elliptic, ovate to obovate, membranous, 5-7 mm long, 3-4 mm wide, glabrous, sessile; base cuneate to cordate-amplexicaul; apex rounded to obtuse, 3-5-nerved from base; venation obscure, pellucid-punctate. **Inflorescence** axillary or terminal, cymose, 1-15-flowered; pedicels 3-8 mm long. Bracts lanceolate-elliptic, 4-5 mm long, entire. **Sepals** lanceolate to elliptic, 3-5 mm long, 1.5-2.5 mm wide, 3-5-nerved, free, imbricate, glabrous, entire, rounded to acute at apex. **Petals** elliptic to obovate, 3-4 mm long, 1-2 mm wide, 3-5-nerved, free, imbricate, glabrous, entire, rounded to obtuse at apex. **Stamens** 7-15; filaments connate at base, 2-3 mm long. **Ovary** ovoid, 1-locular, parietal placentation, 1.5-2 mm long; styles 3, 0.5-1 mm long; stigma capitate; ovules numerous. **Capsule** ovoid, 3-4 mm long, 3-valved, red. **Seeds** oblong, longitudinal ribbed, numerous, 0.25-0.5 mm long.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; North-eastern: Loei.

Distribution.— India, Sikkim, Bhutan, China, Japan (type), Korea, SE Asia, Australia, New Zealand.

Ecology.— Lower montane forest, open places, alt. 1,300-1,430 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: May-November.

Voucher specimens.— *P. Srisanga* 1119, 1399.

2. *Hypericum wightianum* Wight & Arn.

Ill. Ind. Bot.: 43. 1840; Robson & Long in Fl. Bhutan 1(2): 377. 1984.

Herb, erect or diffuse, sometimes prostrate, 15-30 cm long; stem terete, not or few-branched. **Leaves** elliptic, ovate to obovate, membranous, 1-2.3 cm long, 0.7-1.5 cm long, glabrous, sessile; base cordate-amplexicaul with glands; apex rounded,

obtuse to broadly acute; primary veins 3-5 pairs; venation obscure, distinctly pellucid-punctate. **Inflorescence** in terminal corymbs, 3-15-flowered; pedicels 3-5 mm long. Bracts lanceolate, 6-8 mm long, glandular-fimbriate. **Sepals** lanceolate to elliptic, 4-6 mm long, 1.5-2.5 mm wide, 3-5-nerved, free, imbricate, glabrous, glandular-fimbriate, acute to acuminate at apex. **Petals** elliptic to obovate, 4-5 mm long, 1-2 mm wide, 3-5-nerved, free, imbricate, glabrous, entire, rounded to obtuse at apex. **Stamens** 9, in 3 bundles; filaments 3.5-5 mm long. **Ovary** ovoid to subglobose, 1-locular, parietal placentation, 1.5-2 mm long; styles 3, 1-1.5 mm long; stigma capitate; ovules numerous. **Capsule** ovoid to subglobose, 4-5 mm long, 3-valved, red. **Seeds** oblong, scalariform, numerous, 0.25-0.5 mm long.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Sikkim, Bhutan.

Ecology.— Lower montane forest, open places, pine plantation, alt. 1,300-1,430 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: June-August.

Voucher specimens.— *P. Srisanga* 1987.

COMBRETACEAE

Trees, shrubs or woody climbers. Indumentum of simple hairs, glandular hairs, multicellular hairs or scales usually present. **Leaves** simple, usually opposite or subopposite, rarely verticillate or alternate, entire, exstipulate; glands often present on lamina, at leaf base or on the petiole. **Inflorescence** axillary or terminal, spikes, heads or racemes. **Flowers** bisexual or rarely unisexual (andromonoecious), actinomorphic. **Calyx** 4-5(-8), cupuliform or funnellform, caducous or accrescent. **Corolla** 4-5(-8) or absent, free, usually caducous. **Stamens** twice as many as the petals, biseriate; anthers versatile, dehiscing by longitudinal slits. Disk often present. **Ovary** inferior, surrounded and adnated by a receptacle and constricted above, 1-locular; ovules 2(-6), pendulous, anatropous; style terminal. **Fruit** a drupe, nut or achene, often winged or ridged. **Seed** solitary.

A pantropical family with about 20 genera and 500 species especially in Africa (Mabberley, 1997). Six genera and about 43 species in Thailand. Two genera and 3 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Trees or shrubs. Leaves with simple hairs. Inflorescence in dense globose heads.
Petals absent **1. *Anogeissus***
1. Shrubs or woody climbers. Leaves with simple hairs, glandular hairs or scales.
Inflorescence in spikes, racemes or panicles. Petals mostly present **2. *Combretum***

1. *ANOGEISSUS* (DC.) Guill. & Perr.

In Fl. Seneg. 1: 280, t. 65. 1832; Exell, J. Bot. 69: 127. 1931; Scott, Kew Bull. 33(4): 555. 1979. – *Conocarpus* L. sect. *Leiocarpus* DC., Prodr. 3: 16. 1828. – *Conocarpus* L. sect. *Anogeissus* DC., Prodr. 3: 16. 1828. – *Finetia* Gagnep., Not. Syst. Paris 3: 276. 1914.

Trees or shrubs; branchlets tomentose. Indumentum of simple hairs. **Leaves** opposite or subopposite; glands absent. **Inflorescence** in dense globose heads, axillary or terminal. **Flowers** bisexual, 5-merous. **Calyx** cupuliform. **Petals** absent. Disk present. **Ovary** ellipsoid to subglobose, compressed at base, prolonged into a slender calyx tube at apex. **Fruit** an achene, coriaceous, adnate in dense heads.

Eight species in the Old World tropic (Mabberley, 1997). Two species in Thailand. One species recorded from Doi Phu Kha National Park.

Anogeissus acuminata (Roxb. ex DC.) Guill. & Perr.

In Fl. Seneg. 1: 280, t. 65. 1832; Lecomte in Fl. C.L.V. 10: 108, pl. XIII: 1-7. 1969; Scott, Kew Bull. 33(4): 563. 1979. – *Conocarpus acuminatus* Roxb. ex DC., Prodr. 3: 16. 1828. – *Anogeissus acuminata* var. *lanceolata* Wall. ex C.B. Clarke in Fl. Br. Ind. 2: 451. 1878; Craib in Fl. Siam. Enum. 1: 611. 1931.

Tree, 8-20 m high; branches pendulous. **Leaves** lanceolate to elliptic, 4.5-7 cm long, 1.8-2.5 cm wide, tomentose on both surfaces, glabrescent above; base cuneate; apex acute; primary veins 5-8 pairs; petioles 1-5 mm long, tomentellous. **Inflorescence** 1-3 cm long; heads 1-1.8 cm in diam. **Flowers** yellow, 0.8-1.2 cm long. **Calyx** tube 3-5 mm long, tomentose; lobes 1-2 mm long, glabrous or tomentellous at the base outside, tomentose inside. **Stamens** 3-4 mm long. Disk densely villous. **Ovary** ellipsoid, glabrous at base, tomentose at apex; style 3-4 mm long. **Achene** trapezoid with 2 broad wing at the base, 3-5 mm long, 2-4 mm wide, tomentose, with an erect persistent calyx at apex.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Nan, Tak; North-eastern: Loei; Eastern: Chaiyaphum; South-eastern: Chon Buri; Central: Saraburi; South-western: Uthai Thani, Kanchanaburi, Ratchaburi.

Distribution.— India (type), Bangladesh, Myanmar, S China, Laos, Cambodia, Vietnam.

Ecology.— Deciduous and dry evergreen forest, secondary forest, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: April-May.

Vernacular.— ตะเคียนหนู Ta kien noo (Central).

Voucher specimens.— *P. Srisanga* 581.

2. *COMBRETUM* Loeffl.

Iter Hisp.: 308: 1758 nom. cons.; Exell, J. Bot. 69: 116. 1931; Nanakorn, Thai For. Bull. (Bot.) 16: 155. 1986.

Shrubs or woody climbers, rarely small trees. Indumentum of simple hairs, glandular hairs or scales mostly present, especially on young parts, leaves, flowers and fruits. **Leaves** mostly opposite, rarely ternate; glands absent. **Inflorescence** in axillary or terminal, spikes, racemes or panicles, often subtended by bracts. **Flowers** bisexual, 4-5-merous, sessile or shortly pedicellate. **Calyx** cupuliform or infundibuliform. **Petals** usually early caducous or absent in *C. apetalum* Wall. ex Kurz. **Fruit** a drupe with 5 ridges or nut with 4-5 wings.

About 250 species in tropical region especially Africa except in Australia and Pacific Islands (Mabberley, 1997). Nineteen species in Thailand (Nanakorn, 1986). Only 2 species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|------------------------|
| 1. Inflorescence an elongated spikes. Ovules 2 | 1. <i>C. chinense</i> |
| 1. Inflorescence a subcapitate spikes. Ovules (3-4) | 2. <i>C. punctatum</i> |

1. *Combretum chinense* Roxb. ex G. Don

Trans. Linn. Soc. London 15: 417, 432. 1827; Nanakorn, Thai For. Bull. (Bot.) 16: 171, fig. 73. 1986. – *C. chinense* var. *pubescens* King, J. As. Soc. Beng. 66(2): 339. 1897. – *C. yunnanense* Exell in Fl. Mal. I(4): 540. 1954, pro parte. – *C. ternatum* (Wall. ex C.B. Clarke) Lecomte in Fl. C.L.V. 10: 49. 1969, pro parte.

Woody climber; young parts glabrous or sparsely puberulous, densely covered with reddish scales. **Leaves** oblong, lanceolate to elliptic, chartaceous to thinly subcoriaceous, 7-14 cm long, 3-6 cm wide, covered with sparsely reddish scales; base obtuse to cuneate; apex acute to acuminate; primary veins 6-8 pairs; petioles 4-10 mm long, glabrous to sparsely puberulous, covered with sparsely reddish scales. **Inflorescence** axillary spikes, 7-10 cm long; rachis puberulous, sparsely scales. **Flowers** 4-merous, 6-8 mm long, covered with scales; bracts linear, 2-3 mm long. **Calyx** tube funnel-shaped, 3-4 mm long; lobes triangular, 0.3-0.5 mm long. **Petals** white, obovate, 1.5-2 mm long, obtuse at apex. **Stamens** 4-5 mm long. Disk densely rufous pilose. **Ovary** quadrangular, ellipsoid, 1.5-2 mm long; style 5.5-6.5 mm long; ovules 2. **Fruit** a nut, 4 wings, ovoid to suborbicular in outline, 2.5-3 cm long, 1.8-2.5 cm wide, brownish yellow.

Thailand.— Northern: Nan; Peninsular: Surat Thani, Ranong, Krabi, Narathiwat.

Distribution.— India, China (type), Myanmar, Vietnam, Malaysia, Indonesia, Borneo.

Ecology.— Lower montane forest, by stream, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering: September-October; fruiting: October-November.

Vernacular.— สะแกเตา Sakae thao (Peninsular).

Voucher specimens.— *P. Srisanga* 1705, 1706.

Notes.— New locality recorded from Nan, in Thailand.

2. *Combretum punctatum* Bl.

Bijdr.: 640. 1825; Exell in Fl. Mal. I(4): 539. 1954; Lecomte in Fl. C.L.V. 10: 46, pl. VI: 6-9. 1969; Nanakorn, Thai For. Bull. (Bot.) 16: 187, fig. 80: A-C. 1986.

Scandent shrub or woody climber; young parts glabrous, rarely pubescent, densely covered with rusty scales. **Leaves** oblong, elliptic to ovate, subcoriaceous, 7-10(-12) cm long, 4-7(-9) cm wide, covered with rusty scales; base rounded to cuneate; apex acuminate; primary veins 6-8 pairs; petioles 8-16 mm long, covered with rusty scales. **Inflorescence** axillary or terminal panicle of pseudocapitate spikes, 4-7 cm long, usually with a pair of small floral leaves at base; rachis densely covered with rusty scales. **Flowers** 4-merous, 4.5-6 mm long, covered with rusty scales outside. **Calyx** tube funnel-shaped, 3-4 mm long; lobes shallowly triangular, 0.2-0.4 mm long. **Petals** white, obovate to obovate-lanceolate, 1.5-2 mm long, acute at apex. **Stamens** 5-6 mm long. Disk annular, densely rusty hirsute. **Ovary** quadrangular, ellipsoid, 1.5-2 mm long; style 4-5 mm long; ovules (3-)4. **Fruit** a nut, 4 wings, broadly oblong to suborbicular in outline, 2.8-4 cm long, 2.2-3.5 cm wide, brownish.

Thailand.— Northern: Chiang Mai, Lampang, Nan, Tak; North-eastern: Loei, Phetchabun; Eastern: Nakhon Ratchasima.

Distribution.— China (Hainan), Vietnam, Malaysia, Indonesia (Java-type), Borneo.

Ecology.— Lower montane forest, alt. 1,200-1,300 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: April-June.

Vernacular.— สะแกวัลย์ Sakae wan (Central).

Voucher specimens.— *P. Srisanga* & *S. Watthana* 624.

CONVOLVULACEAE

Climbers, twining or prostrate, rarely shrubs or trees, sometimes parasitic, usually with milky juice. **Leaves** simple, alternate, entire or lobed; stipules absent. **Inflorescence** terminal or axillary, cymose, racemose, panicles or heads or flower solitary. **Flowers** bisexual, actinomorphic, often subtended by a pair of bracts. **Sepals** 5, free or united, imbricate, persistent, sometimes unequal. **Petals** 5, sympetalous, plicate, often induplicate-valvate. **Stamens** 5, inserted towards the base of the corolla tube and alternate with the lobes; filaments often unequal; anthers 2-locular, opening by longitudinal slits. Disk often present. **Ovary** superior, 1-4-

locular; styles free or united; ovules solitary or paired in each loculus, basal, erect. **Fruit** loculicidal, circumscissile or irregular dehiscent capsule, berry, rarely drupe or nut.

An almost cosmopolitan family with about 56 genera and 1,600 species (Mabberley, 1997). Many species are widely cultivated as garden ornamentals and several are used as vegetables and medicines. About 15 genera and 90 species in Thailand. Three genera and 6 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Inflorescence in cymes. Ovary 2-4-locular. Seeds usually 4(-6), rarely fewer
 2. Petals mostly hairy, at least at the midpetaline bands outside. Fruit a berry, indehiscent or breaking up irregularly **1. *Argyreia***
 2. Petals usually glabrous. Fruit a capsule, 4- or 6-valved **3. *Ipomoea***
1. Inflorescence in racemes or panicles. Ovary 1-locular. Seed 1 **2. *Dinetus***

1. *ARGYREIA* Lour.

Fl. Cochinch.: 134. 1790; Fang & Staples in Fl. China 16: 313. 1995. – *Lettsomia* Roxb. in Fl. Ind. ed. Carey & Wall. 2: 75. 1824.

Mostly climbers, rarely scandent or shrubs. **Leaves** entire, petiolate. **Inflorescence** axillary, rarely terminal, in cymes, loose to compact, few- to many-flowered; bracts persistent or early caducous. **Sepals** mostly hairy outside and glabrous inside, rarely glabrous on both sides, more or less enlarged in fruit. **Corolla** campanulate, funnellform or tubular, mostly hairy, at least at the midpetaline bands outside, subentire to deeply 5-lobed. **Stamens** included or exserted; filaments often hairy at the base, usually unequal. **Ovary** 2-4-locular; ovules 4; style 1, filiform, included or exserted; stigma capitate, 2-lobed or 2-globular. **Fruit** a berry, indehiscent or breaking up irregularly. **Seeds** usually 4, rarely fewer.

About 90 species, mainly in tropical Asia, with 1 species in Australia (Queensland) (Fang & Staples, 1995). About 27 species in Thailand. Four species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Corolla shallowly 5-lobed; stamens included
 2. Leaves ovate to orbicular, whitish, grayish or brownish hairy on lower surface; base cordate. Bracts persistent
 3. Inflorescence in few to many-flowered cymes but not subcapitate; peduncle (3-)4-10(-15) cm long. Bracts linear, oblong to narrowly lanceolate **1. *A. mastersii***
 3. Inflorescence subcapitate cymes; peduncle up to 2 cm long. Bracts ovate to broadly ovate **4. *A. wallichii***
 2. Leaves lanceolate, elliptic to narrowly ovate, silvery hairy on lower surface;

base rounded, obtuse to broadly cuneate. Bracts caducous
1. Corolla distinctly 5-lobed; stamens exerted

3. *A. splendens*
2. *A. osyrensis*

1. *Argyreia mastersii* (Prain) Raizada

Indian Forester 93: 754. 1967; Fang & Staples in Fl. China 16: 319. 1995. – *Lettsomia mastersii* Prain, J. As. Soc. Beng. 63: 98. 1894.

Herbaceous climber; stems grayish to brownish villous. **Leaves** ovate to orbicular, 10-18 cm long, 7-16 cm wide, strigose on upper surface, whitish, grayish to brownish villous on lower surface; base cordate; apex acute to acuminate; primary veins 8-13 pairs; petioles 5-15 cm long, villous. **Inflorescence** in axillary cymes, 2-many-flowered; peduncle (3-)4-10(-15) cm long, villous; pedicels 3-8 mm long; bracts linear, oblong to narrowly lanceolate, 2-3 cm long, pubescent, persistent. **Sepals** lanceolate to elliptic, acute to acuminate at apex, 6-9 mm long, sparsely villous outside, inner ones slightly smaller than the outer. **Corolla** red-purple, funnelform to narrowly campanulate, 4-5.5 cm long, shallowly 5-lobed; midpetaline bands villous. **Stamens** unequal, included; filaments pubescent at the base. Disk annular, shallowly 5-lobed. **Ovary** 2-locular, glabrous; style 2.3-3 cm long; stigma capitate, 2-lobed. **Berry** globose, 8-10 mm across, dark purple, enclosed by calyx. **Seeds** 4 or fewer, ovoid-trigonal, dark brown.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan.

Distribution.— India, Myanmar (type), S China (Yunnan).

Ecology.— Lower montane forest, alt. 1,000-1,500 m (Doi Phu Kha).

Phenology.— Flowering: August-October; Fruiting: October-November.

Voucher specimens.— *P. Srisanga* 284, 1634; *P. Srisanga* & *C. Maknoi* 2010.

2. *Argyreia osyrensis* (Roth) Choisy

In DC. Prodr. 9: 334. 1845; Fang & Staples in Fl. China 16: 319. 1995. – *Ipomoea osyrensis* Roth, Nov. Pl. Sp.: 117. 1821. – *Lettsomia aggregata* Roxb., Hort. Beng.: 13. 1814. nom. nud.; in Fl. Ind. ed. Carey & Wall. 2: 76. 1824; Kerr in Fl. Siam. Enum. 3(2): 128. 1954. – *Argyreia aggregata* (Roxb.) Choisy, Mém. Soc. Phys. Genève 6: 427. 1833. – *Lettsomia aggregata* var. *osyrensis* (Roth) C.B. Clarke in Fl. Br. Ind. 4: 192. 1883; Kerr in Fl. Siam. Enum. 3(2): 128. 1954.

Woody climber; stems whitish or grayish tomentose. **Leaves** broadly ovate to orbicular, 4-14 cm long, 4-12 cm wide, tomentose on upper surface, densely grayish to brownish tomentose on lower surface; base cordate; apex acute to acuminate; primary veins 9-11 pairs; petioles 2-5 cm long, densely tomentose. **Inflorescence** in axillary capitate cymes, many-flowered; peduncle 2-5 cm long, densely tomentose; pedicels absent or short; bracts obovate, 8-12 mm long, tomentose, persistent. **Sepals** obovate to spatulate, obtuse at apex, 8-10 mm long, tomentose outside, inner ones slightly smaller than the outer. **Corolla** white to pink, funnelform, 1.2-1.5 cm long, distinctly 5-lobed, acute at apex; midpetaline bands pubescent. **Stamens** unequal,

exserted; filaments pubescent at the base. Disk cupular, subentire. **Ovary** 2-locular, glabrous; style 1.2-1.5 cm long; stigma capitate, 2-lobed. **Berry** globose, 6-10 mm across, red, enclosed by calyx. **Seeds** 4 or fewer, subglobose, brown (Fig. 112).

Thailand.— Almost throughout the country.

Distribution.— India (type), Sri Lanka, Myanmar, S China, Laos, Vietnam, Malaysia, Indonesia.

Ecology.— Dry evergreen and lower montane forest, open places, alt. 1,000-1,200 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: November-December; fruiting: February-March.

Vernacular.— หุ่น Hun (Central).

Voucher specimens.— *P. Srisanga* 452.

3. *Argyreia splendens* (Hornem.) Sweet

Hort. Brit. ed.1: 289. 1826; Fang & Staples in Fl. China 16: 318. 1995. – *Convolvulus splendens* Hornem., Hort. Bot. Hafn. Suppl.: 123. 1819. – *Lettsomia splendens* Roxb., Hort. Beng.: 13. 1814. nom. nud.; in Fl. Ind. ed. Carey & Wall. 2: 75. 1824. – *Argyreia splendens* (Roxb.) Sweet in Fl. Br. Ind. 4: 186. 1883; Kerr in Fl. Siam. Enum. 3(2): 126. 1954.

Herbaceous climber; stems sparsely brownish hairy. **Leaves** lanceolate, elliptic to narrowly ovate, 7-15 cm long, 4-8 cm wide, glabrous on upper surface, silvery hairy on lower surface; base rounded, obtuse to broadly cuneate; apex acute to acuminate; primary veins 9-13 pairs; petioles 3-6.5 cm long, pubescent. **Inflorescence** in axillary cymes, 2-many-flowered; peduncle 5-20 mm long, pubescent; pedicels 2-5 mm long; bracts lanceolate-elliptic, 3-4 mm long, tomentose, caducous. **Sepals** elliptic to ovate, obtuse to broadly acute at apex, 8-10 mm long, silvery sericeous outside, inner ones slightly smaller than the outer. **Corolla** pale purple to violet, funnelform to narrowly campanulate, 4-5 cm long, shallowly 5-lobed; midpetaline bands pubescent. **Stamens** unequal, included; filaments villous at the base. Disk annular, shallowly 5-lobed. **Ovary** 2-locular, glabrous; style 3-3.5 cm long; stigma capitate, 2-lobed. **Berry** globose, 6-8 mm across, red, enclosed by calyx. **Seeds** 4, ovoid-triangular, brown.

Thailand.— Northern: Chiang Mai, Lampang, Phrae, Nan; North-eastern: Phetchabun, Loei, Khon Kaen.

Distribution.— India (E Bengal-type), Sri Lanka, Myanmar, S China (Yunnan).

Ecology.— Deciduous dipterocarp forest, alt. 400-600 m (Wiang Peian Waterfall).

Phenology.— Flowering: October-November; fruiting: December-February.

Vernacular.— เครือเขาหลวง Khrua khao long (Chiang Mai).

Voucher specimens.— *P. Srisanga* 2277.

4. *Argyreia wallichii* Choisy

Mém. Soc. Phys. Genève 6: 422. 1833; Kerr in Fl. Siam. Enum. 3(2): 126. 1954; Fang & Staples in Fl. China 16: 316. 1995.

Woody climber; stems grayish to brownish tomentose. **Leaves** ovate to orbicular, 8-15 cm long, 7-14 cm wide, glabrous or sparsely hairy on upper surface, whitish to grayish tomentose on lower surface; base cordate; apex acute; primary veins 10-15 pairs; petioles 3-9 cm long, brownish tomentose. **Inflorescence** in axillary subcapitate cymes, many-flowered; peduncle up to 2 cm long, brownish pubescent; pedicels absent or very short; bracts ovate to broadly ovate, rounded at apex, 2.5-4 cm long, densely brownish pubescent outside, persistent. **Sepals** elliptic, obtuse at apex, 9-12 mm long, brownish pubescent outside, inner ones slightly smaller than the outer. **Corolla** whitish, pink to purple, tubular-funnelform, 4-5 cm long, shallowly 5-lobed; midpetaline bands whitish villous. **Stamens** unequal, included; filaments villous at the base. Disk annular, shallowly 5-lobed. **Ovary** 2-locular, glabrous; style 3-3.5 cm long; stigma capitate, 2-lobed. **Berry** globose, 7-9 mm across, red, enclosed by calyx. **Seeds** 4 or fewer, ovoid-trigonous, 4-5 mm long, black (Fig. 113).

Thailand.— Northern: Chiang Mai, Chiang Rai, Lamphun, Nan.

Distribution.— India, Bhutan, Sikkim, Myanmar (type), S China, N Vietnam.

Ecology.— Lower montane forest and lower montane scrub, open places on limestone rocks, alt. 1,500-1,700 m (Doi Phu Wae).

Phenology.— Flowering: July-October; fruiting: November-January.

Voucher specimens.— *P. Srisanga* 2161, 2672; *P. Srisanga et al.* 875.

2. *DINETUS* Buch.-Ham. ex Sweet

Brit. Fl. Gard. 2: t. 127. 1825; Fang & Staples in Fl. China 16: 283. 1995.

Twining herbs. **Leaves** mostly entire, petiolate. **Inflorescence** solitary or paired, axillary, racemes or panicles, bracteate; bracteoles minute, at the base of calyx. **Sepals** free or united at base, valvate, equal or unequal, more or less enlarged in fruit. **Corolla** funnelform to salverform tubular, subentire to deeply 5-lobed, glabrous except for an apical tuft of hairs. **Stamens** included; filaments glabrous or hairy at the base. Disk annular, 5-lobed or absent. **Ovary** 1-locular; ovules 2; style 1, filiform, included; stigma entire or 2-lobed. **Fruit** papery, indehiscent. **Seed** 1, often longitudinally keeled, smooth, glabrous.

About 8 species in tropical Asia (Fang & Staples, 1995). About 2-4 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Dinetus racemosus* (Roxb.) Sweet**

Brit. Fl. Gard. 2: t. 127. 1825; Fang & Staples in Fl. China 16: 283. 1995. – *Porana racemosa* Roxb., Hort. Beng.: 13. 1814. nom. nud.; in Fl. Ind. ed. Carey & Wall. 2: 41: 1824; Ooststr., Blumea 3(1): 91. 1938; Kerr in Fl. Siam. Enum. 3(1): 92. 1951.

Twining herb; stems sparsely hairy, glabrescent, sometimes red purplish. **Leaves** ovate, 5-12 cm long, 3-7 cm wide, sparsely hairy on both surfaces, glabrescent; base cordate; apex acuminate; primary veins 7(-9) from the base; petioles 1.5-5 cm long, glabrous to sparsely hairy. **Inflorescence** in axillary panicles, many-flowered, 10-20 cm long; lowermost bracts leaf-like, sessile or shortly petiolate; bracteoles 2, minute; pedicels 3-6 mm long. **Sepals** linear-lanceolate, equal, 1-2 mm long, sparsely pilose, all enlarged in fruit. **Corolla** white, funnellform, 7-9 mm long; lobes divided to the middle. **Stamens** unequal, 1.5-2.5 mm long; filaments pilose at the base. Disk absent. **Ovary** ovoid, glabrous; style ca. 2 mm long; stigma clavate, 2-lobed. **Fruit** oblong, 5-7 mm long, apiculate at apex, brown purplish. **Seed** oblong to ovoid, 3-4 mm long, brown, smooth; enlarged calyx narrowly oblanceolate, 9-13 mm long, distinctly 3 longitudinally nerved, obtuse to rounded at apex with apiculate tip, brown (Fig. 114).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal (type), Bhutan, China, SE Asia.

Ecology.— Lower montane forest, open places and by streams, alt. 1,100-1,500 m (Doi Phu Kha).

Phenology.— Flowering: September-December; fruiting: November-January.

Vernacular.— พุงเครือแดง Phung khrua daeng (Chiang Mai).

Voucher specimens.— *P. Srisanga* 272, 2210.

3. IPOMOEA L.

Sp. Pl.: 159. 1753; Fang & Staples in Fl. China 16: 301. 1995. – *Quamoclit* Moench, Meth.: 453. 1794. – *Batatas* Choisy, Mém. Soc. Phys. Genève 6: 434. 1833. – *Pharbitis* Choisy, Mém. Soc. Phys. Genève 6: 438. 1833. – *Calonyction* Choisy, Mém. Soc. Phys. Genève 6: 441. 1833. – *Exogonium* Choisy, Mém. Soc. Phys. Genève 6: 443. 1833.

Climbers, twining or prostrate, sometimes erect, rarely shrubs. **Leaves** entire, lobed or divided, petiolate. **Inflorescence** mostly axillary, in cymes, loose to compact, 1- to many-flowered; bracts persistent or early caducous. **Sepals** equal or unequal, more or less enlarged in fruit. **Corolla** campanulate, funnellform or salverform, usually glabrous, subentire to deeply 5-lobed. **Stamens** included or exerted; filaments filiform, often hairy at the base, usually unequal. **Ovary** 2-4-locular; ovules 4-6; style 1, filiform, included or exerted; stigma capitate or 2-3-globular. **Fruit** a capsule, 4- or 6-valved, globose or ovoid. **Seeds** 4(-6), rarely fewer.

About 500 species, widely distributed in tropical to warm temperate regions, especially of N and S America (Fang & Staples, 1995). About 24 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Ipomoea soluta* Kerr**

Kew Bull. 1941: 18. 1941; in Fl. Siam. Enum. 3(2): 117. 1954. – *I. campanulata* sensu C.B. Clarke in Fl. Br. Ind. 4: 211. 1883, non L. excl. var. *illustris* C.B. Clarke.

Woody climber; stems grayish to brownish tomentose. **Leaves** ovate to orbicular, 8-13 cm long, 6-10 cm wide, glabrous on upper surface, grayish to yellowish brown tomentose on lower surface; base cordate; apex acuminate; primary veins 12-17 pairs; petioles 2-4 cm long, grayish to brownish tomentose. **Inflorescence** in axillary cymes, many-flowered; peduncle (2-)4-7 cm long, grayish to brownish tomentose; pedicels 0.8-2 cm long, tomentose; bracts early caducous. **Sepals** ovate, obtuse to rounded at apex, 8-13 mm long, brownish pubescent outside, inner ones slightly larger than the outer. **Corolla** white with purple patch in the centre inside, broadly funnelform to campanulate, 6-7.5 cm long, shallowly 5-lobed, glabrous. **Stamens** unequal, included; filaments villous at the base. Disk annular, shallowly 5-lobed. **Ovary** 2-locular, glabrous; style 2.5-3 cm long; stigma capitate, 2-lobed. **Fruit** not known (Fig. 115).

Thailand.— Northern: Chiang Mai, Nan; Eastern: Nakhon Ratchasima; Central: Lop Buri; South-western: Kanchanaburi, Prachuap Khiri Khan.

Distribution.— India (type), Myanmar, Laos.

Ecology.— Lower montane forest, alt. 1,200-1,500 m (Doi Phu Kha).

Phenology.— Flowering: December-February.

Vernacular.— ผักอีน Phak uen (Nan).

Voucher specimens.— *P. Srisanga* 504, 2384, 2690.

CORNACEAE

Trees, shrubs, or rarely perennial herbs. **Leaves** simple, alternate or opposite; stipules absent or present. **Inflorescence** cymose, racemose, umbellate, heads or rarely flower solitary, axillary, terminal or borne on leaves. **Flowers** usually bisexual, sometimes unisexual, actinomorphic. **Calyx** tube adnate to the ovary; lobes 3-5(-7) or subtruncate. **Petals** 3-5(-10), rarely absent, free, valvate or imbricate. **Stamens** as many as and alternate with the petals, or in 2 whorls; anthers 2-locular, opening by longitudinal slits. Disk present. **Ovary** inferior, 1-5(-10)-locular; style 1, simple or lobed; ovule 1 in each loculus, apical, pendulous. **Fruit** a drupe or berry. **Seed** 1.

Forteen genera and about 120 species mainly in N temperate, sometimes in tropical and S temperate regions (Mabberley, 1997). Four genera and about 6 species in Thailand. Three genera and 3 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Shrub. Inflorescence epiphyllous borne on the adaxial surface of the midrib **1. *Helwingia***
1. Tree. Inflorescence not as above
2. Flowers bisexual. Petals valvate **2. *Mastixia***
2. Flowers unisexual. Petals imbricate **3. *Nyssa***

1. *HELWINGIA* Willd.

Sp. Pl. 4: 716. 1805; Pooma, Thai For. Bull. (Bot.) 25: 16. 1997.

Dioecious glabrous shrubs. **Leaves** alternate, serrate, stipulate. **Inflorescence** in umbel, epiphyllous borne on the adaxial surface of the midrib. **Flowers** 3-5-merous, sometimes apetalous, valvate. **Stamens** as many as and alternate with the petals; filaments curved inward; anthers short, dorsifixed. Disk flatten. **Ovary** 3-5-locular. **Fruit** drupaceous.

Four species in E Himalayas eastwards to Japan and southwards to N Thailand. 1 species in Thailand. The genus *Helwingia* has been included in different families (Apiaceae and Araliaceae), and also their own monogeneric family (Helwingiaceae) (Pooma, 1997).

Helwingia himalaica Hook.f. & Thomson ex C.B. Clarke

In Fl. Br. Ind. 2: 726. 1879; Pooma, Thai For. Bull. (Bot.) 25: 16, fig. 1-3. 1997.

Shrub with clustered stem, up to 2 m high; stipules filiform, 1-2 mm long. **Leaves** lanceolate, (5-)9(-11) cm long, 2(-3) cm wide; base cuneate; apex long acuminate; margin spiny denticulate; primary veins 6-10 pairs; petioles (1-)1.5-2 cm long. **Male inflorescence** fascicle of 7-8(-10)-flowered, arising slightly lower than the middle of the blade; pedicels 1-2 mm long. **Sepals** 3, broadly ovate, purplish in bud, turning greenish when mature, ca. 1.5 mm long, 1 mm wide, acute at apex, glabrous. **Petals** absent. **Filaments** free, ca. 1 mm long, glabrous. Disk light purplish, 1-2 mm in diam., ca. 0.5 mm thick, glabrous. **Female inflorescence** 1-3-flowered. **Ovary** ovate, ca. 2 mm long; stigma 3-5-lobed, recurved. **Drupes** 1-3, sessile, ellipsoid, 7-8 mm long, 4-5 mm wide, dull pale green turning red when ripe, wrinkled when dry.

Thailand.— Northern: Nan.

Distribution.— India, Nepal, Bhutan, N Myanmar, S China (Yunnan), Vietnam (Tonkin).

Ecology.— Lower montane forest, alt. 1,100 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: August.

Vernacular.— ต้นใบหูด Dton bai hoot (General).

Notes.— This species could not be traced. Description is based on Pooma (1997).

2. *MASTIXIA* Bl.

Bijdr.: 654. 1826; Matthew, *Blumea* 23(1): 61. 1976; Kubitzki in *Fam. Gen. Vasc. Pl.* 6: 87. 2004.

Evergreen, resinous trees. **Leaves** alternate or opposite; stipules absent. **Inflorescence** in terminal panicle. **Flowers** bisexual. **Calyx** lobes 4-5(-7), persistent. **Petals** 4-5(-6), valvate. **Stamens** 4-5(-6) or 8, 1-2 whorls; filaments subulate, flattened; anthers cordate, dorsifixed; connective slightly protruding beyond the anthers. **Ovary** 1-locular; style stout, ribbed; stigma punctiform, sometimes deeply bifid, 4-5-lobed. **Fruit** a drupe, dark purple to blue, surmounted by the calyx and disk.

thirteen species in India, Sri Lanka, Bhutan, S China (Yunnan) and SE Asia to Solomon Islands (Matthew, 1976). Three species in Thailand. One species recorded from Doi Phu Kha National Park.

Mastixia euonymoides Prain

J. As. Soc. Beng. 67: 295. 1898; Craib in *Fl. Siam. Enum.* 1: 808. 1931; Matthew, *Blumea* 23(1): 64. 1976.

Tree, up to 40 m high; branchlets decussate, 4-angular, glabrous. **Leaves** opposite decussate, lanceolate to ovate, coriaceous, 4-10 cm long, 1.5-4.5 cm wide, glabrous; base cuneate; apex acuminate; primary veins 5-8 pairs; veins distinct on both surfaces; petioles 2-2.5 cm long. **Inflorescence** 4-angular, up to 8 cm long, glabrous. **Calyx** lobes 4, subtruncate, ca. 1 mm long, glabrous, thick. **Petals** 4, greenish white, lanceolate to oblong-elliptic, 3-4 mm long, glabrous, thick. **Stamens** 8, glabrous; filaments 2-2.5 mm long; anthers ca. 0.5 mm long. **Drupe** oblong, 1.5-2 cm long, 0.7-0.8 cm wide, persistent calyx and disk inconspicuous.

Thailand.— Northern: Chiang Mai, Nan, Nakawn Sawan.

Distribution.— India, Myanmar (type).

Ecology.— Lower montane forest, alt. 1,700 m (Doi Phu Kha).

Phenology.— Flowering: July-August; fruiting: October-November.

Uses.— Wood for construction.

Vernacular.— ตะเคียน Ta khean (Lua-Nan), เซพะโคะ Se pado (Karen-Chiang Mai).

Voucher specimens.— *P. Srisanga* 970, 971; *P. Srisanga* & *C. Maknoi* 2049.

Notes.— New locality recorded from Nan, in Thailand.

3. *NYSSA* L.

Sp. Pl.: 1058. 1753; Wasscher in *Fl. Mal.* I(4): 29. 1948; Phengklai, *Thai For. Bull.* (Bot.) 10: 40. 1977; in *Fl. Thailand* 2(4): 402. 1981; Kubitzki in *Fam. Gen. Vasc. Pl.* 6: 86. 2004.

Dioecious trees. **Leaves** alternate. **Inflorescence** in the axil of a bract with 2 bracteoles. **Flowers** unisexual. **Male flowers** in short racemes or heads. **Female flowers** in 2-12-flowered heads or solitary. **Calyx** subtruncate or 5-toothed. **Petals** (4-)5(-8), imbricate. **Stamens** (8-)10(-16), arranged in two alternate whorls; anthers 2-celled, dorsifixed. Disk pulvinate. **Staminodes** usually present in female flowers. Style simple or bifid. **Fruit** a drupe.

Eight species: 5 in South of N America, 1 in C America, 1 in China and 1 in tropical Asia (Mabberley, 1997). One species in Thailand (Phengklai, 1981b).

Nyssa javanica (Bl.) Wang.

Pflanzenr. 41: 15. 1909; Craib in Fl. Siam. Enum. 1: 809. 1931; Wasscher, Blumea 1 (2): 344. 1935; in Fl. Mal. I(4): 29, fig. 1. 1948; Phengklai, Thai For. Bull. (Bot.) 10: 40, fig. 20. 1977; in Fl. Thailand 2(4): 402, fig. 1. 1981. – *Agathisanthes javanica* Bl., Bijdr.: 645. 1825. – *Nyssa bifida* Craib, Kew Bull. 1913: 69. 1913; in Fl. Siam. Enum. 1: 809. 1931.

Tree, up to 40 m high; twigs tomentose, glabrescent with stiff hairs. **Leaves** oblong, elliptic or obovate, subcoriaceous, 5-20 cm long, 3-9 cm wide, glabrous except along midrib on upper surface, sparsely hairy to densely hairy on lower surface, later glabrescent; base cuneate, slightly attenuate onto the petiole; apex acuminate, obtuse or rounded; primary veins 8-15 pairs; petioles 1-3.5 cm long, flattened, with stiff hairs, glabrescent. **Inflorescence** in axillary, globose heads. **Flowers** (4-)5-merous. **Calyx** campanulate, densely hairy outside; lobes triangular, 0.5-1 mm long. **Petals** yellowish or greenish, ovate to obovate, (2.5-)3-4 mm long, glabrous, recurved. **Male heads** 20-40-flowered; peduncle 0.5-3 cm long, pubescent; pedicels short; stamens (8-)10. **Female heads** with 3-8(-18) sessile flowers; peduncle similar to male ones; staminodes (8-)10; style bifid. **Drupe** ellipsoid, 1.5-2.5 cm long, more or less laterally flattened; exocarp red with sparsely yellowish dots. **Seed** flattened, obovate, acute, on one side with 5 lengthwise grooves, other side with few tubercles on upper half.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei, Phetchabun; Peninsular: Nakhon Si Thammarat.

Distribution.— India, Myanmar, Laos, Vietnam, Malaysia, Indonesia (Java-type).

Ecology.— Lower montane forest; alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: March-May; fruiting May-October. Shedding leaves and producing new leaves before or together with the flowers.

Uses.— Ripe fruit edible.

Vernacular.— มะไฟดง Ma fai dong (Lua-Nan).

Voucher specimens.— *P. Srisanga* 1378.

CRASSULACEAE

Herbs or undershrubs, usually succulent. **Leaves** simple or compound, alternate, opposite or whorled; stipules absent. **Inflorescence** cymose or flower solitary. **Flowers** bisexual, actinomorphic. **Sepals** usually 3-6, free or united. **Petals** the same number as the sepals, free or variously connate. **Stamens** as many or twice as many as the petals, if same number then alternate with the petals; filaments free; anthers 2-locular, opening by longitudinal slits. **Ovary** superior; carpels as many as sepals and petals, free, 1-locular; ovules 1-numerous, inserted on the adaxial suture; styles as many as carpels, free, linear or subulate. **Fruit** a follicle, membranous or leathery, often surrounded by the persistent membranous sepals and petals. **Seeds** minute.

About 33 genera and 1,100 species almost cosmopolitan especially S Africa and Madagascar, excluded from Australia and W Pacific (Mabberley, 1997). Many species are cultivated as ornamentals. Two genera and about 8 species, indigenous or naturalized in Thailand. Two genera and 2 indigenous species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|---|----------------------------|
| 1. Petals connate more than halfway up into a distinct tube | 1. <i>Kalanchoe</i> |
| 1. Petals free or very shortly connate | 2. <i>Sedum</i> |

1. *KALANCHOE* Adans.

Fam. 2: 248. 1763; Backer in Fl. Mal. I(4): 198. 1951. – *Bryophyllum* Salisb., Parad. Lond.: t. 3. 1805.

Erect or ascending, perennial succulent herbs. **Leaves** simple, trifoliolate or pinnately 5-foliolate, entire or more or less deeply incised. **Inflorescence** in terminal corymbose or paniculate cymes. **Sepals** 4, connate at base. **Petals** 4; tube distinct, connate more than halfway up. **Stamens** 8, 2-seriate, inserted on the corolla tube. **Carpels** 4; styles 4; ovules many. **Follicles** 4, enclosed by the persistent membranous sepals and petals.

About 125 in tropical Old World especially S Africa and Madagascar (Mabberley, 1997). About 7 species, indigenous or naturalized in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

Kalanchoe dixoniana Hamet

Kew Bull. 1914: 281. 1914; Craib in Fl. Siam. Enum. 1: 586. 1931.

Erect, perennial succulent herb, 30-60 cm high; stem solitary, glabrous. **Leaves** simple, opposite, sessile, lanceolate, elliptic to narrowly obovate, 5-8 cm long, 1.6-3 cm wide, glabrous on both surfaces; base broadly attenuate, adnate to the stem,

apex obtuse to rounded; margin crenate, undulate. **Inflorescence** in terminal corymbs; peduncle 1.5-3 cm long, sparsely glandular; pedicels 1-4 mm long, glandular. **Sepals** narrowly triangular, 6-8 mm long, 2-2.5 mm wide, acuminate at apex, glandular on both sides; tube 0.5-1 mm long. **Petals** white, glandular outside, glabrous inside; tube tubular-urceolate, 9-12 mm long; lobes elliptic, 5-6 mm long, 2-3 mm wide, acuminate to cuspidate at apex. **Stamens** inserted in the upper half of the corolla tube; filaments glabrous. **Carpels** lanceolate, 9-10 mm long, glabrous. **Fruit** not known (Fig. 116).

Thailand.— Northern: Chiang Mai (type: *Kerr* 2876); Nan.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane scrub, in open areas among limestone rocks, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering: November-December.

Voucher specimens.— *P. Srisanga* 417, 2675.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

2. *SEDUM* L.

Sp. Pl.: 430. 1753; Backer in Fl. Mal. I(4): 197. 1951.

Erect, ascending or prostrate, annual or perennial succulent herbs. **Leaves** simple, alternate, opposite or verticillate, entire or serrate, rarely lacinate, flat or subterete. **Inflorescence** in terminal cymes or flower solitary or spicate in leaf-axils. **Sepals** 4-5, free or nearly so. **Petals** 4-5(-7), free or very shortly connate. **Stamens** as many or twice as many as the petals. **Carpels** 4-5; styles 4-5; ovules many, rarely solitary or few in each carpels. **Follicles** 4-5, erect or spreading.

About 280 species especially in N temperate region and tropical mountains (Mabberley, 1997). Only 1 indigenous species in Thailand.

Sedum sarmentosum Bunge

Mém. Sav. Etr. Petersb. 2: 104. 1834; Craib in Fl. Siam. Enum. 1: 588. 1931.

Perennial succulent herb, 5-12 cm high; stem solitary or few branched near the base, glabrous. **Leaves** simple, alternate, sessile, linear-lanceolate, thick, (6-)10-15(-20) mm long, 1.5-2 mm wide, glabrous on both surfaces; base truncate, adnate to the stem, apex acute to acuminate; margin entire. **Inflorescence** in terminal cymes, few-flowered. **Flowers** sessile or subsessile. **Sepals** lanceolate, thick, 4-6 mm long, 0.75-1 mm wide, acute at apex, glabrous on both sides. **Petals** yellow, lanceolate to narrowly triangular, scarious, 5-6.5 mm long, 1-1.5 mm wide, acute at apex, glabrous on both sides. **Stamens** 10, inserted around the corolla base; filaments 3.5-4.5 mm long, glabrous; anthers globose. **Carpels** lanceolate, 3.5-4.5 mm long, glabrous. **Fruit** 5-follicled, spreading, star-shaped; follicles lanceolate, 4-5 mm long. **Seeds** many, oblong, minute, brown (Fig. 117).

Thailand.— Northern: Chiang Mai; Nan.

Distribution.— China (type).

Ecology.— Lower montane scrub, in open areas among limestone rocks, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: September-December.

Voucher specimens.— *P. Srisanga* 442, 1843, 2123.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

CUCURBITACEAE

Climbing or trailing herbs, rarely undershrubs with watery juice, monoecious or dioecious. **Leaves** simple, alternate, entire or palmately veined or lobed, or compound; tendrils mostly present, axillary, spirally coiled, exstipulate. **Inflorescence** axillary, solitary, cymose, racemose or panicle. **Flowers** unisexual, very rarely bisexual, actinomorphic. **Sepals** (3-)5(-6). **Petals** (3-)5(-6), usually yellow or white. **Male flower**: **calyx** tubular, lobes imbricate or open; **corolla** polypetalous or sympetalous, lobes imbricate or induplicate-valvate; **stamens** free or variously united, mostly 3, rarely 1-5, one anther always 1-locular, the others 2-locular, loculi straight or often curved, flexuous or conduplicate, opening by longitudinal slits. **Female flower**: **calyx** tube adnate to the ovary and often produced beyond; staminode usually not present; **ovary** inferior, (2-)3(-6) intruded parietal placentas; styles simple with 1-3(-5) bilobed stigmas, or 2-3 and each with bilobed stigmas; ovule (1-)numerous. **Fruit** a berry, capsule, pepo or samaroid. **Seeds** (1-)numerous.

About 119 genera and 775 species mainly in tropical and subtropical regions (Mabberley, 1997). Many species are important economic food plants such as cucumber (*Cucumis sativus* L.), pumpkin (*Cucurbita moschata* (Duchesne) Poiret), water melon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai). About 20 genera and 50 species in Thailand. Seven genera and 10 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Stamens 3; filaments free. Style 1
 2. Petals without long fimbriate processes
 3. Anthers connective produced above into a glandular crest. Fruit large, more than 2 cm in diam. **1. *Cucumis***
 3. Anthers connective not produced above into a glandular crest. Fruit smaller, less than 2 cm in diam. **7. *Zehneria***
 2. Petals with long fimbriate processes
 4. Receptacle-tube 7-10 cm long. Fruit large, (10-)15-20 cm in diam.; seeds up to 12 **3. *Hodgsonia***
 4. Receptacle-tube less than 5 cm long. Fruit smaller, less than 10 cm in diam.; seeds numerous **6. *Trichosanthes***
1. Stamens 5; filaments free or united to form a column. Styles 1 or 3

5. Filaments united to form a column. Styles 3 **2. *Gynostemma***
 5. Filaments free. Styles 1 or 3
 6. Leaves compound. Styles 3. Fruit capsule; seeds with apical wing **4. *Neoalsomitra***
 6. Leaves simple or compound. Style 1. Fruit berry; seeds wingless **5. *Thladiantha***

1. *CUCUMIS* L.

Sp. Pl.: 1011. 1753; Keraudren-Aymonin in Fl. C.L.V. 15: 69. 1975.

Annual or perennial herbs, prostrate or trailing, monoecious or rarely dioecious, usually with stiff hairs. **Leaves** simple, entire or palmately 3-5-lobed; tendrils simple. **Male flowers** in fascicles or solitary; **calyx** tube tubular-campanulate, 5-lobed, linear to filiform; **corolla** 5-lobed; **stamens** 3; filaments short, free, inserted near the base of calyx; anthers free, one 1-celled, two 2-celled; connective produced above into a glandular crest; pistillode present. **Female flower** solitary; **calyx** and **corolla** as in male flowers; **ovary** ovoid or cylindrical; style simple; stigmas 3- or 5-lobed; ovules numerous; staminodes 3, linear. **Fruit** a berry, smooth or tubercle. **Seeds** numerous, compressed.

About 32 species in tropical Old World (Mabberley, 1997). About 3-4 native or cultivated species in Thailand. One native species recorded from Doi Phu Kha National Park.

Cucumis hystrix Chakrav.

Journ. Bombay Nat. Hist. Soc. 1: 896. 1952.

Trailing herbs, monoecious. **Leaves** ovate in outline, shallowly 5-lobed, membranous, 10-15 cm long, 8-13 cm wide, strigose on both surfaces; base cordate, apex acuminate; margin irregularly dentate; petioles 4-8 cm long, strigose. **Male inflorescence** in fascicles, 2-5-flowered. **Male flowers**: pedicels 1-3 mm long; receptacle tubular-campanulate; **sepals** linear, ca. 3 mm long, pubescent; **petals** yellow, ovate, 13-15 mm long, pubescent; filaments ca. 1 mm long; anthers ca. 4 mm long; pistillode globose, glabrous. **Female flower** solitary: **ovary** ovoid; style ca. 2 mm long; stigmas ca. 3 mm long. **Fruit** oblong, narrowly ellipsoid, 4-5 cm long, 2-2.5 cm wide, yellow, tuberculate. **Seeds** obovoid, 4-5 mm long, ca. 2 mm wide.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India (Assam-type), China.

Ecology.— Lower montane forest, by streams, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering: March-May; fruiting: September-December.

Uses.— Fruit edible, sour taste.

Vernacular.— มะแตงหนู Ma tang nhu (Nan).

Voucher specimens.— *P. Srisanga* 1701, 2236.

2. GYNOSTEMMA BL.

Bijdr.: 23. 1825; Keraudren-Aymonin in Fl. C.L.V. 15: 24. 1975.

Perennial herbs, prostrate or trailing, dioecious or rarely monoecious. **Leaves** compound with 3-5(-7) leaflets; tendrils simple or bifid. **Male flowers** in panicles, small; pedicels articulate; **calyx** 5-lobed; **corolla** 5-lobed, subulate to lanceolate; **stamens** 5; filaments united to form a column; anthers 1-celled. **Female flowers** as in male flowers; **ovary** globose, 2-3-locular; ovules 2 in each loculus; styles 3; stigmas each bilobed. **Fruit** baccate, globose. **Seeds** 2-3, compressed, broadly ovoid, compressed.

About 4-5 species in tropical Asia. Two species in Thailand and also recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|-------------------------------|---------------------------|
| 1. Leaves with 3 leaflets | 1. <i>G. laxum</i> |
| 1. Leaves with 5(-7) leaflets | 2. <i>G. pentaphyllum</i> |

1. *Gynostemma laxum* (Wall.) Cogn.

In DC., Mon. Phan. 3: 914. 1881 '*laxa*'; Craib in Fl. Siam. Enum. 1: 766. 1931; Keraudren-Aymonin in Fl. C.L.V. 15: 26. 1975. – *Zanonia laxa* Wall., Pl. As. Rar. 2: 29. 1831. – *Gynostemma siamica* Craib, Kew Bull. 1918: 362. 1918; in Fl. Siam. Enum. 1: 767. 1931. – *G. crenulata* Ridl., Journ. Fed. Mal. States Mus. 10: 93. 1920.

Trailing herbs, dioecious. **Leaves** 3-foliolate; petioles 2-6 cm long, pubescent. Leaflets lanceolate to elliptic, membranous to chartaceous, pubescent on nerves on both surfaces; apex acuminate; margin coarsely serrate; median leaflet 5-10 cm long, 2-6 cm wide, slightly asymmetrical cuneate at base; lateral leaflets 4-8 cm long, 2-4 cm wide, obliquely obtuse at base; petiolules 2-5 mm long. **Male inflorescence** 10-30 cm long, pubescent. **Male flowers** white or pale green: pedicels 2-5 mm long; **sepals** triangular, ca. 2 mm long, acute at apex, pubescent; **petals** triangular, ca. 3 mm long, acute at apex, pubescent. **Fruit** globose, 2-3 mm in diam., green, glabrous.

Thailand.— Northern: Chiang Mai (type of *G. siamica*), Nan; Peninsular: Chumphon (type of *G. crenulata*), Ranong.

Distribution.— India (Assam-type), Sikkim, China, Vietnam, Malaysia.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: June-November.

Voucher specimens.— *P. Srisanga* 1766; *P. Srisanga et al.* 818.

2. *Gynostemma pentaphyllum* (Thunb.) Makino

Bot. Mag. Tokyo 16: 179. 1902; Keraudren-Aymonin in Fl. C.L.V. 15: 25, Pl. 5. 1975; Grierson in Fl. Bhutan 2(1): 270. 1991. – *Vitis pentaphylla* Thunb., Fl. Jap.:

105. 1784. – *Gynostemma pedata* Bl., Bijdr.: 23. 1825; Craib in Fl. Siam. Enum. 1: 766. 1931.

Trailing herbs, dioecious. **Leaves** 5(-7)-foliolate; petioles 2-5 cm long, pubescent. Leaflets lanceolate to elliptic, membranous, sparsely hairy on nerves on both surfaces; apex acute; margin serrate; median leaflet 3-10 cm long, 1-4 cm wide, slightly asymmetrical cuneate at base; lateral leaflets 1.5-6 cm long, 1-3 cm wide, slightly asymmetrical cuneate to obliquely obtuse at base; petiolules 1-5 mm long. **Male inflorescence** 10-30 cm long, pubescent. **Male flowers** pale green: pedicels 1-4 mm long; **sepals** triangular, 1-2 mm long, acute at apex, pubescent; **petals** lanceolate, 2.5-3 mm long, acute at apex, pubescent. **Fruit** globose, 2-3 mm in diam., green, glabrous.

Thailand.— Northern: Chiang Mai, Nan; Peninsular: Chumphon, Nakhon Si Thammarat, Pattani.

Distribution.— Japan (type), Korea, China, India, Sri Lanka, Bhutan, Sikkim, SE Asia.

Ecology.— Lower montane forest and lower montane scrub, alt. 1,600-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: August-October.

Vernacular.— ปัญจันท์ Panjakan (Central).

Voucher specimens.— *P. Srisanga* 1489, 2141, 2151.

3. *HODGSONIA* Hook.f. & Thomson

Proc. Linn. Soc. London 2: 257. 1854; Keraudren-Aymonin in Fl. C.L.V. 15: 72. 1975; de Wilde & Duyfjes, Blumea 46(1): 169. 2001.

Large lianas, dioecious. **Leaves** simple, palmately 3-5-lobed; tendrils usually bifid. Flowering nocturnal. **Male flowers** in racemes; **calyx** tube elongated, glandular, 5-lobed; **corolla** white, rotate, 5-lobed, with long fimbriate processes; **stamens** 3; filaments short, free, inserted within the receptacle-tube; anthers one 1-celled, two 2-celled, united into a head. **Female flower** solitary; **calyx** and **corolla** as in male flowers; **ovary** subglobose, 3-carpellate; placentas 6; style simple; stigma 3-lobed, each bilobed; ovules 6 or 12, erect, in each loculus. **Fruit** drupe-like, large, subglobose. **Seeds** large.

About 2 species from NE India through S China to Indonesia (Java and Borneo). Both species occurred in Thailand (de Wilde & Duyfjes, 2001). One species recorded from Doi Phu Kha National Park.

Hodgsonia heteroclita (Roxb.) Hook.f. & Thomson

Proc. Linn. Soc. London 2: 257. 1854; C.B. Clarke in Fl. Br. Ind. 2: 606. 1879; de Wilde & Duyfjes, Blumea 46(1): 172, fig. 2b. 2001. – *Trichosanthes heteroclita* Roxb., Fl. Ind. 3: 705. 1832. – *Hodgsonia macrocarpa* auct. non (Bl.) Cogn.: Gagnep.

in Fl. Gén. I.-C. 2: 1034. 1921; Keraudren-Aymonin in Fl. C.L.V. 15: 74, Pl. 12. 1975; Grierson in Fl. Bhutan 2(1): 263, fig. 31: d-i. 1991.

Large lianas, 20-30 m long. **Leaves** subcircular in outline, subcoriaceous, usually 5-lobed, 15-30 cm in diam., glabrous on both surfaces; base cordate; lobes oblong up to the middle, acute at apex; petioles 4-8 cm long. **Male inflorescence** 15-25 cm long, pubescent, 10-20-flowered. **Male flowers**: pedicels 2-6 mm long; receptacle-tube 7-10 cm long; **sepals** 2-4 mm long; **petals** 3-5 cm long, yellow outside, white inside, fimbriate processes up to 10 cm long, villous, pendent, spiralling; **filaments** ca. 5 mm long; synandrium subglobose, (5-)7-10 mm in diam. **Female flowers**: pedicels 2-3 mm long; receptacle-tube 5-6 cm long; **ovary** ca. 10 mm in diam.; style ca. 5 cm long; stigmas 7-9 mm long. **Fruit** (10-)15-20 cm in diam., reddish-brown green, smooth. **Seeds** trigonous-ellipsoid, 6-7 cm long, 3-4 cm wide.

Thailand.— Almost throughout except in Peninsular.

Distribution.— NE India (type), Bhutan, Sikkim, Myanmar, S China, Laos, Cambodia, Vietnam.

Ecology.— Dry evergreen and lower montane forest, sometimes by streams, alt. 800-1,700 m (Doi Phu Kha)

Phenology.— Flowering: February-March; fruiting: September-December.

Uses.— Seeds edible.

Vernacular.— มะกิง Ma king (Northern).

Voucher specimens.— *P. Srisanga* 1262, 1311.

4. *NEOALSOMITRA* Hutch.

Ann. Bot. n.s. 6: 97. 1942; Keraudren-Aymonin in Fl. C.L.V. 15: 8. 1975.

Lianas, dioecious. **Leaves** simple or compound with 3-5 leaflets; tendrils simple or bifid. **Male flowers** in panicles; **calyx** tube cup-shaped, 5-lobed; **corolla** tube short, 5-lobed; **stamens** 5; filaments free; anthers straight, 1-celled. **Female flowers** in racemes; **calyx** and **corolla** as in male flowers; **ovary** 1-celled or imperfectly 3-celled; placentas 3; styles 3; each stigmas bilobed; ovules numerous. **Fruit** a capsule, 3-valved at apex, clavate or subcylindric, pendulous, truncate at apex; valves opening inwards. **Seeds** compressed, obovoid, with oblique, translucent, apical wing.

About 12 species from India through Malesia to Australia and W Pacific (Mabberley, 1997). About 4 species in Thailand. One species recorded from Doi Phu Kha National Park.

Neosalsomitra integrifoliola (Cogn.) Hutch.

Ann. Bot. n.s. 6: 99. 1942; Keraudren-Aymonin in Fl. C.L.V. 15: 12, Pl. 2. 1975. — *Gynostemma integrifoliola* Cogn. in DC., Mon. Phan. 3: 916. 1881. — *Alsomitra pubigera* Prain, J. As. Soc. Beng. 68: 292. 1898; Craib in Fl. Siam. Enum. 1: 768.

1931. – *A. tonkinensis* Gagnep., Bull. Mus. Nat. Hist. Nat. Paris 24: 372. 1918. – *Neosalsomitra tonkinensis* (Gagnep.) Hutch., Ann. Bot. n.s. 6: 100. 1942.

Lianas; stem glabrous. **Leaves** 5-foliolate; tendrils simple; petioles up to 1 cm long. Leaflets lanceolate to ovate, 3-10 cm long, 1.5-4 cm wide, glabrous on both surfaces; base cuneate; apex acute; petioles 5-15 mm long, glabrous. **Male inflorescence** up to 20 cm long, many-flowered. **Male flowers** white, creamy yellow or greenish: pedicels 6-8 mm long, puberulous; **sepals** ovate, 1-2 mm long, puberulous; **petals** ovate, 2.5-3 mm long, glabrous; **filaments** ca. 1 mm long. **Female inflorescence** up to 10 cm long, many-flowered. **Female flowers**: pedicels up to 10 mm long, puberulous; **ovary** subcylindric, ca. 10 mm long, pubescent. **Fruit** subcylindrical capsule, 7-8 cm long, 1.5-2 cm wide. **Seeds** 20-25 mm long, 5-6 mm wide, including wing.

Thailand.— Northern: Chiang Mai, Nan; Eastern: Nakhon Ratchasima; Central: Saraburi.

Distribution.— Myanmar, China, Laos, Cambodia, Vietnam, Malaysia, Philippines (type).

Ecology.— Lower montane forest, open areas, by roadsides, alt. 1,200 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: November-December.

Voucher specimens.— *P. Srisanga* 2316.

5. *THLADIANTHA* Bunge

Enum. Pl. Chin. Bor.: 29. 1834; Keraudren-Aymonin in Fl. C.L.V. 15: 29. 1975.

Lianas, dioecious. **Leaves** simple, entire or lobes, or compound with 3-7-foliolate; tendrils simple or rarely bifid. **Male flowers** in racemes or cymes or rarely solitary, sometimes with distinctly bracts; **calyx** tube campanulate, 5-lobed; **corolla** yellow, campanulate, 5-lobed; **stamens** 5; filaments free, inserted at the mouth of receptacle-tube; anthers one 1-celled, straight. **Female flowers** in fascicles or solitary; **calyx** and **corolla** as in male flowers; **ovary** oblong, 3-carpellate; style simple; stigma 3-lobed; staminodes 5, linear; ovules numerous. **Fruit** a berry, oblong. **Seeds** obovoid, numerous, compressed.

About 15 species from India through Malesia to Pacific (Mabberley, 1997). About 10 species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--------------------------------------|--------------------------------|
| 1. Bracts present, distinct | 1. <i>T. cordifolia</i> |
| 1. Bracts absent | |
| 2. Seeds 5-6 mm long, 4-5 mm wide | 2. <i>T. hookeri</i> |
| 2. Seeds ca. 10 mm long, 7-8 mm wide | 3. <i>T. sp.</i> |

1. *Thladiantha cordifolia* (Bl.) Cogn.

In DC., Mon. Phan. 3: 424. 1881; Keraudren-Aymonin in Fl. C.L.V. 15: 30, Pl. 6: 1-6. 1975; Grierson in Fl. Bhutan 2(1): 251, fig. 31: a. 1991. – *Luffa cordifolia* Bl., Bijdr.: 929. 1826. – *Thladiantha calcarata* C.B. Clarke, J. Linn. Soc. 15: 126. 1876; Gagnep. in Fl. Gén. I.-C. 2: 1076. 1921; Craib in Fl. Siam. Enum. 1: 759. 1931.

Lianas. **Leaves** ovate, membranous, 7-14 cm long, 5-10 cm wide, pubescent and scabrous on upper surface, densely pubescent on lower surface; base cordate; apex acute to acuminate; margin minutely dentate; petioles 2-8 cm long, densely pubescent. **Male inflorescence** in racemes, up to 10 cm long, pubescent; bracts ovate, green, 1.5-2.5 cm long and wide, pubescent, incised at apex. **Male flowers**: pedicels 3-8 mm long, pubescent; receptacle-tube 5-7 mm long, pubescent; **sepals** yellow, linear-lanceolate, 1-1.5 cm long, pubescent; **petals** yellow, elliptic, ca. 1.5 cm long, pubescent; **filaments** 2-3 mm long; anthers oblong, 2-3 mm long. **Female flowers** solitary: pedicels 2-4 mm long; **ovary** oblong, densely pubescent. **Fruit** oblong-cylindric, 2.5-3 cm long, 1.5-2 cm wide, pubescent. **Seeds** obovoid, 4-5 mm long, 3-4 mm wide.

Thailand.— Northern: Nan; South-western: Kanchanaburi.

Distribution.— India (Assam), Bhutan, Sikkim, Myanmar, China, Laos, Vietnam, Indonesia (Java-type).

Ecology.— Lower montane forest, alt. 1,100-1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: February-September.

Voucher specimens.— *P. Srisanga & C. Maknoi* 2053; *P. Srisanga et al.* 233.

2. *Thladiantha hookeri* C.B. Clarke

In Fl. Br. Ind. 2: 631. 1879; Gagnep. in Fl. Gén. I.-C. 2: 1078. 1921; Craib in Fl. Siam. Enum. 1: 759. 1931; Keraudren-Aymonin in Fl. C.L.V. 15: 32, Pl. 6: 7-10. 1975.

Lianas. **Leaves** simple or compound with 3-foliolate, membranous, scabrous on upper surface; apex acuminate; margin minutely dentate; simple leaves ovate, 5-14 cm long, 3-7 cm wide, obliquely rounded at base; compound leaves: leaflets lanceolate, 13-18 cm long, 2.5-4 cm long, cuneate at base of median leaflets, obliquely rounded at base of lateral leaflets; petioles 3-6 cm long, sparsely pubescent. **Male inflorescence** in racemes, 4-7-flowered; peduncle 2-3 cm long, glabrescent; bracts absent. **Male flowers**: pedicels 1-3 cm long, pubescent; receptacle-tube 4-5 mm long, pubescent; **sepals** yellow, linear-lanceolate, 5-7 mm long, pubescent; **petals** yellow, elliptic, 1.2-1.5 cm long, pubescent; **filaments** ca. 3 mm long; anthers ellipsoid, ca. 3 mm long. **Female flowers** in racemes or solitary: pedicels 2-3 mm long; **ovary** oblong, densely pubescent. **Fruit** oblong-cylindric, 3-3.5 cm long, 1.5-2 cm wide, pubescent. **Seeds** obovoid, 5-6 mm long, 4-5 mm wide.

Thailand.— Northern: Chiang Mai, Nan; South-western: Kanchanaburi.

Distribution.— India (Assam-type), Vietnam, Malaysia.

Ecology.— Dry evergreen forest, alt. 850 m (Sapan Waterfall).

Phenology.— Flowering and fruiting: June-September.
Voucher specimens.— *P. Srisanga* 1942.

3. *Thladiantha* sp.

Lianas. **Leaves** ovate, membranous, 12-15 cm long, 9-12 cm wide, slightly scabrous; base cordate; apex acute to acuminate; margin coarsely dentate; petioles 7-9 cm long, glabrescent. **Flowers** not known. **Fruit** oblong-cylindric, 4-5 cm long, ca. 2 cm wide, yellow, pustulate. **Seeds** ca. 10 mm long, 7-8 mm wide, black.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, by streams, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Fruiting: September-October.

Vernacular.— ตักยางขี้ด Phak yang yuet (Nan).

Voucher specimens.— *P. Srisanga* 1702.

Notes.— Due to lacking the flower materials, the affinity is uncertain.

6. *TRICHOSANTHES* L.

Sp. Pl.: 1008. 1753; Keraudren-Aymonin in Fl. C.L.V. 15: 75. 1975; Duyfjes & Pruesapan, Thai For. Bull. (Bot.) 32: 82. 2004.

Lianas, dioecious, rarely monoecious. **Leaves** simple, usually with 3-9-lobed; tendrils simple or 2-5-fid. Flowering nocturnal. **Male flowers** in racemes or rarely solitary, often with distinctly bracts; **calyx** tube elongated, 5-lobed; **corolla** white, rotate, 5-lobed, with long fimbriate processes; **stamens** 3; filaments free, inserted within the receptacle-tube; anthers one 1-celled, two 2-celled, free or united into a head. **Female flower** solitary; **calyx** and **corolla** as in male flowers; **ovary** ovoid to ellipsoid, 3-carpellate; style simple; stigma 3-lobed; ovules numerous. **Fruit** a berry, globose, ovoid to ellipsoid. **Seeds** numerous, compressed.

About 100 species, throughout subtropical and tropical eastern Asia: from India, S China and Japan, through Malesia, east to tropical Australia and Fiji. Seventeen species in Thailand (Duyfjes & Pruesapan, 2004). One species recorded from Doi Phu Kha National Park.

Trichosanthes tricuspidata Lour.

Fl. Cochinch.: 589. 1790; Gagnep. in Fl. Gén. I.-C. 2: 1042. 1921; Craib in Fl. Siam. Enum. 1: 754. 1931; Keraudren-Aymonin in Fl. C.L.V. 15: 81, Pl. 14. 1975; Duyfjes & Pruesapan, Thai For. Bull. (Bot.) 32: 98, figs. 1: J-K, 5: C. 2004.

Large lianas, dioecious. **Leaves** ovate-pentagonal in outline, subcoriaceous, usually 3-5-lobed, 15-23 cm in diam., scabrous on both surfaces; base cordate; lobes elliptic to triangular, acute at apex; petioles 3-9 cm long, pubescent, glabrescent.

Male inflorescence in racemes, 10-20 cm long; bracts ovate, red, up to 4 cm long and wide, glandular, puberulous, incised at apex. **Male flowers:** pedicels up to 1 cm long; receptacle-tube 1-2 cm long; **sepals** red, 1-1.5 cm long; **petals** white with red stripes, 1-3 cm long, with fimbriate processes at apex; **stamens** included; synandrium cylindric, ca. 1 cm long. **Female flowers:** pedicels ca. 1 cm long; **ovary** ovoid, 10-15 mm long, glabrous. **Fruit** ellipsoid to ovoid, 6-9 cm long, 2.5-6 cm wide, red, glabrous. **Seeds** obovoid, 12-14 mm long, 6-7 mm wide.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Lampang, Nan; North-eastern: Sakon Nakhon, Nong Khai; Eastern: Chaiyaphum; South-eastern: Chathaburi; Central: Lob Buri.

Distribution.— Laos, Cambodia, Vietnam.

Ecology.— Dry evergreen and lower montane forest, alt. 1,000 m (Doi Phu Kha, Tham Pha Khaw).

Phenology.— Flowering: June-July; fruiting: September-October.

Vernacular.— ชี้กาแดง Khi ka daeng (Northern).

Voucher specimens.— *P. Srisanga* 1935.

7. ZEHNERIA Endl.

Prodr. Fl. Norfolk: 69. 1833; Keraudren-Aymonin in Fl. C.L.V. 15: 50. 1975; de Wilde & Duyfjes, Thai For. Bull. (Bot.) 32: 15. 2004.

Trailing herbs, monoecious or dioecious. **Leaves** simple, sometimes shallowly lobed; tendrils usually simple, rarely bifid. **Male flowers** in racemes, corymbs or fascicles, rarely solitary; **calyx** tube campanulate or infundibuliform, 5-lobed; **corolla** tube short, 5-lobed, inserted at the margin of calyx; **stamens** 3; filaments short, free, or absent; anthers straight, one 1-celled, two 2-celled. **Female flowers** in racemes or solitary; **calyx** and **corolla** as in male flowers; **ovary** subglobose to oblong, 3-carpellate; style simple; stigma 3-lobed; staminodes usually present. **Fruit** a berry, globose, ovoid to ellipsoid. **Seeds** obovoid to ellipsoid, compressed.

About 35 species in tropical Old World. Eight species in Thailand (de Wilde & Duyfjes, 2004). One species recorded from Doi Phu Kha National Park.

Zehneria bodinieri (H. Lév.) W.J. de Wilde & Duyfjes

Thai For. Bull. (Bot.) 32: 17. 2004 (see also for synonymy and discussion). — *Melothria bodinieri* H. Lév., Fl. Kouy-Tcheou: 122. 1914.

Trailing herbs, monoecious. **Leaves** ovate-triangular, membranous, 4-9 cm long, 3-6 cm wide, scabrous on upper surface, glabrous on lower surface; base cordate, apex acuminate; margin dentate; petioles 2-4 cm long, glabrescent. **Male inflorescence** in corymbs, 3-7-flowered; peduncle 2-2.5 cm long. **Male flowers:** pedicels 1-3 mm long; receptacle campanulate; **sepals** ca. 2 mm long, pubescent inside; **petals** white, ovate, 2-3 mm long, pubescent; filaments ca. 1 mm long.

Female flower solitary: pedicels 3-5 mm long; **ovary** ellipsoid, 3-4 mm long, glabrous; stigmas globose; staminodes 3, subulate, 2-2.5 mm long. **Fruit** globose, 8-12 mm in diam., reddish, glabrous. **Seeds** obovoid, 4-5 mm long, 2.5-3 mm wide.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lampang, Nan, Tak, Phitsanulok; North-eastern: Loei; Eastern: Chaiyaphum; South-western: Phetchaburi; Peninsular: Surat Thani.

Distribution.— India, China, SE Asia.

Ecology.— Lower montane forest, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: June-August.

Voucher specimens.— *P. Srisanga* 1984.

DILLENACEAE

Trees, shrubs or climbers, rarely undershrubs or herbs, evergreen or deciduous. **Leaves** simple, alternate, rarely opposite, entire or dentate, rarely pinnatifid or trilobed, usually with prominent parallel lateral nerves; stipules absent or wing-like and adnate to the petiole, mostly deciduous. **Inflorescence** axillary or terminal, racemose or cymose or flower solitary. **Flowers** mostly bisexual, regular. **Sepals** (3-) 5(-20), much imbricate, persistent. **Petals** (2-)5(-6), yellow or white, imbricate, often crumpled in bud, deciduous. **Stamens** numerous, rarely definite, free or variously united into bundles at the base; anthers opening by longitudinal slits or by apical pores. **Ovary** superior; carpels several, rarely 1; styles free; ovules 1 or more, erect from the base or from the inner angle. **Fruit** dry and dehiscent or indehiscent and enclosed by enlarged fleshy sepals. **Seeds** usually with a crested or lacinate aril.

Twelve genera and about 300 species in tropical and subtropical regions especially Australasia (Mabberley, 1997). Three genera and 16 species in Thailand (Hoogland, 1972; Na Songkhla & Chandraprasong, 2001). Only 1 species recorded from Doi Phu Kha National Park.

DILLENIA L.

Sp. Pl.: 535. 1753; Hoogl., *Blumea* 7(1): 3. 1952 (revision); in *Fl. Thailand* 2(2): 95. 1972.

Trees or shrubs, evergreen or deciduous. **Leaves** simple, alternate, entire to dentate or undulate; midrib and veins distinct on both surfaces; petioles grooved above, usually amplexicaul wings. **Inflorescence**: in evergreen species, flower solitary and terminal or in simple or once or twice branched terminal racemes; in deciduous species, in one- to several-flowered lateral clusters. **Flowers** distinctly pedicellate. **Sepals** (4-)5(-18), free, fleshy, enlarged in fruit. **Petals** (4-)5(-6), free. **Stamens** numerous, sometimes staminodes present. **Ovary** superior; carpels 4-20, free, each with 4-numerous ovules. **Fruit** either indehiscent and enclosed by enlarged sepals or dehiscent with enlarged sepals spreading. **Seeds** with or without aril.

About 65 species from Madagascar through India, S China, SE Asia and Malesia to N Australia (Queensland) and Fiji Islands (Hoogland, 1952; 1972).

***Dillenia parviflora* Griff.**

Not. Pl. As. 4: 704. 1854; Hoogl., Blumea 7(1): 125. 1952; in Fl. Thailand 2(2): 98. 1972. – *D. kerrii* Craib, Kew Bull. 1911: 8. 1911; in Fl. Siam. Enum. 1: 23. 1925. – *D. elata* auct. non Pierre: Craib in Fl. Siam. Enum. 1: 22. 1925.

Deciduous tree up to 30 m high, flowering with or before new leaves. **Leaves** obovate to elliptic-oblong, 15-25 cm long, 8-12.5 cm wide, slightly scabrid, hirsute on both surfaces, glabrescent above; base obtuse, rounded or acute, decurrent; apex obtuse to acute; margin dentate; primary veins 25-35 pairs; petioles 1-3 cm long, densely hirsute. **Inflorescence** (1-)2-4(-7)-flowered lateral clusters; bracts 12-15 cm long, 5-7 cm wide, densely sericeous on both sides; pedicels 10-30 mm long, hirsute. **Sepals** 5, ovate, green, 12-16 mm long, 7-10 mm wide, glabrous except shortly hirsute at apex inside, densely sericeous outside. **Petals** 5, obovate, yellow, 22-25 mm long, 10-12 mm wide, rounded at apex, narrowly towards the base. **Stamens** in 2 distinct groups: outer group ca. 140-170, slightly curved, 5-6.5 mm long; inner group ca. 11-14, reflexed at apex, 12-15 mm long; anthers opening by longitudinal slits. **Carpels** 5-8, lanceolate, 4-5 mm long, 1-1.5 mm wide, glabrous, each with 12-16 ovules; styles recurved, 5-7 mm long. **Fruit** indehiscent, orange, globose, 15-20 mm across, 1-4-seeded in each carpel. **Seeds** obovoid, ca. 5 mm long, 3.5 mm wide, exarillate (Fig. 118).

Thailand.— Northern: Chiang Mai, Lampang, Phrae, Nan; South-western: Kanchanaburi.

Distribution.— Myanmar (type).

Ecology.— Dry evergreen and lower montane forest, alt. 900-1,300 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: February-May; fruiting: April-July.

Vernacular.— มะसानหิ้ง Masan hing (Chiang Mai).

Voucher specimens.— *P. Srisanga et al.* 841.

EBENACEAE

Trees and shrubs, usually dioecious. **Leaves** simple, alternate, entire, exstipulate. **Inflorescence** axillary, in small cymes, fasciculate or flower solitary. **Flowers** usually unisexual, 3-7-merous, regular. **Calyx** persistent, more or less united at base, often enlarged in fruit. **Corolla** convolute, contorted, usually united at base. **Stamens** few to numerous, epipetalous or borne on receptacle, free or united, isomerous or in 2 whorls. Staminodes usually present in female flowers. **Ovary** superior, rarely inferior, 2-16-locular; ovules 1-2 in each loculus, pendulous; styles 1-

8, free or united below. **Fruit** usually a berry. **Seeds** large, sometimes with ruminant endosperm.

Two genera: *Diospyros* L. with about 475 species widespread in tropical and subtropical regions and *Euclea* Murray with about 12 species in tropical Africa to Arabia and Comoro Islands (Mabberley, 1997). One genus with 60 species in Thailand (Phengklai, 1981a).

DIOSPYROS L.

Sp. Pl.: 1057. 1753; Phengklai in Fl. Thailand 2(4): 281. 1981; Wallnöfer in Fam. Gen. Vasc. Pl. 6: 128. 2004. – Maba J. R. & G. Forst., Char. Gen. Pl.: 121, no. 61. t. 61. 1776.

Trees or shrubs, evergreen or deciduous, usually dioecious, sometimes monoecious or polygamous, mostly unarmed, all parts often turning blackish when dry. **Leaves** penninerved. **Inflorescence** cymose or fasciculate, axillary or ramiflorous, rarely cauliflorous or flower solitary. **Flowers** unisexual. **Calyx** more or less deeply lobed; lobes valvate or imbricate. **Corolla** caducous. **Stamens** 6-numerous, free or in pairs, borne on the base of corolla tube or in bundles on receptacle; anthers basifixed, 2-locular, dehiscing by longitudinal slits. Rudimentary ovary usually present in male flowers. **Staminodes** usually present in female flowers. **Ovary** superior, (3-)4(-16)-locular; ovules 1(-2) in each loculus, pendulous; styles 1-5. **Fruit** a berry, sometimes dry or woody. **Seeds** 1-many; endosperm ruminant or smooth.

Diospyros (Ebony) is valuable timber trees, some species are cultivated for various uses such as for edible fruit: *D. kaki* L.f. (Japanese persimmon, Kaki); for medicine and dye: *D. malabarica* (Desr.) Kostel. and *D. mollis* Griff.; for ornamental: *D. decandra* Lour. etc. Only 3 species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Flowers distinctly pedicellate
 2. Deciduous tree. Calyx campanulate; lobes elliptic-ovate, villous on both sides. Corolla urceolate, 6-8 mm long, divided to a quarter up to a third, glabrous on both sides except along the mid-line of lobes **1. *D. glandulosa***
 2. Evergreen tree. Calyx funnel-shaped; lobes linear-lanceolate, sericeous outside, glabrous to sparsely hairy inside. Corolla salver-shaped, 15-20 mm long, divided to half way, sericeous outside, glabrous inside **2. *D. martabanica***
1. Flowers subsessile **3. *D. sumatrana***

1. *Diospyros glandulosa* Lace

Kew Bull. 1915: 349. 1915; Fletcher in Fl. Siam. Enum. 2: 371. 1938; Phengklai in Fl. Thailand 2(4): 339, fig. 29. 1981.

Deciduous tree, up to 10 m high. **Leaves** oblong to elliptic, chartaceous to subcoriaceous, 8-14 cm long, 3-5.5 cm wide, pubescent on both surfaces; base acute; apex acuminate; primary veins 4-7 pairs, ascending towards the apex, impressed on upper surface, prominent on lower surface; scalariform veins conspicuous on lower surface; petioles 6-10 mm long, tomentose. **Male flowers** cymose, 4(-5)-merous; pedicels ca. 2 mm long, pubescent. **Calyx** campanulate, 3-5 mm long, divided nearly to the base; lobes elliptic-ovate, villous on both sides. **Corolla** urceolate, pink, 6-8 mm long, divided to a quarter up to a third, glabrous on both sides except along the mid-line of lobes. **Stamens** 14-30, sericeous along the mid-line of anthers. Rudimentary ovary glabrous. **Female flowers** solitary, 4-merous; pedicels 2-5 mm long, pubescent. **Calyx** and **Corolla** as in male flowers, but larger. **Ovary** ovoid, 8-locular, pubescent; style 1, pubescent; stigmas 4. **Staminodes** 12, glabrous. **Berry** globose, 2.5-4 cm long and wide, sericeous, depressed at both ends; fruiting calyx divided nearly to the base, tomentose on both sides, lobes not reflexed, more or less undulate and plicate, nerves conspicuous; fruit-stalk 3-5 mm long; endosperm smooth.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei; Eastern: Chaiyaphum.

Distribution.— India, Myanmar (type), Laos.

Ecology.— Lower montane forest, open areas and along edges of forest, alt. 1,200-1,400 m (Doi Phu Kha).

Phenology.— Flowering March-May; fruiting: September-December.

Uses.— Ripe fruit edible; wood used for cabinet work.

Vernacular.— บะก้วยฤๅ Ba kluai rusi (Northern).

Voucher specimens.— *P. Srisanga* & *S. Watthana* 661, 681.

2. *Diospyros martabanica* C.B. Clarke

In Fl. Br. Ind. 3: 554. 1882; Fletcher in Fl. Siam. Enum. 2: 373. 1938; Phengkklai in Fl. Thailand 2(4): 371, fig. 48. 1981. – *Gunisanthus mollis* Kurz, J. As. Soc. Beng. 42(2): 88. 1873. – *Diospyros eugenii* Lec., Not. Syst. Paris 4: 103. 1928.

Evergreen tree, up to 12 m high. **Leaves** lanceolate to oblong, subcoriaceous, 7-17 cm long, 2-6 cm wide, pubescent, glabrescent on upper surface, hispid or sericeous on lower surface; base obtuse, rounded, truncate to subcordate; apex acute or cuspidate; primary veins 8-14 pairs, arched and anastomosing well away from the margin, impressed on upper surface, prominent on lower surface; scalariform veins conspicuous on lower surface; petioles 2-5 mm long, sericeous. **Male flowers** solitary, cymose or paniculate, (4-)5(-6)-merous; pedicels 5-10 mm long, sericeous. **Calyx** funnel-shaped, 7-8 mm long, divided to the base; lobes linear-lanceolate, 7-8 mm long, 1.5-2 mm wide, sericeous outside, glabrous to sparsely hairy inside. **Corolla** salver-shaped, yellow, 15-20 mm long, divided to half way, sericeous outside, glabrous inside. **Stamens** 12-16, unequal in length, glabrous or with very few hairs at the top of anthers. Rudimentary ovary pilose. **Female flowers** solitary, (4-)5(-6)-merous; pedicels 1-1.5 cm long, sericeous. **Calyx** and **Corolla** as in male flower, but larger. **Ovary** ovoid, 4-5-locular, tomentose; style 1, tomentose. **Berry** ellipsoid to

subglobose, 1.5-2.5 cm long and wide, dry at maturity, sericeous, base depressed, apex acute; fruiting calyx divided to the base, sericeous outside, glabrous to sparsely hairy inside, lobes linear-lanceolate, reflexed, not plicate or undulate, without nerves; fruit-stalk 1-2 cm long; endosperm ruminant.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— India, Myanmar (type), Laos, Vietnam, Malaysia.

Ecology.— Tropical mixed deciduous, dry evergreen and lower montane forest, alt 700-1,500 m (Doi Phu Kha, Tham Pha Kong).

Phenology.— Flowering February-April; fruiting May-August.

Voucher specimens.— *P. Srisanga* 557, 1381, 2525; *P. Srisanga et al.* 2467.

Notes.— New locality recorded from Nan, in Thailand.

3. *Diospyros sumatrana* Miq.

Pl. Jungh. 1: 203. 1852; Phengkklai in Fl. Thailand 2(4): 361, fig. 43. 1981. – *Guatteria flavicans* Wall., Cat. No. 7295. 1832. nom. nud. – *Diospyros flavicans* Hiern, Trans. Camb. Phil. Soc. 12(1): 205. 1873; Fletcher in Fl. Siam. Enum. 2: 370. 1938. – *D. clavigera* C.B. Clarke in Fl. Br. Ind. 3: 558. 1882. – *D. decipiens* C.B. Clarke in Fl. Br. Ind. 3: 563. 1882. – *D. dumosa* King & Gamble ex King, Bull. Herb. Boiss. Sér. 2. 5: 428. 1905. – *D. graciliflora* King & Gamble, J. As. Soc. Beng. 74: 211. 1905. – *D. glomerulata* King & Gamble, J. As. Soc. Beng. 74: 229. 1905. – *D. tubicalyx* Ridl., Fl. Mal. Pen. 2: 285. 1923.

Evergreen tree, up to 15 m high. **Leaves** elliptic to oblong, chartaceous, 5-10 cm long, 2-4 cm wide, pubescent, glabrescent on upper surface; base cuneate; apex acute, cuspidate or caudate; primary veins 3-10 pairs, arched and anastomosing well away from the margin, impressed on upper surface, prominent on lower surface; petioles 1-7 mm long, pubescent. **Male flowers** solitary or few-flowered fascicles, 4-merous, fragrant, subsessile. **Calyx** campanulate, 5-10 mm long, divided nearly to the base; lobes broadly ovate, pubescent outside, sparsely hairy inside. **Corolla** salver-shaped, white, 10-16 mm long, divided to half way, glabrous on both sides except along the mid-line and apex of tube outside. **Stamens** 10-20, unequal in length, glabrous. Rudimentary ovary absent. **Female flowers** solitary or cymose, 4-merous, subsessile. **Calyx** and **Corolla** as in male flower, but larger. **Ovary** ellipsoid to ovoid, 4-locular, glabrous; style 1. **Staminodes** 8, glabrous. **Berry** ellipsoid, 2-2.5 cm long, 1-1.5 cm wide, dry at maturity, glabrous, rounded at both ends; fruiting calyx divided to the base, pubescent, glabrescent, lobes not reflexed, plicate or undulate, without nerves; endosperm smooth.

Thailand.— Northern: Nan; Peninsular: Krabi, Nakhon Si Thammarat, Ranong, Satun, Surat Thani, Trang.

Distribution.— India, Myanmar, Malaysia, Indonesia (type).

Ecology.— Dry evergreen forest, alt 1,000-1,100 m (Ton Tong Waterfall).

Phenology.— Flowering March-April; fruiting May-December.

Voucher specimens.— *P. Srisanga* 596.

Notes.— New locality recorded from Nan, in Thailand.

ELAEAGNACEAE

Shrubs or small trees, sometimes scandent, often armed. Vegetative parts and flowers with peltate scales or stellate hairs, silvery or coppery brown. **Leaves** simple, alternate, rarely opposite (*Shepherdia* Nutt.), entire; stipules absent. **Inflorescence** axillary, fasciculate, spicate, racemes or flower solitary. **Flowers** bisexual or unisexual, actinomorphic. **Sepals** (2-)4(-6), petaloid, connate; tube constricted above the ovary; lobes valvate. **Petals** absent. **Stamens** same number as and alternate with the sepals (*Elaeagnus* L.) or twice as and alternate and opposite with the sepals (*Hippophae* L. and *Shepherdia* Nutt.), inserted in the tube or at the base of the sepals; anthers 2-locular, opening by longitudinal slits. **Ovary** inferior, 1-locular; style 1; ovule 1, basal, erect. **Fruit** drupaceous.

Three genera with about 45 species mainly in temperate N hemisphere, few in tropical Asia and Australia (Mabberley, 1997). One genus and about 3 species in Thailand. One species recorded from Doi Phu Kha National Park.

ELAEAGNUS L.

Sp. Pl.: 121. 1753; 'T Hart & Veldkamp, Blumea 26(2): 395. 1980; Dassanayake in Fl. Ceylon 10: 136. 1996; Bartish & Swenson in Fam. Gen. Vasc. Pl. 6: 133. 2004.

Erect or scandent shrubs, rarely small trees, often armed. **Leaves** alternate. **Inflorescence** in fascicles, cymes or racemes. **Flowers** bisexual. **Sepals** 4. **Stamens** 4, arising from the edge of calyx tube and alternate with the lobes. **Fruit** enclosed in the enlarged perianth-tube (calyx-tube), usually with 8 longitudinal ribs; exocarp fleshy; mesocarp bony or leathery.

About 40 species in Europe, Asia, Australia and N America (Mabberley, 1997).

Elaeagnus latifolia L.

Sp. Pl.: 121. 1753; Dassanayake in Fl. Ceylon 10: 137. 1996.

Scandent shrub, armed. **Leaves** lanceolate, elliptic to narrowly ovate, (2-)5-12 cm long, (1-)3-5(-7) cm wide, young leaves scaly above, older leaves more or less glabrous and green above, densely covered with silvery or rusty brown scales below; base obtuse to cuneate; apex acute to obtuse; margin sometimes undulate; primary veins 4-7 pairs; petioles 5-15 mm long, scaly. **Inflorescence** in fascicles of 2-15-flowered; pedicels 1-3 mm long, elongated in fruit. **Sepals** silvery white to creamy yellow, densely scales; tube: lower part tubular, 1.5-2 mm long, ca. 1 mm wide; upper part campanulate, 4-angulate, 4-7 mm long, 3-5 mm wide; lobes ovate, 3-5 mm long, acute at apex. **Filaments** 1-1.5 mm long; anthers grey-brown or pale yellow, 0.5-1 mm long. **Style** 7-12 mm long, scaly, particularly at base, straight, curved and hook-like at tip. **Fruit** reddish orange to reddish brown, ovoid-oblong, 1-2.5 cm long, densely scales. **Seed** narrowly ovoid, 10-12 mm long.

Thailand.— Northern: Chiang Mai; Nan.

Distribution.— India, Sri Lanka (type), China, Continental SE Asia.
 Ecology.— Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).
 Phenology.— Flowering: November-March; fruiting: March-May.
 Uses.— Fruit edible, sour or sweet taste.
 Vernacular.— มะหลออด Ma lot (Northern); มะลิ็ด Ma lit (Lua-Nan).
 Voucher specimens.— *P. Srisanga* 390, 1349, 2383, 2694.

ELAEOCARPACEAE

Trees or shrubs. **Leaves** simple, mostly alternate or rarely subopposite; stipules persistent or caducous. **Inflorescence** cymose, racemose or flower solitary. **Flowers** bisexual, rarely polygamous, actinomorphic. **Sepals** 4-5, valvate. **Petals** 4-5, free, widened at apex, fimbriate, dentate or lobed. **Stamens** 10-numerous; anthers basifixed, 2-locular, dehiscent by terminal pores or slits, or dehiscent lengthwise; connective mostly with varying appendages. Disc usually present. **Ovary** sessile, 2-8-locular; ovules 2-30 in each loculus, anatropous, pendulous; style simple, subulate. **Fruit** a capsule, drupe or berry.

Nine genera and about 540 species in tropical and subtropical regions of E and SE Asia, Australasia, Pacific areas, Madagascar, S America and West Indies (Mabberley, 1997). Two genera and 19 species in Thailand (Phengklai, 1981c). Two genera and 7 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Flowers in raceme; stamens on a raised torus. Fruit a drupe, smooth **1. *Elaeocarpus***
 1. Flower solitary; stamens on a flattened torus. Fruit a spiny capsule **2. *Sloanea***

1. *ELAEOCARPUS* L.

Sp. Pl.: 515. 1753; Phengklai in Fl. Thailand 2(4): 409. 1981; Coode in Fam. Gen. Vasc. Pl. 6: 141. 2004. – *Monocera* Jack, Mal. Misc. 1(5): 43. 1820.

Trees or shrubs. **Leaves** alternate or very rarely subopposite, coriaceous or subcoriaceous, shallowly crenate or serrate; domatia sometimes present in nerve axils on lower surface; stipules mostly early caducous, glabrous. **Inflorescence** in axillary racemes. **Flowers** bisexual, rarely polygamous, 5-merous. **Sepals** free or shortly connate at base. **Petals** free, fimbriate or laciniate at apex. **Stamens** numerous on a raised torus; anthers basifixed, linear, aristate or comose or not so, opening by terminal pores. **Ovary** sessile, 2-9-locular, glabrous or hairy; ovules 2-16 in each loculus; style subulate; stigma acute. **Fruit** a drupe, smooth, with a single bony endocarp.

About 200 species in tropical E and SE Asia, to Australia and the Pacific. Seventeen species in Thailand (Phengklai, 1981c). Five species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|---------------------------------|
| 1. Leaves pubescent on both surfaces. Anthers not aristate at apex | 1. <i>E. braceanus</i> |
| 1. Leaves glabrous on both surfaces or at most sparsely hairy on midrib and lower surfaces. Anthers aristate at apex | |
| 2. Ovary glabrous | 5. <i>E. sp.</i> |
| 2. Ovary hairy | |
| 3. Petals less than 7 mm long. Petioles swollen at both ends | 2. <i>E. prunifolius</i> |
| 3. Petals more than 10 mm long. Petioles not swollen at both ends | |
| 4. Primary veins curved; veins not scalariform | 3. <i>E. sphaericus</i> |
| 4. Primary veins more or less straight; veins scalariform | 4. <i>E. varunua</i> |

1. *Elaeocarpus braceanus* Watt ex C.B. Clarke

J. Linn. Soc. 25: 8. 1889; Craib in Fl. Siam. Enum. 1: 194. 1925; Phengklai in Fl. Thailand 2(4): 412, fig. 5. 1981.

Evergreen tree up to 25 m high; twigs shortly hairy. Stipules caducous. **Leaves** oblong, elliptic to obovate, 8-16 cm long, 3.5-5.5 cm wide, serrate to subentire, pubescent on both surfaces; base acute to obtuse; apex acute to cuspidate; primary veins 9-13 pairs, curved and anastomosing, depressed on upper surface, prominent on lower surface; petioles 1-3 cm long, pubescent. **Inflorescence** below the leaves in axils of fallen leaves, 5-15 cm long; pedicels 1-5 mm long, pubescent. **Sepals** lanceolate to ovate, 5-6 mm long, ca. 2 mm wide, pubescent on both sides. **Petals** white or creamy yellow, obovate, 6-8 mm long, 4-5 mm wide, pubescent on both sides, with one distinct hairy basal ridge inside, lacinate at apex about half to 1/3 the length of the petal. **Stamens** numerous, 2.5-3 mm long, glabrous; anthers not aristate at apex. **Ovary** ovoid, shortly hairy, 3-locular; style shortly hairy in lower half only; disc distinctly 5-lobed. **Drupe** ellipsoid, ca. 3 cm long, 2 cm wide, green, glabrous, rounded at both ends; fruit-stalk ca. 1 cm long, pubescent, glabrescent (Fig. 34).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Myanmar (type).

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: November-February; fruiting: January–May.

Vernacular.— มุ่นดอย Mun doi (Northern).

Voucher specimens.— *P. Srisanga* 385, 2683.

2. *Elaeocarpus prunifolius* Wall. ex C. Muell.

Annot. Elaeocarp.: 15. 1849; Phengklai in Fl. Thailand 2(4): 432, fig. 16. 1981. – *E. robertsonii* Gamble, Kew Bull. 1912: 199. 1912; Craib in Fl. Siam. Enum. 1: 197. 1925.

Evergreen tree up to 10 m high; twigs glabrous. Stipules caducous. **Leaves** oblong to elliptic, 10-16 cm long, 3-6 cm wide, serrate to subentire, glabrous on both surfaces; base acute to obtuse; apex acute to cuspidate; primary veins 6-8 pairs, curved and anastomosing, prominent on both surfaces; petioles 1.5-4 cm long, swollen at both ends, glabrous, geniculate. **Inflorescence** in axils of present leaves, 4-6 cm long; pedicels 8-10 mm long, glabrous. **Sepals** lanceolate, 5-7 mm long, 1-2 mm wide, pubescent outside, glabrous inside. **Petals** white or creamy white, oblong or obovate-oblong, 5-6 mm long, 2-3 mm wide, pubescent on both sides, with one distinct hairy basal ridge inside, laciniate at apex about 1/5 the length of the petal. **Stamens** numerous, 4-5 mm long, pubescent; anthers aristate at apex. **Ovary** ovoid, covered with stiff hairs, 3-locular; style with long hairs in lower half; disc distinctly 10-lobed. **Fruit** not known.

Thailand.— Northern: Chiang Mai, Lampang, Nan; North-eastern: Loei.

Distribution.— India (type), Myanmar, China.

Ecology.— Lower montane forest, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering: February-March.

Voucher specimens.— *P. Srisanga et al.* 2482.

3. *Elaeocarpus sphaericus* (Gaertn.) K. Schum.

Pflanzenfam. 3(6): 5. 1890; Phengklai in Fl. Thailand 2(4): 412, fig. 4. 1981. – *Ganitrus sphaerica* Gaertn., Fruct. 2: 271, t. 139. 1791. – *Elaeocarpus ganitrus* Roxb. ex Mast. in Fl. Br. Ind. 1: 400. 1874; Craib in Fl. Siam. Enum. 1: 195. 1925.

Evergreen tree up to 25 m high; twigs pubescent. Stipules caducous. **Leaves** lanceolate, oblong, 10-18 cm long, 3-5 cm wide, serrulate, glabrous on both surfaces or at most sparsely hairy on midrib and lower surfaces; base acute to obtuse; apex acute or acuminate; primary veins 8-13 pairs, curved, prominent on lower surface, often with domatia in nerves axils on lower surface; petioles 1-2 cm long, pubescent. **Inflorescence** below the leaves in axils of fallen leaves, 6-10 cm long; pedicels 8-10 mm long, pubescent. **Sepals** lanceolate, 7-8 mm long, ca. 2 mm wide, pubescent outside, only ciliate along limb inside. **Petals** oblong or obovate-oblong, 10-20 mm long, 3-5 mm wide, pubescent outside, glabrous inside, laciniate at apex about half the length of the petal. **Stamens** numerous, 7-8 mm long, sparsely hairy; anthers aristate at apex. **Ovary** ovoid, covered with long hairs, 5-locular; style with long hairs in lower half; disc distinctly 5-lobed. **Drupe** globose or subglobose, bluish green, 2.5-3 cm long and wide, glabrescent, rounded at both ends; fruit-stalk ca. 1 cm long, pubescent, glabrescent.

Thailand.— Northern: Chiang Mai, Nan, Sukhothai; North-eastern: Phetchabun; South-eastern: Trat; South-western: Kanchanaburi.

Distribution.— India (type), Nepal, Myanmar, Cambodia, Malaysia, Indonesia, Australia.

Ecology.— Lower montane forest, by streams, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering: March-May; fruiting: September-January.

Vernacular.— มุ่นโคม Mun khome (Northern).

Voucher specimens.— *P. Srisanga* 1254; *P. Srisanga* & *C. Maknoi* 2054.

4. *Elaeocarpus varunua* Buch.-Ham. ex Mast.

In Fl. Br. Ind. 1: 407. 1874; Craib in Fl. Siam. Enum. 1: 198. 1925; Phengklai in Fl. Thailand 2(4): 432, fig. 17. 1981.

Evergreen tree up to 15 m high; twigs pubescent, glabrescent. Stipules caducous. **Leaves** ovate to obovate, 11-23 cm long, 4-9 cm wide, serrate, glabrous on both surfaces or at most hairy along midrib on lower surface; base acute or obtuse; apex cuspidate; primary veins 8-14 pairs, more or less straight; veins scalariform, prominent on lower surface; petioles 2.5-7 cm long, glabrous. **Inflorescence** in axils of present leaves, 8-12 cm long; pedicels 0.8-1.2 cm long, pubescent. **Sepals** lanceolate, 8-12 mm long, ca. 2 mm wide, pubescent on both sides. **Petals** white, oblong or obovate-oblong, 8-12 mm long, ca. 3 mm, covered with long hairs on both sides, with 3 basal hairy ridges inside, hairs directed towards the base, laciniate at apex about 1/4 the length of the petal. **Stamens** numerous, 6-8 mm long, pubescent; anthers aristate at apex. **Ovary** ovoid, covered with long hairs, 3-locular; style long hairy in lower half only; disc distinctly 10-lobed. **Drupe** ovoid or ellipsoid, 1-1.5 cm long, ca. 0.5 cm wide, glabrous, rounded at both ends; fruit-stalk 1-1.5 cm long, pubescent, glabrescent (Fig. 35).

Thailand.— Northern: Nan.

Distribution.— Nepal (type), Myanmar, Laos, Malay Peninsula.

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering and Fruiting: March-June.

Vernacular.— มุ่นหลวง Mun luang (Northern).

Voucher specimens.— *P. Srisanga* 1309.

5. *Elaeocarpus* sp.

Evergreen tree up to 15 m high; twigs pubescent, glabrescent. Stipules caducous. **Leaves** oblanceolate, 10-18 cm long, 2.5-6 cm wide, serrate, glabrous on both surfaces; base acute to cuneate; apex acute to cuspidate; primary veins 10-17 pairs, curved, prominent on lower surface, often with domatia in nerves axils on lower surface; petioles 1-2.5 cm long, sparsely hairy, glabrescent. **Inflorescence** in axils of present leaves, 7-14 cm long; pedicels 1-1.7 cm long, pubescent. **Sepals** lanceolate, 8-12 mm long, 1.5-3 mm wide, pubescent outside and apex inside. **Petals** creamy yellow, oblong or obovate-oblong, 8-12 mm long, ca. 3 mm wide, covered with long

hairs on both sides, with one distinct hairy basal ridge inside, hairs directed towards the apex, laciniate at apex about 1/5 the length of the petal. **Stamens** numerous, 6-8 mm long, pubescent; anthers aristate at apex. **Ovary** ovoid, glabrous, 2-locular; style glabrous; disc 10-lobed. **Fruit** not known.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,300 m (Doi Phu Kha).

Phenology.— Flowering: March.

Voucher specimens.— *P. Srisanga et al.* 2465.

Notes.— Possibly new species or new recorded for Thailand. This specimens is similar to *E. hainanensis* Oliv, but differs by the following characters: leaves oblanceolate (vs. lanceolate); pedicels shorter; flowers smaller and stamens pubescent (vs. glabrous).

2. *SLOANEA* L.

Sp. Pl.: 521. 1753; Phengklai in Fl. Thailand 2(4): 405. 1981; Coode in Fam. Gen. Vasc. Pl. 6: 139. 2004. – *Echinocarpus* Bl., Bijdr.: 56. 1825.

Trees. **Leaves** alternate, chartaceous or subcoriaceous, entire or serrate; stipules caducous. **Flower** solitary in axils of leaves on the upper part of young branches, bisexual, 4-5-merous. **Sepals** free or slightly joined. **Petals** free, apex dentate or laciniate. **Stamens** numerous on a flattened torus; anthers basifixed, linear, aristate, opening by longitudinal slits. **Ovary** sessile, (3-)4(-5) locular, hairy; ovules 2-30 in each loculus; style subulate; stigma pointed. **Fruit** a spiny capsule, dehiscing into (3-)4(-6) parts when fully mature. **Seeds** 1-2, ellipsoid to ovoid, with well-developed red or orange aril.

About 120 species in tropical Asia and America; 2 species in Thailand (Phengklai, 1981c). Both species also recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves glabrous, entire or rarely few teeth near apex. Spines on capsule long, 8-15 mm long **1. *S. sigun***
 1. Leaves tomentose, serrate. Spines on capsule short, 1-3 mm long **2. *S. tomentosa***

1. *Sloanea sigun* (Bl.) K. Schum.

Pflanzenfam. 3(6): 5. 1890; Phengklai in Fl. Thailand 2(4): 406, fig. 1. 1981. – *Echinocarpus sigun* Bl., Bijdr.: 56. 1825. – *Sloanea kerrii* Craib, Kew Bull. 1925: 23. 1925; in Fl. Siam. Enum. 1: 194. 1925.

Evergreen tree up to 30 m high; twigs glabrous. **Leaves** ovate, obovate, elliptic or oblong, chartaceous, 6-22 cm long, 2.5-8.5 cm wide, glabrous on both surfaces, entire or rarely few teeth near apex; base rounded to cuneate; apex acute to

cuspidate; primary veins 5-8 pairs, curved and anastomosing; veins prominent on lower surface; petioles 1-5 cm long, glabrous, swollen at both ends. **Flowers** 4(-5)-merous; pedicels 1-5 cm long, puberulous, glabrescent. **Sepals** ovate, 4-8 mm long, pubescent on both sides. **Petals** yellow, ovate or obovate, 5-9 mm long, sparsely hairy on both sides. **Stamens** 4-7 mm long, sparsely hairy. **Ovary** ovoid, hairy; style hairy. **Capsule** globose, 4-6 cm in diam. including 8-15 mm long spines; fruit-stalk 1-7 cm long. **Seeds** black, ellipsoid, 10-13 mm long (Figs. 119-120).

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; North-eastern: Loei.

Distribution.— India, Myanmar, Cambodia, Malaysia, Indonesia (Java-type).

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: September-February; fruiting almost throughout the year.

Voucher specimens.— *P. Srisanga* 359, 1442, 1713, 1714, 1790; *P. Srisanga* & *S. Watthana* 709; *P. Srisanga et al.* 834.

2. *Sloanea tomentosa* (Benth.) Rehd. & Wils.

In Sarg., Pl. Wils. 2: 362. 1915; Craib in Fl. Siam. Enum. 1: 194. 1925; Phengkhai in Fl. Thailand 2(4): 406, fig. 2. 1981. — *Echinocarpus tomentosus* Benth., J. Linn. Soc. 5, Suppl. 2: 73. 1861. — *Sloanea mollis* Gagnep. in Fl. Gén. I.-C. 1: 564. 1911.

Deciduous tree up to 30 m high; twigs tomentose. **Leaves** elliptic, ovate to obovate, chartaceous, 11-26 cm long, 5.5-14 cm wide, tomentose on both surfaces, serrate; base rounded, obtuse or broadly cuneate; apex acuminate or cuspidate; primary veins 7-10 pairs, curved and anastomosing; veins prominent on lower surface; petioles 2-5.5 cm long, tomentose. **Flowers** 4(-5)-merous; pedicels 2-4.5 cm long, tomentose. **Sepals** ovate, 7-9 mm long, pubescent on both sides. **Petals** yellow, ovate or obovate, 9-12 mm long, pubescent on both sides. **Stamens** 8-10 mm long, pubescent. **Ovary** ovoid, 6-8 mm long, pubescent; style 10-14 mm long, pubescent, glabrous and twist near the top. **Capsule** globose, 4-6 cm in diam. including 1-3 mm long spines; fruit-stalk 2-4 cm long.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— E Himalayas (type), Myanmar, S China (Yunnan), Vietnam.

Ecology.— Lower montane forest, by streams, alt. 1,200-1,500 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting May-January; shedding leaves before flowering; flushing before or during flowering.

Voucher specimens.— *P. Srisanga* 1329, 2266.

Notes.— New locality recorded from Nan, in Thailand.

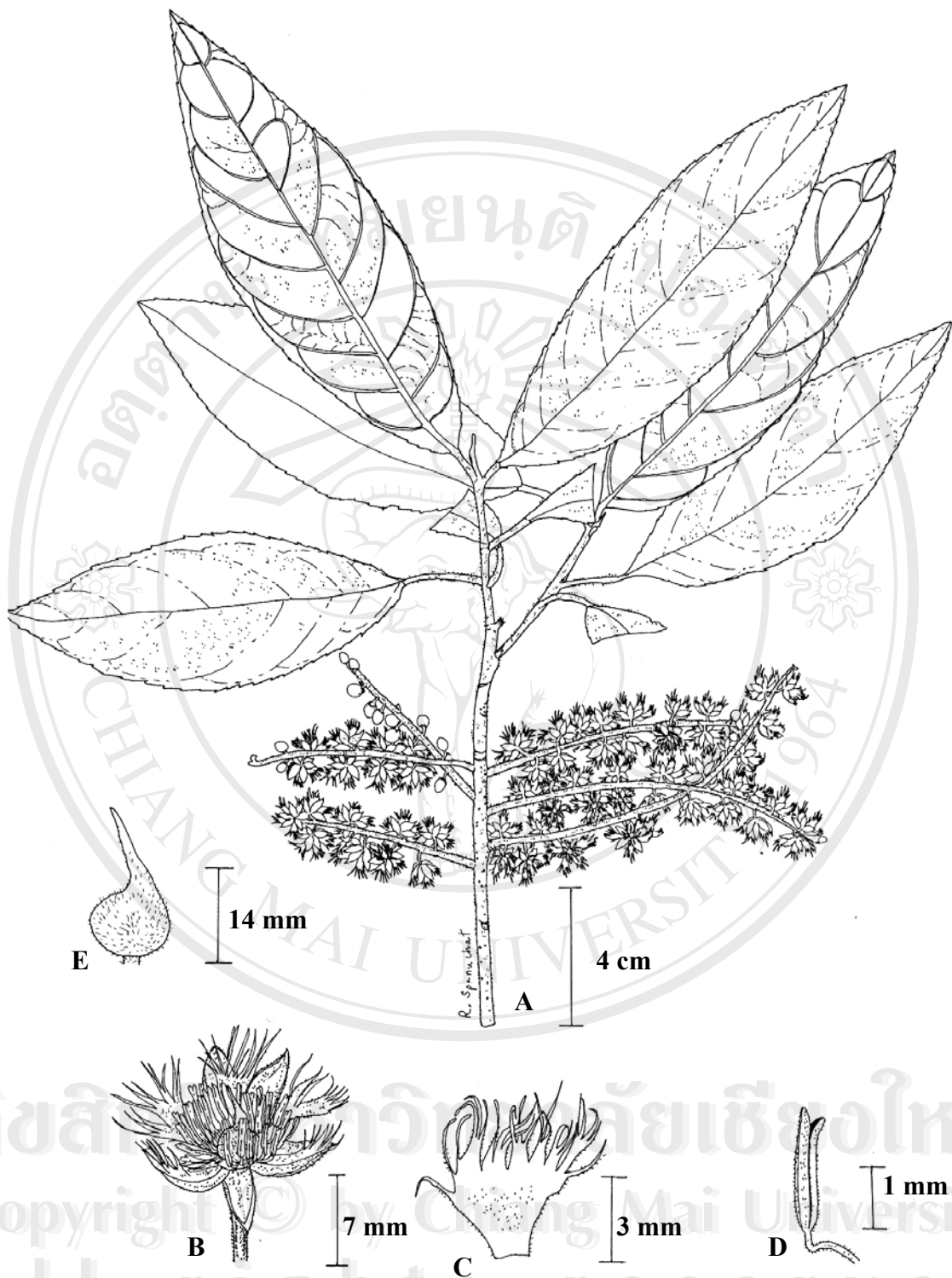


Figure 34. *Elaeocarpus braceanus* Watt ex C.B. Clarke

A. flowering branch; B. flower; C. petal; D. stamen; E. pistil.

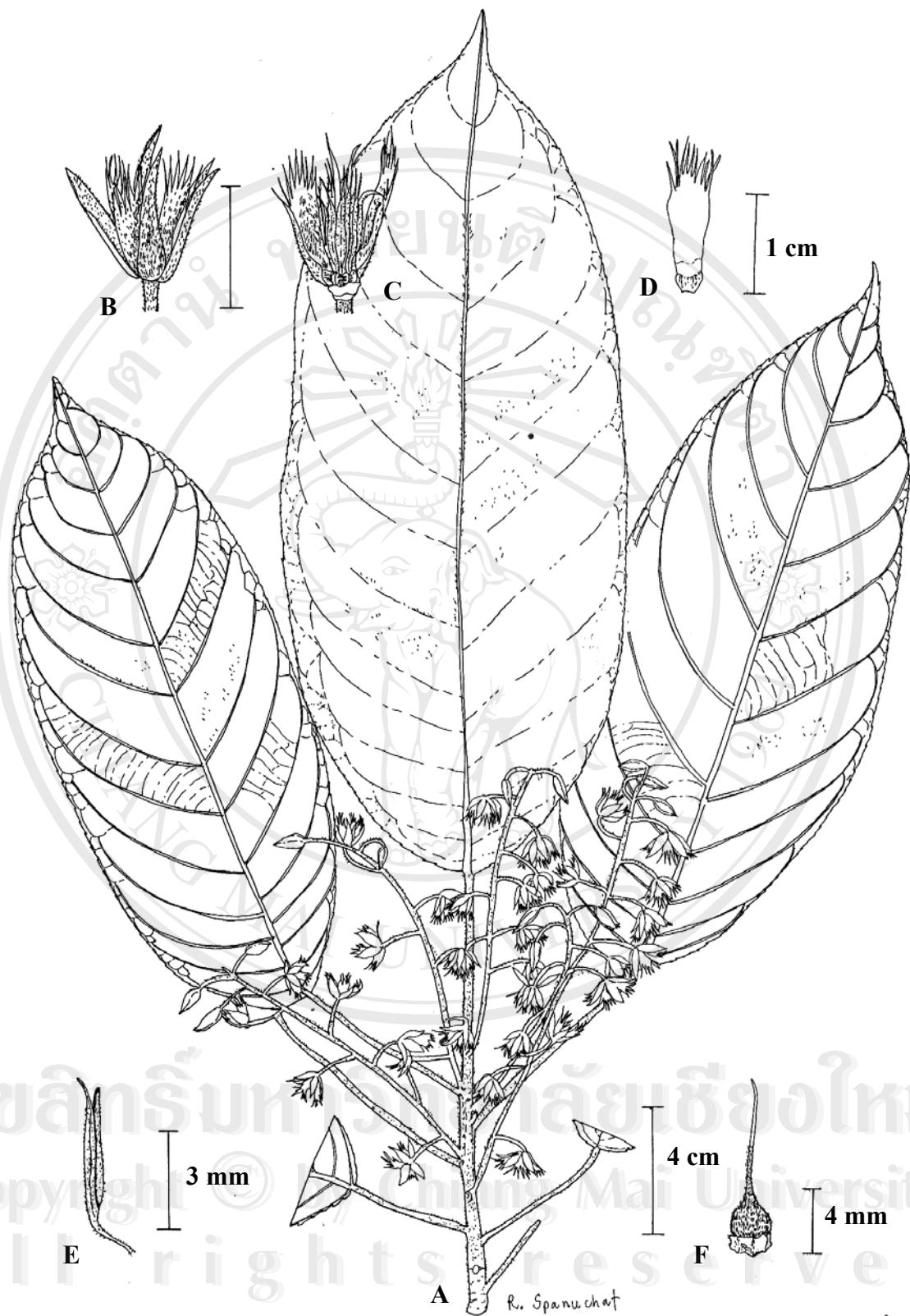


Figure 35. *Elaeocarpus varunua* Buch.-Ham. ex Mast.

A. flowering branch; B. flower; C. opened flower; D. petal; E. stamen; F. pistil.
All from P. Srisanga 1309.

ERICACEAE

Undershrubs, shrubs or trees, rarely climbers or herbs, sometimes epiphytic or chlorophyll less; stipules absent. **Leaves** simple, alternate, opposite or whorled. **Inflorescence** axillary or terminal, usually in bracteate racemes, sometimes flower solitary. **Flowers** bisexual, actinomorphic or slightly zygomorphic. **Sepals** (2-)4-5(-7), connate, at least at base, valvate or imbricate, deciduous or persistent. **Petals** (3-)4-5(-7), usually connate with convolute or imbricate lobes, rarely free. **Stamens** (2-)5(-8), 10(-16); filaments free or rarely somewhat connate; anthers 2-locular, opening by terminal pores, very rarely by longitudinal slits. **Ovary** inferior or superior, (1-)4-5(-12)-locular, axile placentation; style solitary; ovules (1-)numerous in each loculus. Disk intrastaminal, surrounding and often attached to the ovary. **Fruit** loculicidal or septicidal capsule, berry or drupe. **Seeds** small, sometimes winged.

A cosmopolitan family with 124 genera and about 4,100 species including Epacridaceae, Monotropaceae, Pyrolaceae and Vacciniaceae (Stevens et al., 2004). About 10 genera and 40 species in Thailand. Five genera and 7 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Ovary inferior. Fruit a berry, crowned by persistent calyx lobes and disk
 2. Corolla tubular-cylindrical, (0.8-)2.5-4(-5) cm long, pink or red **1. *Agapetes***
 2. Corolla tubular-urceolate, less than 0.8 cm long, pinkish white **5. *Vaccinium***
1. Ovary superior. Fruit a capsule
 3. Fruit a septicidal capsule, cylindrical, elongate **4. *Rhododendron***
 3. Fruit a loculicidal capsule, globose
 4. Corolla urceolate-campanulate. Capsule about or more than 1 cm in diam. Seeds with wing on one side **2. *Craibiodendron***
 4. Corolla tubular-cylindrical. Capsule less than 0.5 cm in diam, often with pale colour longitudinal ribs. Seeds spindle-shaped, unwinged **3. *Lyonia***

1. *AGAPETES* G. Don

Gen. Hist. 3: 862. 1834; Sleumer, Fl. Mal.I(6): 878. 1967; Stevens et al. in Fam. Gen. Vasc. Pl. 6: 184. 2004.

Epiphytic or lithophytic shrubs; stems much swollen at the base. **Leaves** alternate, more or less coriaceous. **Inflorescence** axillary, racemes, few-flowered fascicles or flower solitary. **Flowers** 5-merous, actinomorphic, showy; pedicels articulated, rarely continuous. **Calyx** tube adnate to the ovary, subcylindrical to subglobose; lobes 5, persistent. **Corolla** usually pink or red, tubular-cylindrical, (0.8-)2.5-4(-5) cm long; lobes 5. **Stamens** 10; filaments linear, free; anthers with or without spurs, opening by terminal pores, rarely by longitudinal slits. **Ovary** inferior, 5-locular; style filiform; stigma truncate or capitate. Disk annular cushion. **Fruit** a berry, crowned by persistent calyx lobes and disk.

About 400 species from E Himalayas, China to SE Asia and Malesia. Most Indo-Malesian species of *Vaccinium* L. are provisionally included here (Stevens et al., 2004). About 10 species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Branchlets, inflorescence and flowers glandular hairy. Corolla 0.8-1 cm long **1. *A. inopinnata***
1. Branchlets, inflorescence and flowers glabrous. Corolla more than 2 cm long
2. Leaves lanceolate to narrowly elliptic, 7-12 cm long, 2.5-4 cm wide. Corolla lobes about as long as tube. Anthers without spurs **2. *A. lobbii***
2. Leaves oblong-lanceolate, 11-20 cm long, 2.5-5 cm wide. Corolla lobes much shorter than tube. Anthers with spurs **3. *A. megacarpa***

1. *Agapetes inopinnata* Airy Shaw

Kew Bull. 14: 299. 1960; Watthana & Trisonthi, Thai For. Bull. (Bot.) 27: 19, figs. 1-3. 1999. – *Vaccinium glandulosissimum* C.Y. Wu ex W.P. Fang & Z.H. Pan, Acta Phytotax. Sin. 19: 109. 1981. – *Agapetes glandulosissimum* (C.Y. Wu ex W.P. Fang & Z.H. Pan) S.H. Hang, Acta Bot. Yunnan. 5: 148, fig. 1. 1983.

Epiphytic shrub up to 1.5 m high; branchlets densely dark brownish glandular hairy. **Leaves** lanceolate to narrowly elliptic, 3-6 cm long, 1.3-2.3 cm wide, glabrous on both surfaces; base rounded; apex acuminate; margin entire; petioles 1-2 mm long. **Inflorescence** terminal or axillary racemes, 2-6-flowered, 2-4 cm long, all parts glandular hairy; pedicels 6-8 mm long, articulated. **Calyx** red, campanulate; tube 1-1.5 mm long; lobes triangular, 1-1.5 mm long. **Corolla** red with bright green at lobes, tubular-cylindrical to cylindrical-urceolate, 8-10 mm long, glabrous inside, glandular hairy outside; lobes triangular, ca. 1 mm long. **Filaments** 2-2.5 mm long, glabrous or sparsely glandular hairy; anthers 4-4.5 mm long, minutely spinulose especially on the lower half, with spur on the back. **Style** 8-9 mm long, glabrous; stigma capitate. **Fruit** subglobose, ca. 1 cm long and wide, white, glandular hairy when young. **Seeds** brown, ca. 1.5 mm long.

Thailand.— Northern: Nan.

Distribution.— Myanmar, S China (Yunnan).

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: February-July.

Voucher specimens.— *P. Srisanga et al.* 863, 2430; *S. Watthana* 224.

Notes.— Rare species.

2. *Agapetes lobbii* C.B. Clarke

In Fl. Br. Ind. 3: 448. 1882; Sleumer, Dansk Bot. Ark. 23(3): 303, figs. 1-2. 1966.

Epiphytic or lithophytic shrub up to 2 m high; branchlets glabrous. **Leaves** lanceolate to narrowly elliptic, 7-12 cm long, 2.5-4 cm wide, glabrous on both surfaces; base broadly cuneate with a basal gland on each side; apex acuminate; margin entire; petioles 1.5-3.5 mm long. **Inflorescence** axillary or cauliflorous racemes, 10-20(-25)-flowered, 3-12 cm long, glabrous; pedicels red, 1-1.5 cm long, articulated. **Calyx** red or green, campanulate; tube 0.5-1 mm long; lobes triangular, 2-2.5 mm long, long acuminate at apex, glabrous on both sides. **Corolla** red, tubular-cylindrical, distinctly 5-ridged, glabrous on both sides; tube 10-15 mm long; lobes narrowly triangular, 14-17 mm long, curved and twisted outwards. **Filaments** 2-4 mm long, glabrous; anthers 2.7-3 cm long, minutely spinulose especially on the lower half, appendaged at base, without spur. **Style** 3-3.5 mm long, glabrous; stigma truncate. **Fruit** not known (Fig. 121).

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan, Phitsanulok; North-eastern: Loei.

Distribution.— India, Myanmar.

Ecology.— Lower montane forest, alt. 1,600-1,750 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: January-March.

Vernacular.— สะเม็ก Sa mek (Loei).

Voucher specimens.— *P. Srisanga* 455, 2369; *P. Srisanga et al.* 2429.

Notes.— Rare species.

3. *Agapetes megacarpa* W.W. Sm.

Notes Roy. Bot. Gard. Edinb. 11: 194. 1920.

Epiphytic shrub up to 1 m high; branchlets glabrous. **Leaves** oblong-lanceolate, 11-20 cm long, 2.5-5 cm wide, glabrous on both surfaces; base obtuse with a basal gland on each side; apex acuminate; margin entire; petioles 1.5-3 mm long. **Inflorescence** axillary racemes, 7-10-flowered, 8-11 cm long, glabrous; pedicels red, 2.5-3.5 cm long, articulated. **Calyx** red, campanulate; tube 4-5 mm long; lobes narrowly triangular, 7-10 mm long, acute at apex, glabrous on both sides. **Corolla** pink or red with darker stripes, tubular-cylindrical, 5-ridged, glabrous on both sides; tube 4-4.8 cm long; lobes narrowly triangular, 0.8-1.2 cm long, curved outwards. **Filaments** 3-4 mm long, sparsely hairy on the upper half; anthers 4.5-5 cm long, minutely spinulose especially on the lower half, appendaged at base, with spur on the back. **Style** 5.5-6 mm long, glabrous; stigma capitate. **Fruit** not known (Fig. 122).

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— S China (Yunnan).

Ecology.— Dry evergreen and lower montane forest, often near streams, alt. 800-1,500 m (Doi Phu Kha, Doi Phu Wae, Sapan Waterfall).

Phenology.— Flowering: June-November.

Voucher specimens.— *P. Srisanga* 739, 1581, 1863, 2233; *S. Watthana* 389.

Notes.— Rare species.

2. *CRAIBIODENDRON* W.W. Sm.

Rec. Bot. Surv. India 4: 276. 1911; Stevens et al. in Fam. Gen. Vasc. Pl. 6: 180. 2004.

Small trees. **Leaves** alternate, entire, more or less coriaceous. **Inflorescence** terminal, racemes or panicles. **Flowers** 5-merous, actinomorphic. **Sepals** 5, connate, imbricate, persistent. **Petals** 5, connate, urceolate-campanulate. **Stamens** 10, included; filaments free, geniculate; anthers without spurs or appendages, opening by terminal pores. **Ovary** superior, 5-locular; ovules attached at the top of placentas column, pendulous; style cylindric; stigma truncate. **Fruit** a loculicidal capsule, globose, about or more than 1 cm in diam. **Seeds** with wing on one side.

About 5 species in S China (Yunnan) and Continental SE Asia. About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

Craibiodendron stellatum (Pierre) W.W. Sm.

Kew Bull. 1914: 129. 1914; Dop in Fl. Gén. I.-C. 3: 729, fig. 82: 11-16. 1930; Fletcher in Fl. Siam. Enum. 2: 316. 1938; Sleumer, Dansk Bot. Ark. 23(1): 80. 1963. – *Schima stellata* Pierre ex Laness., Pl. Util. Col. France: 295. 1886. – *Craibiodendron shanicum* W.W. Sm., Rec. Bot. Surv. India 4: 277. 1911.

Small tree, 4-6 m high; branchlets glabrous. **Leaves** oblong-lanceolate to elliptic, 6-10 cm long, 2-5 cm wide, glabrous on both surfaces; base broadly cuneate to rounded; apex obtuse, rounded to emarginate; petioles 4-8 mm long, glabrous, rugose. **Inflorescence** terminal panicles, many-flowered, 8-15 cm long, puberulous; pedicels 2-4 mm long, puberulous, articulated. **Sepals** ovate, 1-1.5 mm long, puberulous, shortly acute at apex. **Corolla** creamy white, urceolate-campanulate to subcylindrical, 4-4.5 mm long, glabrous inside, puberulous outside; lobes triangular, ca. 1 mm long. **Filaments** 2-2.5 mm long, puberulent; anthers 0.75-1 mm long. **Ovary** ca. 1 mm long, pubescent; style ca. 2 mm long, glabrous. **Capsule** 10-12 mm in diam., 5-valved, puberulous, glabrescent. **Seeds** 4-7 in each loculus, compressed, 1-2 mm long; wings 3-4 mm long.

Thailand.— Northern: Chiang Mai, Chiang Rai, Phayao, Lamphun, Lampang, Nan; North-eastern: Loei.

Distribution.— Myanmar, S China (Yunnan), Laos, Cambodia (type), Vietnam.

Ecology.— Deciduous and dry evergreen forest, alt. 800-1,000 m (Doi Phu Wae).

Phenology.— Flowering: November-December; fruiting: January-March.

Voucher specimens.— *P. Srisanga* 2615.

3. *LYONIA* Nutt.

Gen. N. Am. Pl. 1: 266. 1818, nom cons.; Sleumer in Fl. Mal. I(6): 674. 1967; Stevens et al. in Fam. Gen. Vasc. Pl. 6: 181. 2004.

Shrubs or small trees, evergreen or deciduous. **Leaves** alternate, more or less coriaceous. **Inflorescence** terminal or axillary, racemes. **Flowers** 5-merous, actinomorphic. **Sepals** 5, connate, valvate, persistent. **Petals** 5, connate, tubular-cylindrical. **Stamens** 10, included; filaments free, flat, with a pair of appendages near apex; anthers dorsifixed, without spurs or appendages, opening by terminal pores. **Ovary** superior, 5-locular, axile placentation; ovules numerous; style cylindrical; stigma truncate. **Fruit** a loculicidal capsule, globose, less than 0.5 cm in diam, often with pale colour longitudinal ribs. **Seeds** spindle-shaped, unwinged.

About 35 species mainly in SE USA to Mexico and the Greater Antilles, few in E and SE Asia. About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

Lyonia ovalifolia (Wall.) Drude

In Engl. & Prantl, Nat. Pfl. Fam. 4(1): 44. 1889; Sleumer, Dansk Bot. Ark. 23(1): 80. 1963; in Fl. Mal. I(6): 675, figs. 57-59. 1967; Long & Rae in Fl. Bhutan 2(1): 395. 1991. – *Andromeda ovalifolia* Wall., As. Res. As. Soc. Beng. 13: 391. 1820. – *Pieris ovalifolia* (Wall.) D. Don., Edinb. Phil. J. 17: 159. 1834; Dop in Fl. Gén. I.-C. 3: 725. 1930. – *Xolisma ovalifolia* (Wall.) Rehd., J. Arn. Arb. 5: 52. 1924; Fletcher in Fl. Siam. Enum. 2: 315. 1938.

Small tree, 5-8 m high; branchlets terete, puberulous, glabrescent. **Leaves** variable in shape and size, lanceolate, elliptic to ovate, (5-)6-10(-15) cm long, (3-)4-5.5(-7) cm wide, sparsely dark puberulous on both surfaces; base rounded, subcordate to broadly cuneate to rounded; apex acute to acuminate; primary veins (8-)10-15 pairs, prominent on lower surface; petioles 3-10(-12) mm long, puberulous. **Inflorescence** axillary racemes, many-flowered, 8-15(-18) cm long, puberulous; pedicels 2-4 mm long, puberulous, articulated. **Sepals** lanceolate to ovate, 2-3 mm long, puberulous, acute at apex. **Corolla** white, tubular-cylindrical, 8-12 mm long, puberulous on both sides; lobes triangular, ca. 0.5 mm long. **Filaments** 4-5 mm long, hairy towards to base, with a pair of appendages near apex; anthers 1-1.5 mm long. **Ovary** 1-1.5 mm long, pubescent; style 7-10 mm long, glabrous. **Capsule** 4-5 mm in diam., 5-valved, glabrous, with pale colour longitudinal ribs. **Seeds** ca. 1 mm long.

Thailand.— Northern: Chiang Mai, Lampang, Nan; North-eastern: Loei.

Distribution.— E Himalayas, China, Japan, Myanmar, Laos, Cambodia, Vietnam, Malaysia.

Ecology.— Dry evergreen and lower montane forest, in open places, alt. 1,000-1,600 m (Doi Phu Wae, Nan Watershed).

Phenology.— Flowering: February-July; fruiting: August-November.

Vernacular.— ม้าแดง Mao daeng (Chiang Mai).

Voucher specimens.— *P. Srisanga* 302, 1799; *P. Srisanga* & *C. Maknoi* 2077; *P. Srisanga et al.* 885, 2437.

4. RHODODENDRON L.

Sp. Pl.: 392. 1753; Sleumer in Fl. Mal. I(6): 474. 1966; Stevens et al. in Fam. Gen. Vasc. Pl. 6: 171. 2004.

Trees or shrubs, evergreen or rarely deciduous, terrestrial or epiphytic. **Leaves** alternate, opposite or in pseudowhorls, more or less coriaceous, scales or hairs usually present. **Inflorescence** mostly terminal or rarely axillary, condensed umbelliform racemes which is occasionally reduced to a single flower. **Flower** buds with numerous perulae varying in shape and size from the outer to the inner ones, early or late caducous; bracteoles 2, at the base of pedicels. **Calyx** cup- or disk-shaped, sometimes merely rim-like, 5(-7)-lobed or subentire, persistent. **Corolla** tubular, campanulate, funnel-shaped or salver-shaped, actinomorphic, 5(-7)-lobed, imbricate. **Stamens** 5-10(-14), inserted at the corolla base, often unequal; filaments linear to filiform; anthers dorsifixed, without spurs or appendages, opening by terminal pores. Disk mostly thick and prominent, 5-10(-14)-lobed. **Ovary** superior, 5(-7)-locular, axile placentation; ovules numerous; style cylindrical; stigma capitate, sometimes crenate to deeply lobed. **Fruit** a septicidal capsule, cylindrical, elongate; central column persistent. **Seeds** spindle-shaped to ellipsoid or flattened, winged or not.

About 850 species mainly in tropical and subtropical E, SE Asia and Malesia. About 12 species in Thailand. One species recorded from Doi Phu Kha National Park.

Rhododendron aff. lyi Lév.

Evergreen shrub, 1-2 m high; branchlets with brown scales and hairs, caducous. **Leaves** alternate, condensed in the upper most twigs, lanceolate, oblanceolate, elliptic to narrowly obovate, (1.5-)4-5(-6) cm long, (0.8-)1.5-2.5(-3) cm wide, brown pilose above and along the margin, caducous, densely brown scales beneath, each scale not touching each other; base cuneate; apex acute; margin entire, revolute; midrib impressed above, raised and prominent beneath; venation obscure; petioles 3-6 mm long, brown pilose and scales. **Inflorescence** terminal, umbelliform, 3-4(-5)-flowered. Perulae ovate, concave, with scales along the median, puberulous outside especially the base, long white ciliate along the margin. **Flowers** fragrant. **Calyx** cup-shaped, 5-lobed, 2-3 mm long, hairy along the margin. **Corolla** white or white with pinkish tinges, campanulate, 4.5-5 cm long, 5-lobed, rounded and crenulate at apex, sparsely scales outside, glabrous except puberulous at base. **Stamens** 10; filaments 3.5-4 cm long, white villous about one third from the base; anthers oblong, 5-5.5 mm long, glabrous. **Ovary** conical, ca. 5 mm long, densely scales; style 4-4.3 cm long, sparsely scales and hairs about one forth from the base; stigma capitate, lobed. **Capsule** ellipsoidal-cylindrical, 1.7-2.3 cm long. **Seeds** spindle-shaped, ca. 2 mm long (Fig. 123).

Thailand.— Northern: Nan.

Ecology.— Lower montane scrub, among limestone rocks, alt. 1,700-1,750 m (Doi Phu Wae).

Phenology.— Flowering: February-March; fruiting: November-December.

Voucher specimens.— *P. Srisanga* 420, 1833; *P. Srisanga et al.* 2416.

Notes.— Very closed to *R. lyi* Lév. only differs by hairy style base and *R. ludwigianum* Hoss. by not pubescent all over corolla.

5. *VACCINIUM* L.

Sp. Pl.: 349. 1753; Sleumer, Fl. Mal.I(6): 746. 1967; Stevens et al. in Fam. Gen. Vasc. Pl. 6: 183. 2004.

Shrubs or small trees, rarely climbers or epiphytic; stems sometimes swollen at the base. **Leaves** alternate, more or less coriaceous. **Inflorescence** axillary or terminal, racemes or flower solitary, rarely few-flowered fascicles. **Flowers** 5-merous, actinomorphic, pedicels continuous, rarely articulated, subtended with a bract and 2 bracteoles. **Calyx** tube adnate to the ovary, subcylindrical to campanulate; lobes 5, erect, persistent. **Corolla** usually pinkish white, tubular-urceolate, usually less than 0.8 cm long; lobes 5. **Stamens** 10; filaments linear, free; anthers dorsifixed, with or without spurs, opening by terminal pores, rarely by longitudinal slits. **Ovary** inferior, 5-locular; style filiform, about as long as the corolla; stigma truncate or obtuse. Disk annular. **Fruit** a berry, purple to black, rarely red or white, crowned by persistent calyx lobes and disk.

About 140 species in temperate and tropical America, Asia and Pacifics, few species in Europe, Africa and Madagascar. The limits of the genus unclear (Stevens et al., 2004). About 7 species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

Vaccinium sprengelii (G. Don) Sleum.

Bot. Jahrb. Syst. 71: 460. 1941; Dansk Bot. Ark. 23(1): 79. 1963. – *Agapetes sprengelii* G. Don, Gen. Hist. 3: 862. 1834. – *Vaccinium exaristatum* Kurz, J. As. Soc. Beng. 42: 286. 1873; Fl. Burm. 2: 91. 1877; Fletcher in Fl. Siam. Enum. 2: 312. 1938. – *V. garrettii* Craib, Kew Bull. 1916: 265. 1916; Fletcher in Fl. Siam. Enum. 2: 313. 1938. – *V. harmandiana* Dop in Fl. Gén. I.-C. 3: 709. 1930; Fletcher in Fl. Siam. Enum. 2: 313. 1938. – *V. apricum* Fletcher, Kew Bull. 1936: 36. 1936; in Fl. Siam. Enum. 2: 312. 1938. – *V. glabrum* Fletcher, Kew Bull. 1936: 36. 1936; in Fl. Siam. Enum. 2: 313. 1938. – *V. pedicellatum* Fletcher, Kew Bull. 1936: 37. 1936; in Fl. Siam. Enum. 2: 313. 1938. – *V. winitii* Fletcher, Kew Bull. 1936: 39. 1936; in Fl. Siam. Enum. 2: 314. 1938.

Small tree, 4-7 m high; branchlets pubescent, glabrescent. **Leaves** reddish when young, variable in shape and size, lanceolate, elliptic to ovate, 2.5-7.3 cm long, 1.3-4 cm wide, puberulous towards the base, glabrescent; base broadly cuneate to rounded; apex obtuse, rounded, acute to acuminate; margin serrate; petioles 1.5-2.5 mm long, puberulous, glabrescent. **Inflorescence** axillary or terminal racemes, many-flowered, 2-6 cm long, puberulous, glabrescent; pedicels 1-5 mm long, articulated. **Calyx** tube adnate to the ovary, campanulate; lobes triangular, 0.75-1 mm long, glabrous, acute to acuminate at apex. **Corolla** pinkish white, tubular-urceolate, 5-8 mm long, shallowly 5-ridged, glabrous inside, glabrous or sparsely hairy outside;

lobes triangular, 0.5-1 mm long. **Filaments** 1.5-2.5 mm long, densely hairy at base; anthers 0.75-1 mm long, with terminal appendage, 1-1.5 mm long. **Style** 5-7 mm long, glabrous; stigma truncate. **Fruit** subglobose, 5-6 mm long and wide, glabrous. **Seeds** triangulate, 1-2 mm long (Fig. 124).

Thailand.— Northern: Almost throughout; North-eastern: Phetchabun, Loei, Nang Khai, Khon Kaen; Eastern: Chaiyaphum; South-eastern: Trat; South-western: Kanchanaburi.

Distribution.— SE Tibet, India (Assam), Myanmar, China, Laos, Cambodia, Vietnam.

Ecology.— Dry evergreen, pine and lower montane forest, in open places, lower montane scrub, alt. 700-1,750 m (Doi Phu Kha, Doi Phu Wae, Doi Phu Huat).

Phenology.— Flowering: December-March; fruiting: March-May.

Uses.— Young leaves edible.

Vernacular.— ส้มปี Som pi, ส้มเปาะ Som pae (Northern).

Voucher specimens.— *P. Srisanga* 508; *P. Srisanga et al.* 2418.

EUPHORBIACEAE

Trees, shrubs, climbers or herbs, sometimes with milky juice or succulents, occasionally dioecious or monoecious. **Leaves** simple or compound, alternate or rarely opposite, sometimes reduced; mostly stipulate. **Inflorescence** terminal or axillary, cymose, thyriform, paniculate, racemose, spicate or with the flowers aggregated into 2-bracteate terminal capitate pseudanthia or bilaterally symmetrical pseudanthia with connate bracts forming a cyathium. **Flowers** usually actinomorphic, unisexual or sometimes bisexual. **Sepals** (1-)3-6(-8), valvate or imbricate, sometimes much reduced or absent. **Petals** (1-)3-6(-8) or absent, usually free, rarely united. **Stamens** (1-)5-numerous, free or connate; anthers 2(-4)-locular, opening by longitudinal slits or rarely by apical pores; vestige of ovary often present in the male flowers. **Ovary** superior, (1-)3(-20)-locular, apical or axile placentation; styles (1-)3(-20), free or variously united; ovules 1-2 in each loculus. Disk often present in both sexes. **Fruit** berry, capsule, drupe, samara or schizocarp. **Seeds** often with a conspicuous caruncle.

About 334 genera and about 8,100 species cosmopolitan (Mabberley, 1997; Radcliffe-Smith, 2001). About 84 genera and 400 species in Thailand. Twenty-one genera and 28 species recorded from Doi Phu Kha National Park (Table 9).

Annotated Checklist of Euphorbiaceae

The following checklist includes Euphorbiaceae collected from this study between 1998 and 2003. The genera are arranged alphabetically as well as for the species within the genera. Voucher specimens were also compared with the materials deposited at CMU and QBG.

Table 9. Checklist of Euphorbiaceae of Doi Phu Kha National Park

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	References
<i>Acalypha indica</i> L.	Han maeo	LMF, open place	1,100-1,600	Jun-Nov	Jun-Nov	PS 1152, 1487; PS et al. 838	Airy Shaw (1972)
<i>Antidesma montanum</i> Bl.	Ma mao khon	LMF	1,600-1,700	Mar-May	Jul-Sep	PS 976, 1421; PS & C. Puff 1095 PS & S. Wattthana 652, 711; PS et al. 769	Airy Shaw (1972); Hoffmann (2000)
<i>Aporosa villosa</i> (Wall. ex Lindl.) Baill.	Mueat luang	DEF, PF	1,000-1,100	Jan-Feb	Mar-May	PS 517, 519, 520; PS et al. 2463	Airy Shaw (1972)
<i>Baccaurea ramiflora</i> Lour.	Ma fai	MDF, DEF	700-800	Feb-Mar	May-Jul	PS 559	Airy Shaw (1972); Welzen et al. (2000)
<i>Baliospermum siamense</i> Craib	Plao tong taek	LMF	1,400-1,700	May-Aug	Nov-Dec	PS 726, 738, 1208, 1411; PS & C Maknoi 2028	Airy Shaw (1972)
<i>Bischofia javanica</i> Bl.	Toem	DEF, LMF	600-1,500	Jan-Feb	Nov-Dec	PS 332, 402, 479, 2717	Radcliffe-Smith (2001)
<i>Breynia glauca</i> Craib	Phak wan dang, Ra ngap phit	MDF, DEF	800-900	Jan-Dec	Jan-Dec	PS 576	Airy Shaw (1972); Welzen et al. (2000)
<i>Breynia retusa</i> (Dennst.) Alston		LMF, Pine Plantation	1,400-1,500		May-Jul	PS 1417; PS et al. 750	Airy Shaw (1972); Welzen et al. (2000)
<i>Bridelia affinis</i> Craib		LMF, OP	1,300		Jul-Aug	PS et al. 733, 2230; PS & S. Wattthana 706	Airy Shaw (1972); Welzen et al. (2000)
<i>Bridelia glauca</i> Bl.		LMF, OP	1,100-1,700	Apr-Jun	Oct-Nov	PS et al. 888	Airy Shaw (1972); Welzen et al. (2000)

(continued)

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	References
<i>Claoxylon longifolium</i> (Bl.) Endl. ex Hassk.	Phak wan	LMF	1,200-1,700	Mar-Apr	Jul-Aug	PS 981, 1331, 1383; PS & C. Maknoi 2039	Airy Shaw (1972)
<i>Cleidiocarpon laurinum</i> Airy Shaw	Ma kho	DEF, LMF	900-1,500	Jan-Feb	Jun-Sep	PS 1543, 1939, 2342	Radcliffe-Smith (2001)
<i>Cleidion</i> sp.		MDF, DEF	700-800	Mar-Apr		PS 556	
<i>Croton delphyi</i> Gagnep.	Plao	DEF	1,000-1,100	Mar-Apr	Mar-Apr	PS 592	Airy Shaw (1972)
<i>Drypetes dasycarpa</i> (Airy Shaw) Phuph. & Chayamarit	Mak in	LMF	1,500-1,750	Nov-Dec	Nov-Dec	PS 366, 372, 379, 1227, 1234	Phuphathanaphong & Chayamarit (2000)
<i>Glochidion assamicum</i> (Muell. Arg.) Hook.f.	Khi mot	LMF	1,000-1,100	May-Jun	Aug-Sep	PS & C. Maknoi 2084	Airy Shaw (1972); Welzen et al. (2000)
<i>Glochidion rubrum</i> Bl.		LMF, open place	1,200-1,600	May-Jun	Nov-Dec	PS 946, 2626	Airy Shaw (1972); Welzen et al. (2000)
<i>Homonoia riparia</i> Lour.	Khrai nam	DEF, by streams	700	Jan-Dec	Jan-Dec	PS 2519	Airy Shaw (1972); Welzen et al. (2000)
<i>Mallotus khasianus</i> Hook.f.		LMF	1,500-1,800	Jan-Feb	Jul-Feb	PS 467, 496, 501, 972, 979, 1181 1287; PS & S. Wattana 626; PS et al. 60	Airy Shaw (1972); Welzen et al. (2000)
<i>Mallotus paniculatus</i> (Lam.) Muell. Arg.	Soi dao	LMF, RS	1,500-1,600	Aug-Sep	Nov-Dec	PS 2238	Airy Shaw (1972); Welzen et al. (2000)
<i>Mallotus peltatus</i> (Geisel.) Muell. Arg.		DEF, by falls	900-1,000	Mar-Apr	Jul-Aug	PS 598	Airy Shaw (1972);

(continued)

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	References
<i>Mallotus philippensis</i> (Lam.) Muell. Arg.	Ma kai khat	DEF, LMF, roadsides	800-1,100	Jul-Nov	Jan-Mar	PS 258, 354	Airy Shaw (1972); Welzen et al. (2000)
<i>Megistostigma burmanicum</i> (Kurz) Airy Shaw	Han taen	LMF, by streams	1,100-1,200	Oct-Jan	Oct-Jan	PS 1166, 1251	Airy Shaw (1972)
<i>Ostodes paniculata</i> Bl.	Ma khang dong	LMF	1,400-1,700	Feb-Apr	Jun-Sep	PS 542, 1343, 1643; PS & C. Maknoi 2042; PS & S. Watthana 683; PS et al. 761, 830, 2478	Airy Shaw (1972)
<i>Phyllanthus emblica</i> L.	Makham pom	LMF, open place	1,200-1,300	Feb-Mar	Sep-Mar	PS et al. 2450	Airy Shaw (1972)
<i>Phyllanthus urinaria</i> L.	Makham pom di	LMF, roadsides	1,300-1,400	Oct-Nov	Oct-Nov	PS 1122	Airy Shaw (1972)
<i>Sauropus garrettii</i> Craib		DEF	700	Jun-Jul		PS 2516	Airy Shaw (1972)
<i>Trigonostemon thyrsoideus</i> Stapf	Lot thanong luang	DEF, by streams	750-900	Mar-Jun	Jul-Sep	PS 586, 1459, 1601, 1954	Airy Shaw (1972) Fig. 125

FABACEAE (LEGUMINOSAE)

Trees, shrubs, herbs or climbers. **Leaves** simple or compound, alternate, stipulate. **Inflorescence** in racemes, spikes, panicles or heads. **Flowers** usually bisexual, rarely unisexual, zygomorphic or actinomorphic. **Sepals** (3-)5(-6), connate, usually valvate. **Petals** 5, rarely absent, equal or unequal. **Stamens** usually 10, rarely few or more, free or connate into a tube, anthers usually opening by longitudinal slits. Staminodes sometimes present. **Ovary** superior, 1-locular, marginal placentation; ovules (1-)2-many. **Fruit** a pod, dehiscent or not, occasionally breaking up into 1-seeded sections.

A cosmopolitan family with about 642 genera and 18,000 species. A family contains many important foods and ornamentals. About 130 genera and 700 species in Thailand. Nineteen genera and 43 species recorded from Doi Phu Kha National Park.

KEY TO SUBFAMILIES

- | | |
|--|----------------------------|
| 1. Flowers actinomorphic. Corolla valvate | 2. Mimosoideae |
| 1. Flowers zygomorphic. Corolla imbricate | |
| 2. Corolla caesalpinaceous; petals usually free; upper petal innermost | 1. Caesalpinioideae |
| 2. Corolla papilionaceous; two lower petals connate; upper petal outermost | 3. Papilionoideae |

1. CAESALPINIOIDEAE

KEY TO THE GENERA

- | | |
|-----------------------|-----------------------|
| 1. Leaves simple | 2. Bauhinia |
| 1. Leaves compound | |
| 2. Fertile stamens 5 | 1. Acrocarpus |
| 2. Fertile stamens 10 | 3. Caesalpinia |

1. *ACROCARPUS* Wight ex Arn.

Mag. Zool. & Bot. 2: 547. 1839; Larsen, Larsen & Vidal in Fl Thailand 4(1): 50. 1984.

Unarmed, deciduous trees. Stipules small, caducous. **Leaves** bipinnate; leaflets opposite, petiolulate. **Inflorescence** axillary, racemose, 1-3 together, bottlebrush-like. **Flowers** bisexual, pedicellate. Receptacle campanulate. **Sepals** 5, imbricate, subequal. **Petals** 5, subequal. **Stamens** 5, free, exserted; anthers versatile. **Ovary** stipitate; ovules many; style short; stigma small. **Pod** elongate, long-stipitate, narrowly winged. **Seeds** compressed.

Two species in tropical Asia. One species in Thailand (Larsen et al., 1984).

Acrocarpus fraxinifolius Wight ex Arn.

Mag. Zool. & Bot. 2: 547. 1839; Craib in Fl. Siam. Enum. 1: 507. 1928; Larsen, Larsen & Vidal in Fl Thailand 4(1): 50, fig. 10: 6-9, Pl. III: 1. 1984.

Tree up to 30 m high, often with buttresses; bark greyish; young shoots appressed yellowish tomentose. **Leaves** unpaired bipinnate; petioles 5-20 cm long; main rachis 10-60 cm long, pubescent when young, glabrescent; pinnae 3-5 pairs; leaflets 4-9 pairs, ovate to ovate-oblong, 2-15 cm long, 2-7 cm wide, pubescent on lower surface when young, glabrescent, slightly obliquely cuneate at base, acute to acuminate at apex, subsessile. **Racemes** 1-3 together, dense-flowered, 20-25 cm long. **Flowers** reflexed after anthesis; pedicels 4-6 mm long, pubescent. Receptacle 4-6 mm long, pubescent. **Sepals** ovate, 3-4 mm long, pubescent, rounded at apex. **Petals** red, oblong-oblongate, 6-10 mm long, pubescent, obtuse at apex. **Filaments** yellowish orange with green at base, glabrous, thick, twice the length of the petals. **Ovary** glabrous or sparsely hairy at base; ovules 15-20. **Pod** long-stalked, 8-15 cm long, 1-2 cm wide, flatten, slightly torulose, with a 3-5 mm broad wing along the upper suture. **Seeds** pale brown, compressed.

Thailand.— Northern: Chiang Mai, Lamphun, Lampang, Phrae, Nan; North-eastern: Loei; Eastern: Nakhon Ratchasima; South-eastern: Prachinburi.

Distribution.— India (Assam), Sikkim, Myanmar (type), Laos, Indonesia (Sumatra, Java).

Ecology.— Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: January-February, after shedding the leaves; fruiting: April-May.

Uses.— Wood for indoor construction.

Vernacular.— แดงน้ำ Daeng nam (Lampang, Phrae).

Voucher specimens.— *P. Srisanga* 1298.

2. *BAUHINIA* L.

Sp. Pl.: 374. 1753; Larsen & Larsen, Nat. Hist. Bull. Siam Soc. 25: 1. 1973; Larsen, Larsen & Vidal in Fl Thailand 4(1): 4. 1984.

Trees, shrubs or woody climbers with tendrils. Stipules normally early caducous. **Leaves** simple, entire, emarginate, bilobed or divided in 2 free leaflets; midrib often bristly between the lobes; base often with 2 darker alveoles. **Inflorescence** corymbs or panicles. **Flowers** bisexual, rarely unisexual, with a more or less pronounced receptacle. **Sepals** 5, cup-shaped, spathaceous or splitting into free segments during anthesis. **Petals** 5, equal or not. **Stamens** 1-3, 5, 10; anthers usually opening by longitudinal slits, rarely by a central pore; staminodes often present. **Ovary** usually stipitate, rarely sessile. **Pod** dehiscent, rarely indehiscent.

A pantropical genus with about 300 species. About 43 species in Thailand. Five species recorded from Thailand.

KEY TO THE SPECIES

1. Woody climbers with tendrils
 2. Bud small, less than 10 mm long. Petals white
 3. Apex of leaves lobed rounded. Ovary glabrous **1. *B. glauca* subsp. *tenuiflora***
 3. Apex of leaves lobed acute to acuminate. Ovary hairy **3. *B. ornata* var. *subumbellata***
 2. Bud large, more than 10 mm long. Petals creamy white to yellow or orange-brown
 4. Petals creamy white to yellow **2. *B. nervosa***
 4. Petals orange-brown **5. *B. wallichii***
1. Trees or shrubs **4. *B. variegata***

1. *Bauhinia glauca* (Wall. ex Benth.) Benth. subsp. *tenuiflora* (Watt ex C.B. Clarke) K. & S.S. Larsen

Nat. Hist. Bull. Siam Soc 25: 10. 1973; Larsen, Larsen & Vidal in Fl. Thailand 4(1): 41, fig. 8: 7-10, Pl. II: 2. 1984. — *B. tenuiflora* Watt ex C.B. Clarke, J. Linn. Soc. 25: 18, t. 6. 1889; Craib in Fl. Siam. Enum. 1: 530. 1928. — *B. polysperma* Pierre ex Gagnep., Not. Syst. Paris 2: 177. 1912; Craib in Fl. Siam. Enum. 1: 525. 1928.

Woody climber with tendrils; young branches reddish pubescent, glabrescent. Stipules linear, ca. 4 mm long, caducous. **Leaves** ovate to rotundate, 5-9 cm in diam., glabrous on upper surface, sparsely pubescent on lower surface, 9-11-nerved, bifid to 1/5 with narrow sinus; base truncate to cordate; apex of lobes rounded; petioles 1-2(-3) cm long, sparsely pubescent. **Inflorescence** in short, dense corymbs; bracts and bracteoles linear, ca. 5 mm long; pedicels 10-20 mm long, pubescent, with bracteoles inserted near the middle. Buds ovoid, 5-7 mm long, hairy. Receptacle tubular, 2.5-3 cm long, pubescent, striate. **Calyx** splitting into 2-3 reflexed segments. **Petals** white, broadly obovate, subequal, 12-14 mm long, including 2-3 mm long claw, hairy outside. **Fertile stamens** 3; filaments red, 8-12 mm long, glabrous, anthers red, ellipsoid, ca. 2 mm long; staminodes 7, 2 in between the stamens ca. 3 mm long, 5 short, subulate, connate at base. **Ovary** ca. 8 mm long, glabrous, shortly stipitate; style very short; stigma obliquely peltate. **Pod** 18-25 cm long, 3-5.5 cm wide, thin-valved, flat, indehiscent. **Seeds** 10-25, ovate, flattened, 5-8 mm long.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Nan, Phitsanulok; North-eastern: Kalasin, Phetchabun, Sakon Nakhon; Eastern: Chaiyaphum, Nakhon Ratchasima; South-eastern: Chanthaburi.

Distribution.— Myanmar (type), S China, Laos, Cambodia, Vietnam.

Ecology.— Lower montane forest, alt. 1,100-1,500 m (Doi Phu Kha).

Phenology.— Flowering: July-October; fruiting: October-December.

Vernacular.— เสือขาวเครือ Sieo khrua (Northern).

Voucher specimens.— *P. Srisanga* 247, 1707.

2. *Bauhinia nervosa* (Wall. ex Benth.) Baker

In Fl. Br. Ind. 2: 283. 1878; Larsen, Larsen & Vidal in Fl. Thailand 4(1): 35, fig. 8: 1-2. 1984. – *Phanera nervosa* Wall. ex Benth. in Miq., Pl. Jungh.: 262. 1852.

Woody climber with tendrils; young branches brown pubescent. Stipules ovate-auriculate, ca. 6 mm long. **Leaves** ovate to rotundate, 7-8 cm in diam., glabrous on upper surface, brown pubescent on lower surface, 11-13-nerved, bifid to 1/3 with broad sinus; base cordate; apex of lobes rounded to obtuse; petioles 1.5-3 cm long, brown pubescent. **Inflorescence** in axillary or terminal, lax corymbs; bracts lanceolate, ca. 15 mm long; pedicels 3.5-4.5 cm long, brown pubescent, with bracteoles inserted near the middle. Buds obovoid, 1.5-2 cm long, brown pubescent. Receptacle tubular, 1.5-2 cm long, brown pubescent, striate. **Calyx** splitting into 4 reflexed segments, each subequal, 1.5-2.5 cm long, brown pubescent. **Petals** creamy white to yellow, with red at base of standard, ovate-orbicular, subequal, up to 2.5 cm long; claw 8-13 mm long, pubescent. **Fertile stamens** 3; filaments red, 3-4.5 cm long, glabrous, anthers red, 8-10 mm long; staminodes 6, filiform, subequal, up to 7 mm long. **Ovary** 10-14 mm long, densely brown tomentose; stipe 4-7 mm long; style 12-15 mm long, densely brown tomentose; stigma peltate. **Pod** not known.

Thailand.— Northern: Nan, Phitsanulok; North-eastern: Loei.

Distribution.— India (type), Myanmar.

Ecology.— Dry evergreen forest, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: June-July.

Vernacular.— เสี้ยวแก้ว Sieo kao (General).

Voucher specimens.— *P. Srisanga* 1938.

Notes.— Rare species.

3. *Bauhinia ornata* Kurz var. *subumbellata* (Pierre ex Gagnep.) K. & S.S. Larsen

In Fl. C.L.V. 18: 209. 1980; Na Songkhla & Klinratana, Thai For. Bull. (Bot.) 29: 29, fig. 1. 2001. – *B. subumbellata* Pierre ex Gagnep., Not. Syst. Paris 2: 180. 1912. – *B. inflexilobata* Merr., J. Arn. Arb. 21: 369. 1940.

Large woody climber with tendrils; young branches pubescent, glabrescent. Stipules falcate-ovate, ca. 5 mm long, early caducous. **Leaves** ovate to suborbicular, 9-16 cm in diam., glabrous on both surfaces or sparsely puberulous on midrib and veins on lower surface, 11-13-nerved, bifid to 1/3 with narrow sinus; base cordate; apex of lobes acute to acuminate; petioles 5-11 cm long, sparsely pubescent. **Inflorescence** in axillary or terminal corymbs, hairy; bracts subulate, pubescent outside; pedicels 4-6 cm long, sparsely hairy, with minute bracteoles inserted below or at most at the middle. Buds ovoid, 6-8 mm long, hairy. Receptacle tubular, 6-8 mm long, sparsely hairy, striate. **Calyx** splitting into 2-4(-5) reflexed segments, 8-10 mm long, glabrous inside, puberulous outside. **Petals** white, suborbicular to obovate, unequal, 2.2-2.5 cm long, 1-1.8 cm wide, including 3-6 mm long claw, hairy outside. **Fertile stamens** 3; filaments 15-18 mm long, pilose at base, anthers oblong, 5-6 mm

long; staminodes 2. **Ovary** oblong, 7-9 mm long, golden-brown pubescent; stipe 1-1.5 mm long; style 7-8 mm long, glabrous; stigma peltate. **Pod** 18-30 cm long, 4.5-7 cm wide, flat, dehiscent. **Seeds** 8-12, ovate, flattened, 2-2.6 cm long (Fig. 126).

Thailand.— Northern: Chiang Rai, Nan.

Distribution.— Laos (type), Vietnam.

Ecology.— Dry evergreen forest, by streams, alt. 800-850 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: January-March.

Vernacular.— เสี้ยวเครือ Sieo khrua (Northern).

Voucher specimens.— *P. Srisanga* 1281, 1325.

Notes.— Rare species. Pod describes for the first time.

4. *Bauhinia variegata* L.

Sp. Pl.: 375. 1753; Craib in Fl. Siam. Enum. 1: 531. 1928; Larsen & Larsen, Nat. Hist. Bull. Siam Soc. 25: 18. 1973; Larsen, Larsen & Vidal in Fl Thailand. 4(1): 11, fig. 1: 4-5, Pl. I: 1. 1984. – *B. candida* Ait. Hort. Kew. 2: 49. 1789. – *Phanera variegata* (L.) Benth. in Miq., Pl. Jungh.: 262. 1852.

Deciduous tree or shrub up to 15 m high; young branches pubescent, glabrescent. Stipules minute, 1-2 mm long, early caducous. **Leaves** broadly ovate to subrotundate, 6-16 cm in diam., glabrous and glaucous on upper surface, sparsely puberulous on lower surface, 11-13-nerved, bifid to $\frac{1}{4}$ - $\frac{1}{3}$ with broad sinus; base cordate; apex of lobes rounded; petioles 3-4 cm long, glabrous. **Inflorescence** in short, lateral racemes, mainly on the old branches, few-flowered; pedicels short, stout, ca. 5 mm long. Bracts and bracteoles minute, triangular. Buds fusiform, 3-4 cm long. Receptacle ca. 15 mm long. **Calyx** spathaceous. **Petals** white or purple, obovate, unequal, 4-5.5 cm long, short-clawed. **Fertile stamens** 5, unequal; filaments 2-4 cm long; anthers 6-7 mm long. **Ovary** ca. 2 cm, pubescent mainly on the sutures; stipe ca. 1.5 cm long; style ca. 1 cm long; stigma small, capitate. **Pod** dehiscent, obliquely striate, 20-30 cm long, 2-2.5 cm wide. **Seeds** 10-25, flattened, 10-15 mm in diam. (Fig. 127).

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan; South-western: Kanchanaburi.

Distribution.— India (type), Myanmar, S China, Laos, N Vietnam.

Ecology.— Tropical mixed deciduous, dry evergreen and lower montane forest, often as a dominant, alt. 500-1,400 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: January-March; fruiting: March-April.

Uses.— Young leaves and flowers edible.

Vernacular.— เสี้ยวดอกขาว Sieo dok khao (Northern).

Voucher specimens.— *P. Srisanga* 490.

5. *Bauhinia wallichii* J.F. Macbr.

Contrib. Gray Herb. n.s. 59: 23. 1919; Larsen, Larsen & Vidal in Fl. C.L.V. 18: 194, Pl. 34: 1-3. 1980; Larsen, Thai For. Bull. (Bot.) 27: 25, figs. 1-3. 1999. – *Phanera macrostachya* Benth. in Miq., Pl. Jungh.: 262. 1852. – *Bauhunia melanophylla* Merr., J. Arn. Arb. 23: 172. 1942.

Large woody climber with tendrils; young branches furrowed, glabrescent. Stipules oblong, ca. 4.5 mm long, 1.3 mm wide, glabrous inside, sparsely hairy outside, early caducous. **Leaves** ovate to suborbicular, 6-16 cm in diam., glabrous on upper surface, sparsely hairy on lower surface particularly on the nerves when young, glabrescent, 9-11-nerved, subentire with a sinus less than 3 mm to bifid 1/5 with broad sinus; base cordate; apex of lobes acute to acuminate; petioles 3-6 cm long, sparsely pubescent to glabrous. **Inflorescence** in terminal racemes, up to 20 cm long, pubescent; bract lanceolate, acuminate, ca. 3 mm long, hairy outside; pedicels 10-15 mm long, pubescent, with minute bracteoles inserted above the middle. Buds ovoid, ca. 10 mm long, densely light brown pubescent. Receptacle asymmetrical campanulate, 5-7 mm long, slightly curved, striate. **Calyx** cup-shaped; lobes 5, ca. 4 mm long, obtuse. **Petals** orange-brown, ovate to orbicular, subequal, 5-8 mm long, with 2-4 mm long claw, densely light brown silky on both sides. **Fertile stamens** 3; filaments ca. 2 cm long; anthers ca. 2 mm long; staminodes 7, 5 jointed to form a digitate body 3-4 mm long, 2 minute. **Ovary** ca. 10 mm, densely brownish pubescent; stipe short; style ca. 1 cm long, glabrous; stigma small. **Pod** 10 cm long, 3 cm wide, flat, dehiscent. **Seeds** ca. 4, ovate, flattened, ca. 1 cm long.

Thailand.— Northern: Nan.

Distribution.— India (Assam-type), Myanmar, S China (Yunnan), N Vietnam.

Ecology.— Dry evergreen and lower montane forest, by streams, alt. 600-1,200 m (Doi Phu Kha).

Phenology.— Flowering: April-May; fruiting: November-December.

Voucher specimens.— *P. Srisanga* 2609; *R. Pooma* 1503 (BKF).

Notes.— Rare species.

3. *CAESALPINIA* L.

Sp. Pl.: 380. 1753; Vidal & Hul Thol, Bull. Mus. Natn. Hist. Natn. Paris 395 (Bot. 27): 71. 1976; Larsen, Larsen & Vidal in Fl Thailand 4(1): 61. 1984. – *Mezoneuron* Desf., Mem. Mus. Hist. Nat. Paris 4: 245. 1818.

Climbers, shrubs or small trees, usually prickly. Stipules present or absent, persistent or caducous. **Leaves** alternate, bipinnate; rachis often prickly; pinnae opposite, usually even in number; leaflets opposite or alternate, sessile or petiolulate. **Inflorescence** axillary or terminal, paniculate or racemose. **Flowers** usually bisexual. Receptacle short, persistent or shed. **Sepals** 5, usually unequal, the lowest one hood-shaped, imbricate. **Petals** 5, unequal, the upper one (standard) different in shape and size, sometimes with a liguliform appendage. **Stamens** 10, free, equal or alternately unequal, mostly hairy at the base. **Ovary** pubescent or glabrous, sessile or shortly

stalked; ovules 1-10; style slender; stigma terminal, funnel-shaped or bilobed. **Pod** dehiscent or indehiscent, thin or thick, winged or wingless, sometimes spiny, twisted or furrowed. **Seeds** globose or flattened, orbicular, elliptic or reniform in outline.

A pantropical genus with about 100 species. Eighteen species in Thailand (Larsen et al., 1984). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaflets 4-5 pairs, 5-10 cm long, 3-6 cm wide, acute to acuminate at apex
1. *C. cucullata*
1. Leaflets 6-8 pairs, 1.2-2.5 cm long, 0.6-1.5 cm wide, rounded-emarginate at apex
2. *C. hymenocarpa*

1. *Caesalpinia cucullata* Roxb.

Fl. Ind. ed. 2, 2: 358. 1832; Larsen, Larsen & Vidal in Fl Thailand 4(1): 82, fig. 21: 5-8. 1984. – *Mezoneurum cucullatum* (Roxb.) Wight & Arn., Prodr.: 283. 1834; Craib in Fl. Siam. Enum. 1: 499. 1928. – *M. cucullatum* var. *robustum* Craib in Fl. Siam. Enum. 1: 499. 1928.

Woody climber, strongly armed with recurved prickles. Stipules wanting. **Leaves:** rachis 15-30 cm long; pinnae 2-5 pairs; leaflets 4-5 pairs, opposite, ovate, 5-10 cm long, 3-6 cm wide, glabrous, obliquely rounded to cuneate at base, acute to acuminate at apex; petiolules 2-4 mm long. **Racemes** axillary and combined into large terminal panicles, glabrous. Bracts early caducous. Pedicels 4-10 mm long, glabrous. **Sepals** glabrous, the lowest one hood-shaped. **Petals** orange-yellow; standard reddish, bilobed, butterfly-shaped. **Filaments** short hairy at base. **Ovary** glabrous, stipitate; ovules 1(-2). **Pod** elliptic-oblong, 8-13 cm long, 3-4 cm wide, including 5-8 mm wide wing, yellow, shiny. **Seeds** 1(-2).

Thailand.— Northern: Lampang, Nan; North-eastern: Loei; Eastern: Nakhon Ratchasima; South-eastern: Chanthaburi; South-western: Ratchaburi.

Distribution.— India (Assam-type), Nepal, Sikkim, S China (Yunnan), SE Asia, Andaman Islands.

Ecology.— Lower montane forest, alt. 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering: October-November; fruiting: January-March.

Vernacular.— กำแพง Kam chai (Northern).

Voucher specimens.— *P. Srisanga* 357, 502, 1890.

2. *Caesalpinia hymenocarpa* (Prain) Hattink

Reinwardtia 9: 35. 1974; Larsen, Larsen & Vidal in Fl Thailand 4(1): 79, fig. 20: 8-12. 1984. – *Mezoneurum hymenocarpum* Jacks, nom. nud.; Craib in Fl. Siam. Enum. 1:

500. 1928. — *Mezoneuron hymenocarpum* Prain, J. As. Soc. Beng. 66: 233, 472. 1897.
— *M. laoticum* Gagnep., Not. Syst. Paris 2: 208. 1912.

Woody climber, armed with recurved prickles. Stipules scale-like, minute. **Leaves:** rachis 20-40 cm long; pinnae 6-10 pairs; leaflets 6-8 pairs, opposite or subopposite, obovate, 1.2-2.5 cm long, 0.6-1.5 cm wide, pubescent, sometimes glabrescent, obliquely rounded at base, rounded-emarginate at apex; petiolules ca. 1 mm long. **Racemes** axillary and combined into terminal panicles. Bracts early caducous. Pedicels 8-15 mm long, pubescent. **Sepals** pubescent, the lowest one hood-shaped. **Petals** yellow; standard orbicular with a claw protracted into a glabrous, bilobed ligule. **Filaments** hairy. **Ovary** glabrous, shortly stipitate; ovules 4-6. **Pod** lanceolate, 10-15 cm long, 2.5-3.5 cm wide, including 6-12 mm wide wing, red, shiny. **Seeds** 3-6.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Phrae, Nan, Sukhothai, Tak; Eastern: Chaiyaphum, Nakhon Ratchasima; South-eastern: Chonburi, Chanthaburi; Central: Saraburi; South-western: Kanchanaburi; Peninsular: Ranong, Nakhon Si Thammarat.

Distribution.— Sri Lanka, Myanmar (type), S China (Yunnan), Laos, Cambodia, Vietnam, Andaman Islands, Malay Archipelago.

Ecology.— Dry evergreen forest, open places, secondary forest, roadsides, alt. 800-1,100 m (Doi Phu Kha).

Phenology.— Flowering: July-September; fruiting: October-December.

Vernacular.— หนามจันทน์ Nam chan (Northern).

Voucher specimens.— *P. Srisanga* 250, 298.

2. MIMOSOIDEAE

KEY TO THE GENERA

1. Trees. Inflorescence pedunculate heads, umbels or corymbs. Stamens numerous
 2. Staminal tube longer than the corolla tube. Pod straight, flattened; seeds with distinct pleurogram **1. *Albizia***
 2. Staminal tube as long as the corolla tube or shorter. Pod straight to spirally curved, compressed or turgid; seeds without pleurogram **2. *Archidendron***
1. Scandent shrubs or lianas. Inflorescence spikes or spiciform racemes. Stamens 10 **3. *Entada***

1. *ALBIZIA* Durazzini

Mag. Tosc. 3(4): 11. 1772; Nielsen, Adansonia, sér. 2, 19: 204. 1979; in Fl. C.L.V. 19: 74. 1981; in Fl. Thailand 4(2): 181. 1985. — *Serialbizzia* Kosterm., Bull. Organ. Natuurw. Onderz. Indonesie 20: 15. 1954.

Trees, shrubs or sometimes scandent shrubs to climbers, rarely armed with recurved hooks from the bases of the leaf-scars. Stipules herbaceous, very often caducous, rarely spinescent. **Leaves** bipinnate, not sensitive, with glandular rachis and pinnae; leaflets opposite. **Inflorescence** in pedunculate heads, umbels or corymbs, erect, most often two kinds of flowers in the heads or corymbs (when only 1 kind of flower present, the staminal tube longer than the corolla tube). **Flowers** bisexual, the central perhaps functionally male, sessile or pedicellate. **Sepals** 5, united. **Petals** (4-)5, united. **Stamens** numerous, the lower part of the filaments united in a tube; anthers eglandular, glabrous. **Pod** straight, flattened, dehiscent or indehiscent; endocarp not separate from exocarp. **Seeds** brown, with distinct pleurogram.

About 150 species, mainly in tropical regions. Thirteen native species in Thailand (Nielsen, 1985). One species recorded from Doi Phu Kha National Park.

Albizia chinensis (Osborne) Merr.

Am. J. Bot. 3: 575. 1916; Nielsen, *Adansonia*, sér. 2, 19: 221. 1979; in Fl. C.L.V. 19: 84, Pl. 15: 1-6. 1981; in Fl. Thailand 4(2): 188, fig. 46: 1-6, Pl. V: 4, VI: 1. 1985. — *Mimosa chinensis* Osb. *Dagb. Ostind. Resa*: 233. 1757. — *Acacia stipulata* DC., *Prodr.* 2: 469. 1825. — *Albizia stipulata* (DC.) Boivin, *Enc. 19^e Siecle* 2: 33. 1838; Bak. in Fl. Br. Ind. 2: 300. 1878; Gagnep. in Fl. Gén. I.-C. 2: 87. 1913; Craib in Fl. Siam. Enum. 1: 557. 1928.

Tree, up to 20 m high; branchlets terete, puberulous to tomentose, glabrescent. Stipules up to 1.5 cm long, 3 cm wide, auriculate, early caducous. **Leaves**: rachis 10-25 cm long; gland just below the junctions of the pinnae, ca. 3 mm long, flat to suburceolate; pinnae 4-14 pairs, 4-10 cm long; leaflets (10-)20-30 pairs, opposite, asymmetrical oblong, chartaceous, up to 1 cm long, 0.3 cm wide, sessile, faintly sericeous on both surfaces; base truncate; apex acute; midrib forming the upper margin or nearly so; lateral veins prominent. **Inflorescence** in terminal panicles, 10-15 cm long or solitary pedunculate head with 3-4 together in clusters; peduncle 1-3 cm long, puberulous to tomentose, bearing a head of 10-20 sessile dimorphic flowers: central flower (slightly larger) and marginal flowers (slightly smaller). **Calyx** 2.5-5 mm long, tubular to narrowly funnel-shaped, puberulous to tomentose; lobes small, deltoid, acute at apex. **Corolla** white, funnel-shaped, 7-10 mm long, puberulous to tomentose; lobes 2-2.5 mm long, ovate, acute at apex. **Staminal tube** slightly longer than corolla tube. **Ovary** glabrous, sessile. **Pod** oblong, up to 15 cm long, 2 cm wide, chartaceous, light brown, indehiscent. **Seeds** ellipsoid, flattened, 6-7 mm long, 4-5 mm wide, ca. 1 mm high.

Thailand.— Northern: Chiang Mai, Lampang, Phrae, Nan, Phitsanulok; North-eastern: Loei; South-western: Kanchanaburi.

Distribution.— India, Sri Lanka, Myanmar, China (type), Laos, Cambodia, Vietnam, Indonesia.

Ecology.— Lower montane forest, alt. 1,200-1,300 m (Doi Phu Wae).

Phenology.— Flowering: March-April; fruiting: November-December.

Vernacular.— กางหลวง Kang luang (Northern).

Voucher specimens.— *P. Srisanga* 449.

2. *ARCHIDENDRON* F. v. Mueller

Fragm. Phyt. Austr. 5: 59. 1865; Nielsen, Adansonia, sér. 2, 19: 10. 1979; in Fl. C.L.V. 19: 112. 1981; Nielsen, Baretta-Kuipers & Guinet, Opera Bot. 76: 30. 1984 (revision); Nielsen in Fl. Thailand 4(2): 206. 1985.

Trees or shrubs, unarmed. Stipules usually inconspicuous, caducous, or absent. **Leaves** bipinnate, not sensitive, most often with glands on petiole, rachis and pinnae; leaflets opposite or alternate, but at least the terminal ones opposite. **Inflorescence** axillary or terminal, sometimes cauliflorous, in pedunculate heads, umbels or corymbs, simple or compound and then collected in panicles. **Flowers** uniform, bisexual or unisexual. **Sepals** 5, united; lobed valvate. **Petals** 5, united; lobes valvate. **Stamens** numerous; filaments united into a tube, shorter than or as long as the corolla tube; anthers eglandular, glabrous. **Ovary** sessile or stipitate, glabrous or puberulous. **Pod** compressed or turgid, straight to spirally curved, dehiscing along both sutures. **Seeds** funiculate, without aril or pleurogram.

About 100 species in Asia, Australia and Pacifics (Nielsen et al., 1984; Nielsen, 1985). About 12 species in Thailand. Four species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|--------------------------------|
| 1. Branchlets terete | |
| 2. Pod woody, turgid, straight or slightly curved, never contorted in a spiral | |
| 3. Pod oblong, 9-14 cm long, ca. 4.5 cm wide | 1. <i>A. alternifoliolatum</i> |
| 3. Pod cylindric, 5-8 cm long, ca. 2 cm wide | 3. <i>A. aff. laoticum</i> |
| 2. Pod coriaceous, compressed, contorted in a spiral | 4. <i>A. lucidum</i> |
| 1. Branchlets angular | 2. <i>A. clypearia</i> |

1. *Archidendron alternifoliolatum* (T.L. Wu) Nielsen

Acta Phytotax. Sin. 21(2): 164. 1983; Nielsen, Baretta-Kuipers & Guinet, Opera Bot. 76: 77. 1984. – *Cylindrokelupha alternifoliolata* T.L. Wu, Acta Phytotax. Sin. 19(2): 219, Pl. 9: 3. 1981. – *Albizia alternifoliolata* (T.L. Wu) Y.H. Huang, Acta Bot. Yunnan. 5(2): 139. 1983.

Tree, 10-15 m high; branchlets terete with longitudinal ridges, brownish, lenticellate, puberulous to glabrous. **Leaves**: rachis (7-)9-12 cm long, puberulous to glabrescent; gland 2-4.5 cm above the base, ca. 1 mm long, sessile, elliptic or circular in outline; pinnae 1-2 pairs, 5-15 cm long, puberulous; glands 1-3 mm below the junctions of the petiolules, 0.5-1 mm in diam., circular, often with raised margins;

leaflets (2-)3(-4) pairs, proximal pairs alternate, distal pair always opposite, lanceolate to elliptic, chartaceous, 6-19 cm long, 2.5-6 cm wide, glabrous on both surfaces or with few hairs along midrib and leaf base; base cuneate often asymmetrical; apex acuminate; midrib and veins prominent on lower surface; petiolule 2-4 mm long, puberulous. **Inflorescence** axillary and terminal panicles, up to 12 cm long, puberulous; peduncle 0.8-2 cm long, puberulous to sericeous, bearing a head of 15-22 sessile or subsessile flowers, each subtended by a ca. 1 mm long, triangular, sericeous bract. **Calyx** 2-2.5 mm long, funnel-shaped, sericeous; lobes triangular. **Corolla** white, funnel-shaped, 5-6 mm long, sericeous; lobes 1.5-2 mm long. **Staminal tube** shorter than corolla tube, 2-2.5 mm long. **Ovary** 1.5-2 mm long, glabrous, stipitate; stipe ca. 1.5 mm long, glabrous. **Pod** woody, turgid, oblong, straight or slightly curved, never contorted in a spiral, 9-14 cm long, ca. 4.5 cm wide, glabrous, dehiscent along both sutures. **Seeds** ca. 5-7, ellipsoid, flattened, discoid, ca. 2.8 cm long, 2 cm wide, 1-2 cm high, the terminal ones turbinate-truncate (Figs. 36, 128).

Thailand.— Northern: Nan.

Distribution.— S China (Yunnan-type).

Ecology.— Lower montane forest, alt. 1,500-1,650 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: July-September.

Voucher specimens.— *P. Srisanga* 539, 1990; *P. Srisanga et al.* 792; *R. Pooma* 1388 (CMU).

Notes.— Rare species, new recorded for Thailand.

2. *Archidendron clypearia* (Jack) Nielsen

Adansonia, sér. 2, 19: 15. 1979; in *Fl. C.L.V.* 19: 115, Pl. 21: 1-5. 1981; Nielsen, Baretta-Kuipers & Guinet, *Opera Bot.* 76: 52. 1984; Nielsen in *Fl. Thailand* 4(2): 208, fig. 52: 1-5. 1985. — *Inga clypearia* Jack, *Mal. Misc.* 2(7): 78. 1822. — *Pithecellobium clypearia* (Jack) Benth., *J. Bot.* 3: 209. 1844; Bak. in *Fl. Br. Ind.* 2: 305. 1878; Gagnep. in *Fl. Gén. I.-C.* 2: 106. 1913; Craib in *Fl. Siam. Enum.* 1: 557. 1928. — *P. angulatum* Benth., *J. Bot.* 3: 208. 1844; Bak. in *Fl. Br. Ind.* 2: 306. 1878; Gagnep. in *Fl. Gén. I.-C.* 2: 106. 1913; Craib in *Fl. Siam. Enum.* 1: 557. 1928.

Shrub or small tree, up to 8 m high; branchlets angular to winged by decurrent ridges, brownish, puberulous to tomentose. **Leaves**: rachis 20-30 cm long, puberulous to tomentose; gland 1.5-2 cm above the base, 3-5 mm long, sessile to stipitate, elliptic or circular in outline; pinnae 1-10 pairs, 2-15 cm long, puberulous to tomentose; glands below the junctions of the petiolules, 0.5-1 mm in diam., circular, flat to slightly concave, stipitate; leaflets 3-10 pairs, opposite, ovate to trapezoid, chartaceous, 1-8 cm long, 0.5-4 cm wide, puberulous on both surfaces; base cuneate often asymmetrical; apex acuminate; midrib and veins prominent on lower surface; petiolule 0.5-2 mm long, puberulous. **Inflorescence** terminal panicles; peduncle 1-2.5 cm long, puberulous or tomentose, bearing a head of ca. 10 pedicellate flowers. **Calyx** 1-3 mm long, cup-shaped to funnel-shaped, sericeous; lobes triangular. **Corolla** white, funnel-shaped, 5-6 mm long, sericeous; lobes 0.5-1 mm long. **Staminal tube** as long as corolla tube. **Ovary** ca. 1.5 mm long, puberulous to sericeous, stipitate; stipe 1-1.5 mm long. **Pod** up to 20 cm long, ca. 1 cm wide,

compressed, contorted in a spiral, somewhat sinuate between the seeds, coriaceous, yellowish orange outside, reddish inside, puberulous to tomentose, dehiscent first along ventral suture. **Seeds** dangling from the funicle after dehiscence, ellipsoid to subglobose, 6-10 mm long and wide, 6-7 mm high.

Thailand.— Almost throughout the country.

Distribution.— India, China, SE Asia (Penang-type).

Ecology.— Dry evergreen and lower montane forest, often in disturb areas, along roadsides, alt. 1,000-1,400 m (Doi Phu Kha, Doi Phu Huat).

Phenology.— Flowering: December-March; fruiting: April-July.

Vernacular.— มะขามป่น Ma kham pae (Lampang).

Voucher specimens.— *P. Srisanga* 394, 488, 516; *P. Srisanga et al.* 2487.

3. *Archidendron aff. laoticum* (Gagnep.) Nielsen

Small tree, 4 m high; branchlets terete with longitudinal ridges, brownish, puberulous to glabrous. **Leaves:** rachis ca. 5 cm long, puberulous to glabrescent; gland ca. 1.5 cm above the base, ca. 3 mm long, sessile, elliptic in outline; pinnae 1 pairs, 10-13 cm long, glabrous; leaflets 2-3 pairs, proximal pairs alternate or opposite, distal pair always opposite, elliptic, chartaceous, 6-15 cm long, 3-7 cm wide, glabrous on both surfaces; base cuneate often asymmetrical; apex acuminate; midrib and veins prominent on lower surface; petiolule 2-4 mm long, glabrous. **Flowers** not known. **Pod** woody, turgid, cylindric, 5-8 cm long, ca. 2 cm wide, glabrous, dehiscent along both sutures. **Seeds** (1-)4-8(-9), broadly ellipsoid, flattened, discoid, 1.6-2.3 cm long and wide, 0.8-1.2 cm high.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen and lower montane forest, alt. 1,000 m (Tham Pha Kaow).

Phenology.— Fruiting: June-July.

Voucher specimens.— *P. Srisanga* 2552.

Notes.— Closed to *A. laoticum*. Due to lacking flower materials. The affinity is uncertain.

4. *Archidendron lucidum* (Benth.) Nielsen

Adansonia, sér. 2, 19: 19. 1979; in Fl. C.L.V. 19: 120, Pl. 21: 9-11. 1981; Nielsen, Baretta-Kuipers & Guinet, Opera Bot. 76: 72. 1984; Nielsen in Fl. Thailand 4(2): 214, fig. 53: 6-8. 1985. — *Pithecellobium lucidum* Benth., J. Bot. 3: 207. 1844; Gagnep. in Fl. Gén. I.-C. 2: 100. 1913.

Tree, 8-10 m high; branchlets terete, puberulous to glabrescent. **Leaves:** rachis 1-10 cm long, puberulous to glabrescent; gland 0.5-2 cm above the base, ca. 0.5 mm long, sessile to substipitate, circular in outline, with raised margin; pinnae 1-2 pairs, 8-15 cm long, puberulous; glands ca. 0.5 cm below the junctions of the petiolules, similar to rachis gland; leaflets 3-4 pairs, proximal pairs alternate, distal pair always

opposite, lanceolate, ovate to subtrapezoid, chartaceous, 6-10 cm long, 2-4 cm wide, glabrous on both surfaces, sometimes sparsely puberulous on lower surface; base cuneate often asymmetrical; apex acuminate; midrib and veins prominent on lower surface; petiolule 2-4 mm long, puberulous. **Inflorescence** axillary and terminal panicles, up to 20 cm long, puberulous; peduncle 1-2 cm long, puberulous, bearing a head of ca. 15 sessile flowers. **Calyx** 1.5-2 mm long, funnel-shaped, sericeous; lobes small, triangular. **Corolla** white, funnel-shaped to campanulate, 4-5 mm long, sericeous; lobes 1.5-2 mm long. **Staminal tube** slightly shorter than corolla tube, 2-2.5 mm long. **Ovary** ca. 1 mm long, glabrous, stipitate; stipe ca. 1 mm long, glabrous. **Pod** up to 20 cm long, 2-3 cm wide, compressed, contorted in a spiral, coriaceous, brownish red outside, reddish orange inside, glabrous, dehiscent along both sutures. **Seeds** dangling from the funicle after dehiscence, ellipsoid, 11-13 mm long, 7-8 mm wide.

Thailand.— Northern: Nan; North-eastern: Loei; Central: Nakhon Nayok.

Distribution.— China (type), Laos, Cambodia, Vietnam.

Ecology.— Lower montane forest, alt. 1,300 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: July-September.

Voucher specimens.— *P. Srisanga* 2710.

3. *ENTADA* Adans.

Fam. 2: 318. 1763; Nielsen in Fl. C.L.V. 19: 17. 1981; in Fl. Thailand 4(2): 141. 1985. – *Pusaetha* Kuntze, Rev. Gen. Pl. 1: 204. 1891. – *Entadopsis* Britton & Rose in N. Am. Fl. 23: 191. 1928.

Scandent shrubs or lianas, unarmed. Stipules not spinescent. **Leaves** bipinnate, not sensitive; rachis and pinnae glandless; the terminal pinnae transformed into tendrils; leaflets opposite. **Inflorescence** axillary or supra-axillary, spikes or spiciform racemes, erect. **Flowers** bisexual or unisexual with only male, uniform. **Sepals** 5, united; lobes valvate. **Petals** 5, free or shortly united at the base. **Stamens** 10, fertile, free; anthers glabrous with a caducous, subsessile to stipitate gland on the apex of the connective. **Ovary** sessile to shortly stipitate, glabrous. **Pod** straight or curved to spirally twisted; valves splitting transversely at maturity into 1-seeded segments; exocarp loosening, leaving the persisting endocarp as a closed envelope around the seed; the segments falling away from the suture, which persists as an empty frame. **Seeds** globular to compressed, with or without pleurogram.

About 30 species, mainly in tropical region (Nielsen, 1985). Four species in Thailand (Nielsen, 1985; Chuakul & Nielsen, 1998). One species recorded from Doi Phu Kha National Park.

Entada rheedei Spreng. subsp. *sinohimalensis* (Grierson & Long) Panigrahi

Taxon 34(4): 714. 1985; Grierson & Long in Fl. Bhutan 1(3): 638. 1987. – *E. pursaetha* DC. subsp. *sinohimalensis* Grierson & Long, Notes Roy. Bot. Gard. Edinb. 37(2): 348. 1979; Nielsen in Fl. C.L.V. 19: 24, Pl. 3: 7-8. 1981. – *E. scandens* auct. non (L.) Benth.: Baker in Fl. Br. Ind. 2: 287. 1878, pro parte. – *E. laotica* Gagnep.,

Bull. Soc. Bot. France 99: 46. 1952; Nielsen, *Adansonia*, sér. 2, 19(3): 342. 1980. – *E. "Entity C"* Brenan, Kew Bull. 1955: 165. 1955.

Woody climber; branchlets terete with longitudinal shallow grooves, brown puberulous to velutinous. **Leaves:** rachis 5-8 cm long, brown puberulous to velutinous; pinnae (1-)2 pairs, (4-)6-10(-15) cm long, brown puberulous to velutinous; leaflets (4-)5-6 pairs, opposite or subopposite, distal pair usually larger than proximal pairs, elliptic, oblong to narrowly obovate, (1.3-)2-4(-5.5) cm long, 1-2.3 cm wide, puberulous on both surfaces, especially along midrib and margin; base rounded to subcordate, often asymmetrical; apex rounded, obtuse to broadly acute; petiolule 0.5-2 mm long, densely puberulous. **Inflorescence** spikes, solitary in the leaf axils or sometimes more spikes from a short-shoot; rachis 8.5-15 cm long, brown puberulous to velutinous. **Flowers** foetid, sessile, each subtended by a ca. 1 mm long, brown puberulous to velutinous bract. **Calyx** green, campanulate, 1-1.3 mm long, brown puberulous to velutinous; lobes broad triangular. **Petals** yellowish, elliptic, 2-3 mm long, glabrous. **Stamens** white; filaments 5-6 mm long; anthers ca. 0.8 mm long. **Ovary** ca. 1 mm long, glabrous, sessile or subsessile. **Pod** straight to slightly curved, oblong, up to 2 m long, 7-15 cm wide; endocarp and exocarp woody. **Seeds** subcircular, flattened, ca. 4 cm long and wide, 1-1.5 cm thick (Fig. 37).

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— Nepal, Sikkim, NE India, Bangladesh, S China (Yunnan), Laos.

Ecology.— Lower montane forest, often in open disturbed places, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: February-June; fruiting: September-October.

Voucher specimens.— *P. Srisanga* 1418; *P. Srisanga* & *S. Watthana* 643; *R. Pooma*, *Mauric* & *Greijmans* 1409 (CMU).

Notes.— New recorded for Thailand.

3. PAPILIONOIDEAE

Annotated Checklist of Papilionoideae

The following checklist includes Papilionoideae collected from this study between 1998 and 2003. The genera are arranged alphabetically as well as for the species within the genera. Voucher specimens were also compared with the materials deposited at QBG. Thirteen genera and 29 species recorded from Doi Phu Kha National Park (Table 10).

All rights reserved

Table 10. Checklist of Fabaceae-Papilionoideae of Doi Phu Kha National Park.

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	References
<i>Cajanus goensis</i> Dalz.	Khruea khao khon, Paep Phi	LMF, roadsides	1,300-1,400	Feb-Mar		PS 487, PS et al. 2491	Thuan (1979); Lock & Heald (1994)
<i>Campylotropis pinetorum</i> (Kurz) Schindl.	Thua khao	LMS, open places	1,700	Nov-Dec	Dec-Jan	PS 411, 1834, 2656	Thuan et al. (1987)
<i>Clitoria mariana</i> L.		LMF	1,500	Aug-Sep	Oct-Nov	PS 2157	Thuan (1979)
<i>Crotalaria alata</i> D. Don	Hing men noi	MDF, DEF	1,000	Aug-Sep	Aug-Sep	PS 2179	Niyomdham (1978)
<i>Crotalaria assamica</i> Benth.	Ma hing nam	DDF, LMF, LMS	450-1,700	Jun-Dec	Jun-Dec	PS 1501, 2212, 2291; PS et al. 858	Niyomdham (1978)
<i>Crotalaria bracteata</i> Roxb. ex DC.	Ma hing dong	DDF	450-600	Oct-Dec	Oct-Dec	PS 2284	Niyomdham (1978)
<i>Crotalaria ferruginea</i> Graham ex Benth.	Tan fak	LMS, open places	1,700-1,800	Nov-Jan	Nov-Jan	PS 444	Niyomdham (1978)
<i>Crotalaria kurzii</i> Baker ex Kurz	Ma hing nok	DDF	500	Oct-Dec	Dec-Feb	PS 2275	Niyomdham (1978)
<i>Crotalaria sessiliflora</i> L.	Phuang khon	DDF	500	Oct-Dec	Dec-Feb	PS 2281	Niyomdham (1978)
<i>Crotalaria tetragona</i> Roxb. ex Anderl.	Khang lueai	MDF	800	Oct-Dec	Dec-Feb	PS 2275	Niyomdham (1978)
<i>Dalbergia culirata</i> Graham ex Benth.	Ket khao khwai	DEF, LMF	800-1,300	Feb-Mar	Jun-Aug	PS et al. 893, 2449	Niyomdham (2002)
<i>Dalbergia kingiana</i> Prain		LMF	1,250-1,650	Oct-Mar	Jan-May	PS 523, 1615, 2379	Niyomdham (2002)
<i>Dalbergia nigrescens</i> Kurz var. <i>saigonensis</i> (Pierre) Gagnep.	Kra phi	DEF, PF	1,000-1,100		Feb-Mar	PS 506	Niyomdham (2002)
<i>Dalbergia oliveri</i> Gamble ex Prain	Chingchan	DEF, OP	800-900	Feb-Apr	Jun-Aug	PS et al. 894	Niyomdham (2002)
<i>Dalbergia ovata</i> Graham ex Benth.	Du dong	DEF, LMF, RS	1,000-1,300	Jan-Feb	Mar-Jun	PS 593, 2721	Niyomdham (2002)
<i>Dalbergia stipulacea</i> Roxb.	Kham khrua	DEF	1,000	Mar-Apr	Jun-Jul	PS 2553	Niyomdham (2002)

(continued)

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	References
<i>Dalbergia velutina</i> Benth.		DEF, LMF, roadsides	1,000-1,100	Feb-Mar	Mar-Apr	PS 591, 594	Niyomdham & Ho (1996); Niyomdham (2002)
<i>Dalbergia volubilis</i> Roxb.	Khrua maet	DEF, LMF	1,000-1,100		Feb-Mar	PS 515	Niyomdham (2002)
<i>Desmodium oblatum</i> Baker ex Kurz		DDF, MDF	400-500	Sep-Nov	Nov-Jan	PS 2286	Dy Phon et al. (1994)
<i>Desmodium oblongum</i> Wall. ex Benth.	Ya kae hak lueang	DDF, LMF, LMS	500-1,700	Aug-Dec	Dec-Mar	PS 2144, 2280	Dy Phon et al. (1994)
<i>Desmodium repandum</i> (Vahl) DC.		DDF, MDF	400-500	Aug-Oct	Oct-Dec	PS 310	Dy Phon et al. (1994)
<i>Desmodium sequax</i> Wall.		LMF, RS	1,500-1,600	Aug-Sep	Oct-Nov	PS 1514	Dy Phon et al. (1994)
<i>Dumasia villosa</i> DC. var. <i>leiocarpa</i> (Benth.) Baker	Hae phan chan	LMF, open places	1,800	Nov-Dec	Feb-Mar	PS 1842	Thuan (1979); Lock & Heald (1994)
<i>Erythrina stricta</i> Roxb.	Thong lang pa	LMF, open places	1,200-1,300	Feb-Mar	Apr-May	PS 2628; PS et al. 245	Thuan (1979)
<i>Indigofera caudata</i> Dunn	Kram chao	LMF, open places roadsides	1,600-1,700	Jun-Sep	Oct-Dec	PS & C. Maknoi 2025; PS et al. 865	De Kort & Thijssse (1984); Thuan et al. (1987); Larsen & Larsen (1995)
<i>Mucuna macrocarpa</i> Wall.	Saba ling	LMF	1,500-1,600	Feb-Mar	May-Sep	PS et al. 2436; PS s.n.	Thuan (1979)
<i>Pueraria wallichii</i> DC.	Ma pap wo	DEF	800	Nov-Dec	Dec-Feb	PS 2601	Lock & Heald (1994)
<i>Shuteria hirsuta</i> Baker		LMF, open places	1,300	Nov-Dec	Feb-Mar	PS 1835	Thuan (1979)
<i>Vigna angularis</i> (Willd.) Ohwi & Ohashi		LMF, by streams	1,100-1,200	Oct-Dec	Dec-Feb	PS 1842	Thuan (1979)

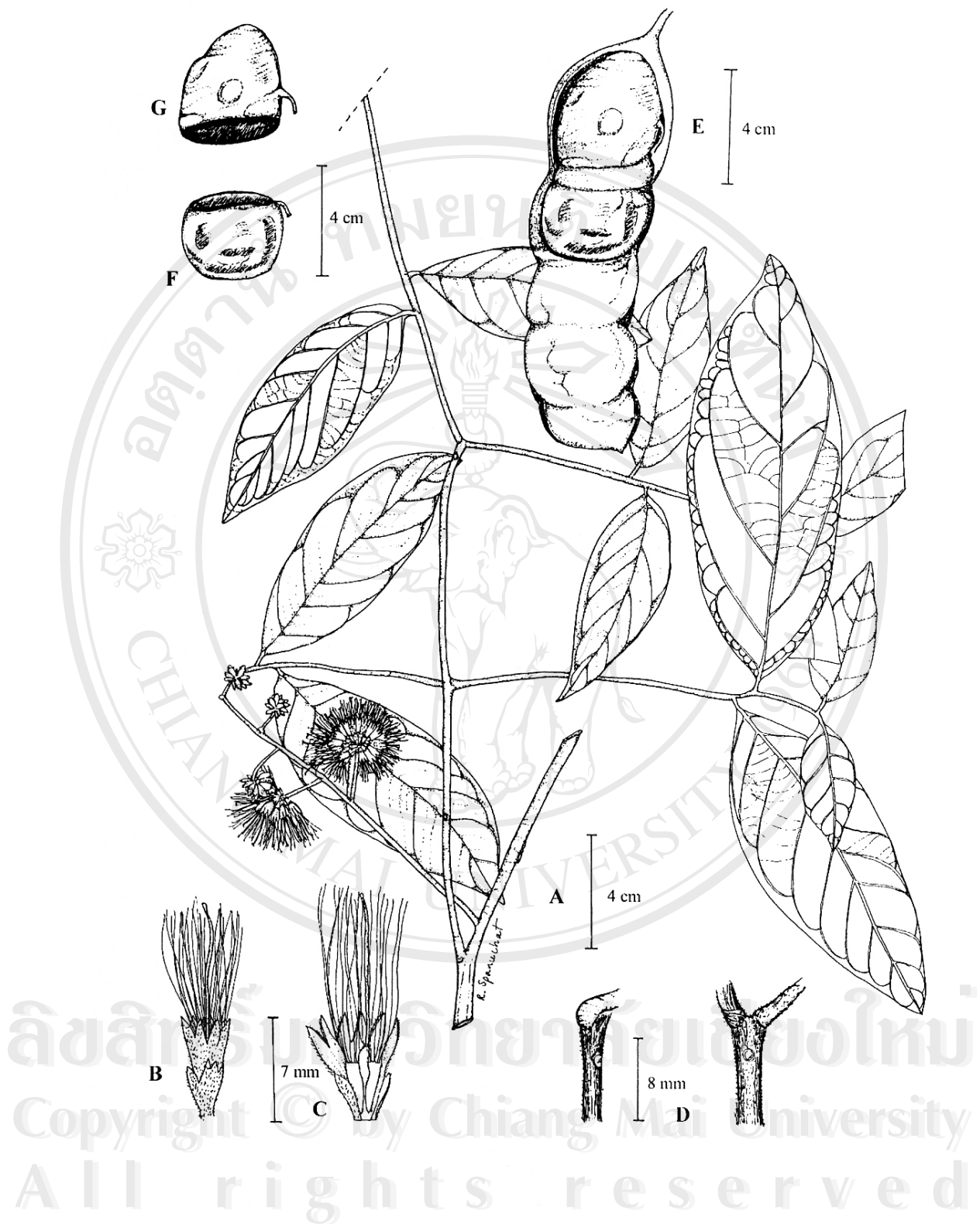


Figure 36. *Archidendron alternifoliolatum* (T.L. Wu) Nielsen

A. flowering branch; B. flower; C. opened flower; D. distal pinna gland, lateral view (left), dorsal view (right); E. pod; F. middle seed with funiculus; G. proximal seed with funiculus.

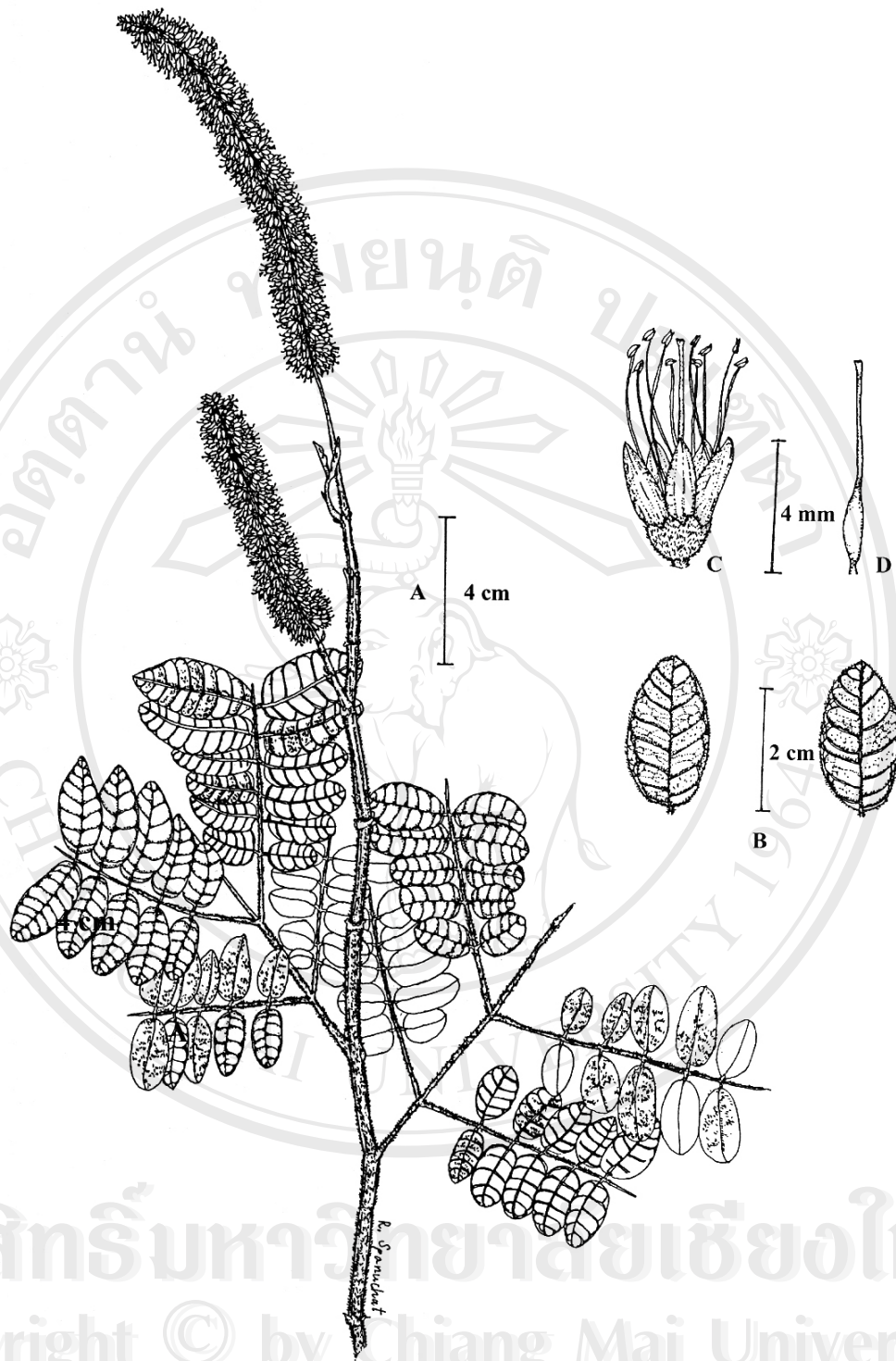


Figure 37. *Entada rheedei* Spreng. subsp. *sinohimalensis* (Grierson & Long) Panigrahi

A. flowering branch; B. leaflet, upper surface (left), lower surface (right); C. flower; D. pistil. All from P. Srisanga & S. Watthana 643.

FAGACEAE

Trees or rarely shrubs, monoecious. **Leaves** simple, alternate, evergreen or deciduous; stipules present, usually deciduous. **Inflorescence** pendulous, erect or variously reduced, axillary or terminal. **Flowers** unisexual. **Male flowers** in catkin or head; tepals (4-)6(-9), small, scale-like; stamens (4-)6-12(-90); anthers 2-locular, opening by longitudinal slits. **Female flowers** 1-7(-15) at base of male inflorescence or in different axils, within an involucre of often numerous imbricate scales; tepals adnate to the ovary, 4-6-lobed; staminodes present or absent; ovary inferior, 3-6-locular; styles as many as the ovary loculi; ovules 2 in each loculus. **Fruit** a nut, free or adnate to the accrescent involucre (cupule), sometimes completely enclosed; involucre often hardened, cupular or altogether closed, often tuberculate or echinate. **Seed** usually solitary by abortion, without endosperm.

An almost cosmopolitan family with 8 genera and about 700 species except in tropical and S Africa (Mabberley, 1997). Four genera and about 120 species in Thailand. Three genera and 15 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|---|------------------------------|
| 1. Male inflorescence erect, straight. Stamens usually 12. Stigma minute, punctiform at the tip of the style | |
| 2. Cupule lobed, usually spiny, containing 1-3 nuts | 1. <i>Castanopsis</i> |
| 2. Cupule cup-shaped, not lobed, covered by scales or lamellae, containing 1 nut | 2. <i>Lithocarpus</i> |
| 1. Male inflorescence pendulous. Stamens usually 6. Stigma dilated, covering the more or less recurved upper surface of the style. Cupule cup-shaped, not lobed, containing 1 nut | 3. <i>Quercus</i> |

1. *CASTANOPSIS* Spach

Hist. Nat. Veg. Phan. 11: 185. 1842; Kubitzki in Fam. Gen. Vasc. Pl. 2: 307. 1993.

Trees, evergreen or deciduous. **Inflorescence** erect, straight; spikes mostly unisexual, if bisexual and then male flowers at distal part. **Perianth** of both sexes cup-shaped, usually 6-lobed. **Male flowers**: stamens usually 12; rudimentary ovary usually present. **Female flowers**: ovary 3-locular; styles 3; stigmas minute, punctiform at the tip of the style. **Cupule** lobed, irregularly dehiscent, usually spiny, containing 1-3 nuts.

About 110 species in E, S and SE Asia (Kubitzki, 1993b). About 33 species in Thailand. Four species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|-----------------------------------|----------------------------------|
| 1. Leaves entire | |
| 2. Spines black with brown at tip | 1. <i>C. argyrophylla</i> |

2. Spines brown
 3. Leaves pubescent beneath. Fruit large, more than 2 cm in diam. **2. *C. armata***
 3. Leaves glabrous beneath. Fruit small, ca. 1.5 cm in diam. **4. *C. tribuloides***
 1. Leaves coarsely serrate at apex **3. *C. cf. thaiensis***

1. ***Castanopsis argyrophylla*** King ex Hook.f.

In Fl. Br. Ind. 5: 622. 1888; Hick. & A. Camus in Fl. Gén. I.-C. 5: 1014. 1929; Huang, Zhang & Bartholomew in Fl. China 4: 324. 1999.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Myanmar, S China (Yunnan), Laos, Vietnam.

Ecology.— Lower montane forest and lower montane scrub, alt. 1,500-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: January-February; fruiting: June-September.

Vernacular.— ก่อหยม Ko yum (Northern).

Voucher specimens.— *P. Srisanga* 988, 2164; *P. Srisanga et al.* 791, 862.

2. ***Castanopsis armata*** (Roxb.) Spach

Hist. Veg. Phan. 11: 185. 1842; Hick. & A. Camus in Fl. Gén. I.-C. 5: 1031. 1929.

Thailand.— Northern: Chiang Mai, Nan; South-eastern: Trat.

Distribution.— India, Bhutan, Sikkim, Bangladesh, Myanmar.

Ecology.— Dry evergreen and lower montane forest, alt. 1,000 m (Doi Phu Kha, Tham Pha Kaow).

Phenology.— Flowering: February-March; fruiting: June-September.

Uses.— Seeds edible.

Vernacular.— ก่อหรั่ง Ko rang, มะก้อ Ma ko (Chiang Mai), ก่อเงาะ Ko ngeow (Nan).

Voucher specimens.— *P. Srisanga* 2564.

3. ***Castanopsis cf. thaiensis*** Phengklai

Thai For. Bull. (Bot.) 32: 117, fig. 2. 2004.

Thailand.— Northern: Nan.

Distribution.— Endemic to Doi Phu Kha?

Ecology.— Lower montane forest, alt. 1,200-1,500 m (Doi Phu Kha).

Phenology.— Flowering: March-April.

Voucher specimens.— *P. Srisanga* 1350; *P. Srisanga & S. Watthana* 666.

4. *Castanopsis tribuloides* (Smith) A. DC.

J. Bot. 1: 182. 1863; Hook.f. in Fl. Br. Ind. 5: 622. 1888; Hick. & A. Camus in Fl. Gè n. I.-C. 5: 1017. 1929; Huang, Zhang & Bartholomew in Fl. China 4: 329. 1999.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, S China, Myanmar, Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering: April-May; fruiting: September-October.

Uses.— Seeds edible.

Vernacular.— ก๋อใบเลื่อม Ko bai lueam (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1640.

2. *LITHOCARPUS* Bl.

Bijdr.: 526. 1825; Kubitzki in Fam. Gen. Vasc. Pl. 2: 307. 1993.

Trees, usually evergreen. **Inflorescence** erect, straight; spikes unisexual or bisexual and then male flowers at distal part. **Flowers** solitary or in clusters of 3 or more. **Perianth** of both sexes cup-shaped, usually 6-lobed. **Male flowers**: stamens usually 12; rudimentary ovary usually present. **Female flowers**: ovary 3-locular; styles 3; stigmas minute, punctiform at the tip of the style. **Cupule** solitary or in dichasial clusters, cup-shaped, not lobed, covered by scales or lamellae, containing 1 nut.

About 100 species from NE India through China and Malesia to New Guinea, one species in SW USA (Kubitzki, 1993b). About 53 species in Thailand. Six species recorded from Doi Phu Kha National Park.

1. *Lithocarpus polystachyus* (Wall. ex A. DC.) Rehd.

J. Arn. Arb. 1: 130. 1919. – *Quercus polystachya* Wall. ex A. DC., Prodr. 16(2): 107. 1864; Hook.f. in Fl. Br. Ind. 5: 610. 1888.

Thailand.— Northern: Chiang Mai, Lamphun, Nan.

Distribution.— Myanmar, Vietnam.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: March-June; fruiting: September-December.

Vernacular.— ก๋อนก Ko nok (Chiang Rai).

Voucher specimens.— *P. Srisanga* 740.

2. *Lithocarpus thomsonii* (Miq.) Rehd.

J. Arn. Arb. 1: 132. 1919; Huang, Zhang & Bartholomew in Fl. China 4: 346. 1999. – *Quercus thomsonii* Miq., Ann. Mus. Lugd.-Bat. 1: 109. 1863; Hook.f. in Fl. Br. Ind. 5: 615. 1888.

Thailand.— Northern: Chiang Mai, Lampang, Nan; Eastern: Nakhon Ratchasima; South-eastern: Prachin Buri.

Distribution.— India, Myanmar, China, Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,200-1,400 m (Doi Phu Kha).

Phenology.— Flowering: December-January; fruiting: September-October.

Vernacular.— ก้อขาว Ko khao (Northern).

Voucher specimens.— *P. Srisanga* 389, 2407.

3. *Lithocarpus truncatus* (King ex Hook.f.) Rehd. & Wils.

In Sargent, Pl. Wilson. 3: 207. 1916; Huang, Zhang & Bartholomew in Fl. China 4: 344. 1999. – *Quercus truncatus* King ex Hook.f. in Fl. Br. Ind. 5: 618. 1888.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Myanmar, China, Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,500 m (Doi Phu Wae).

Phenology.— Flowering: March-May; fruiting: August-October.

Vernacular.— ก้อดุก Ko duk (Chiang Mai).

Voucher specimens.— *P. Srisanga* 2162.

4. *Lithocarpus* sp. 1

Ecology.— Lower montane forest, alt. 1,300 m (Doi Phu Huat).

Phenology.— Flowering: January-February.

Voucher specimens.— *P. Srisanga* 518.

5. *Lithocarpus* sp. 2

Ecology.— Lower montane forest, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering: November-December.

Voucher specimens.— *P. Srisanga* 2303.

6. *Lithocarpus* sp. 3

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: December-January.

Voucher specimens.— *P. Srisanga* 2371, 2629.

3. *QUERCUS* L.

Sp. Pl.: 994. 1753; Kubitzki in Fam. Gen. Vasc. Pl. 2: 308. 1993.

Trees or shrubs, evergreen or deciduous. **Spikes** unisexual. **Male inflorescence** pendulous; flowers solitary or 1-3 together; perianth 3-6-lobed; stamens usually 6. **Female inflorescence** solitary in erect, few-flowered; perianth smaller than the male flowers; ovary 3-locular; styles 3, recurved; stigmas dilated, covering the more or less recurved upper surface of the style. **Cupule** cup-shaped, not lobed, covered by scales or lamellae, containing 1 nut.

About 350-450 species in the northern temperate and subtropical regions with extension into the tropics in W Malesia and northwestern S America (Kubitzki, 1993b). About 33 species in Thailand. Five species recorded from Doi Phu Kha National Park.

1. *Quercus brandisiana* Kurz

J. As. Soc. Beng. 1: 108. 1873; Hook.f. in Fl. Br. Ind. 5: 604. 1888.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan.

Distribution.— Myanmar (type).

Ecology.— Lower montane forest, alt. 1,200-1,300 m (Doi Phu Wae).

Phenology.— Fruiting: February-March.

Vernacular.— ก่อสีเสียด Ko si siat (Chiang Mai).

Voucher specimens.— *P. Srisanga et al.* 2453.

2. *Quercus helferiana* A. DC.

Prodr. 16(2): 101. 1864; Hook.f. in Fl. Br. Ind. 5: 605. 1888; Hick. & A. Camus in Fl. Gèn. I.-C. 5: 958. 1929; Huang, Zhang & Bartholomew in Fl. China 4: 329. 1999.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— India, Myanmar, S China, Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,200 m (Doi Phu Wae).

Phenology.— Flowering: December-January.

Vernacular.— ก่อแอบหลวง Ko aep luang (Chiang Mai).

Voucher specimens.— *P. Srisanga* 2627.

3. *Quercus kingiana* Craib

Kew Bull. 1911: 472. 1911; Hick. & A. Camus in Fl. Gèn. I.-C. 5: 945. 1929; Huang, Zhang & Bartholomew in Fl. China 4: 379. 1999.

Thailand.— Northern: Chiang Mai (type), Lamphun, Nan.

Distribution.— Myanmar, S China (Yunnan).

Ecology.— Lower montane forest, alt. 1,600 m (Doi Phu Wae).

Phenology.— Flowering: October-December; fruiting: July-September.

Vernacular.— ก่อแดง Ko daeng, ก่อตี Ko ti (Chiang Mai), ก่อตาหมู Ko ta moo (Nan).

Voucher specimens.— *P. Srisanga* 1818.

4. *Quercus lineata* Bl. var. *hildebrandii* King

Thailand.— Northern: Chiang Mai, Nan (Fig. 130).

Distribution.— Myanmar (type).

Ecology.— Lower montane forest, alt. 1,300-1,800 m (Doi Phu Kha).

Phenology.— Flowering: November-December; fruiting: January-March.

Vernacular.— ก้อหมวก Ko muak (Northern).

Voucher specimens.— *P. Srisanga* 454, 1236, 1670.

5. *Quercus vestita* Rehd. & Wils.

In Sargent, Pl. Wilson. 3: 236. 1916.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— India, Myanmar, Laos.

Ecology.— Lower montane forest, alt. 1,400 m (Doi Phu Kha).

Phenology.— Flowering: January-February; fruiting: August-September.

Vernacular.— ก้อเอบ Ko aep (Chiang Rai).

Voucher specimens.— *P. Srisanga* 485.

FLACOURTIACEAE

Trees or shrubs. **Leaves** simple, alternate, rarely opposite or whorled; stipules present or not, often caducous. **Inflorescence** mostly axillary, cymose, spike-like racemes, panicles, sometimes condensed to glomerules or reduced to few-flowered fascicles or flower solitary. **Flowers** bisexual or unisexual, dioecious or polygamous, actinomorphic. **Sepals** 3-8(-15), free or connate at base, usually imbricate, sometimes accrescent in fruit. **Petals** 3-8(-15) or absent, free, usually imbricate, alternate with sepals or spirally arranged and not distinct from sepals. **Stamens** (4-)numerous, rarely few, mostly free, rarely connate into a column; anthers 2-locular, mostly opening by longitudinal slits. **Ovary** mostly superior, 1-locular, parietal or almost basal or rarely axile placentation; ovules 2 or more in each placenta; styles 1-10, free or connate; stigmas as many as the placentas. **Fruit** a berry, capsule or drupe. **Seeds** sometimes arillate.

About 86 genera and 875 species mainly in tropical region (Mabberley, 1997). At present, DNA evidence re-arranged this family into many small families. Eleven genera and about 40 species in Thailand (Sleumer, 1985; Brockelman et al., 2002). Two genera and 2 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Only sepals present. Fruit a berry 1. *Flacourtia*
 1. Both sepals and petals present. Fruit an indehiscent capsule,
 usually with thick and hard pericarp 2. *Hydnocarpus*

1. *FLACOURTIA* L' Hérít.

Stirp. Nov. 3: 59, t. 30,31. 1785; Sleum. in Fl. Mal. I(5): 69. 1954; Lescot in Fl. C.L.V. 11: 34. 1970; Sleum., Blumea 30(2): 239. 1985.

Trees or shrubs; trunks usually thorny; branches often with axillary spines when young, unarmed when old. **Leaves** alternate, mostly crenate; stipules absent. **Inflorescence** in axillary racemes. **Flowers** mostly unisexual, rarely bisexual. **Sepals** (3-)4-6(-7), slightly connate at base, imbricate. **Petals** absent. **Stamens** 15-numerous, free; anthers dorifixed, versatile. **Ovary** superior, parietal placentation; ovules 2 in each placenta; styles (2-)4-6(-10), free or connate. **Fruit** a berry.

About 15 species in Africa and Asia to Polynesia (Sleumer, 1954). Three species in Thailand (Sleumer, 1985). Only 1 species recorded from Doi Phu Kha National Park.

Flacourtia rukam Zoll. & Mor.

Syst. Verz.: 33. 1846; Sleum. in Fl. Mal. I (5): 73, fig. 31-33. 1954; Lescot in Fl. C.L.V. 11: 39, pl. IV: 6-10. 1970; Sleum., Blumea 30(2): 240. 1985.

Tree, 5-15 m high; young branches with spines, lenticellate. **Leaves** elliptic to ovate, 6-10(-14) cm long, (3-)4-5(-6) cm wide, puberulous or glabrous on both surfaces; base cuneate to rounded; apex acute to acuminate with obtuse tip; margin crenate-serrate; primary veins 4-7 pairs; petioles 5-8 mm long, puberulous. **Inflorescence** in axillary racemes, few-flowered, pubescent. **Flowers** unisexual; pedicels 3-5 mm long, pubescent. **Sepals** (3-)4(-6), greenish yellow, ovate-acuminate, ca. 2 mm long, pubescent on both sides. **Stamens** numerous; filaments 3-4 mm long, glabrous. **Ovary** flask-shaped, 2-3 mm long, 4-6(-8) placentas; styles 4-6(-8), 1.5-3 mm long, free, slightly divergent. **Fruit** globose to subglobose, 2-2.5 cm across, red.

Thailand.— Northern: Nan; Peninsular: Nakhon Si Thammarat, Trang.

Distribution.— China, Vietnam, Malaysia, Indonesia (Java-type).

Ecology.— Dry evergreen and lower montane forest, naturalized, alt. 1,000-1,100 m (Doi Phu Kha).

Phenology.— Flowering: May-June; fruiting: July-August.

Uses.— Fruit edible.

Vernacular.— ตะขบ Ta khop (General), มะเกว้น Ma kwen (Northern).

Voucher specimens.— *P. Srisanga* 259.

2. *HYDNOCARPUS* Gaertn.

Fruct. 1: 288, t. 60, fig. 3. 1788; Sleum. in Fl. Mal. I(5): 14. 1954; Lescot in Fl. C.L.V. 11: 7. 1970; Sleum., Blumea 30(2): 226. 1985. – *Taraktogenos* Hassk., Nat. Tijd. Ned. Ind. 10: 127. 1855.

Trees. **Leaves** alternate, entire or serrate; petioles thickened at apex; stipules early caducous. **Inflorescence** in axillary cymes or fascicles or flower solitary. **Flowers** unisexual. **Sepals** (3-)4-5(-11), free or rarely slightly connate at base, concave, imbricate. **Petals** 4-5, 8 or rarely up to 14, free, with a pilose scale at the base inside. **Stamens** 5-numerous, free; anthers basifixed. **Ovary** superior, sessile, parietal placentation; ovules 2-many in each placenta; stigmas 3-6(-7), sessile. **Fruit** an indehiscent capsule, usually with thick and hard pericarp. **Seeds** densely packed in a pulp, arillate.

About 40 species in S and SE Asia (Sleumer, 1954). Seven species in Thailand (Sleumer, 1985). Only 1 species recorded from Doi Phu Kha National Park.

Hydnocarpus kurzii (King) Warb. subsp. *australis* Sleum.

Bot. Jahrb. 69: 23: 1938; in Fl. Mal. I(5): 21. 1954; Blumea 30(2): 229. 1985. – *Taraktogenos kurzii* auct. non King: Craib in Fl. Siam. Enum. 1: 97. 1925.

Dioecious tree, 8-20 m high. **Leaves** oblong-lanceolate, subcoriaceous, (12-) 15-23(-26) cm long, 4-8(-9.5) cm wide, glabrous on both surfaces; base cuneate; apex shortly acuminate; margin entire; primary veins 7-8(-10) pairs; petioles 1.2-2(-3) cm long, puberulous. **Inflorescence** in short axillary cymes, 5-9-flowered, pubescent. **Flowers** with unpleasant odour; pedicels 5-10 mm long, pubescent. **Sepals** 4, brownish, suborbicular, ovate-rotundate, 4-5 mm long, free, puberulous outside, glabrous inside. **Petals** 8, brownish yellow, ovate, 4-5 mm long, glabrous, ciliate at margin; scale 2-3 mm long, long ciliate at margin. **Stamens** (15-)18-25; filaments 3-4 mm long, densely hairy. **Ovary** ovoid, fulvous tomentose, 6(-7) placentas. **Fruit** globose to subglobose, 8-10 cm across, densely dark brown tomentose; pericarp 8-10 mm thick. **Seeds** 15-30, angular-ovoid, 2.5-3 cm long, 1-1.5 cm wide.

Thailand.— Northern: Lamphun, Phrae, Nan, Tak; Peninsular: Nakhon Si Thammarat, Phangnga, Pattalung, Pattani.

Distribution.— Myanmar (type), Malaysia.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: May-June; fruiting: November-March.

Vernacular.— กระเบา Kra bao (Northern).

Voucher specimens.— *P. Srisanga* 1361, 1393, 2270; *P. Srisanga et al.* 771.

FUMARIACEAE

Herbs sometimes scandent, often with swollen underground parts, usually glabrous. **Leaves** alternate or rarely subopposite, pinnately to ternately divided; stipules absent. **Inflorescence** axillary or terminal, cymose or racemose, rarely flower solitary. **Flowers** bisexual, mostly zygomorphic or disymmetric. **Sepals** 2, petaloid, not enclosed the petals in bud, caducous. **Petals** 4 in 2 whorls of 2, imbricate, more or less connivent; the two outer often saccate or spurred at the base; the two inner narrower and sometimes coherent to the apex. **Stamens** 2 or 4, free and opposite the petals or 6 and united in two bundles and opposite the outer petals; anthers 2-locular, opening by longitudinal slits. **Ovary** superior, 1-locular, 2 parietal placentas; ovules 1-many. **Fruit** usually a capsule, longitudinal dehiscent, rarely breaking into 1-seeded segments or nut. **Seeds** usually arillate.

Seventeen genera and about 530 species mainly in N temperate region (Lidén, 1993). Two genera and 2-3 species in Thailand. One species recorded from Doi Phu Kha National Park.

DACTYLICAPNOS Wall.

Tent. Fl. Nep.: 51, t. 39. 1826; Lidén, Op. Bot. 88: 20. 1986; in Fam. Gen. Vasc. Pl. 2: 314. 1993. – *Dicentra* subgenus *Dactylicapnos* (Wall.) Stern, Brittonia 13: 1-52. 1961.

Annual or perennial scandent herbs. **Leaves** alternate, ternate with tendriform ultimate leaflets; primary veins 3-7 from base. **Inflorescence** in axillary and terminal racemes. **Flowers** disymmetric vertically. **Petals** yellow; the two outer fused and forming a compressed tube, saccate or spurred at the base, hooded and divergent at apex; the two inner exposed at mouth and coherent at apex, tapering into long slender clawed at the base. **Stamens** 6 in two bundles; filaments adherent to the outer petals, each bundle expanded at base into a nectariferous gland enclosed by swollen base of outer petals. **Capsule** lanceolate to ovate or torulose. **Seeds** many, black.

About 10 species distributed in Himalayas to SE Asia (Lidén, 1993; Mabberley, 1997).

Dactylicapnos scandens (D. Don) Hutch.

Kew Bull. 1921: 105. 1921. – *Dielytra scandens* D. Don, Prodr. Fl. Nepal.: 198. 1825. – *Dicentra scandens* (D. Don) Walp., Rep.: 118. 1842.

Perennial scandent herb. **Leaves** 2-3 ternate; leaflets elliptic to ovate, membranous, (1.5-)2-3.5(-4) cm long, (0.5-)1-2(-2.5) cm wide, the terminal leaflet slightly to much larger than the lateral leaflets in each ternate, entire, glabrous; base cuneate; apex broadly acute; primary veins 5-7 from base. **Inflorescence** in pendulous leaf-opposed racemes, 7-10-flowered; peduncle 2-7 cm long, glabrous; bracts lanceolate, 4-10 mm long, glabrous. **Sepals** triangular-ovate, 4-6 mm long, 2-3 mm wide, glabrous, sparsely teeth. **Outer petals** 1.8-2.2 cm long; inner petals 1.6-1.8 cm long. **Ovary** and style 1.6-2 cm long, glabrous; stigma flattened, bi-lobed.

Capsule lanceolate to narrowly ellipsoid, 2.5-3 cm long, 5-7 mm long, including persistent style. **Seeds** kidney-shaped, 1.5-2 mm long, densely papillate, glossy.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal (type), Bhutan, Sikkim, Myanmar, China.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: October-November; fruiting: December-January.

Vernacular.— ระง้าทอง Raya thong (Chiang Mai).

Voucher specimens.— *P. Srisanga* 387, 1887.

Notes.— New locality recorded from Nan, in Thailand.

GELSEMIACEAE

Shrubs or woody climbers. **Leaves** simple, opposite, entire, exstipulate. **Inflorescence** terminal cymes or occasionally flower solitary. **Flowers** bisexual, 5-merous, actinomorphic, heterostylous. **Calyx** united or free. **Corolla** united, imbricate. **Stamens** exerted; anthers basifixed. **Ovary** superior, 2-locular, 2-many ovules in each loculus, axile placentation; style single; stigma twice dichotomously divided. **Fruit** a capsule. **Seeds** flattened, usually winged.

Two genera: *Gelsemium* Juss. with 3 species in Asia and America and *Mostuea* Didr. with 8 species in tropical Africa and S America (Mabberley, 1997). One species in Thailand (Griffin & Parnell, 1997).

Gelsemiaceae, often included in the Loganiaceae *sensu lato* as tribe Gelsemieae, is here treated as a distinct family according to Mabberley (1997).

GELSEMIUM Juss.

Gen. Pl.: 150. 1789; Leenhouts in Fl. Mal. I(6): 343. 1962; Griffin & Parnell in Fl. Thailand 6(3): 205. 1997. - *Medicia* Gardn. & Champ. in Hook., J. Bot. Kew Misc. 1: 324. 1849.

Woody climbers; twigs terete. **Leaves** petiolate. **Inflorescence** terminal cymes. **Flowers** yellow. **Calyx** free, glabrous or ciliate. **Corolla** funnel-shaped. **Stamens** glabrous; filaments strap-shaped; anthers sagittate. **Ovary** glabrous, with several ovules in each loculus. **Fruit** septicidal capsule, 2-valved. **Seeds** several, usually winged.

Three species, one in Asia and the others in SE North America, Mexico and Guatemala (Leenhouts, 1962).

Gelsemium elegans (Gardn. & Champ.) Benth.

J. Linn. Soc. Bot. 1: 90. 1856; Kerr in Fl. Siam. Enum. 3: 51. 1951; Leenhouts in Fl. Mal. I(6): 343, fig. 27. 1962; Griffin & Parnell in Fl. Thailand 6(3): 206, fig. 89, pl. XX: 2. 1997. - *Medicia elegans* Gardn. & Champ. in Hook., J. Bot. Kew Misc. 1: 324. 1849.

Woody climber; stems glabrous. **Leaves** ovate to lanceolate, chartaceous, 5-12 cm long, 2-5 cm wide, glabrous; base rounded to cuneate; apex long acuminate; midrib sunken above; petioles 0.5-1 cm long, glabrous. **Inflorescence** 3-12 cm long, glabrous; bracteoles narrowly lanceolate, 1-2 mm long, ciliate. **Flowers** with long slender pedicels up to 6 mm long. **Calyx** lanceolate, 1.5-3 mm long, 1-1.5 mm wide, ciliate. **Corolla** yellow or orange, 12-15 mm long; tube 6-9 mm long, with red-spotted inside; lobes 4-6 mm long, 2-3 mm wide, reflexed, broadly acute or cuspidate at apex. **Stamens** exerted beyond the corolla tube; filaments 6-8 mm long, inserted about the middle of the tube; anthers oblong, 1-2 mm long, dorsifixed. **Ovary** narrowly ellipsoid, 2-3 mm long; style 8-10 mm long. **Capsule** ellipsoid, 8-12 mm long, 5-7 mm wide, black, with 8-10-seeded per cell. **Seeds** flattened, warty, winged all around and lacinate, 3-4 mm long and wide including wing.

Thailand.— Northern: Chiang Mai, Phrae, Nan; South-western: Kanchanaburi; Peninsular: Krabi, Narathiwat.

Distribution.— India, Sri Lanka, Myanmar, China (Hong Kong-type), Laos, Vietnam, Malaysia, Indonesia.

Ecology.— Edges of dry evergreen and lower montane forests, alt. 800-1,500 m (Doi Phu Kha).

Phenology.— Flowering: July-November; fruiting: November-March.

Uses.— Whole plant, but especially leaves and roots, very poisonous (various alkaloids); minimal dose can be used as febrifuges and as general central nervous system relaxants. Used nefariously for murder and suicide (a single cup-of-tea made with three leaves from the plant is lethal) (Griffin & Parnell, 1997).

Vernacular.— มะเค็ด Ma khet (Lua-Nan), มะลินรอก Mali narok (General), ช้างน้ำ Sua na tua (Maeo-Nan).

Voucher specimens.— *P. Srisanga* 249, 341, 1893; *P. Srisanga et al.* 2476.

GENTIANACEAE

Annual or perennial herbs, rarely shrubs, trees or climbers. **Leaves** simple, opposite or in rosettes, entire; stipules mostly absent. **Inflorescence** terminal or axillary, solitary or in cymes. **Flowers** bisexual. **Calyx** (2-)4-5(-12)-lobed, with or without wings. **Corolla** tubular to campanulate, actinomorphic or less often zygomorphic; lobes 4-5(-12), twisted to the right. **Stamens** as many as and alternate with corolla lobes, inserted on the corolla tube; filaments usually terete and short; anthers 2-locular, basifixed, rarely dorsi-versatile, dehiscing by longitudinal slits, rarely by terminal pores. **Ovary** superior, usually sessile, rarely stipitate, 1-2-locular with parietal placentation; ovules numerous. **Fruit** a septicidal capsule, rarely berry. **Seeds** numerous, small.

A cosmopolitan family with about 78 genera and 1,225 species mainly in temperate and subtropical regions and in tropical mountains (Mabberley, 1997). Twelve genera included *Fagraea* Thunb., often placed in Loganiaceae *sensu lato* as tribe Potalieae, is here treated as part of Gentianaceae (Mabberley, 1997; Hul, 2003). About 40 species in Thailand (Ubolcholaket, 1987; Griffin & Parnell, 1997; Maxwell,

2000; Suksathan 2001a, 2002; Suksathan & Sasirat, 2000). Four genera and 6 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Autotrophic plants with green leaves
 2. Corolla without glands at base of each lobe
 3. Corolla more or less zygomorphic. Anthers opening by longitudinal slits.
 - Ovary 1-locular **1. *Canscora***
 3. Corolla actinomorphic. Anthers opening by terminal pores.
 - Ovary 2-locular **3. *Exacum***
 - 4. *Swertia***
 2. Corolla with 1 or 2 distinct glands at base of each lobe
 1. Saprophytic plants without chlorophyll **2. *Cotylanthera***

1. *CANSCORA* Lam.

Enc. 1: 601. 1783; Ubolcholaket in Fl. Thailand 5(1): 73. 1987; Thiv, Blumea 48(1): 1. 2003. – *Orthostemon* R. Br., Prodr.: 451. 1810. – *Pladera* Soland. ex Roxb., Fl. Ind. 1: 416. 1820, pro parte. – *Heterocanscora* C.B. Clarke, J. Linn. Soc. 14: 431. 1875.

Annual, erect, glabrous herbs. **Leaves** attenuate towards the base, upper leaves sessile, 3-nerved. **Inflorescence** in terminal and axillary cymes, many-flowered, occasionally solitary and terminal. **Flowers** 4-merous. **Calyx** tubular or urceolate, smooth or striate, with longitudinal ridges, crests or wings. **Corolla** more or less zygomorphic; tube cylindric about as long as calyx; lobes usually shorter than tube. **Stamens** inserted in corolla tube at different levels; anthers opening by longitudinal slits. Disk absent. **Ovary** sessile, 1-locular; style filiform; stigma capitate or bilobed. **Capsule** oblong or ovoid, bivalved.

About 30 species, from Africa to Australia, mostly in SE Asia; 6 species in Thailand excluded *Canscora carinata* Dop (*Cracosna carinata* (Dop) Thiv) (Ubolcholaket, 1987; Hul, 2003). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Corolla white, 15-20(-25) mm long. Style 7-10 mm long **1. *C. andrographioides***
1. Corolla pink, 8-10(-12) mm long. Style 2-3 mm long **2. *C. diffusa***

1. *Canscora andrographioides* Griff. ex C.B. Clarke

J. Linn. Soc. 14: 431. 1875; Fletcher & Kerr in Fl. Siam. Enum. 3: 65. 1951; Ubolcholaket, Thai For. Bull. (Bot.) 14: 101, fig. 5. 1983; Toyokuni, Acta Phytotax. Geobot. 36: 123. 1985; Ubolcholaket in Fl. Thailand 5(1): 77, fig. 26: 7. 1987; Thiv, Blumea 48(1): 9. 2003.

Herb up to 60 cm high; stem quadrangular. **Leaves** elliptic to narrowly ovate, herbaceous, 2-6 cm long, 1-3 cm wide, glabrous; base attenuate; apex acute; 3-nerved from base, sessile to subsessile. **Inflorescence** terminal and axillary cymes; pedicels 0.5-1.5 cm long. **Calyx** tubular, with 8 longitudinal ridges, glabrous; tube 10-12 mm long; lobes triangular, 1.5-2 mm long. **Corolla** white, 15-20(-25) mm long; lobes obovate, 2 broader than the others. **Stamens** unequal, 3 with filaments 1.5-2 mm long, 1 with filament 2.5-3.5 mm long. **Ovary** cylindric-oblong, 6-9 mm long; style 7-10 mm long; stigma bilobed. **Capsule** ellipsoid-oblong, 7-8 mm long.

Thailand.— Northern: Nan; South-eastern: Chanthaburi, Trat; Central: Nakhon Nayok; Peninsular: Phuket, Phangnga.

Distribution.— India (type), Myanmar, China, Laos, Cambodia, Vietnam, Malaysia.

Ecology.— Dry evergreen and lower montane forest, alt. 800-1,350 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-February.

Uses.— Whole plant used for making spirit by soaking in local whisky and drink for good health.

Vernacular.— ไก้สังเค็ดัน Khong sa den (Lua-Nan).

Voucher specimens.— *P. Srisanga* 339, 1126, 2409.

Notes.— New locality recorded from Nan, in Thailand.

2. *Canscora diffusa* (Vahl) R. Br. ex Roem. & Schult.

Syst. Veg. 3: 301. 1818; Fletcher & Kerr in Fl. Siam. Enum. 3: 66. 1951; Ubolcholaket, Thai For. Bull. (Bot.) 14: 101. 1983; Toyokuni, Acta Phytotax. Geobot. 36: 123. 1985; Ubolcholaket in Fl. Thailand 5(1): 77, fig. 26: 4. 1987; Thiv, Blumea 48(1): 11. 2003. – *Gentiana diffusa* Vahl, Symb. Bot. 3: 47. 1794. *Exacum diffusum* (Vahl) Willd., Sp. Pl. 1(2): 637. 1798.

Herb up to 40 cm high; stem quadrangular. **Leaves** elliptic to narrowly ovate, herbaceous, 1-3 cm long, 0.5-1.5 cm wide, glabrous; base attenuate; apex acute; 3-nerved from base, sessile to subsessile. **Inflorescence** terminal and axillary cymes; pedicels 0.5-1.5 cm long. **Calyx** tubular, with 4 longitudinal ridges, glabrous; tube 4-6 mm long; lobes triangular, 1-1.5 mm long. **Corolla** pink, 8-10(-12) mm long; lobes obovate. **Stamens** unequal, 3 with filaments ca. 1 mm long, 1 with filament ca. 1.5 mm long. **Ovary** cylindric-oblong, 5-6 mm long; style 2-3 mm long; stigma bilobed. **Capsule** ellipsoid-oblong, 5-7 mm long.

Thailand.— Northern: Chiang Mai, Lampang, Nan; South-eastern: Chanthaburi; South-western: Ratchaburi, Kanchanaburi.

Distribution.— Tropical Africa, Madagascar, S and SE Asia, Australia, Indonesia (type).

Ecology.— Dry evergreen forest, alt. 800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: November-January.

Voucher specimens.— *P. Srisanga* 2605.

2. *COTYLANTHERA* Bl.

Bijdr. 2: 707. 1825; Hara, J. Jap. Bot. 50(11): 321. 1975; Ubolcholaket in Fl. Thailand 5(1): 78. 1987.

Small saprophytic glabrous herbs, without chlorophyll. **Leaves** scale-like, opposite, sessile. **Flowers** solitary or in 2-3-flowered fascicles, terminal; pedicel indistinct. **Calyx** deeply 4-lobed, not ribbed or winged. **Corolla** 4, divided below the middle. **Stamens** 4; anthers opening by a single apical pore. Disk absent. **Ovary** 2-locular; style filiform; stigma capitate. **Capsule** broadly ovoid to subglobose.

Four species in Himalaya, Myanmar, China (Yunnan), Vietnam, Philippines, Indonesia, Borneo and New Guinea (Hara, 1975). Two species in Thailand. One species recorded from Doi Phu Kha National Park.

Cotylanthera paucisquama C.B. Clarke

In Fl. Br. Ind. 4: 94. 1883; Hara, J. Jap. Bot. 50(11): 321, figs. 1-2. 1975; Ho & Pringle in Fl. China 16: 3. 1995; Aitken in Fl. Bhutan 2(2): 607, fig. 61: i-m. 1999; Hul in Fl. C.L.V. 31: 24, pl. 6. 2003. – *C. yunnanensis* W.W. Sm., Notes Roy. Bot. Gard. Edin. 13: 158. 1921.

Erect herb up to 15 cm long; stem simple, fleshy, white. **Leaves** ovate, 3-4 mm long, 1-1.5 mm wide, acuminate at apex. **Flower** solitary. **Calyx** white, ovate, 3-5 mm long, 1.5-2 mm wide, acuminate at apex. **Corolla** violet; tube ca. 2 mm long; lobes oblong, 12-14 mm long, 2-3 mm wide, obtuse at apex. **Stamens** slightly curved on one side; filaments 4-5 mm long, glabrous; anthers sagittate-lanceolate, 5-5.5 mm long, cordate at base, obtuse at apex. **Ovary** ovoid, 2-4 mm long, style slightly curved, 8-9 mm long (Fig. 38).

Thailand.— Northern: Nan.

Distribution.— Himalayas (Sikkim-type), S China (Yunnan), Vietnam.

Ecology.— Lower montane forest, alt. 1,700-1,800 m (Doi Phu Kha).

Phenology.— Flowering: July-August.

Voucher specimens.— *P. Srisanga* 1978; *P. Srisanga* & *C. Maknoi* 2020.

Notes.— Rare species, few specimens collected. New recorded for Thailand.

3. *EXACUM* L.

Sp. Pl.: 112. 1753; Ubolcholaket in Fl. Thailand 5(1): 79. 1987.

Annual or perennial, erect, glabrous herbs, usually branched. **Leaves** attenuate towards the base, 3-5-nerved, sessile to subsessile. **Inflorescence** many-flowered, cymose or thyrsoïd, terminal and axillary, usually combined with solitary, axillary flowers; pedicels distinct. **Flowers** 4-5-merous. **Calyx** divided nearly to the base with 4 or 5 wings. **Corolla** actinomorphic; lobes usually longer than the tube. **Stamens** inserted to the corolla throat; anthers opening by apical pores. Disk absent.

Ovary sessile, 2-locular; style filiform, asymmetrical in place but projected on one side of the corolla; stigma capitate, entire or obscurely bilobed. **Capsule** oblong or globose.

About 65 species, from Africa through tropical Asia (Mabberley, 1997). Three species in Thailand (Ubolcholaket, 1987). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Flowers 5-merous
1. Flowers 4-merous

1. *E. sutaepense*
2. *E. tetragonum*

1. *Exacum sutaepense* Hosseus ex Craib

Kew Bull. 1914: 8. 1914; Fletcher & Kerr in Fl. Siam. Enum. 3: 64. 1951; Toyokuni, Acta Phytotax. Geobot. 32: 199, fig. 1, 2:2. 1981; Ubolcholaket, Thai For. Bull. (Bot.) 14: 109, fig. 9. 1983; Toyokuni, Acta Phytotax. Geobot. 36: 124. 1985; Ubolcholaket in Fl. Thailand 5(1): 80, fig. 26: 2. 1987.

Herb up to 25 cm high; stem quadrangular. **Leaves** elliptic to narrowly ovate, herbaceous, 7-15 mm long, 4-8 mm wide, glabrous; base attenuate; apex acute; 3-nerved from base, sessile to subsessile. **Inflorescence** terminal and axillary cymes. **Flowers** 5-merous; pedicels 2-7 mm long. **Calyx** ovoid, glabrous; tube 0.5-1 mm long; lobes lanceolate, 2.5-4 mm long, acute to acuminate at apex; wings 5, 1-1.5 mm wide. **Corolla** blue; tube 3-4 mm long; lobes lanceolate, 4-6 mm long, acute at apex. **Filaments** 0.5-1 mm long; anthers oblong, straight, 1.5-2.5 mm long. **Ovary** globose, 2-3 mm long, glabrous; style 3-4 mm long; stigma capitate. **Capsule** globose, 3-4 mm long and wide.

Thailand.— Northern: Chiang Mai (type: *Hosseus* 194: E), Nan; South-western: Kanchanaburi.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, open grassy ground, alt. 1,700-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-December.

Vernacular.— นางอ้วดอย Nang ua doi (Northern).

Voucher specimens.— *P. Srisanga* 287, 1224.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

2. *Exacum tetragonum* Roxb.

Fl. Ind. 1: 413. 1820; Fletcher & Kerr in Fl. Siam. Enum. 3: 65. 1951; Toyokuni, Acta Phytotax. Geobot. 32: 201, fig. 5. 1981; Ubolcholaket, Thai For. Bull. (Bot.) 14: 105, fig. 7. 1983; Toyokuni, Acta Phytotax. Geobot. 36: 124. 1985; Ubolcholaket in Fl. Thailand 5(1): 79, fig. 26: 3, pl. V: 1. 1987. — *E. stylosum* Wall. ex G. Don, Gen. Syst.

4: 212. 1837. – *E. tetrapterum* Meyen ex Griseb. in DC., Prodr. 9: 561. 1845. – *E. tetragonum* Roxb. var. *stylosa* (Wall. ex G. Don) C.B. Clarke in Fl. Br. Ind. 4: 95. 1883. – *E. cambodianum* Dop, Bull. Soc. Bot. France 59: 145. 1912.

Erect herb up to 1 m high; stem quadrangular. **Leaves** elliptic to narrowly ovate, herbaceous, 2-6 cm long, 1-3 cm wide, glabrous; base attenuate; apex acute; 3-5-nerved from base, sessile. **Inflorescence** terminal and axillary cymes. **Flowers** 4-merous; pedicels 4-10 mm long. **Calyx** ovoid to ellipsoid, glabrous; tube 0.5-1 mm long; lobes lanceolate, 6-7 mm long, acuminate at apex; wings 4, 0.5-1 mm wide. **Corolla** violet; tube 5-7 mm long; lobes elliptic, 12-15 mm long, acute to acuminate at apex. **Filaments** 1-1.5 mm long; anthers narrowly lanceolate, curved in the upper part, 6-8 mm long. **Ovary** subglobose, 3-4 mm long, glabrous; style 10-13 mm long, curved; stigma capitate. **Capsule** subglobose to ovoid, 3.5-7 mm long, 2.5-6 mm wide.

Thailand.— Northern: Chiang Mai, Lamphun, Nan, Phitsanulok; North-eastern: Nakhon Phanom, Loei, Khon Kaen; Eastern: Ubon Ratchathani, Chaiyaphum, Nakhon Ratchasima; South-eastern: Prachin Buri; South-western: Kanchanaburi; Peninsular: Chumphon, Nakhon Si Thammarat, Phatthalung, Yala, Pattani, Satun.

Distribution.— India (Bangal-type), China, SE Asia, New Guinea, N Australia.

Ecology.— Deciduous Dipterocarp forest, open grassy ground, alt. 700-800 m (Wiang Peian Waterfall, Doi Phu Kha).

Phenology.— Flowering and fruiting: October-December.

Vernacular.— เอื้องดิน Ueang din (Chiang Mai).

Voucher specimens.— *P. Srisanga* 2273.

4. *SWERTIA* L.

Sp. Pl.: 266. 1753; Ubolcholaket in Fl. Thailand 5(1): 90. 1987. – *Agathodes* D. Don ex G. Don, Gen. Syst. 4: 177. 1837; D. Don, Trans. Linn. Soc. 17: 522. 1837. – *Ophelia* D. Don ex G. Don, Gen. Syst. 4: 178. 1837; D. Don, Trans. Linn. Soc. 17: 524. 1837.

Annual or perennial, erect, glabrous herbs. **Leaves** sessile with narrow base, 1- or 3-nerved. **Inflorescence** cymose or thyrsoïd, terminal and axillary, often flowering profusely. **Flowers** 4-5-merous; pedicels distinct. **Calyx** deeply divided; lobes erect, not ribbed or winged. **Corolla** lobes nearly free, as many as calyx lobes, with 1 or 2 depressions or glands inside at the base of each lobe, naked or covered by a basal scale, margins of glands fimbriate throughout or at apex only. **Stamens** inserted at the base of corolla lobes; filaments linear, often more or less enlarged downwards; anthers dorsi-versatile. Disk absent. **Ovary** 1-locular; stigma bilobed, subsessile. **Capsule** ovoid or ellipsoid.

About 100 species, mainly in N Hemisphere of Africa and Asia. Four species in Thailand (Ubolcholaket, 1987; Suksathan, 2001). One species recorded from Doi Phu Kha National Park.

Swertia striata Coll. & Hemsl.

J. Linn. Soc. Bot. 28: 91. 1890; Fletcher & Kerr in Fl. Siam. Enum. 3: 73. 1951; Ubolcholaket, Thai For. Bull. (Bot.) 14: 125, fig. 19. 1983; Toyokuni, Acta Phytotax. Geobot. 36: 125, fig. 2. 1985; Ubolcholaket in Fl. Thailand 5(1): 91, fig. 26: 13, pl. VI: 3. 1987.

Erect herb up to 30 cm high; stem quadrangular. **Leaves** lanceolate to elliptic, herbaceous, 1.5-3.5 cm long, 0.3-1 cm wide, glabrous; base attenuate; apex acute; 1- or 3-nerved from base. **Inflorescence** terminal and axillary cymes. **Flowers** 5-merous; pedicels 5-13 mm long. **Calyx** lobes lanceolate, 4-7 mm long, glabrous, acute at apex. **Corolla** white with longitudinal dark purplish veins, 8-10 mm long, acute at apex; with 2 distinct glands at base of each lobe inside; margin of glands surrounded by 1-2 mm long hairs except at the base. **Filaments** 4-5 mm long; anthers ellipsoid, 1-3 mm long. **Ovary** oblong, 5-7 mm long, glabrous. **Capsule** oblong, 7-10 mm long, 1-2 mm wide.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Myanmar (Shan States-type).

Ecology.— Lower montane scrub, open grassy ground among limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: October-January.

Vernacular.— หญ้าดอกกลาย Ya dok lai (Chiang Mai).

Voucher specimens.— *P. Srisanga* 419, 1822, 2654; *P. Suksathan* 1791.

Notes.— New locality recorded from Nan, in Thailand.

GESNERIACEAE

Herbs, shrubs, rarely small trees or climbers, sometimes epiphytic; stem erect, ascending, decumbent, creeping or pendulous. **Leaves** simple, opposite, rarely alternate, whorled or spiral, sometimes member of a pair unequal; stipules absent. **Inflorescence** axillary or terminal, usually cymose or flower solitary. **Flowers** bisexual, zygomorphic, usually showy. **Sepals** (4-)5, free or connate and then 2- or 3-lipped, usually valvate. **Petals** (4-)5, sympetalous, often more or less 2-lipped; lobes imbricate, adaxial ones usually enclosed. **Fertile stamens** 2 or 4, rarely 5, often with staminodes 3 or 1; filaments adnate to the corolla; anthers 2-locular, opening by longitudinal slits or by apical pores, rarely by basal pores, connate or connivent in pairs, rarely free. **Ovary** superior, inferior or half-inferior, mostly 1-locular, 2 parietal placentation and usually more or less intrusive placentas or very rarely 2-locular with axile placentation; disk present; style simple; stigmas 1-2; ovules numerous. **Fruit** a capsule, rarely berry. **Seeds** small, numerous.

About 140-150 genera and more than 3,500 species mainly in tropical and subtropical regions both of the Old and the New World (Weber, 2004). Many species are widely cultivated as ornamentals. About 27 genera and 144 species in Thailand. Ten genera and 22 species recorded from Doi Phu Kha National Park.

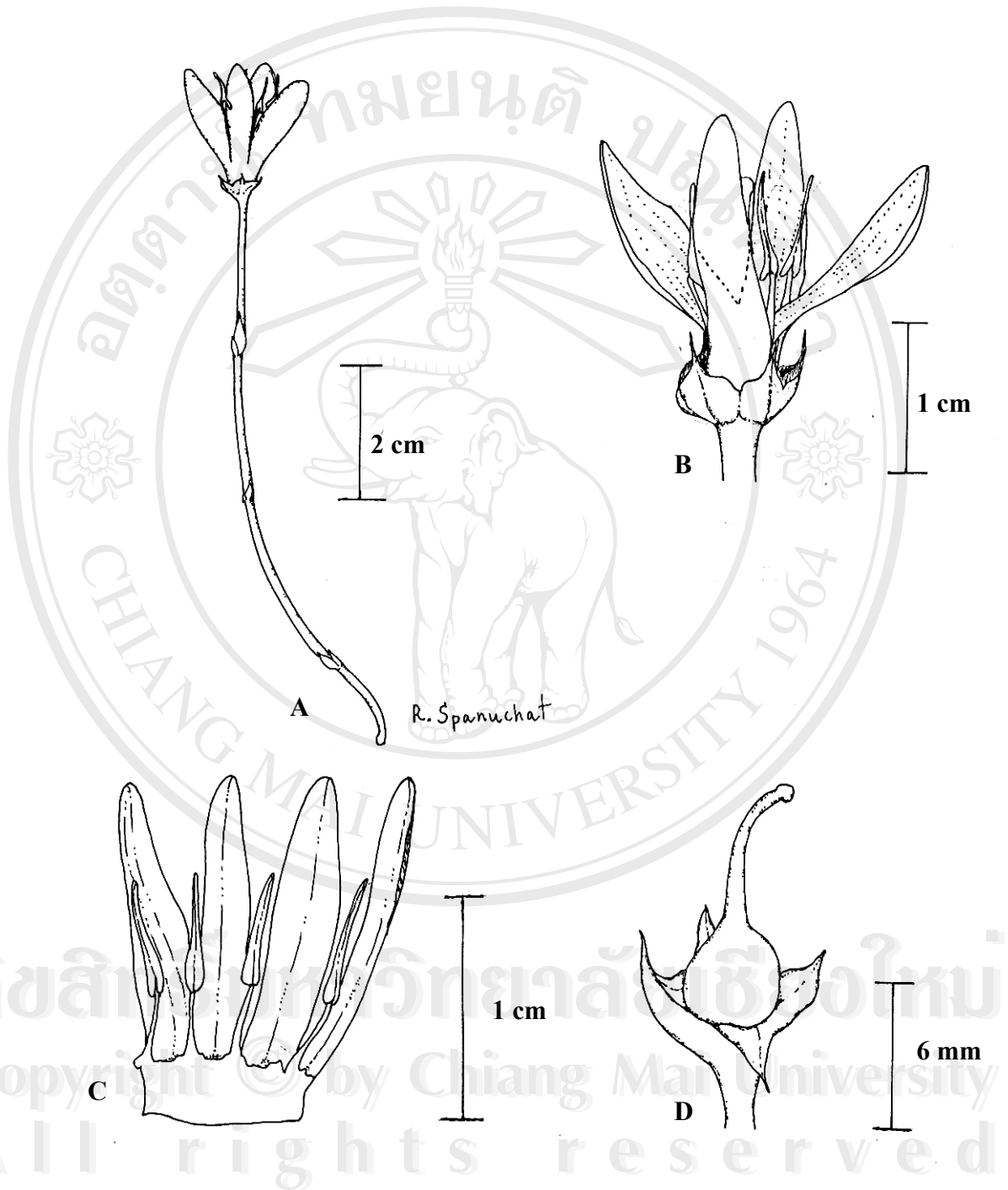


Figure 38. *Cotylanthera paucisquama* C.B. Clarke

A. plant; B. flower; C. opened corolla; D. pistil. All from P. Srisanga 1978.

KEY TO THE GENERA

1. Ovary and fruit more or less elongate, longer than wide
 2. Seeds with apical appendage
 3. Corolla bright red, orange, yellow or greenish **1. *Aeschynanthus***
 3. Corolla white, blue or purplish **5. *Lysionotus***
 2. Seeds without apical appendage
 4. Leaves with arachnoid tomentose on lower surface **6. *Paraboea***
 4. Leaves glabrous or pubescent, never arachnoid tomentose
 5. Anthers basifixed; thecae parallel **7. *Petrocosmea***
 5. Anthers dorsifixed
 6. Stigma not capitate. Capsule not stipitate **2. *Chirita***
 6. Stigma capitate. Capsule often stipitate **3. *Didymocarpus***
1. Ovary and fruit more or less globose or ovoid, about as long as wide
 7. Herbs. Sepals connate. Fruit a capsule
 8. Lowermost cauline leaf solitary, ovate-cordate, with long petiole; upper leaves opposite, 1-2-paired, ovate, sessile. Inflorescence pseudoterminal, densely contracted pair-flowered cymes. Fruit a circumscissile capsule **4. *Epithema***
 8. Plants not as above
 9. Leaves alternate. Inflorescence terminal, unilateral racemes with two-flowered rows. Fruit a loculicidal capsule **8. *Rhynchoglossum***
 9. Leaves opposite, strongly anisophyllous. Inflorescence in terminal cymes. Fruit a capsule, falling irregularly into pieces in the upper half **10. *Stauranthera***
 7. Shrubs or subshrubs. Sepals free. Fruit a berry **9. *Rhynchotechum***

1. *AESCHYNANTHUS* Jack

Trans. Linn. Soc. London 14: 42. 1823, nom. cons.; Wang et al. in Fl. China 18: 375. 1998; Weber in Fam. Gen. Vasc. Pl. 7: 145. 2004.

Epiphytic, rarely terrestrial, subshrubs; stem terete, rarely subquadrangular, erect, spreading or pendulous, clinging to the substrate by nodal roots. **Leaves** opposite, often arranged in a single plane, rarely whorled, fleshy or leathery; nerves usually obscure; margin entire, rarely obscurely denticulate. **Inflorescence** in axillary cymes, few-flowered or flower solitary, in leaf axils or emerging from scaly bracts and forming a pseudoterminal cluster; bracteoles ovate or scaly, rarely large and coloured, usually deciduous. **Sepals** 5, free or connate to form a cup-shaped or cylindrical, equal or rarely unequal. **Corolla** usually red to orange, or rarely yellow or greenish, zygomorphic; tube usually long, arcuate; lobes bilabiate, often with dark spots or stripes. **Stamens** 4, didynamous, included or exserted; anthers basifixed, cohering in pairs at the tips, opening by longitudinal slits; staminode 1 or absent. Nectary ring- or cup-shaped. **Ovary** linear, stipitate; stigma 1, capitate or peltate. **Fruit** a loculicidal capsule, linear, straight. **Seeds** with a triangular appendage at both ends or a filiform appendage at the apical and one to many filiform appendages at the hilar end.

About 160 species from India and S China throughout Malesia to New Guinea and the Solomon Islands (Weber, 2004). About 20 species in Thailand (Burt, 2001; 2002). Seven species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|-----------------------------------|
| 1. Corolla green | 1. <i>A. acuminatus</i> |
| 1. Corolla red or orange | |
| 2. Plant with conspicuous red floral bracts. Calyx more than 3 cm long.
Corolla more than 7 cm long | 6. <i>A. superbus</i> |
| 2. Plant not as above | |
| 3. Calyx deeply divided to the base | |
| 4. Calyx less than 3 mm long, acute at apex. Corolla at most 2.5 cm long | 2. <i>A. andersonii</i> |
| 5. Leaves (2-)2.5-4 cm long | 4. <i>A. monetarius</i> |
| 5. Leaves (0.6-)1-2 cm long | 3. <i>A. lineatus</i> |
| 4. Calyx more than 5 mm long, rounded at apex. Corolla at least 2.5 cm long | |
| 3. Calyx tube distinctly longer than the lobes | |
| 6. Calyx less than 1.5 cm long; lobes less than 4 mm long | 5. <i>A. stenosphonius</i> |
| 6. Calyx more than 2.5 cm long; lobes more than 8 mm long | 7. <i>A. sp.</i> |

1. *Aeschynanthus acuminatus* Wall. ex A. DC.

Prodr. 9: 263. 1845; Barnett in Fl. Siam. Enum. 3(3): 198. 1962; C.B. Clarke in Fl. Br. Ind. 4: 341. 1884; Wang et al. in Fl. China 18: 377. 1998; Burt, Thai For. Bull. (Bot.) 29: 83. 2001.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei; Peninsular: Chumphon, Phangnga (Fig. 39).

Distribution.— India, Nepal, Bhutan, Myanmar, China, Laos, Vietnam, Malaysia.

Ecology.— Dry evergreen and lower montane forest, on tree trunks by streams, alt. 850-1,300 m (Doi Phu Kha).

Phenology.— Flowering: November-January; fruiting: March-April.

Vernacular.— กระตุกไถ่ Kraduk kai (Loei).

Voucher specimens.— *P. Srisanga* 1290, 1316, 1886, 2729.

2. *Aeschynanthus andersonii* C.B. Clarke

Comm. & Cyrt. Beng.: 75, t. 48B. 1874; Wang et al. in Fl. China 18: 382. 1998; Burt, Thai For. Bull. (Bot.) 29: 83. 2001.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Myanmar, S China (Yunnan).

Ecology.— Lower montane forest, on tree trunks, alt. 1,300-1,750 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: August-November; fruiting: October-November.

Vernacular.— ว่านไก่อแดง Wan kai daeng (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1150, 1664, 1671, 1829, 2159, 2170.

3. *Aeschynanthus lineatus* Craib

Kew Bull. 1913: 201. 1913; Barnett in Fl. Siam. Enum. 3(3): 200. 1962; Wang et al. in Fl. China 18: 383. 1998; Burtt, Thai For. Bull. (Bot.) 30: 167. 2002 '*alineatus*'.

Thailand.— Northern: Chiang Mai (type), Nan (Fig. 40).

Distribution.— S China (Yunnan).

Ecology.— Lower montane forest, on tree trunks, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: August-September; fruiting: November-January.

Vernacular.— ไก่อรือขาว Kai riao (General).

Voucher specimens.— *P. Srisanga* 1657, 1724, 2355; *P. Srisanga* & *C. Maknoi* 2014.

4. *Aeschynanthus cf. monetarius* Dunn

Kew Bull. 1920: 135. 1920; Burtt, Thai For. Bull. (Bot.) 30: 168. 2002.

Thailand.— Northern: Tak, Nan.

Distribution.— Endemic to Thailand?

Ecology.— Lower montane forest, on tree trunks, alt. 1,800 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 1517.

5. *Aeschynanthus stenosphonius* W.T. Wang

Bull. Bot. Res. 3(4): 49. 1983; Burtt, Thai For. Bull. (Bot.) 30: 168. 2002.

Thailand.— Northern: Chiang Rai? (Vieng Pa Paw-type), Nan (Fig. 41).

Distribution.— Endemic to Thailand?

Ecology.— Dry evergreen forest, on tree trunks by falls, alt. 950 m (Thon Thong Waterfall).

Phenology.— Flowering: August-September.

Vernacular.— ว่านไก่อ่ดิน Wan kai ten (General).

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2092.

Notes.— Rare species.

6. *Aeschynanthus superbus* C.B. Clarke

Comm. & Cyrt. Beng.: 73, t. 46. 1874; in Fl. Br. Ind. 4: 342. 1884; Barnett in Fl. Siam. Enum. 3(3): 203. 1962; Wang et al. in Fl. China 18: 379. 1998; Burt, Thai For. Bull. (Bot.) 30: 168. 2002.

Thailand.— Northern: Chiang Mai, Nan (Figs. 42, 131).

Distribution.— India (type), Bhutan, Myanmar, China.

Ecology.— Lower montane forest, on tree trunks, alt. 1,200-1,400 m (Doi Phu Kha).

Phenology.— Flowering: August-September; fruiting: November.

Vernacular.— ไ้ค้ค้ Kai khao (General).

Voucher specimens.— *P. Srisanga* 1610, 2306; *P. Srisanga & C. Puff* 1077.

Notes.— Rare species.

7. *Aeschynanthus* sp.

Ecology.— Lower montane forest, on tree trunks, alt. 1,600 m (Doi Phu Kha).

Phenology.— Flowering: July-August.

Voucher specimens.— *P. Srisanga* 919.

2. *CHIRITA* Buch.-Ham. ex D. Don

Edinb. Phil. J. 7: 83. 1822; Wang et al. in Fl. China 18: 311. 1998; Weber in Fam. Gen. Vasc. Pl. 7: 141. 2004.

Annual or perennial herbs, acaulescent, rosulate or caulescent, erect or creeping. **Leaves** opposite, equal to unequal in each pair, sometimes ternate or whorled. **Inflorescence** in axillary cymes, 1-many-flowered. **Sepals** free or connate, linear-lanceolate to suborbicular, equal to subequal. **Corolla** zygomorphic, narrowly tubular to broadly funnel-shaped, more or less bilabiate. **Stamens** 2, fused, rarely free, included; anthers dorsifixed, opening by longitudinal slits; thecae divergent, rarely parallel; staminodes 3, rarely 1 or absent. Nectary cup-shaped. **Ovary** linear, sessile; stigma usually with the upper lobes absent and the lower lobe expanded into a bifid lamina. **Fruit** a loculicidal capsule, linear to vary narrowly ovoid, straight. **Seeds** without appendage.

Between 80-140 species from W Himalayas and E & S China to S India, Sri Lanka and W Malesia (Weber, 2004). About 25 species in Thailand (Burt, 2001). Four species recorded from Doi Phu Kha National Park.

1. *Chirita anachoreta* Hance

Ann. Sci. Nat. Bot., sér. 5, 5: 231. 1866; Barnett in Fl. Siam. Enum. 3(3): 221. 1962; Wang et al. in Fl. China 18: 343. 1998; Burt, Thai For. Bull. (Bot.) 29: 87. 2001.

Thailand.— Northern: Chiang Mai, Nan; Central: Nakhon Nayok; South-eastern: Trat.

Distribution.— Myanmar, China, Laos, Vietnam.

Ecology.— Dry evergreen forest, on rocks by streams, alt. 820 m (Sapan Waterfall).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 1602.

2. *Chirita hamosa* R. Br.

Cyrtandr.: 117. 1839; Barnett in Fl. Siam. Enum. 3(3): 224. 1962; C.B. Clarke in Fl. Br. Ind. 4: 360. 1884; Wang et al. in Fl. China 18: 345. 1998; Burtt, Thai For. Bull. (Bot.) 29: 87. 2001.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— India, Myanmar, China, Laos, Vietnam, Malaysia.

Ecology.— Lower montane forest, in open areas on limestone rocks, alt. 1,250 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 1572.

3. *Chirita* sp. 1

Ecology.— Lower montane forest, on rocks, alt. 1,870 m (Doi Phu Kha).

Phenology.— Flowering: July-August.

Voucher specimens.— *P. Srisanga* 928.

4. *Chirita* sp. 2

Ecology.— Lower montane forest, on rocks, alt. 1,700-1,800 m (Doi Phu Kha).

Phenology.— Flowering: July-September.

Voucher specimens.— *P. Srisanga* 1535, 1986.

3. *DIDYMOCARPUS* Wall.

Edinb. Phil. J. 1: 378. 1819; Wang et al. in Fl. China 18: 349. 1998; Weber in Fam. Gen. Vasc. Pl. 7: 142. 2004.

Perennial herbs, acaulescent or caulescent. **Leaves** opposite, equal to unequal in each pair. **Inflorescence** in pedunculate cymes, terminal or axillary, few- to many-flowered. **Sepals** free or connate. **Corolla** zygomorphic, tubular to trumpet-shaped, widening towards the mouth, more or less bilabiate; lobes rounded. **Stamens** 2, included; anthers dorsifixed, opening by longitudinal slits; thecae divaricate, confluent

at apex; staminodes 2-3 or absent. **Ovary** linear; stigma capitate. **Fruit** a loculicidal capsule, bivalved, usually stipitate, linear, straight. **Seeds** without appendage.

Over 70 species from N & NE India, Nepal and S China southwards to the Malay Peninsula and N Sumatra (Weber, 2004). About 18 species in Thailand (Burtt, 2001). Four species recorded from Doi Phu Kha National Park.

1. *Didymocarpus aureo-glandulosus* C.B. Clarke

In Fedde, Rep. Nov. Sp. 4: 292. 1907; Barnett in Fl. Siam. Enum. 3(3): 211. 1962; Wang et al. in Fl. China 18: 345. 1998; Burtt, Thai For. Bull. (Bot.) 29: 87. 2001.

Thailand.— Northern: Chiang Mai (type), Nan; North-eastern: Loei.
Ecology.— Lower montane forest, on tree trunks, alt. 1,600 m (Doi Phu Kha).
Phenology.— Flowering: July-August.
Voucher specimens.— *P. Srisanga* 251.

2. *Didymocarpus purpureobracteatus* W.W. Sm.

Notes Roy. Bot. Gard. Edinb. 5: 153. 1912; Wang et al. in Fl. China 18: 356. 1998.

Thailand.— Northern: Chiang Mai, Nan.
Distribution.— S China (Yunnan).
Ecology.— Lower montane forest, on rocks by streams, alt. 1,100-1,200 m (Doi Phu Kha).
Phenology.— Flowering: September-October.
Voucher specimens.— *P. Srisanga* 1708.

3. *Didymocarpus* sp. 1

Ecology.— Lower montane forest, on rocks, alt. 1,700-1,800 m (Doi Phu Kha).
Phenology.— Flowering and fruiting: July-August.
Voucher specimens.— *P. Srisanga* 917.

4. *Didymocarpus* sp. 2

Ecology.— Lower montane forest, on rocks, alt. 1,700-1,800 m (Doi Phu Kha).
Phenology.— Flowering and fruiting: July-September.
Voucher specimens.— *P. Srisanga* 1534, 1981.

4. **EPITHEMA** Bl.

Bijdr.: 737. 1826; Wang et al. in Fl. China 18: 400. 1998; Weber in Fam. Gen. Vasc. Pl. 7: 129. 2004.

Annual herbs; stem fleshy. Lowermost cauline leaf solitary, ovate-cordate, with long petiole; upper leaves opposite, 1-2-paired, ovate, subsessile. **Inflorescence** pseudoterminal, densely contracted pair-flowered cymes, usually embraced by their cucullate bract. **Sepals** connate in the lower half; lobes triangular, spreading after anthesis and the calyx forming a campanulate rain splash cup. **Corolla** white or bluish; tube cylindrical; lobes bilabiate. **Fertile stamens** 2, the posterior pair; filaments inserted above middle of corolla tube; anthers apically coherent; thecae divaricate, apically confluent, opening by longitudinal slits. **Staminodes** 2; filaments longer than those of fertile stamens, distal parts upcurved. Nectary cup-shaped. **Ovary** 1-locular. **Fruit** a circumscissile capsule, globose, membranous.

More than 20 species from India and S China to SE Asia and New Guinea, 1 species in W Africa (Weber, 2004). About 4 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Epithema saxatile* Bl.**

Bijdr.: 738. 1826; Barnett in Fl. Siam. Enum. 3(3): 207. 1962; Burt, Thai For. Bull. (Bot.) 29: 94. 2001.

Thailand.— Almost throughout the country.

Distribution.— Malaysia.

Ecology.— Dry evergreen forest, on rocks by streams, alt. 820 m (Sapan Waterfall).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 1591

5. *LYSIONOTUS* D. Don

Edinb. Phil. J. 7: 85. 1822; Wang et al. in Fl. China 18: 385. 1998; Weber in Fam. Gen. Vasc. Pl. 7: 147. 2004.

Epiphytic herbs or subshrubs; stem glabrous. **Leaves** opposite or in whorl of three, isophyllous or anisophyllous. **Inflorescence** in pedunculate cymes, few- to many-flowered. **Sepals** almost free to the base. **Corolla** white, blue or purplish, infundibuliform, slightly bilabiate; tube straight, inflated in upper half; lobes rounded. **Stamens** 2, adnate to the corolla tube near the middle, included; filaments flattened and curved; anthers basifixed, coherent; thecae subparallel, not confluent, opening by longitudinal slits. Nectary annular. **Ovary** 1-locular, cylindrical; stigma slightly bilamellate. **Fruit** a loculicidal capsule, straight, long. **Seeds** with appendages at both ends.

About 30 species from N India and Nepal, eastwards through S China, N Thailand, N Vietnam to S Japan (Weber, 2004). One species in Thailand.

***Lysionotus serratus* D. Don**

Edinb. Phil. J. 7: 86. 1822; Barnett in Fl. Siam. Enum. 3(3): 203. 1962; Wang et al. in Fl. China 18: 392. 1998; Burt, Thai For. Bull. (Bot.) 29: 100. 2001.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; North-eastern: Loei.

Distribution.— India, Nepal, Bhutan, Myanmar, China, Vietnam.

Ecology.— Dry evergreen and lower montane forest, on tree trunks, alt. 950-1,530 m (Doi Phu Kha, Thon Thong Waterfall).

Phenology.— Flowering and fruiting: July-August.

Voucher specimens.— *P. Srisanga* 253, 961; *P. Srisanga & C. Maknoi* 2097.

6. *PARABOEA* (C.B. Clarke) Ridl.

J. Straits Branch Roy. As. Soc. 43: 63. 1905; Wang et al. in Fl. China 18: 362. 1998; Weber in Fam. Gen. Vasc. Pl. 7: 147. 2004. – *Didymocarpus* Wall. sect. *Paraboea* C. B. Clarke in A. & C. DC., Monogr. Phan. 5: 105. 1883.

Perennial acaulescent or caulescent herbs, usually woolly, at least the young stem. **Leaves** opposite or spiral in some rosulate species, arachnoid tomentose on lower surface. **Inflorescence** in pedunculate cymes, few- to many-flowered. **Sepals** free. **Corolla** blue, purple or white, obliquely campanulate, slightly bilabiate. **Stamens** 2, adnate to the corolla tube near the base, included; filaments usually thick; anthers dorsifixed, coherent; thecae divaricate, apically confluent, opening by longitudinal slits. **Ovary** 1-locular, cylindrical; stigma small, capitate. **Fruit** a loculicidal capsule, usually spirally twisted or rarely straight. **Seeds** unappendaged.

About 90 species in S China, SE Asia and Malesia (Weber, 2004). About 29 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Paraboea glabrisepala* B.L. Burt**

Kew Bull. 1941: 21. 1941; Thai For. Bull. (Bot.) 29: 103. 2001. – *Boea glabrisepala* (B.L. Burt) Barnett in Fl. Siam. Enum. 3(3): 230. 1962.

Thailand.— Northern: Chiang Mai (type), Nan.

Distribution.— Endemic to Thailand?

Ecology.— Lower montane scrub, open places on limestone rocks, alt. 1,250-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: June-September.

Voucher specimens.— *P. Srisanga* 1573, 2137; *P. Srisanga et al.* 876.

7. *PETROCOSMEA* Oliv.

Hook. Ic. Pl. 18: t. 1716. 1887; Wang, Acta Bot. Yunnan. 7: 49. 1985; Wang et al. in Fl. China 18: 302. 1998; Weber in Fam. Gen. Vasc. Pl. 7: 136. 2004.

Perennial acaulescent herbs. **Leaves** few to many, in a basal rosette, ovate to orbicular; base cuneate to cordate, rarely peltate; apex acute, obtuse to rounded, petiolate. **Inflorescence** in pedunculate cymes, few- to several-flowered. **Sepals** free, equal or fused to a 3-partite calyx. **Corolla** blue, purple or white, campanulate; tube short; lobes rounded. **Stamens** 2; filaments short, inserted near corolla base; anthers basifixed, coherent at apex; thecae parallel, apically confluent or not, opening by longitudinal slits. Nectary absent. **Ovary** 1-locular, ovoid or conical; stigma capitate or globose. **Fruit** a loculicidal capsule, ovoid or oblong.

About 27 species in NE India, Myanmar, S China, Thailand, S Vietnam (Weber, 2004). About 4 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Petrocosmea kerrii* Craib**

Kew Bull. 1918: 365. 1918; Barnett in Fl. Siam. Enum. 3(3): 237. 1962; Wang et al. in Fl. China 18: 302. 1998; Burt, Thai For. Bull. (Bot.) 29: 106. 2001.

Thailand.— Northern: Chiang Mai (type), Nan.

Distribution.— Myanmar, S China (Yunnan).

Ecology.— Lower montane forest and lower montane scrub, on rocks, also in open places in crevice of limestone rocks, alt. 1,650-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: May-July.

Voucher specimens.— *P. Srisanga* 1424; *P. Srisanga et al.* 779, 869.

8. RHYNCHOGLOSSUM Bl.

Bijdr.: 741. 1826; Burt, Notes Roy. Bot. Gard. Edin. 24: 167. 1962; Wang et al. in Fl. China 18: 399. 1998; Weber in Fam. Gen. Vasc. Pl. 7: 128. 2004.

Annual or perennial herbs; stem terete, fleshy. **Leaves** alternate, obliquely ovate-cordate; base strongly asymmetrical, shortly petiolate. **Inflorescence** terminal, unilateral racemes with two-flowered rows; bracts small, linear. **Sepals** connate in the lower half, sometimes with wings at the line of fusion; lobes narrowly triangular, acute. **Corolla** strongly zygomorphic; tube cylindrical, white; lobes bright blue, upper lip 2-lobed, short, upright or reclined, lower lip large, roundish or elongate, entire or slightly 3-lobed. **Fertile stamens** 2 or 4; filaments inserted near middle of corolla; anthers coherent in pairs; thecae parallel or divaricate, apically confluent, opening by longitudinal slits. **Ovary** 1-locular. **Fruit** a loculicidal capsule, globose or ovoid, included within persistent calyx.

About 10 species from India and S China to SE Asia and New Guinea, 1 or more species in C America (Mexico to Peru) (Weber, 2004). One species in Thailand.

***Rhynchoglossum obliquum* Bl.**

Bijdr.: 741. 1826; C.B. Clarke in Fl. Br. Ind. 4: 367. 1884; Burt, Notes Roy. Bot. Gard. Edin. 24: 167. 1962; Barnett in Fl. Siam. Enum. 3(3): 208. 1962; Burt, Thai For. Bull. (Bot.) 29: 106. 2001.

Thailand.— Almost throughout the country.
 Distribution.— India, Nepal, Sri Lanka, China, SE Asia.
 Ecology.— Open places on limestone rocks, alt. 1,250 m (Doi Phu Kha).
 Phenology.— Flowering: August-September.
 Voucher specimens.— *P. Srisanga* 1571

9. RHYNCHOTECHUM Bl.

Bijdr.: 775. 1826; Wang et al. in Fl. China 18: 393. 1998; Weber in Fam. Gen. Vasc. Pl. 7: 131. 2004.

Shrubs or subshrubs; stem erect. **Leaves** opposite or whorled, subequal. **Inflorescence** in axillary cymes. **Sepals** 5, free, equal. **Corolla** tubular-campanulate, slightly bilabiate; lobes rounded. **Fertile stamens** 4, included; filaments inserted near the base or in the middle of corolla; anthers free; thecae parallel, apically confluent, opening by longitudinal slits. Nectary ring-shaped or absent. **Ovary** 1-locular, ovoid; stigma globose. **Fruit** a berry, ovoid or globose.

About 13-15 species from NE India, Nepal, Bhutan, S China to SE Asia, Malesia and New Guinea (Weber, 2004). Two species in Thailand. One species recorded from Doi Phu Kha National Park.

***Rhynchotechum obovatum* (Griff.) B.L. Burt**

Notes Roy. Bot. Gard. Edinb. 24: 38. 1962; Barnett in Fl. Siam. Enum. 3(3): 204. 1962; Burt, Thai For. Bull. (Bot.) 29: 107. 2001.

Thailand.— Northern: Almost throughout.
 Distribution.— E Himalayas, Myanmar, China, Laos, Cambodia, Vietnam.
 Ecology.— Dry evergreen and lower montane forest, in moist places and also by streams, alt. 800-1,700 m (Doi Phu Kha, Nan Watershed, Sapan Waterfall).
 Phenology.— Flowering: June-July; fruiting: October-November.
 Vernacular.— ช้างสวน Cha san (Chiang Mai).
 Voucher specimens.— *P. Srisanga* 304, 737, 1129, 2582; *P. Srisanga & C. Maknoi* 2046.

10. *STAURANTHERA* Benth.

Scroph. Ind.: 57. 1835; Wang et al. in Fl. China 18: 396. 1998; Weber in Fam. Gen. Vasc. Pl. 7: 128. 2004.

Perennial herbs; stem fleshy. **Leaves** opposite, strongly anisophyllous; large leaves obliquely elliptic to ovate, base strongly asymmetrical, apex acute to acuminate or blunt; small leaves reduced to a tiny cordi- or reniform. **Inflorescence** in terminal cymes of flower solitary; bracts small. **Sepals** connate, with conspicuous plication at the sinuses. **Corolla** rotate and widely campanulate or zygomorphic and spurred at the base, blue or white, sometimes with a yellow blotch at the palate. **Fertile stamens** 4; filaments adnate to corolla base; anthers coherent and forming a cross-like figure; thecae slightly divergent, opening by longitudinal slits. **Ovary** 1-locular. **Fruit** a capsule, globose, falling irregularly into pieces in the upper half.

Five or more species from NE India and S China to SE Asia, Malesia and New Guinea (Weber, 2004). One species in Thailand. (Burt, 2001).

Stauranthera grandiflora Benth.

Scroph. Ind.: 57. 1835; C.B. Clarke in Fl. Br. Ind. 4: 371. 1884; Barnett in Fl. Siam. Enum. 3(3): 205. 1962; Burt, Thai For. Bull. (Bot.) 29: 107. 2001.

Thailand.— Northern: Chiang Mai, Nan; Peninsular: Chumphon, Songkhla.

Distribution.— India, Myanmar, Vietnam, Malaysia.

Ecology.— Dry evergreen forest, in moist places, alt. 1,000 m (Tham Pha Khaw).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 1920.

HAMAMELIDACEAE

Trees or shrubs, deciduous or evergreen, often with stellate indumentum. **Leaves** simple, alternate, rarely opposite; margin entire or dentate; stipules mostly paired, often persistent sometimes large. **Inflorescence** spike or head, rarely raceme or condensed thyrse or panicle. **Flowers** small to medium-sized, mostly yellow, white, greenish or red, bisexual or andromonoecious, rarely unisexual, actinomorphic or very rarely zygomorphic. **Sepals** 4-5(-7) or absent, imbricate, persistent or rarely fused and then abscising or dehiscing at anthesis. **Petals** 4-5 or absent, caducous. **Stamens** (1-)4-5(-24); anthers 2-locular, opening by longitudinal slits or by valves. **Ovary** inferior, half-inferior or superior; carpels 2, united at least basally; styles subulate, free, often recurved; ovules 1, rarely more in each locus. **Fruit** a capsule.

Thirty genera and about 100 species widespread but chiefly subtropical region especially E Asia (Endress, 1993; Mabberley, 1997). Six genera and about 7 species in Thailand (Phengklai, 2001a; Suddee & Middleton, 2003). One species recorded from Doi Phu Kha National Park.

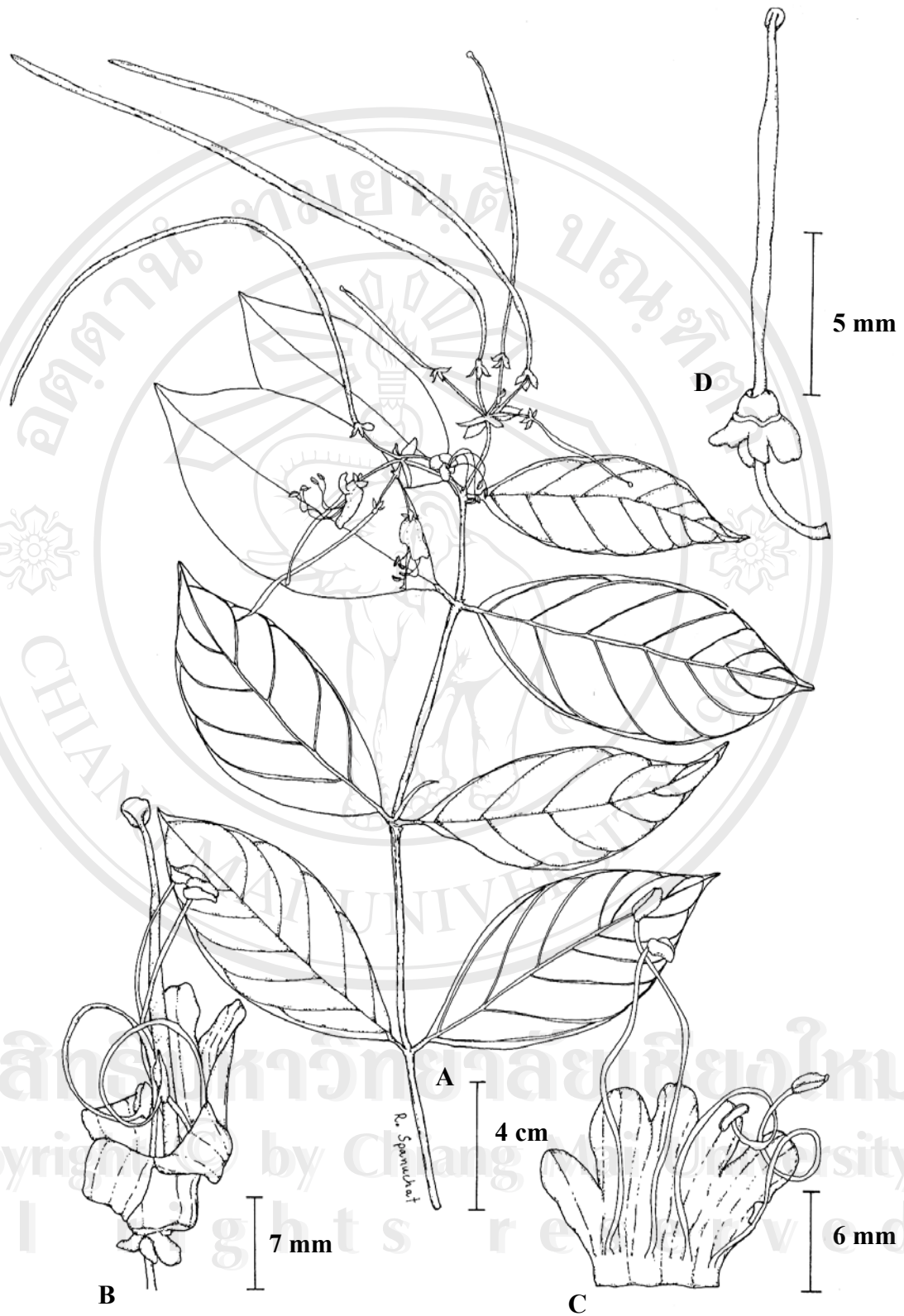


Figure 39. *Aeschynanthus acuminatus* Wall. ex A. DC.

A. habit; B. flower; C. opened corolla; D. pistil.

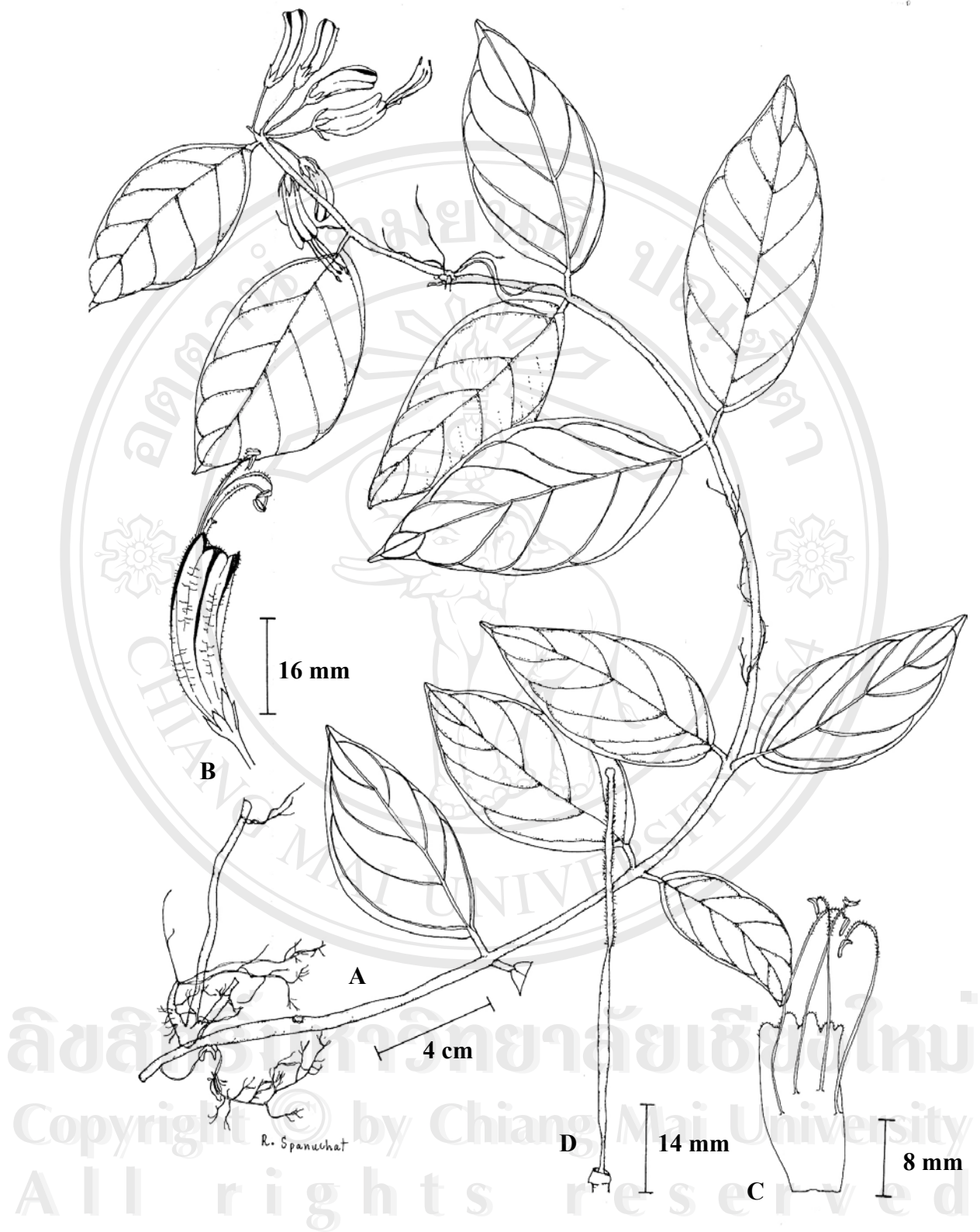


Figure 40. *Aeschynanthus lineatus* Craib

A. habit; B. flower; C. opened corolla; D. pistil.

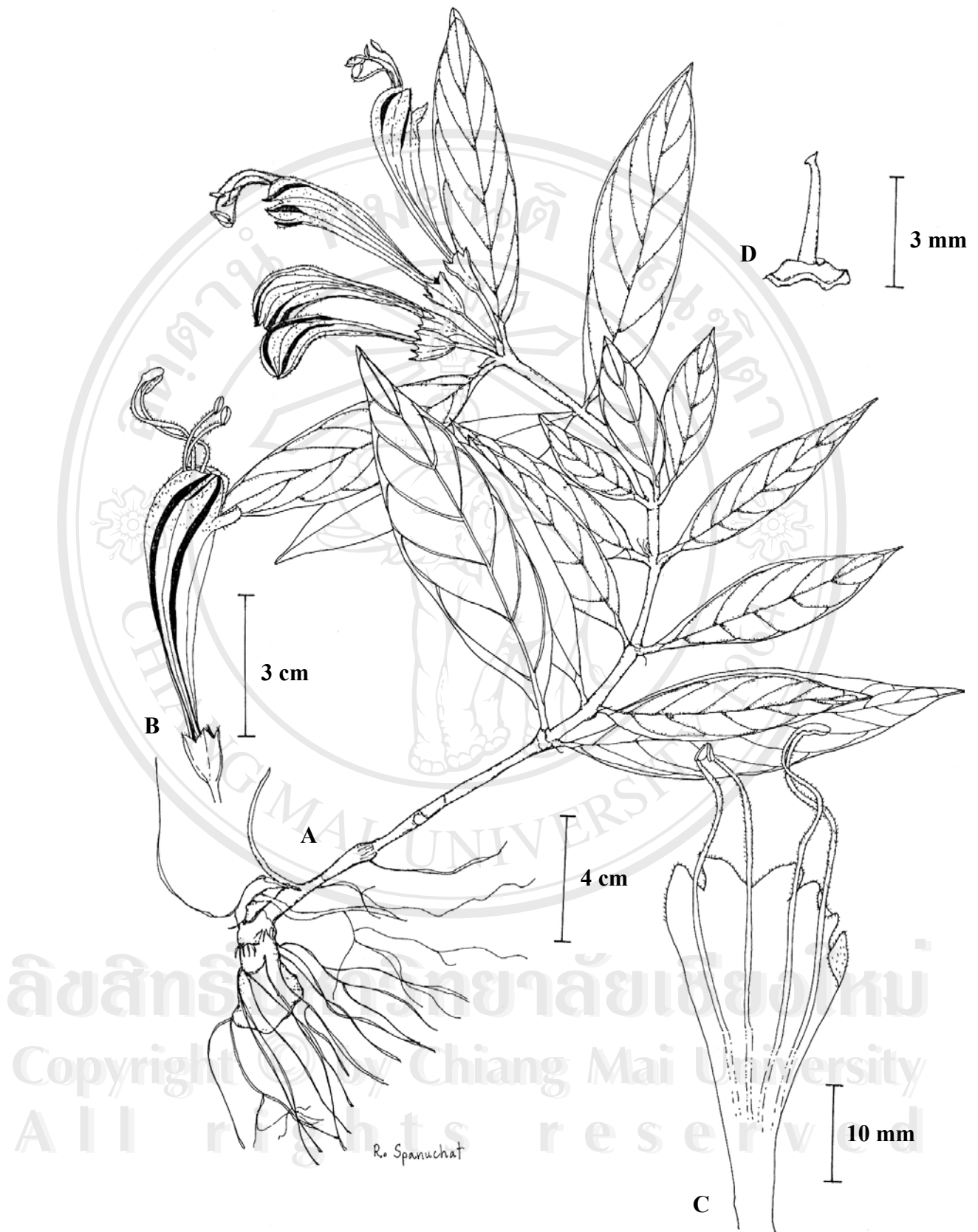


Figure 41. *Aeschynanthus stenosphonius* W.T. Wang

A. habit; B. flower; C. opened corolla; D. pistil.

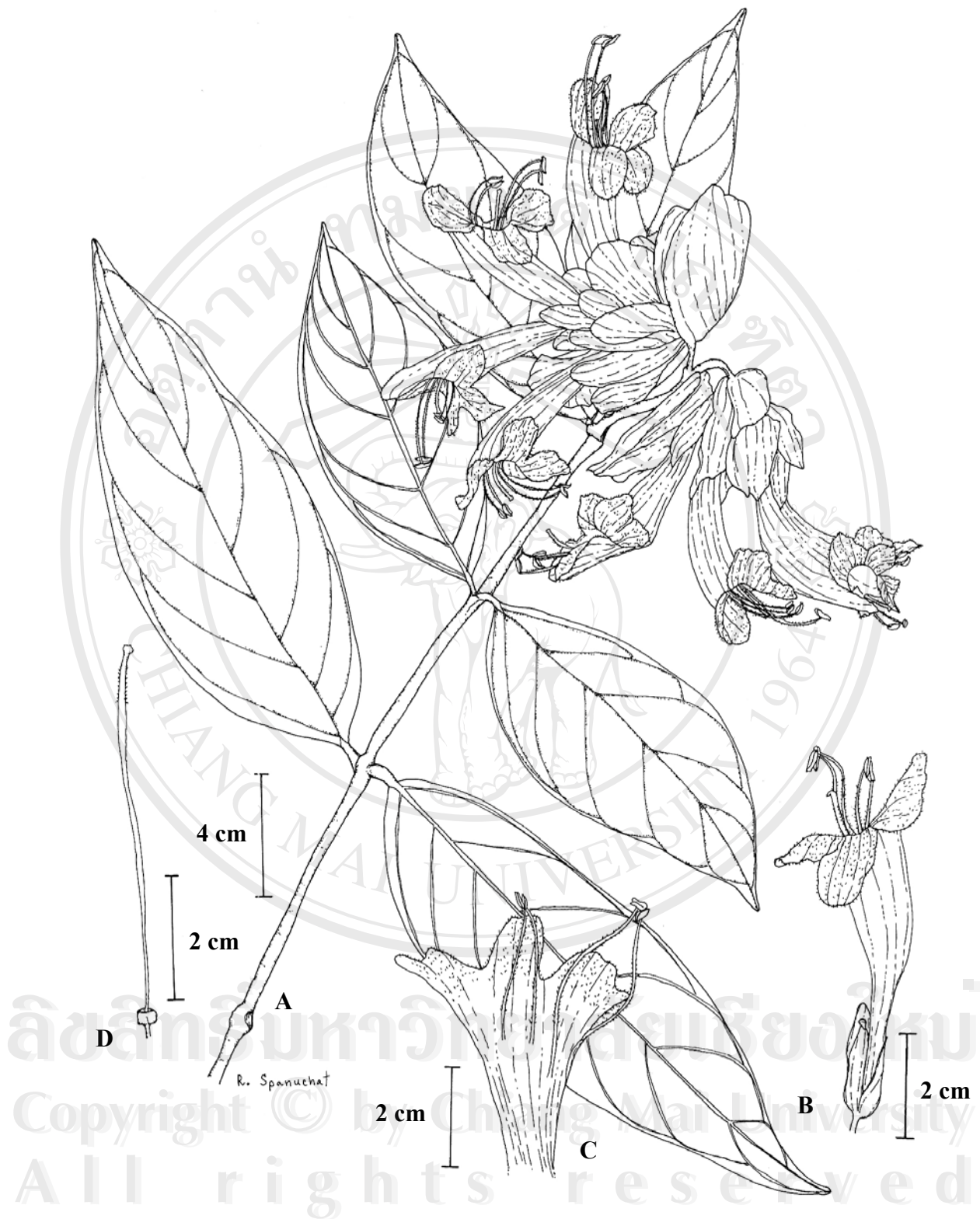


Figure 42. *Aeschynanthus superbus* C.B. Clarke

A. habit; B. flower; C. opened corolla; D. pistil.

SYCOPSIS Oliv.

Trans. Linn. Soc. 23: 83. 1860; Walker, J. Arn. Arb. 25: 335. 1944; Endress in Fam. Gen. Vasc. Pl. 2: 328. 1993; Zhiyun, Hongda & Endress in Fl. China 9: 27. 2003.

Andromonoecious, evergreen trees or shrubs. **Leaves** alternate, penninerved. **Inflorescence** terminal or axillary, dense spike or head. **Flowers** subtended by a bract. **Sepals** 5-6, irregular. **Petals** absent. **Stamens** 5-10, free, inserted on margin of floral cup; filaments equal or unequal; anthers opening by longitudinal slits, connective apiculate. **Ovary** superior, surrounded by a floral cup; ovules 1 in each carpel; styles 2, divergent. **Capsule** arranged spirally along axis, dehiscent by two 2-lobed valves, surrounded at base by the floral cup. **Seeds** wingless.

About 2-3 species in India (Assam), China and Thailand. *Sycopsis dunnii* Hemsl. recorded in Thailand (Phengklai, 2001a) had been transferred to *Distyliopsis* P.K. Endress as *Distyliopsis dunnii* (Hemsl.) P.K. Endress (Endress, 1970). Thus, there is only 1 species of *Sycopsis* in Thailand.

***Sycopsis griffithiana* Oliv.**

Trans. Linn. Soc. 23: 83, t. 8. 1860; C.B. Clarke in Fl. Br. Ind. 2: 427. 1878; Walker, J. Arn. Arb. 25: 336. 1944.

Tree up to 15 m high; branchlets lenticellate, stellate pubescent, glabrescent. **Leaves** lanceolate to elliptic, chartaceous, 5-11 cm long, 2-5 cm wide, sparsely stellate pubescent on both surfaces, glabrescent; base cuneate; apex acute to acuminate; margin entire or coarsely dentate near apex; midrib impressed above, raised and prominent below; primary veins 5-7 pairs, prominent on lower surface; petioles 4-8 mm long, stellate pubescent. **Inflorescence** in terminal or axillary head-like spike, 6-8-flowered; peduncle 2-5 mm long, densely pubescent. Floral bracts brown, ovate, concave, 4-6 mm long, densely stellate pubescent, unequal, the outer most larger than the inner. Floral cup 1-2 mm long, densely stellate pubescent. **Stamens** 6-8, on the rim of floral cup; filaments 4-6(-9) mm long, glabrous, unequal; anthers yellow, 2.5-3 mm long, glabrous. **Ovary** densely stellate pubescent; ovules pendulous; styles 4-5 mm long, glabrous on upper half, densely stellate pubescent on lower half. **Capsule** ellipsoid to ovoid, 13-15 mm long, brown. **Seeds** ellipsoid, 7-9 mm long, orange, glabrous; persistent floral cup covered about 3-7 mm high from the base (Figs. 43, 132).

Thailand.— Northern: Nan.

Distribution.— India (Assam-type).

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: September-November; fruiting: December-May.

Voucher specimens.— *P. Srisanga* 977, 1185, 1213, 1257, 1433, 1723, 2241, 2612, *P. Srisanga* & *C. Maknoi* 2023.

Notes.— Very rare species, previously only known from India (Assam). New recorded for Thailand.

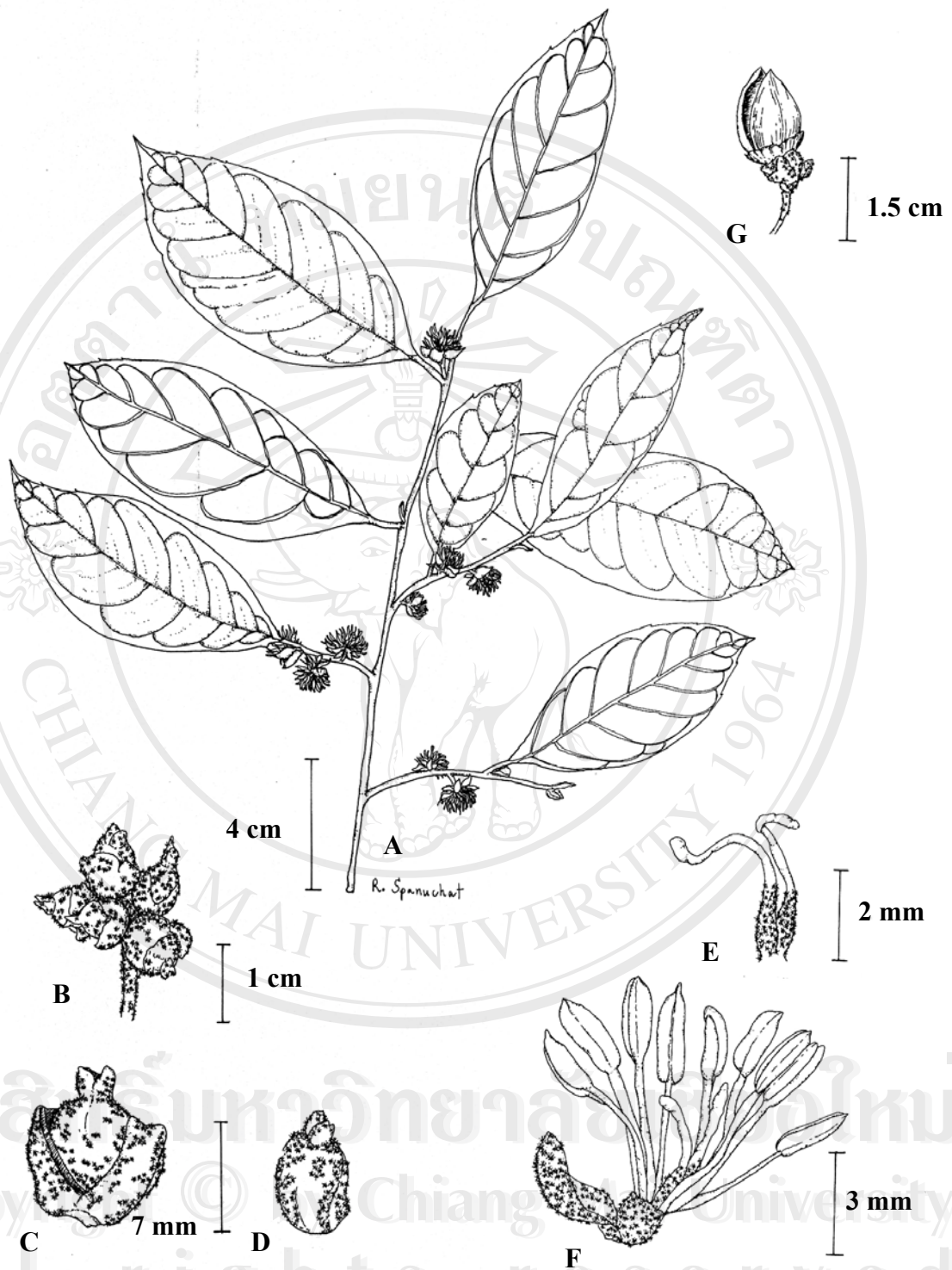


Figure 43. *Sycopsis griffithiana* Oliv.

A. flowering branch; B. young infructescence; C-D. young fruit; E. styles; F. bisexual flower; G. fruit.

HYDRANGEACEAE

Herbs, shrubs or climbers. **Leaves** simple, opposite, rarely distichous, serrate or dentate, exstipulate. **Inflorescence** in compound corymbs or panicles. **Flowers** bisexual or sometimes the marginal flowers sterile and with enlarged petals-like sepals. **Calyx** tube more or less adnate to the ovary; lobes 4-5(-12). **Petals** 4-5(-12), imbricate or valvate. **Stamens** twice the number of petals or numerous; filaments free or connate at base; anthers basifixed. **Ovary** inferior, half-inferior or superior, (2-)3-5 (-12)-locular, axile or intrusive parietal placentation; styles as many as the loculi, free or connate at base; ovules numerous. **Fruit** a berry or loculicidal capsule. **Seeds** numerous, small.

Seventeen genera and about 190 species in N temperate to Malesian regions (Mabberley, 1997). *Hydrangea macrophylla* (Thunb.) Ser. natives to Japan and Korea widely cultivated for ornamentals in northern Thailand. Only 1 species native to Thailand (Wongprasert, 2002).

DICHROA Lour.

Fl. Cochinch.: 301. 1790; Wongprasert in Fl. Thailand 7(4): 662. 2002; Hufford in Fam. Gen. Vasc. Pl. 6: 212. 2004.

Shrubs. **Leaves** serrate or dentate, petiolate. **Inflorescence** in terminal panicle. **Flowers** blue. **Calyx** (4-)5(-6)-lobed, valvate; tube adnate to the ovary. **Petals** (4-)5(-6), valvate, reflex at anthesis. **Stamens** 4-5 or 8-12; filaments filiform; anthers large, thick, ovoid, shallowly incised at both ends. **Ovary** half-inferior, (4-)5 (-6) parietal placentation; styles (4-)5(-6), divergent. **Fruit** a berry, blue.

Twelve species from China to SE Asia. One species in Thailand (Wongprasert, 2002).

Dichroa febrifuga Lour.

Fl. Cochinch.: 301. 1790; Wongprasert, Thai For. Bull. (Bot.) 26: 25, figs. 1-3. 1998; in Fl. Thailand 7(4): 662, fig. 1, pl. XXIV: 2A-B. 2002.

Shrub, 1-4 m high. **Leaves** elliptic, obovate to oblanceolate, chartaceous, 9-20 cm long, 3-9 cm wide, sparsely pubescent on both surfaces, with few scattered hairs along midrib and veins; base cuneate or attenuate; apex acuminate; margin serrate; primary veins 8-12 pairs; petioles 1.5-3 cm long, sparsely hairy, then glabrescent. **Inflorescence** in panicles, 6-15 cm long, pubescent; peduncle 5-10 cm long. **Flowers** many, blue; pedicels 1-5 mm long, pubescent. **Calyx** campanulate, 1-3 mm long; lobes broadly acute, glabrous inside, sparsely hairy outside. **Petals** oblong or ovate, acute or obtuse at apex, glabrous, 4-7 mm long, 1.5-3 mm wide. **Filaments** connate at base, 3-5 mm long, glabrous; anthers 1-2 mm long, blue. **Ovary** ovoid or conical, sparsely hairy; styles 3-4 mm long, blue. **Berry** subglobose, 3-5 mm long and wide, sparsely hairy or glabrous, blue, crowned by the persistent calyx lobes and remnant styles in the center. **Seeds** ovoid, numerous, small.

Thailand.— Northern: Chiang Mai, Nan, Tak; North-eastern: Loei; South-eastern: Chanthaburi; South-western: Kanchanaburi; Peninsular: Chumphon, Ranong, Surat Thani, Krabi, Nakhon Sri Thammarat, Trang, Narathiwat.

Distribution.— India, Nepal, Bhutan, Sikkim, Myanmar, China, Vietnam, Cambodia, Malaysia, Indonesia, Philippines, Papua New Guinea.

Ecology.— Lower montane forest, often along streams, alt. 1,500-1,800 m (Doi Phu Kha).

Phenology.— Flowering: June-August; fruiting: November-January.

Uses.— Decoction from roots and leaves is used as an emetics and anti-febrifuge.

Vernacular.— ฮ่อมดง Hom dong (Northern).

Voucher specimens.— *P. Srisanga* 380, 729, 902.

ICACINACEAE

Trees, shrubs or woody climbers. **Leaves** simple, alternate or rarely opposite; stipules absent. **Inflorescence** terminal and axillary, usually cymose, paniculate, rarely in heads or umbels. **Flowers** bisexual or unisexual by abortion, actinomorphic. **Calyx** (3-)4-5(-6), free or connate; lobes imbricate or rarely valvate. **Corolla** (3-)4-5 (-6), rarely absent, free or united, valvate. **Stamens** as the same number and alternate with the petals, free; anthers 2-locular, opening by longitudinal slits. Disk sometimes present. **Ovary** superior, (1-)3(-5)-locular, sometimes only 1-locular fertile; style terminal; ovules pendulous from near the top of the ovary. **Fruit** a drupe. **Seed** 1.

Fifty-two genera and about 300 species mostly in the tropical region (Mabberley, 1997). Thirteen genera and 18 species in Thailand (Sleumer, 1970). Six genera and 7 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Trees or shrubs
 2. Flower bisexual
 3. Leaves turning blackish when dry. Disk absent. Ovary pubescent; style excentric. Drupe with a big unilateral swelling which becomes succulent at maturity **1. Apodytes**
 3. Leaves remaining green or turning brownish when dry. Disk present. Ovary glabrous. Drupe without a lateral swelling **6. Pittosporopsis**
 2. Flowers unisexual. Rudimentary ovary conspicuous **2. Gomphandra**
1. Woody climbers
 4. Leaves opposite. Inflorescence cymose
 5. Tendrils present **3. Iodes**
 5. Tendrils absent **4. Mappianthus**
 4. Leaves alternate. Inflorescence in heads or umbels **5. Miquelia**

1. *APODYTES* E. Meyer ex Arn.

In J. Bot. Lond. 3: 155. 1840; Sleum., Blumea 17: 184. 1969; in Fl. Thailand 2(1): 81. 1970.

Trees. **Leaves** alternate, penninerved. **Inflorescence** in terminal and axillary corymbs. **Flowers** bisexual. **Calyx** cup-shaped, (4-)5-dentate, small. **Corolla** (4-)5, valvate, free or a little coherent at base, finally spreading. **Stamens** (4-)5; filaments subulate, glabrous; anthers subsagittate. Disk absent. **Ovary** with a lateral swelling; style excentric, ending in a small oblique stigma. **Drupe** obliquely ellipsoid, more or less compressed; style persistent, finally lateral and almost basal; the swelling developed to a distinct succulent appendage. **Seed** ovate-reniform, compressed.

Two species: one widely distributed and variable species in Africa, SE Asia and Malesia, and a second one limited to NE Australia (Sleumer, 1969; 1970).

Apodytes dimidiata E. Meyer ex Arn.

In J. Bot. Lond. 3: 155. 1840; Sleum., Blumea 17: 185. 1969; in Fl. Thailand 2(1): 81. 1970. — *A. cambodiana* Pierre, Fl. For. Cochinch.: t. 267, fig. A. 1892; Craib in Fl. Siam. Enum. 1: 273. 1926.

Tree, 8-15(-25) m high; branchlets with sparsely oblong lenticels. **Leaves** oblong to ovate-elliptic, thin coriaceous, 5-13 cm long, 2.5-6 cm wide, glabrous except minutely hairs on the midrib above, brownish black in the dry state; base acute, obtuse to rounded; apex acute to shortly acuminate, rarely obtuse; primary veins 6-10 pairs; petioles 1-2 cm long, minutely hairs. **Inflorescence** many-flowered, 3-8 cm long, minutely hairs. **Flowers** slightly fragrant. **Sepals** ca. 0.25 mm long. **Petals** white to yellowish, oblong, 4-6 mm long, glabrous. **Filaments** white, ca. 1.5 mm long; anthers 3-3.5 mm long. **Ovary** narrowly ovoid, densely to laxly pubescent, ca. 1 mm long; style 2-2.5 mm long, glabrous. **Drupe** obliquely ellipsoid, compressed, veined, first dark purple, blackish and shiny when mature, 5-6 mm long, 9-10 mm wide, with a large lateral succulent scarlet appendage and the lateral style almost at its base.

Thailand.— Northern: Chiang Mai, Nan, Phitsanulok; North-eastern: Loei, Udon Thani; Peninsular: Nakhon Si Thammarat.

Distribution.— Tropical and subtropical Africa (type), Madagascar, S India, Sri Lanka, Myanmar, S China (Yunnan), Hainan, Laos, Cambodia (type of *A. cambodiana*), Vietnam, Malesia.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: March-June; fruiting: July-October.

Voucher specimens.— *P. Srisanga* 524, 944, 1390; *P. Srisanga* & *S. Watthana* 622; *P. Srisanga* & *C. Puff* 1085.

2. *GOMPHANDRA* Wall. ex Lindl.

Nat. Syst. ed. 2: 439. 1836; emend. Beccari, Malesia 1: 109. 1877; Sleum., Blumea 17: 189. 1969; in Fl. Thailand 2(1): 78. 1970. — *Stemonurus* Bl., Bijdr.: 648. 1826, pro. parte.

Dioecious trees or shrubs. **Leaves** alternate, penninerved. **Inflorescence** in axillary cymose. **Flowers** unisexual. **Calyx** cupular, minutely 4-5-dentate. **Corolla** 4-5(-6), free or coherent at base. Disk absent or obscure. **Male flowers**: stamens 4-5 (-6), usually exserted; filaments flattened, with subclavate hairs on the ventral side below the anthers and dorsally at the connective; rudimentary ovary conspicuous. **Female flowers**: sometimes petals absent; ovary cylindrical; stigma sessile, discoid, slightly 4-5-lobed or crenate. **Drupe** ellipsoid or oblong, sometimes shortly beaked; endocarp with 8-10(-14) longitudinal ridges especially prominent in the dry fruit.

About 33 species in SE Asia extending eastwards to the Solomon and Santa Cruz Islands. Two species in Thailand (Sleumer, 1969; 1970). One species recorded from Doi Phu Kha National Park.

***Gomphandra tetrandra* (Wall.) Sleum.**

Notizbl. Bot. Gart. Berlin-Dahlem 15: 238. 1940; Blumea 17: 204. 1969; in Fl. Thailand 2(1): 79. 1970. – *Lasianthera?* *tetrandra* Wall. in Fl. Ind. ed. Carey & Wall. 2: 328. 1824. – *Gomphandra pauciflora* Craib, Kew Bull. 1914: 123. 1914; in Fl. Siam Enum. 1: 273. 1926.

Tree, 5-15 m high; branchlets slender, without lenticels. **Leaves** oblong to elliptic, chartaceous to subcoriaceous, (5-)8-11 cm long, 3-5 cm wide, glabrous; base cuneate; apex acuminate to caudate; primary veins 5-6 pairs; petioles 6-13 mm long, minutely hairs. **Inflorescence** 2-3.5 cm long, minutely hairs. **Sepals** ca. 0.5 mm long. **Petals** white or greenish white, oblong-lanceolate, 3.5-4.5 mm long, glabrous. **Male flowers**: filaments 2-3 mm long, with distinct white penicillate hairs; anthers 0.5-1 mm long; rudimentary ovary green, obconical, 2-3 mm long, glabrous, enlarged. **Female flowers**: ovary 2-3 mm long, glabrous; stigma 4-5-lobed. **Drupe** oblong-ellipsoid, 1.5-2.3 cm long, 0.5-0.8 cm wide, green, glabrous.

Thailand.— Northern: Chiang Rai, Nan (Doi Wao, type of *G. pauciflora*: Kerr 2433: E, K); South-western: Ratchaburi.

Distribution.— India (type), Sri Lanka, Myanmar, China, Laos, Cambodia, Vietnam.

Ecology.— Dry evergreen and lower montane forest, 850-1,800 m (Doi Phu Kha).

Phenology.— Flowering: November-March; fruiting: November-April.

Voucher specimens.— *P. Srisanga* 457, 541, 545, 1228, 1288, 1293, 1789, 1909, 2341, 2726; *P. Srisanga et al.* 2473.

3. IODES BI.

Bijdr.: 29. 1825; Sleum., Blumea 17: 219. 1969; in Fl. Thailand 2(1): 85. 1970. – *Erythrostaphyle* Hance, J. Bot. Lond. 11: 266. 1873.

Dioecious climbing shrubs or lianas; branchlets hairy, generally bearing short axillary or leaf-opposed bifid tendrils. **Leaves** opposite, decussate, penninerved, hairy. **Inflorescence** in axillary cymes usually combined in loose panicles, often

elongate and many flowered in male inflorescence, shorter and rather few flowered in female inflorescence. **Flowers** unisexual, small; pedicels short or almost sessile. **Calyx** cup-shaped; lobes 4-5, divided to the halfway or more, small. **Corolla** 4-5, connate, valvate. **Male flowers:** stamens (3-)4-5; filaments very short or absent; anthers almost basifixed; rudimentary ovary present. **Female flowers:** sometimes petals absent; ovary ovoid conical; staminodes sometimes present; stigma sessile, discoid, faintly lobed. **Drupe** ovoid to ellipsoid, laterally compressed, longitudinally crested; exocarp fleshy, thin, yellow to red; endocarp crustaceous, irregularly ribbed or reticulately lacunose or warty outside, smooth inside.

About 14 species in tropical Africa, Madagascar, India (Assam) to China and SE Asia. Two species in Thailand (Sleumer, 1969; 1970). Both species also recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves densely soft rusty tomentose beneath. Petals absent in female flowers **1. *I. cirrhosa***
1. Leaves sparsely hairy beneath. Petals present in female flowers **2. *I. vitiginea***

1. *Iodes cirrhosa* Turcz.

Bull. Soc. Nat. Moscou 27(2): 281. 1854; Sleumer, Blumea 17: 221. 1969; in Fl. Thailand 2(1): 86. 1970. – *I. ovalis* auct. non Bl.: Mast. in Fl. Br. Ind. 1: 596. 1875; Craib in Fl. Siam. Enum. 1: 276. 1926. – *I. tomentella* Miq., Fl. Ind. Bat. 1: 796. 1856. – *I. brandisii* Kurz, J. As. Soc. Beng. 41(2): 298. 1872.

Woody climber, 5-10(-18) m long; branchlets rusty tomentose. **Leaves** elliptic to ovate, firmly chartaceous, 5-15(-18) cm long, 3.5-8(-11) cm wide, densely soft rusty tomentose on both surfaces especially below, glabrescent above; base rounded to subcordate; apex shortly acuminate; primary veins 4-6 pairs, curved and prominent beneath; petioles 1-2(-3.5) cm long, rusty tomentose. **Inflorescence** 2-12 cm long, rusty tomentose. **Flowers** 5-merous. **Calyx** small, divided almost to the base, strigose. **Corolla** white or yellowish, oblong-lanceolate, 2-3 mm long, strigose. **Male flowers:** anthers sessile, 0.5-1 mm long; rudimentary ovary hairy. **Female flowers:** petals and staminodes absent; ovary ca. 1 mm long, densely strigose. **Drupe** red or pink, oblique ovoid, 1.5-2 cm long, 1-1.5 cm wide, appressed rusty tomentose; endocarp reticulately lacunose (Fig. 133).

Thailand.— Northern: Chiang Rai, Nan, Tak; Peninsular: Chumphon, Ranong, Songkhla, Pattani.

Distribution.— India, Myanmar, Laos, Vietnam, Malaysia, Indonesia (Java-type).

Ecology.— Dry evergreen forest, alt. 700-900 m (Doi Phu Kha, Tham Pha Kong).

Phenology.— Flowering: February-March; fruiting: June-August.

Voucher specimens.— *P. Srisanga* 256, 2524.

2. *Iodes vitiginea* (Hance) Hemsl.

J. Linn. Soc. Bot. 23: 115. 1886; Sleum., Blumea 17: 223. 1969; in Fl. Thailand 2(1): 87. 1970. – *Erythrostaphyle vitiginea* Hance, J. Bot. Lond. 11: 266. 1873. – *Iodes ovalis* Bl. var. *vitiginea* (Hance) Gagnep. in Fl. Gén. I.-C. 1: 845. 1911; Craib in Fl. Siam. Enum. 1: 276. 1926.

Woody climber, 5-10 m long; branchlets glabrous or sparsely hairy and glabrescent. **Leaves** elliptic to ovate, chartaceous, 5-15 cm long, 3.5-8 cm wide, sparsely hairy on both surfaces; base rounded to subcordate; apex acuminate; primary veins 4-6 pairs, curved and prominent beneath; petioles 1-2(-3.5) cm long, glabrous. **Inflorescence** 3-12 cm long, puberulous. **Flowers** 5-merous. **Calyx** small, divided almost to the base, strigose. **Corolla** green, oblong-lanceolate, 2-3 mm long, strigose. **Male flowers**: anthers sessile, 0.5-1 mm long; rudimentary ovary hairy. **Female flowers**: petals present; ovary 2-3 mm long, glabrous. **Drupe** not known.

Thailand.— Northern: Nan; North-eastern: Nakhon Phanom; Eastern: Ubon Ratchathani; Peninsular: Surat Thani.

Distribution.— China (type), Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga & C. Puff* 1079.

Notes.— New locality recorded from Nan, in Thailand.

4. *MAPPIANTHUS* Hand.-Mazz.

Sitzungsanz. Akad. Wiss. Math. Naturw. Kl. Wien 58: 150. 1921; Sleum., Blumea 17: 225. 1969. – *Iodes* Bl. sect. *Lasiodes* Baill., Adansonia 10: 268. 1872.

Dioecious climbing shrubs or lianas, without tendrils. **Leaves** opposite, decussate, penninerved. **Inflorescence** in axillary cymes. **Flowers** unisexual, small; pedicels short. **Calyx** cup-shaped; lobes 5, minute. **Corolla** 5, connate, valvate. **Male flowers**: stamens 5; filaments distinct; anthers almost basifixed; rudimentary ovary present. **Female flowers**: sometimes petals absent; ovary ovoid conical, hairy; staminodes sometimes present; stigma sessile, capitate, lobed. **Drupe** ovoid to ellipsoid; exocarp fleshy, thin; endocarp crustaceous, longitudinal shallow furrows and warty outside, smooth inside.

Two species in India (Assam), China and SE Asia (Sleumer, 1969; Mabberley, 1997). Closely related to and possibly congeneric with *Iodes* Bl. One species newly recorded from Doi Phu Kha National Park.

Mappianthus iodoides Hand.-Mazz.

Sitzungsanz. Akad. Wiss. Math. Naturw. Kl. Wien 58: 150. 1921; Sleum., Blumea 17: 225. 1969.

Woody climber, 5-10 m long; branchlets with lenticels, sparsely substrigose. **Leaves** oblong to elliptic, chartaceous, 8-12 cm long, 3.5-5 cm wide, sparsely substrigose on both surfaces, glabrescent or nearly glabrous except on veins and nerves beneath, densely glandular beneath; base broadly cuneate; apex shortly caudate; midrib impressed above, prominent beneath; primary veins 4-6 pairs, curved and prominent beneath; reticulation distinct; petioles 1-1.5 cm long, strigose. **Infructescence** 1.5-3 cm long, strigose. **Drupe** orange, ellipsoid, 3-3.7 cm long, 1.7-2.3 cm wide, strigose.

Thailand.— Northern: Nan.

Distribution.— China (type), N Vietnam.

Ecology.— Dry evergreen and lower montane forest, by streams, alt. 900-1,200 m (Doi Phu Kha).

Phenology.— Fruiting: August-October.

Voucher specimens.— *P. Srisanga* 1559, 1697.

Notes.— New genus recorded for Thailand.

5. *MIQUELIA* Meisn.

Pl. Vasc. Gen. 1: 152. 1838 nom. cons.; Sleum., Blumea 17: 229. 1969; in Fl. Thailand 2(1): 89. 1970.

Dioecious climbing or twining shrubs. **Leaves** alternate, entire or coarsely lobed or toothed. **Inflorescence** in heads or umbels, on an elongate peduncles; heads or umbels solitary or in lax racemes or panicles. **Flowers** unisexual, small, sessile. **Calyx** small; lobes 4-5, divided almost to the base. **Corolla** 4-5, connate, valvate. **Male flowers**: stamens 4-5; filaments short; anthers dorsifixed; rudimentary ovary minute. **Female flowers**: staminodes flattish, very short; ovary cylindrical, hairy; stigma sessile, disk shaped. **Drupe** oblong, ovoid to ellipsoid, laterally compressed; exocarp fleshy, thin; endocarp crustaceous, rugose or shallowly lacunose outside, verrucose inside.

About 8 species in India and SE Asia. One species in Thailand (Sleumer, 1969; 1970).

Miquelia kleinii Meisn.

Pl. Vasc. Gen. 2: 109. 1838; Sleum., Blumea 17: 230. 1969; in Fl. Thailand 2(1): 89. 1970.

Woody climber; branchlets granulate. **Leaves** elliptic to broadly lanceolate, membranous, 13-18 cm long, 6-9 cm wide, very sparsely hairy below, granular on both surfaces especially above; base cordate; apex acuminate; margin entire or coarsely shallowly few lobes; primary veins 4-8 pairs, the lowest from near the base; petioles 3-4 cm long, sparsely strigose. **Inflorescence** in heads, 10-15-flowered; peduncle 5-10 cm long, glabrous. **Calyx** ca. 1 mm long, glabrous. **Corolla** greenish, ca. 2 mm long; lobes about halfway, glabrous. **Drupe** ellipsoid, 1.7-2 cm long, 1-1.4 cm wide, rugose, granular, strigose.

Thailand.— Northern: Nan; South-eastern: Prachin Buri; Peninsular: Chumphon.

Distribution.— India (Assam-type).

Ecology.— Dry evergreen forest, by streams, alt. 900-1,000 m (Doi Phu Kha).

Phenology.— Flowering: June-July; fruiting: August-October.

Voucher specimens.— *P. Srisanga* 1562.

Notes.— New locality recorded from Nan, in Thailand.

6. *PITTOSPOROPSIS* Craib

Kew Bull. 1911: 28. 1911; Sleum., Blumea 17: 241. 1969; in Fl. Thailand 2(1): 83. 1970.

Shrub or small tree. **Leaves** alternate, penninerved. **Inflorescence** in axillary pedunculate cymes. **Flowers** bisexual. **Calyx** 5; lobes divided to the halfway, persistent. **Corolla** 5, free. **Stamens** 5; filaments free; anthers versatile; cells separated by the connective which surpasses them as a marked glabrous apiculus. Disk annular, fleshy, very low, connate to the ovary. **Ovary** ovoid-ellipsoid, narrowed upwards to the rather short style; stigma truncate or bilobed. **Drupe** subglobose; exocarp thin; endocarp thin, crustaceous. **Seed** with ruminant endosperm.

A monotypic genus in Myanmar, S China (Yunnan), Thailand, Laos and Vietnam.

Pittosporopsis kerrii Craib

Kew Bull. 1911: 28. 1911; in Fl. Siam. Enum. 1: 273. 1926; Sleum., Blumea 17: 241. 1969; in Fl. Thailand 2(1): 84. 1970. — *P. nervosa* Gagnep., Not. Syst. Paris 13: 136. 1947.

Shrub or small tree, up to 7 m high; branchlets smooth, sparsely pubescent. **Leaves** oblong, lanceolate to narrowly elliptic, chartaceous to thinly coriaceous, 13-20 cm long, 4-7 cm wide, glabrous; base cuneate, slightly oblique; apex acuminate to caudate; margin entire; midrib impressed above, raised and prominent beneath; primary veins 5-7 pairs, impressed above, raised and prominent beneath; reticulation coarse and raised beneath; petioles 1-2 cm long, glabrous to sparsely pubescent. **Inflorescence** 1.5-3.5 cm long, brown yellowish pubescent, many-flowered. **Flowers** slightly fragrant; pedicels ca. 2 mm long, pubescent with 3-4 small bracts. **Calyx** cup-shaped, 1.5-2 mm long, pubescent. **Corolla** white, oblong-spathulate, acute at apex, 6-7 mm long, 1-2 mm wide, pubescent outside, glabrous inside. **Filaments** flattened, 4-5 mm long, sparsely pubescent; anthers 1.5-2 mm long, glabrous. **Ovary** ca. 1 mm long, glabrous; style 2-3 mm long, glabrous. **Drupe** greenish yellow, subglobose, 2-2.5 cm long and wide, glabrous. **Seed** white.

Thailand.— Northern: Chiang Mai (type), Lampang, Nan.

Distribution.— Myanmar, S China (Yunnan), Laos, Vietnam (type of *P. nervosa*).

Ecology.— Dry evergreen forest, often by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: August-September.

Uses.— Boiled seed edible, slightly bitter taste.

Vernacular.— ประยงค์ Prayong (Lua-Nan), มะขาม Ma khom (Lua, General).

Voucher specimens.— *P. Srisanga* 569, 1277, 1321, 1471, 1568, 2723.

JUGLANDACEAE

Trees or rarely large shrubs, monoecious or dioecious, deciduous or evergreen. **Leaves** pinnately compound, alternate or opposite, exstipulate; leaflets entire or serrate, sessile or petiolulate, usually with scales on the lower surface. **Inflorescence** terminal on new growth, lateral on old wood or sometimes at the base of new growth, drooping or rarely erect catkins or spikes; staminate and pistillate catkins separate or combined into an androgynous panicle with the central spike wholly or partly pistillate and lateral catkins staminate; staminate inflorescence a solitary catkin or cluster of 3-8 catkins; pistillate inflorescence a many-flowered catkin or a 2- to several-flowered spike. **Flowers** unisexual, small. **Staminate flowers** with rounded to elongated receptacle; bract unlobed or 3-lobed; bracteoles 2, fused to receptacle and appearing as part of calyx or absent. Sepals (1-)4 or absent. Petals absent. Stamens 3-105; filaments short or absent; anthers basifixed, erect, 2-locular, dehiscing by longitudinal slits. **Pistillate flowers**: bract unlobed or 3-lobed; bracteoles 2-3 or absent. Sepals 4, fused with an ovary, free at apex, or absent. Petals absent. Pistil bicarpellate, or very rarely in individual flowers with 3-4 carpels. Ovary inferior, 1-locular above, with incomplete partitions at base, 2-, 4- or 8-chambered at base; ovule 1, erect; style 1; stigmas 2-4-branched. **Fruit** a nut, with dehiscent or indehiscent husk, or 2-3 or circular-winged samara. **Seed** 1.

Eight genera and about 60 species, mostly in temperate and subtropical regions (Stone, 1993). Two genera and about 4 species in Thailand. One genus and 2 species, one with 2 varieties recorded from Doi Phu Kha National Park.

ENGELHARDIA Lesch. ex Bl.

Bijdr. 10: 528. 1825; Jacobs in Fl. Mal. I(6): 145. 1960; Manning, Bull. Torrey Bot. Club 93(1): 34. 1966; Ann. Missouri Bot. Gard. 65(4): 1076. 1978; Hô in Fl. C.L.V. 26: 16. 1992; Stone in Fam. Gen. Vasc. Pl. 2: 356. 1993; Lu, Stone & Grauke in Fl. China 4: 278. 1999. – *Pterilema* Reinw., Syll. Pl. Nov. Soc. Ratisb. 2: 13. 1826.

Monoecious or dioecious trees, deciduous or evergreen. **Leaves** alternate, paripinnate; leaflets 2-14, asymmetrical, entire or serrate, sessile or petiolulate, usually with scales on the lower surface. **Inflorescence** terminal on new growth or lateral on old wood or sometimes at the base of new growth, drooping catkins or spikes; staminate and pistillate catkins separate or combined into an androgynous panicle with the central spike wholly or partly pistillate and lateral catkins staminate; staminate inflorescence in cluster of 3-6 catkins; pistillate inflorescence a many-flowered catkin or a 2- to several-flowered spike. **Staminate flowers**: bract 3-lobed; bracteoles 2, fused to receptacle and appearing as part of calyx. Sepals 4. Stamens 4-13, sessile or

subsessile. **Pistillate flowers:** bract 3-lobed; bracteoles 2. Sepals 4, fused with an ovary, free at apex. Pistil bicarpellate. Ovary inferior, 1-locular above, with incomplete partitions at base, 2-, 4-chambered at base; ovule 1, erect; style 1; stigmas 2-4-branched. **Fruit** a nut, with 3-winged samara.

About 5 species in India, Nepal, China and SE Asia (Manning, 1966, 1978; Stone, 1993). The number of species is open to question, more than 10 have been recognized in SE Asia (Lu, Stone & Grauke, 1999).

KEY TO THE SPECIES

- | | |
|---|---|
| 1. Leaflets entire | 1. <i>E. spicata</i> |
| 2. Leaflets sparsely hairy beneath, glabrescent, acute to acuminate at apex | 1.1. <i>E. spicata</i> var. <i>aceriflora</i> |
| 2. Leaflets tomentose beneath, rounded, obtuse to merely acute at apex | 1.2. <i>E. spicata</i> var. <i>colebrookeana</i> |
| 1. Leaves serrate | 2. <i>E. sp.</i> |
1. ***Engelhardia spicata*** Lesch. ex Bl.

Bijdr. 10: 528. 1825; Koord. & Valet., Bijdr. 5: 165, 170. 1900; Jacobs in Fl. Mal. I (6): 151, fig. 1c, 3, 7-9. 1960; Manning, Bull. Torrey Bot. Club 93(1): 41. 1966; Hô in Fl. C.L.V. 26: 22, pl. 4. 1992; Lu, Stone & Grauke in Fl. China 4: 279. 1999. – *E. roxburghiana* Lindl. ex Wall., Pl. As. Rar. 2: 85, t. 199, fig. 7. 1831. – *Juglans pterococca* Roxb., Fl. Ind. ed. Carey 3: 631. 1832 '*plerococca*'. – *Gyrocarpus pendulus* Blanco, Fl. Filip. Ed. 2: 55. 1845 '*Gyrocarpos pendulos*'. – *Engelhardia philippinensis* C. DC., Ann. Sci. Nat. Bot. 4, 18: 34, t. 2, fig. 15. 1862. – *E. pterococca* Roxb. ex Kuntze, Rev. Gen. Pl.: 637. 1891.

Monoecious tree, (4-)10-20(-30) m high, deciduous. **Leaves** rachis 15-30(-35) cm long, glabrous or pubescent; leaflets (4-)8-14, lanceolate, elliptic to narrowly ovate, 7-17 cm long, (2-)4-6(-8) cm wide, glabrous or pubescent, usually with tuft of hairs in leaf axils and grayish brown scales on the lower surface; base oblique; apex rounded, obtuse, acute to acuminate; margin entire, sessile or petiolulate. **Inflorescence** lateral on old wood or sometimes at the base of new growth. **Staminate catkins** 6-13 cm long; bract 2-4 mm long, lateral lobes narrowed, sometimes much reduced; stamens (6-)8-12; anthers ca. 1 mm long, hirsute, sessile or subsessile. **Pistillate catkins** (6-)10-15 cm long; bract hairy; flowers sessile, style hispid. **Infrutescence** (10-)20-30(-45) cm long; rachis pubescent. **Nut** ovoid to subglobose, 3-5 mm in diam., hispid, with persistent style and stigmas; wings 2-4 cm long, sparsely hispid, glabrescent, the median one longest.

Notes.— *E. spicata* is a very variable species and the variation of its characters seems to occur more or less at random and not bound to a geographical pattern (Jacobs, 1960). Three varieties has been recognized by various botanists (Manning, 1966, 1978; Hô, 1992; Lu, Stone & Grauke, 1999). The typical variety has glabrous leaflets, with acute to acuminate at apex; petiolules 3-10 mm long. Infrutescence (15-

)22-45 cm long. Its has widely distribution from E Himalayas: India, Nepal, Bhutan, Sikkim, Pakistan, S China through SE Asia. In Thailand, it commonly found in deciduous and evergreen forest in northern, north-eastern, eastern and south-western regions at altitude between (100-)800-1,800 m.

1.1. *Engelhardia spicata* Lesch. ex Bl. var. *aceriflora* (Reinw.) Koord. & Valet.

Bijdr. 5: 167, 171. 1900; Manning, Bull. Torrey Bot. Club 93(1): 42. 1966; Hô in Fl. C.L.V. 26: 26, pl. 4: 4-5. 1992; Lu, Stone & Grauke in Fl. China 4: 279. 1999. – *Pterilema aceriflorum* Reinw., Syll. Pl. Nov. Soc. Eatisb. 2: 13. 1826 – *Engelhardia aceriflora* (Reinw.) Bl., Fl. Jav. Jugl.: 11, t. 2, 5B. 1829. – *E. pterococca* Roxb. ex Kuntze var. *aceriflora* (Reinw.) Kuntze, Rev. Gen. Pl.: 637. 1891.

This variety has sparsely hairy to glabrescent on leaflets beneath, with acute to acuminate at apex; petiolules absent or shortly so, up to 5 mm long. Infrutescence 15-30(-40) cm long.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan; South-western: Kanchanaburi.

Distribution.— From E Himalayas: India, Nepal, Bhutan, Sikkim, Pakistan, S China through SE Asia.

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: November-March; leafless in short period between December-January.

Vernacular.— คำหอด Kha hot (Northern); ไม้อกลี Mai Gree (Lue-Nan).

Voucher specimens.— *P. Srisanga* 386, 2357, 2359, 2677; *P. Srisanga et al.* 2435.

Notes.— Possibly conspecific with the typical variety as also point out by Jacobs (1960).

1.2. *Engelhardia spicata* Lesch. ex Bl. var. *colebrookeana* (Lindl. ex Wall.) Koord. & Valet.

Bijdr. 5: 169, 172. 1900; Manning, Bull. Torrey Bot. Club 93(1): 43. 1966; Lu, Stone & Grauke in Fl. China 4: 279. 1999. – *E. colebrookeana* Lindl. ex Wall., Pl. As. Rar. 3: 4, t. 208. 1832. – *E. pterococca* Roxb. ex Kuntze var. *colebrookeana* (Lindl. ex Wall.) Kuntze, Rev. Gen. Pl.: 637. 1891. – *E. spicata* Lesch. ex Bl. var. *colebrookeana* (Lindl. ex Wall.) Kuntze, Rev. Gen. Pl.: 637. 1891; Jacobs in Fl. Mal. I (6): 153. 1960. – *E. villosa* Kurz var. *integra* Kurz, For. Fl. Burma 2: 492. 1877. – *E. esquirolii* Lév., Fedd. Rep.12: 507. 1913. – *E. spicata* Lesch. ex Bl. var. *integra* (Kurz) Manning in Fl. Mal. I(6): 953. 1972; Hô in Fl. C.L.V. 26: 24, pl. 4: 6-8. 1992.

This variety has more or less tomentose on leaflets beneath, with rounded, obtuse to merely acute at apex; petiolules up 5 mm long or rarely absent. Infrutescence shortest when compare to others variety, 10-17(-25) cm long.

Thailand.— Northern: Chiang Mai, Phrae, Nan; North-eastern: Loei, Phetchabun; Eastern: Chaiyaphum; South-western: Kanchanaburi.

Distribution.— E Himalayas: India, Nepal, Bhutan, Sikkim, Pakistan, S China through SE Asia.

Ecology.— Lower montane forest, alt. 1,250-1,450 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: February-April; leafless in short period between January-February or not shed.

Vernacular.— คำหัด Kha hot (Northern); ไม้ก๊อ Mai Gree (Lua-Nan).

Voucher specimens.— *P. Srisanga* 1353, 1356; *P. Srisanga* & *S. Watthana* 621.

2. *Engelhardia* sp.

Tree, ca. 7 m high. **Leaves** rachis (6-)10-15 cm long, pubescent; leaflets 6-8, oblong-elliptic, (4.5-)7-14 cm long, 2-5 cm wide, pubescent, with brown scales on the lower surface; base cuneate, oblique; apex acute; margin serrate; petiolules (1-)4-6 mm long, pubescent. **Inflorescence** and **infrutescence** not known.

Thailand.— Northern: Nan.

Ecology.— Lower montane scrub, limestone bedrocks, alt. 1,700 m (Doi Phu Wae).

Voucher specimens.— *P. Srisanga* 2645.

Notes.— Possibly new variety of *E. serrata* Bl. or new species. It characterized by serrate leaf with distinct petiolules and with brown scales on the lower surface.

LAMIACEAE (LABIATAE)

Trees, shrubs, subshrubs or herbs, unarmed, erect, aromatic or not; stem erect or prostrate, usually quadrangular, sometimes conspicuously noded. Indumentum usually present, simple, capitate-glandular or stellate hairs. **Leaves** simple, rarely digitately or pinnately compound, opposite, often decussate, rarely whorled or alternate, exstipulate. **Inflorescence** terminal or axillary, usually in pairs, or in short, fascicled cymes forming verticillasters, or in cincinni, in many cases compound into spicate, racemose, capitate or paniculate; bracts often present, sometimes conspicuous, persistent or caducous; bracteoles present or absent. **Flowers** bisexual, mostly zygomorphic. **Sepals** 4-5(-9), connate, actinomorphic or zygomorphic, sometimes 2-lipped, persistent, often accrescent. **Petals** 4-5(-16), sympetalous, actinomorphic or often zygomorphic, 2-lipped; lobes imbricate. **Stamens** usually 4 and didynamous, or 2 by abortion and then staminodes often present, inserted on the corolla tube; filaments sometimes hairy, usually free, rarely connate at base; anthers linear to rounded; thecae 2, parallel or divaricate, sometimes confluent, rarely 1 by abortion, opening by longitudinal slits. Disk usually present. **Ovary** superior, 2-carpellate, often 4-locular by intrusion of carpel wall forming false septum, or 2-locular and free towards apex; ovules 4, usually basal or sub-basal, erect, rarely apical, pendulous, 1 in each loculus in 4-locular ovaries, or 2 in each loculus in 2-locular ovaries; style

simple, gynobasic or terminal; stigma usually 2-lobed, often with unequal arms. **Fruit** consisting of 4, 1-seeded schizocarpous nutlets which remain enclosed in the persistent calyx, or drupaceous.

An almost cosmopolitan family with about 252 genera and over 6,700 species. The limits of the family have been much debated but recent evaluations of Lamiales include many genera of Verbenaceae within Lamiaceae (Mabberley, 1997). About 50 genera and 245 species in Thailand. Twenty-three genera and 39 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Calyx 2-lipped, accrescent; lips entire, rounded, becoming appressed at maturity, enclosing nutlets until posterior lip detaches to release them, rarely calyx indehiscent, inflated; posterior lip usually folded to produce a scutellum **21. *Scutellaria***
 1. Calyx not as above
 2. Style terminal or subterminal
 3. Leaves simple
 4. Corolla mostly zygomorphic, 2-lipped or 1-lipped and then with anterior lip present
 5. Corolla less than 1.5 cm long
 6. Corolla with posterior lip 4-lobed, each lobe similar and anterior lip 1-lobed, much larger, concave **4. *Caryopteris***
 6. Corolla not as above
 7. Trees, shrubs, or rarely subshrubs, sometimes epiphytic or climbers. Corolla 4-lobed. Fruit drupaceous **20. *Premna***
 7. Herbs, subshrubs, or rarely shrubs. Corolla 5-lobed. Fruit a schizocarp of 4 nutlets
 8. Corolla usually 1-lipped with anterior lip present or rarely 2-lipped and then posterior lip short or obsolescent
 9. Inflorescence in dense verticillasters, spiciform or subcapitate thyrses **1. *Ajuga***
 9. Inflorescence in axillary or terminal cymes, paniculiform to spiciform thyrses; verticillasters 2-6-flowered **22. *Teucrium***
 8. Corolla distinctly 2-lipped with posterior lip 2-lobed, emarginate to entire and anterior lip 3-lobed, with median lobe largest **8. *Cymaria***
5. Corolla more than 1.5 cm long
 10. Shrubs or undershrubs. Corolla hypocrateriform with slender tube and narrow mouth. Stamens much exserted **5. *Clerodendrum***
 10. Trees. Corolla infundibuliform with broad mouth. Stamens slightly exserted or included **11. *Gmelina***
4. Corolla mostly actinomorphic to subactinomorphic
 11. Corolla lobes 4
 12. Plants with stellate hairs. Inflorescence axillary **3. *Callicarpa***
 12. Plants glabrous or hairy and then with simple or stellate hairs. Inflorescence terminal **20. *Premna***
 11. Corolla lobes 5 **5. *Clerodendrum***

3. Leaves usually palmately compound with 3-8-foliolate **23. *Vitex***
2. Style gynobasic
13. Corolla with posterior lip 3-4-lobed and anterior lip 1-lobed
14. Calyx strongly 2-lipped with posterior lip 1-lobed and anterior lip 4-lobed
15. Inflorescence in dense verticillasters **2. *Anisochilus***
15. Inflorescence not densely so
16. Calyx lobes unequal; posterior lip decurrent, curving upwards; teeth of anterior lip subulate, with median lobes longer than lateral lobes **16. *Orthosiphon***
16. Calyx lobes equal or unequal; posterior lip lanceolate to obovate; teeth of anterior lip lanceolate to subulate **18. *Plectranthus***
14. Calyx actinomorphic or 2-lipped and then with posterior lip 3-lobed and anterior lip 2-lobed
17. Calyx actinomorphic or 2-lipped. Corolla strongly 2-lipped, 5-lobed with posterior lip 4-lobed **13. *Isodon***
17. Calyx 2-lipped. Corolla weakly 2-lipped, 4-lobed with posterior lip 3-lobed **19. *Pogostemon***
13. Corolla with posterior lip 1-2-lobed and anterior lip 3-lobed **14. *Leucas***
18. Calyx 8-10(-12)-lobed
18. Calyx 5-lobed
19. Nutlets winged at apex **7. *Colquhounia***
19. Nutlets rounded or truncate at apex
20. Plants with stellate hairs **12. *Gomphostemma***
20. Plants glabrous or with simple hairs
21. Erect perennial herb, pubescent with glandular hairs. Corolla strongly 2-lipped, 4-lobed; posterior lip long, hooded, often deeply concave, broadened or with 2 teeth at base **15. *Microtoena***
21. Plant not as above
22. Corolla more than 2 cm long **17. *Paraphlomis***
22. Corolla less than 1 cm long
23. Inflorescence in axillary cymes; verticillasters globose **6. *Clinopodium***
23. Inflorescence in axillary or terminal spike-like
24. Corolla tube cylindrical or infundibular **9. *Elsholtzia***
24. Corolla tube saccate, swollen and ventrally abruptly widened **10. *Eurysolen***

1. *AJUGAL*.

Sp. Pl.: 561. 1753; Keng in Fl. Mal. I(8): 312. 1978; Li & Hedge in Fl. China 17: 63. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 201. 2004.

Annual or perennial herbs, rarely subshrubs. **Leaves** simple, opposite, dentate to incised, rarely subentire. **Inflorescence** in dense verticillasters, spiciform or subcapitate thyrses. **Calyx** actinomorphic or weakly zygomorphic, not accrescent, 5-lobed. **Corolla** 2-lipped or 1-lipped and then with only anterior lip present, persisting as a sheath around fruit; posterior lip short or obsolescent, usually 2-lobed or retuse;

anterior lip 3-lobed, median lobe large, broadening distally and usually emarginate or bipartite. **Stamens** 4, didynamous, usually slightly exerted; thecae divergent to divaricate, confluent at dehiscence. **Ovary** shallowly 4-lobed; style subterminal; stigma lobes equal to unequal. **Fruit** usually a schizocarp of 4 nutlets, rarely drupaceous with 4-lobed, usually glabrous, attachment-scar lateral.

About 40-50 species, mainly in Europe and temperate Asia (Harley et al., 2004). About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Ajuga macrosperma* Wall. ex Benth.**

Pl. As. Rar. 1: 58. 1830; Hook.f. in Fl. Br. Ind. 4: 704. 1885; Doan in Fl. Gén. I.-C. 4: 1044, fig. 109: 9-13. 1936; Murata, SE Asian Studies 14(2): 178. 1976; Li & Hedge in Fl. China 17: 69. 1994; Clement in Fl. Bhutan 2(2): 944, fig. 86: a-b. 1999.

Erect herb, sometimes stoloniferous, up to 50 cm high, pubescent. **Leaves** lanceolate, elliptic to ovate, 4-10 cm long, 1.5-5 cm wide, sparsely pubescent on both surfaces; base cuneate, attenuate onto the petiole; apex obtuse to bluntly acute; margin coarsely incised; petioles 1-2 cm long, sparsely pubescent, narrowly winged. **Inflorescence** terminal, condensed, forming cylindrical spike-like, 5-10 cm long, villous; verticillasters 6-12-flowered. **Flowers** sessile or subsessile. **Calyx** narrowly campanulate, 5-6 mm long, strigose; teeth ovate, 1-2 mm long, subequal. **Corolla** blue to purple, tubular, 7-9 mm long, sparsely villous; tube 5-6 mm long, obliquely spreading, slightly curved near the middle; posterior lip oblong, straight; median lobe of anterior lip narrowly obcordate, emarginate; lateral lobes oblong, emarginate, as long as or slightly longer than the posterior lip. **Stamens** exerted. **Nutlets** obovoid, ca. 2.5 mm long, 1.5 mm wide.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, Sikkim, Myanmar, China, Laos, Vietnam.

Ecology.— Dry evergreen and lower montane forest, alt. 900-1,500 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: March-May.

Voucher specimens.— *P. Srisanga* 473; *Kerr* 4948 (BK).

2. *ANISOCHILUS* Wall. ex Benth.

Edward's Bot. Reg. 15: sub t. 1300. 1830; Li & Hedge in Fl. China 17: 268. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 266. 2004.

Annual or perennial erect herbs or subshrubs, aromatic; stem quadrangular. **Leaves** simple, opposite. **Inflorescence** terminal, in dense verticillasters, elongate or capitulate, forming oblong-ovoid or cylindrical spike-like, with sessile cymes; bracts caducous. **Calyx** tubular, ventrally gibbous, straight or curving slightly upwards, sometimes apically deflexed, strongly 2-lipped, 5-lobed; lobes unequal; posterior lip

1-lobed, ovate or lanceolate, not decurrent, deflexed at throat, sometimes curving upwards apically; anterior lip 4-lobed, with small rounded or lanceolate teeth or truncate, sometimes split between median lobes, the sinus sometimes very deep, so that posterior lip appears 5-lobed. **Corolla** strongly 2-lipped, 5-lobed; posterior lip 4-lobed, ascending, median lobes exceeding lateral lobes, more rarely truncate with inconspicuous lobes; anterior lip 1-lobed, horizontal or slightly deflexed, concave or cucullate; tube narrow, curved and dilating distally towards throat. **Stamens** 4, free, held over or within lower lip, sometimes shortly exerted. Disk 4-lobed with anterior lobe much larger, exceeding ovaries. **Ovary** deeply 4-lobed, glabrous; style gynobasic, long, slender. **Fruit** a schizocarp of 4 nutlets; nutlets ovoid, glabrous.

About 15-20 species in India, China and continental SE Asia (Harley et al., 2004). About 3 species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

Anisochilus pallidus Wall. ex Benth.

Pl. As. Rar. 2: 18. 1830; Hook.f. in Fl. Br. Ind. 4: 629. 1885; Doan in Fl. Gén. I.-C. 4: 942. 1936; Murata, SE Asian Studies 14(2): 179. 1976; Li & Hedge in Fl. China 17: 268. 1994; Clement in Fl. Bhutan 2(2): 992, fig. 89: f-g. 1999.

Erect annual herb, up to 2 m high, pubescent. **Leaves** lanceolate to elliptic, 4-13 cm long, 2-6 cm wide, sparsely pubescent on both surfaces, dark glandular on lower surface; base cuneate, attenuate onto the petiole; apex acuminate; margin dentate; petioles 1-3 cm long, pubescent. **Inflorescence** terminal, dense-flowered, elongate, forming oblong-ovoid or cylindrical spike-like, 1-4 cm long, pubescent. **Calyx** ovoid, ca. 1 mm long, pubescent outside; posterior lip subulate, recurved, beaked; anterior lip with minute teeth. **Corolla** bluish purple, 4-6 mm long, pubescent; tube recurved at middle; posterior lip with unequal lobes, median lobes orbicular, lateral lobes minute; anterior lip obovate, concave. **Stamens** included in anterior corolla lip. **Nutlets** ellipsoid, brown, ca. 1 mm long.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Nan, Tak.

Distribution.— India, Bhutan, Myanmar, S China (Yunnan), Laos, Vietnam.

Ecology.— Lower montane forest, sometimes among grasses in open places, alt. 1,500-1,600 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: October-January.

Voucher specimens.— *P. Srisanga* 1156, 1230, 1831.

3. *CALLICARPA* L.

Sp. Pl.: 111. 1753; Chen & Gilbert in Fl. China 17: 4. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 267. 2004.

Trees or shrubs, rarely climbers, usually with stellate hairs, sometimes gland dots present; branchlets terete or quadrangular. **Leaves** simple, opposite or in whorls

of three. **Inflorescence** axillary, cymose. **Calyx** tubular or shortly campanulate, 4-lobed or truncate, not accrescent in fruit. **Corolla** white, blue, violet to purple, tubular to infundibular or hypocrateriform, 4-lobed, actinomorphic. **Stamens** 4, epipetalous, exserted; anthers oblong or elliptic, dorsifixed; thecae parallel, opening by longitudinal slits or terminal pores. **Ovary** imperfectly 2-locular; ovule 2 in each loculus; style terminal, exserted; stigma peltate or capitate. **Fruit** drupaceous, globose, with hard pyrene. **Seeds** 4, oblong.

About 140 species in Asia, America, tropical Australia and Pacific Islands (Harley et al., 2004). About 13 species in Thailand (Fletcher, 1938). Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|-------------------------|
| 1. Leaves entire; petioles 3-7 cm long | 1. <i>C. arborea</i> |
| 1. Leaves serrate; petioles 0.3-2 cm long | |
| 2. Leaves cuneate at base; petioles 0.8-2 cm long | 2. <i>C. longifolia</i> |
| 2. Leaves cordate at base; petioles 0.3-0.6 cm long | 3. <i>C. rubella</i> |

1. *Callicarpa arborea* Roxb.

Fl. Ind. 1: 390. 1820; C.B. Clarke in Fl. Br. Ind. 4: 567. 1885; Dop in Fl. Gén. I-C. 4: 792. 1935; Fletcher, Kew Bull. 1938: 412. 1938; Chen & Gilbert in Fl. China 17: 6. 1994; Rae in Fl. Bhutan 2(2): 919; fig. 84: e. 1999.

Tree, 5-10(-15) m high; branchlets densely tomentose with stellate hairs. **Leaves** elliptic to ovate, subcoriaceous, 11-30 cm long, 5-13 cm wide, subglabrous on upper surface, densely yellowish brown stellate tomentose with yellow gland dots on lower surface; base cuneate to rounded; apex acuminate; margin entire; petioles 3-7 cm long, densely tomentose with stellate hairs. **Inflorescence** 7-14 cm long; peduncles quadrangular; pedicels ca. 0.5 mm long. **Flowers** fragrant. **Calyx** cup-shaped, truncate or nearly so, ca. 0.5 mm long, densely gray stellate tomentose outside. **Corolla** purple, sparsely puberulous; tube 2-2.5 mm long; lobes ca. 1 mm long. **Stamens** 6-7 mm long, glabrous. **Ovary** densely stellate tomentose. **Fruit** globose, 2-3 mm long and wide, black or purple.

Thailand.— Northern: Chiang Mai, Phrae, Nan; South-eastern: Chanthaburi; South-western: Kanchanaburi; Peninsular: Chumphon, Ranong, Surat Thani, Phuket, Trang, Satun, Pattani.

Distribution.— India, Nepal, Bhutan, Sikkim, Bangladesh (Chittagong-type), Myanmar, China, Laos, Vietnam, Cambodia, Malaysia, Indonesia.

Ecology.— Dry evergreen and lower montane forest, alt. 900-1,500 m (Doi Phu Kha).

Phenology.— Flowering: April-June; fruiting: August-December.

Vernacular.— หมากป่า (Northern).

Voucher specimens.— *P. Srisanga* 1404.

2. *Callicarpa longifolia* Lam.

Enc. 1: 563. 1785; C.B. Clarke in Fl. Br. Ind. 4: 570. 1885; Dop in Fl. Gén. I.-C. 4: 802. 1935; Fletcher, Kew Bull. 1938: 414. 1938; Chen & Gilbert in Fl. China 17: 10. 1994; Rae in Fl. Bhutan 2(2): 920. 1999.

Shrub, 2-3(-5) m high; branchlets quadrangular, stellate pubescent. **Leaves** lanceolate to elliptic, subcoriaceous, 8-16(-20) cm long, 2.5-5.5 cm wide, subglabrous on upper surface, yellowish brown stellate pubescent with yellow gland dots on lower surface; base cuneate, attenuate on to the petiole; apex acuminate to caudate; margin serrate; petioles 0.8-2 cm long, stellate pubescent. **Inflorescence** 2-3 cm long; peduncles 0.5-1.5 cm long; pedicels ca. 0.5 mm long. **Calyx** cup-shaped, truncate to minutely 4-lobed, ca. 1 mm long, gray puberulous outside. **Corolla** pale purple, stellate pubescent; tube ca. 1 mm long; lobes ca. 0.5 mm long. **Stamens** 4-5 mm long, glabrous. **Ovary** puberulous. **Fruit** globose, 1.5-2 mm long and wide, white.

Thailand.— Northern: Chiang Mai, Lampang, Nan; South-eastern: Chanthaburi, Trat; South-western: Prachuap Khiri Khan; Peninsular: Chumphon, Surat Thani, Songkhla, Trang, Satun, Pattani, Narathiwat.

Distribution.— India, Nepal, Bhutan, Myanmar, China, Laos, Vietnam, Malaysia (Malacca-type).

Ecology.— Dry evergreen forest, alt. 700-800 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering: May-August; fruiting: August-December.

Vernacular.— ข้าวตอก Khao tok (Nothern).

Voucher specimens.— *P. Srisanga* 1239, 2587.

3. *Callicarpa rubella* Lindl.

Bot. Reg. 11: t. 883. 1825; C.B. Clarke in Fl. Br. Ind. 4: 569. 1885; Dop in Fl. Gén. I.-C. 4: 796. 1935; Fletcher, Kew Bull. 1938: 414. 1938; Chen & Gilbert in Fl. China 17: 13. 1994; Rae in Fl. Bhutan 2(2): 921. 1999.

Shrub, 1.5-3 m high; branchlets stellate pubescent. **Leaves** lanceolate to elliptic, subcoriaceous, 7-16 cm long, 2.5-5 cm wide, pubescent with simple and stellate hairs on upper surface, stellate tomentose with yellow gland dots on lower surface; base cordate, sometimes oblique; apex acuminate to caudate; margin serrate; petioles 3-6 mm long, tomentose with stellate hairs. **Inflorescence** 1.5-4 cm long; peduncles (0.5-)1-3 cm long; pedicels ca. 1 mm long. **Calyx** cup-shaped, 4-lobed, ca. 1 mm long, puberulous with yellow gland dots outside; lobes triangular. **Corolla** pink or purple, puberulous, yellow gland dots; tube 1.5-2 mm long; lobes 0.5-1 mm long. **Stamens** 4-5 mm long. **Ovary** glabrous. **Fruit** globose, 2-3 mm long and wide, purple.

Thailand.— Northern: Chiang Mai, Nan, Sukhothai; South-eastern: Trat; Peninsular: Krabi.

Distribution.— India, Bhutan, Myanmar, China (type), Laos, Vietnam, Malaysia.

Ecology.— Lower montane forest, alt. 1,300-1,600 m (Doi Phu Kha).

Phenology.— Flowering: May-July; fruiting: July-November.

Vernacular.— ฟ้า Pha (Chiang Mai).

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2026.

4. *CARYOPTERIS* Bunge

Pl. Mongolico-Chin.: 27. 1835; Chen & Gilbert in Fl. China 17: 43. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 203. 2004.

Shrubs or undershrubs, strongly aromatic. **Leaves** simple, opposite, petiolate. **Inflorescence** axillary and terminal cymes, corymbose. **Calyx** actinomorphic, 5-lobed. **Corolla** bluish purple or pale green to yellowish, zygomorphic, 5-lobed; posterior lobes 4, similar, more or less entire; anterior lobe 1, much larger, concave, dentate to fimbriate-laciniate. **Stamens** 4, equal or didynamous, exserted; filaments straight, divergent; thecae parallel, separate at dehiscence. **Ovary** 4-locular, unlobed; style subterminal; stigma lobes equal. **Fruit** a schizocarp of 4 nutlets; nutlets glabrous or pubescent, attachment-scar lateral as long as nutlet.

Seven species in Himalayas, E & SE Asia (Harley et al., 2004). About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

Caryopteris paniculata C.B. Clarke

In Fl. Br. Ind. 4: 597. 1885; Dop in Fl. Gén. I.-C. 4: 885. 1935; Fletcher, Kew Bull. 1938: 437. 1938; Chen & Gilbert in Fl. China 17: 46. 1994; Long in Fl. Bhutan 2(2): 936. 1999.

Shrub, 1-3 m high; branchlets puberulous. **Leaves** lanceolate, elliptic to ovate, thick membranous, 7-14 cm long, 3-6.5 cm wide, puberulous on both surfaces; base broadly cuneate to rounded, slightly oblique; apex acuminate to caudate; margin coarsely serrate; primary veins 5-7 pairs; petioles 5-10(-15) mm long, puberulous. **Inflorescence** in axillary paniculate cymes, 2-6 cm long, puberulous; pedicels 1-2 mm long, purplish. **Calyx** purplish, 1.5-2 mm long, puberulous; lobes acute. **Corolla** purplish pale yellow, 3-4 mm long, puberulous outside. **Stamens** 4-5 mm long. **Style** 4-5 mm long. **Fruit** globose, 2-3 mm long and wide, pubescent.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, Sikkim, Myanmar (type), China.

Ecology.— Lower montane forest, alt. 1,100-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-February.

Vernacular.— ครามป่า Kham pa (Chiang Mai).

Voucher specimens.— *P. Srisanga* 495, 1168, 1756, 2326, 2688.

5. CLERODENDRUM L.

Sp. Pl.: 637. 1753; Chen & Gilbert in Fl. China 17: 34. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 199. 2004. – *Volkameria* L., Sp. Pl.: 637. 1753.

Small trees, shrubs, undershrubs, rarely woody climbers or herbs; branchlets usually quadrangular when young. **Leaves** simple, opposite, rarely alternate or whorled, entire or tooth, rarely lobed. **Inflorescence** in terminal thyrses or axillary cymes, less often capitate or flower solitary. **Calyx** actinomorphic, usually accrescent, often showy, 5-lobed, rarely 2-4-lobed or truncate. **Corolla** actinomorphic to subactinomorphic, usually hypocrateriform or 1-lipped with anterior lip present, but usually facing upwards due to resupination, 5-lobed. **Stamens** 4, subequal to didynamous, much exserted; filaments straight or arched; anthers versatile; thecae parallel, separate when dehiscent. **Ovary** 4-locular, unlobed to 4-lobed; style terminal; stigma lobes equal to subequal. **Fruit** drupaceous with four 1-seeded pyrenes or a schizocarp with four 1-seeded mericarps, rarely two 2-seeded mericarps.

About 400-500 species, mostly in palaeotropical, but some in neotropical and a few in temperate region. Many species are cultivated as ornamentals (Harley et al., 2004). About 25 species in Thailand. Five species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves broadly ovate, less than 1.5 x as long as wide
 2. Leaves beneath with only several large glands near base
 3. Calyx lobes lanceolate, 8-12 mm long **1. *C. chinense* var. *simplex***
 3. Calyx lobes triangular, minute, ca. 0.5 mm long **2. *C. colebrookianum***
 2. Leaves beneath with numerous glands throughout the blade, without large glands near base **4. *C. paniculatum***
1. Leaves lanceolate, elliptic to oblanceolate, more than 2 x as long as wide
 4. Leaves opposite, unequal in each pair. Calyx distinctly lobed **3. *C. garrettianum***
 4. Leaves in whorl of 3, sessile or subsessile. Calyx more or less truncate **5. *C. serratum***

1. *Clerodendrum chinense* (Osb.) Mabb. var. *simplex* (Mold.) S.L. Chen

Novon 1: 58. 1991; Chen & Gilbert in Fl. China 17: 39. 1994; Leeratiwong & Chantaranothai, Thai For. Bull. (Bot.) 31: 44. 2003. – *C. philippinum* Schauer var. *simplex* Mold., Phytologia 20: 338. 1970. – *C. lasiocephalum* C.B. Clarke in Fl. Br. Ind. 4: 594. 1885; Fletcher, Kew Bull. 1938: 430. 1938.

Undershrub, 1-2 m high; branchlets subquadrangular to terete, pubescent. **Leaves** opposite, broadly ovate, 9-22 cm long, 8-21 cm wide, strigose on upper surface, pubescent and with several large glands near base on lower surface; base truncate to subcordate; apex acute to acuminate; margin coarsely dentate; primary veins 5-7 pairs; petioles 3-10 cm long, pubescent. **Inflorescence** in terminal densely

corymbose cymes; peduncle robust, pubescent to tomentose; bract red, lanceolate, 1.5-3 cm long, pubescent, with several large glands, acuminate at apex. **Flowers** fragrant. **Calyx** red, salverform, 1.5-2.5 cm long, pubescent; tube 7-13 mm long, with several large glands; lobes lanceolate, 8-12 mm long, acuminate at apex. **Corolla** white, glabrous; tube 2-3 cm long; lobes elliptic to obovate, 0.8-1 cm long. **Drupe** subglobose, 8-10 mm in diam., bluish black, enclosed by persistent inflated calyx.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Tak (type).

Distribution.— India, Myanmar, China.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: May-June; fruiting: September-October.

Vernacular.— ปิ้งหอม Ping hom (General).

Voucher specimens.— *P. Srisanga* 1405.

2. *Clerodendrum colebrookianum* Walp.

Repert. Bot. Syst. 4: 114. 1845; C.B. Clarke in Fl. Br. Ind. 4: 594. 1885; Dop in Fl. Gén. I.-C. 4: 860. 1935; Chen & Gilbert in Fl. China 17: 40. 1994; Long in Fl. Bhutan 2 (2): 932. 1999. — *C. glandulosum* Colebr. ex Lindl., Bot. Reg.: 30, sub t. 19. 1844; Fletcher, Kew Bull. 1938: 430. 1938.

Shrub or undershrub, 1.5-4 m high; branchlets robust, quadrangular, puberulous, glabrescent. **Leaves** opposite, broadly ovate, 13-25 cm long, 10-22 cm wide, puberulous on both surfaces, with several large glands near base on lower surfaces; base subtruncate to cordate; apex acute to acuminate; margin entire to slightly undulate; primary veins 6-9 pairs; petioles 6-15 cm long, puberulous. **Inflorescence** in terminal corymbose cymes, 4-6-branched; peduncle robust, 6-16 cm long, puberulous; bract lanceolate, 1-1.5 cm long, caducous. **Calyx** green, campanulate, 3-4 mm long, puberulous; tube 2.5-3.5 mm long, with several large glands; lobes triangular, minute, ca. 0.5 mm long. **Corolla** white, glabrous, ciliate; tube cylindric, 2.5-3 cm long; lobes oblong, 4-7 mm long. **Drupe** subglobose, 2-4-lobed, 8-10 mm in diam., bluish black, subtended by persistent enlarged turning red calyx.

Thailand.— Northern: Chiang Mai, Lamphun, Lampang, Nan.

Distribution.— India, Nepal, Bhutan, Bangladesh, Myanmar, China, Laos, Vietnam, Malaysia, Indonesia.

Ecology.— Deciduous, dry evergreen and lower montane forest, disturb areas, alt. 600-1,400 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering: September-October; fruiting: October-December.

Vernacular.— ปิ้งขาว Ping khao (General).

Voucher specimens.— *P. Srisanga* 323, 1648.

3. *Clerodendrum garrettianum* Craib

Kew Bull. 1911: 444. 1911; Dop in Fl. Gén. I.-C. 4: 868. 1935; Fletcher, Kew Bull. 1938: 427. 1938; Chen & Gilbert in Fl. China 17: 36. 1994; Leeratiwong & Chantaranothai, Thai For. Bull. (Bot.) 31: 45. 2003.

Shrub or undershrub, 1-2 m high; branchlets terete, puberulous, glabrescent. **Leaves** opposite, usually unequal in each pair, lanceolate, oblong to elliptic, papery, 4-17 cm long, 2-7 cm wide, puberulous on both surfaces; base cuneate, rounded to truncate; apex acuminate to shortly caudate; margin entire or coarsely serrate; primary veins 5-7 pairs; petioles 0.5-7 cm long, puberulous, unequal in each pair. **Inflorescence** in terminal thyrsoid cymes, 3.5-11 cm long, puberulous; bract linear-lanceolate, 0.5-2 mm long, puberulous, acuminate at apex. **Calyx** green, 7-10 mm long, deeply 5-lobed; lobes narrowly lanceolate, 5-7 mm long, puberulous on both sides and glandular inside. **Corolla** greenish to yellowish, puberulous outside; tube 1-1.5 cm long; lobes elliptic to obovate, 6-8 mm long. **Drupe** globose, ca. 6 mm in diam., red.

Thailand.— Northern: Chiang Mai (type), Chiang Rai, Lampang, Nan, Nakhon Sawan; Eastern: Nakhon Ratchasima; South-eastern: Prachin Buri; Central: Phra Nakhon Si Ayutthaya.

Distribution.— S China (Yunnan), Laos.

Ecology.— Dry evergreen and lower montane forest, by streams, alt. 700-1,400 m (Doi Phu Kha, Huay Pong).

Phenology.— Flowering: August-October; fruiting: November-December.

Vernacular.— บำตชวยป่า Ba tai wai pa (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1557, 1677; *P. Srisanga* & *C. Maknoi* 2064.

4. *Clerodendrum paniculatum* L.

Mant. Pl.: 90. 1767; C.B. Clarke in Fl. Br. Ind. 4: 593. 1885; Dop in Fl. Gén. I.-C. 4: 864. 1935; Fletcher, Kew Bull. 1938: 429. 1938; Chen & Gilbert in Fl. China 17: 36. 1994.

Undershrub, up to 1 m high; branchlets quadrangular, puberulous. **Leaves** opposite, ovate to broadly ovate, 7-17 cm long, 6-17 cm wide, strigose on upper surface, puberulous on nerves and with numerous glands on lower surface; base cordate; apex acute; margin coarsely dentate or shallowly 5-lobed; primary veins 4-6 pairs; petioles 1-14 cm long, puberulous. **Inflorescence** in terminal panicles, 10-25 cm long, puberulous; bract lanceolate, 1-1.5 cm long, caducous. **Calyx** green, campanulate, 5-7 mm long, glandular; tube 1-2 mm long; lobes lanceolate, 4-5 mm long. **Corolla** red to orange, puberulous outside; tube cylindric, 1-1.5 cm long; lobes obovate, 8-10 mm long. **Drupe** subglobose, 2-4-lobed, 5-8 mm in diam., black, subtended by persistent enlarged turning orange calyx.

Thailand.— Almost throughout the country.

Distribution.— Myanmar, China, Laos, Vietnam, Cambodia, Malaysia (Penang-type), Indonesia.

Ecology.— Deciduous and dry evergreen forest, disturb areas, alt. 600-900 m (Doi Phu Kha).

Phenology.— Flowering: August-October; fruiting: October-December.

Vernacular.— นมสวรรค์ Nom sawan (Central).

Voucher specimens.— *P. Srisanga* 2598.

5. *Clerodendrum serratum* (L.) Moon

Cat. Pl. Ceylon: 46. 1824; C.B. Clarke in Fl. Br. Ind. 4: 592. 1885; Dop in Fl. Gén. I.-C. 4: 856. 1935; Fletcher, Kew Bull. 1938: 427. 1938; Chen & Gilbert in Fl. China 17: 42. 1994; Long in Fl. Bhutan 2(2): 933. 1999. – *Volkameria serrata* L., Mant. Pl.: 90. 1767.

Shrub or undershrub, 1-4 m high; branchlets subquadrangular, puberulous, glabrescent. **Leaves** in whorl of 3, sessile or subsessile, lanceolate, oblanceolate to narrowly obovate, 10-30 cm long, 3.5-10 cm wide, sparsely puberulous to subglabrous on both surfaces; base attenuate; apex acuminate to shortly caudate; margin coarsely serrate; primary veins 10-12 pairs. **Inflorescence** in terminal thyrsoid, purplish green, up to 40 cm long, puberulous; bract purplish green, ovate, leafy, 1.5-4.5 cm long, 0.5-2.5 cm wide, puberulous; petioles 2-6 mm long, puberulous. **Calyx** green, cup-shaped, more or less truncate, 4-6 mm long, glabrous or puberulous. **Corolla** purplish blue, glabrous; tube 7-10 mm long, hairy in throat; lobes oblong, elliptic to obovate, 7-13 mm long. **Drupe** subglobose, 2-4-lobed, 6-10 mm in diam., black, subtended by persistent calyx.

Thailand.— Almost throughout the country.

Distribution.— E Africa, S and SE Asia (India-type).

Ecology.— Lower montane forest, alt. 1,300-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-December.

Vernacular.— ชะรักป่า Charak pa, หล้าสามเกียน Lua sam kian (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1198.

6. *CLINOPODIUM* L.

Sp. Pl. 2: 587. 1753; Li & Hedge in Fl. China 17: 228. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 241. 2004. – *Calamintha* Mill., Gard. Dict. ed.4: 1. 1754.

Perennial herbs, aromatic. **Leaves** simple, opposite, petiolate to subsessile. **Inflorescence** in axillary cymes; verticillasters 2-many-flowered. **Calyx** 2-lipped or actinomorphic, cylindrical to tubular-campanulate, 5-lobed; posterior lip 3-lobed, often partially fused to form a lip, anterior lip 2-lobed. **Corolla** 2-lipped, 5-lobed; posterior lip 2-lobed, usually notched; anterior lip 3-lobed; tube straight or curved.

Stamens 4, didynamous, included or exserted; filaments usually glabrous; thecae divaricate or parallel. **Ovary** deeply 4-lobed; style gynobasic; stigma lobes equal or unequal. **Fruit** a schizocarp of 4 nutlets; nutlets ovoid to subglobose, glabrous or hairy.

About 100 species, mostly in the New World and temperate Eurasia, but a few in Africa, tropical Asia and Indomalaysia (Harley et al., 2004). About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

Clinopodium gracile (Benth.) Matsumura

Index Pl. Jap. 2: 538. 1912; Li & Hedge in Fl. China 17: 230. 1994. – *Calamintha gracilis* Benth. in DC. Prodr. 12: 232. 1848; Doan in Fl. Gén. I.-C. 4: 989. 1936. – *Satureja gracilis* (Benth.) Loes., Bot. Jahrb. 34, Beibl. 75: 13. 1904; Keng in Fl. Mal. I(8): 361, fig. 22. 1978.

Prostrate herb; stem puberulous, rooting at nodes. **Leaves** ovate to broadly ocvate, 1-3.5 cm long, 0.8-2.5 cm wide, sparsely pubescent on both surfaces; base rounded or broadly cuneate, attenuate onto the petiole; apex obtuse or broadly acute; margin serrate-crenate; petioles 0.5-2 cm long, pubescent. **Inflorescence** in axillary cymes; verticillasters many-flowered, globose; bracts linear, 3-5 mm long, pilose. **Calyx** tubular, 3-5 mm long, accrescent, slightly curved, pilose; teeth erect. **Corolla** pale lilac or bluish, 5-6 mm long, puberulous. **Nutlets** subglobose, ca. 0.5 mm long, brown (Fig. 44).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, China, Japan, Myanmar, Laos, Vietnam, Malaysia, Indonesia.

Ecology.— Lower montane forest and lower montane scrub, open areas, roadsides, wet places, alt. 1,600-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: August-January.

Voucher specimens.— *P. Srisanga* 2132, 2375; *P. Srisanga* & *C. Puff* 1102.

7. COLQUHOUNIA Wall.

Trans. Linn. Soc. Lond. 13: 608. 1822; Li & Hedge in Fl. China 17: 185. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 217. 2004.

Subshrubs or shrubs, sometimes scrambling, with simple or stellate hairs; stem and branches terete. **Leaves** simple, opposite, petiolate, serrate or dentate. **Inflorescence** terminal or axillary, thyrsoïd or capitate cymes. **Calyx** tubular-campanulate, 5-lobed; lobes equal or subequal. **Corolla** 2-lipped, 4-lobed; posterior lip 1-lobed, hooded with upcurved margin, emarginate or entire; anterior lip with subequal 3-lobed; tube strongly dilated in distal part. **Stamens** 4, didynamous, reaching posterior lip of corolla, sometimes slightly exserted; thecae more or less confluent. **Ovary** deeply 4-lobed; style gynobasic; stigma lobes subequal or unequal. **Fruit** a schizocarp of 4 nutlets; nutlets narrowly obovoid-oblong, winged at apex, glanular or glabrous.

About 6 species in India, Nepal, China to SE Asia (Harley et al., 2004). About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

Colquhounia elegans Wall. ex Benth.

Pl. As. Rar. 1: 65. 1830; Hook.f. in Fl. Br. Ind. 4: 674. 1885; Doan in Fl. Gén. I.-C. 4: 1009, fig. 105: 1-4. 1936; Murata, SE Asian Studies 14(2): 182. 1976; Li & Hedge in Fl. China 17: 186. 1994.

Scrambling shrub, hirsute. **Leaves** lanceolate, elliptic to narrowly ovate, 4-8 cm long, 2-4 cm wide, hirsute on both surfaces, bullate on upper surface; base obtuse, rounded to broadly cuneate; apex shortly acuminate; margin crenulate-dentate; petioles 7-12 mm long, hirsute. **Inflorescence** in axillary, capitate cymes, 3-7 cm long, hirsute; pedicels 1-2 mm long, pubescent. **Calyx** narrowly campanulate, 5-8 mm long, pubescent; teeth triangular, 2-3 mm long, equal to subequal. **Corolla** red, 2.2-2.5 cm long, pubescent; tube 1.8-2.2 mm long, slender, curved; posterior lip erect, oblong, rounded or emarginate; anterior lip ovate with subequal. **Stamens** reaching posterior lip of corolla, slightly exserted; filaments hairy. **Nutlets** ca. 3 mm long, 1 mm wide, including wing, glanular.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Phitsanulok; North-eastern: Loei.

Distribution.— Myanmar, S China (Yunnan), Laos, Vietnam, Cambodia.

Ecology.— Lower montane scrub, open places on limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering: November-January; fruiting: December-March.

Voucher specimens.— *P. Srisanga* 445, 1813, 2664.

Notes.— *Colquhounia elegans* Wall. ex Benth. var. *tenuiflora* (Hook.f.) Prain differs in the degree of hairiness, less hairy plant, and smaller flower, possibly conspecific with the typical variety.

8. CYMARIA Benth.

Edward's Bot. Reg. 15: sub t. 1292. 1830; Keng in Fl. Mal. I(8): 315. 1978; Li & Hedge in Fl. China 17: 69. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 268. 2004.

Subshrubs; stem quadrangular. **Leaves** simple, opposite, petiolate. **Inflorescence** axillary or terminal, dichotomous or helicoids cymes. **Calyx** campanulate in flower, broadly campanulate to urceolate or subglobose in fruit, 5-lobed, actinomorphic, accrescent; lobes triangular. **Corolla** white to yellow, 2-lipped, 5-lobed; posterior lip 2-lobed, emarginate to entire; anterior lip 3-lobed, with median lobe largest. **Stamens** 4, didynamous, anterior pair longer, included, thecae divaricate, confluent when dehiscent. Disk absent. **Ovary** shallowly 4-lobed; style subterminal; stigma lobes short, subequal. **Fruit** a schizocarp of 4 nutlets; nutlets obovoid, pubescent, attachment-scar lateral.

About 2-3 species in SE Asia (Harley et al., 2004). About 1-2 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Cymaria dichotoma* Benth.**

Edward's Bot. Reg. 15: sub t. 1292. 1830; Pl. As. Rar. 1: 64. 1830; Hook.f. in Fl. Br. Ind. 4: 705. 1885; Doan in Fl. Gén. I.-C. 4: 1043, fig. 109: 5-8. 1936; Murata, SE Asian Studies 14(2): 183. 1976; Keng in Fl. Mal. I(8): 315, fig. 3: a-b. 1978; Li & Hedge in Fl. China 17: 70. 1994. – *C. acuminata* Decne, Nouv. Ann. Mus. Hist. Nat. Paris 3: 399. 1834.

Subshrub, up to 1 m high; stem and branches pubescent. **Leaves** elliptic, ovate to rhomboid, membranous, 4-9 cm long, 2-5 cm wide, sparsely hairy on both surfaces; base cuneate, attenuate onto the petiole; apex acute to acuminate; margin serrate, crenate or remotely dentate; petioles 1-6 cm long, pubescent. **Inflorescence** in axillary or terminal, dichotomously cymes, 1-3 cm long, finely pubescent; pedicels up to 1 mm long or absent, finely pubescent. **Calyx** campanulate, ca. 1.5 mm long, glandular, pubescent; teeth triangular; fruiting calyx urceolate, 2-3 mm long. **Corolla** yellow, 6-7 mm long, finely pubescent outside; tube 3-4 mm long, cylindric, straight; posterior lip, oblong, slightly concave; anterior lip enlarged, with median lobe largest. **Stamens** ascending under the upper lip, included. **Nutlets** obovoid, 1-1.5 mm long, ca. 0.5 mm wide, hairy and glandular at apex (Fig. 45).

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei; Central: Saraburi; South-western: Kanchanaburi, Prachuap Khiri Khan; Peninsular: Surat Thani, Pattani.

Distribution.— Myanmar, China, Cambodia, Malaysia.

Ecology.— Lower montane forest, also along streams, alt. 1,400-1,600 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: October-December.

Voucher specimens.— *P. Srisanga* 1155, 1910, 2296.

9. *ELSHOLTZIA* Willd.

In Bot. Mag. 4(11): 3. 1790; Keng in Fl. Mal. I(8): 331. 1978; Li & Hedge in Fl. China 17: 246. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 229. 2004. – *Aphanochilus* Benth., Bot. Reg.: sub. t. 1282. 1829.

Annual or perennial herbs or undershrubs, sometimes aromatic; stem quadrangular. **Leaves** simple, opposite, petiolate. **Inflorescence** often cylindrical or capitate, of 2- to several-flowered verticillasters in axils of bracts. **Calyx** campanulate to cylindrical; lobes 5, subequal or posterior lip sometimes shorter; tube glabrous inside. **Corolla** white, yellowish or purplish, 2-lipped, 4-5-lobed; posterior lip 1-2-lobed, erect, notched; anterior lip 3-lobed, spreading; tube cylindrical or infundibular, usually longer than calyx. **Stamens** 4, didynamous or not, usually exserted, ascending divergent; thecae divergent or divaricate, usually confluent at apex. **Ovary** deeply 4-

lobed, glabrous; style gynobasic, usually exerted beyond stamens; stigma lobes equal, often weakly clavate, rarely unequal with posterior lobe shorter. **Fruit** a schizocarp of 4 nutlets; nutlets rarely 1 by abortion, ovoid to oblong, glabrous or sparsely hairy, tuberculate or smooth.

About 40 species in Europe, E & SE Asia (Harley et al., 2004). About 5 species in Thailand. One species recorded from Doi Phu Kha National Park.

Elsholtzia blanda Keng

In Fl. Mal. I(8): 331. 1978. – *Perilla elata* D. Don, Prodr. Nepal.: 115. 1825, non *E. elata* Zoll. & Moritzi, 1845. – *Aphanochilus blandus* Benth., Bot. Reg.: sub. t. 1282. 1829; Pl. As. Rar. 1: 29. 1830. – *Elsholtzia blanda* (Benth.) Benth., Lab. Gen. Sp.: 162. 1833 nom illeg.; Hook.f. in Fl. Br. Ind. 4: 643. 1885; Doan in Fl. Gén. I.-C. 4: 978. 1936; Murata, SE Asian Studies 14(2): 183. 1976; Li & Hedge in Fl. China 17: 250. 1994; Clement in Fl. Bhutan 2(2): 981. 1999.

Erect herb or undershrub, up to 2 m high; stem and branches pubescent. **Leaves** lanceolate to elliptic, 4-14 cm long, 1-4.5 cm wide, puberulous on both surfaces, glabrescent, golden yellow glandular beneath; base cuneate, attenuate onto the petiole; apex acuminate; margin serrate; petioles 3-15 mm long, pubescent. **Inflorescence** terminal and axillary, spike-like, 4-8(-13) cm long, subsecund; verticillasters 7-10-flowered. Bracts lanceolate, 1-2.5 mm long. **Calyx** cylindrical, 1.5-2 mm long, strigose outside; teeth lanceolate, erect; fruiting calyx urceolate, slightly contracted at mouth. **Corolla** white or creamy white, funnelform, 2.5-3 mm long, strigose outside, subglabrous inside; posterior lip emarginate; anterior lip: median lobe subcircular, slightly concave, lateral lobes semicircular. **Nutlets** oblong, ca. 0.75 mm long, brown.

Thailand.— Northern: Chiang Mai, Nan, Phitsanulok.

Distribution.— India, Nepal, Bhutan, Sikkim, China, Continental SE Asia to Indonesia.

Ecology.— Lower montane forest and lower montane scrub, sometimes in open areas among grasses, alt. 1,500-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: October-January; fruiting: November-February.

Voucher specimens.— *P. Srisanga* 1127, 1854, 2265, 2640, 2699.

10. EURYSOLEN Prain

Sci. Mem. Off. Med. Dept. Gov. India 11: 43. 1898; Keng in Fl. Mal. I(8): 333. 1978; Li & Hedge in Fl. China 17: 188. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 215. 2004.

Herbs or subshrubs. **Leaves** simple, opposite, petiolate. **Inflorescence** axillary or terminal, spikes; verticillasters many-flowered, condensed. **Calyx** tubular, 5-lobed, 2-lipped, 10-nerved; posterior lip 3-lobed; anterior lip 2-lobed; lobes subequal or anterior lip slightly longer. **Corolla** weakly 2-lipped, 4-lobed; posterior

lip 1-lobed, short, hooded, emarginate or entire; anterior lip 3-lobed; tube saccate, swollen and ventrally abruptly widened, annulate. **Stamens** 4, didynamous, shortly exerted; anthers subglobose; thecae confluent. **Ovary** deeply 4-lobed; style gynobasic; stigma lobes equal. **Fruit** a schizocarp of 4 nutlets; nutlets ovoid, rounded at apex, glandular.

Monotypic genus in NE India (Manipur) to S China (Yunnan) and continental SE Asia southwards to Indonesia (Harley et al., 2004).

Eurysolen gracilis Prain

Sci. Mem. Off. Med. Dept. Gov. India 11: 43. 1898; Murata, SE Asian Studies 14(2): 184. 1976; Keng in Fl. Mal. I(8): 334, fig. 11. 1978; Li & Hedge in Fl. China 17: 188. 1994.

Herb or subshrub, up to 1 m high; stem and branches terete, pubescent. **Leaves** ovate to rhomboid, membranous, 4-8 cm long, 2-5 cm wide, pubescent on both surfaces, glabrescent, yellow glandular beneath; base cuneate, attenuate onto the petiole; apex acute to shortly acuminate; margin serrate; petioles 1.5-3 cm wide. **Inflorescence** in terminal and upper axillary spikes, 4-9 cm long, pubescent; verticillasters 6-10-flowered. **Calyx** tubular, 3-4 mm long, sparsely puberulous and glandular outside, slightly enlarged in fruit. **Corolla** white, tubular, 5-7 mm long. **Nutlets** ca. 1 mm long (Fig. 46).

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei; Eastern: Chaiyaphum, Nakhon Ratchasima.

Distribution.— NE India (Manipur) to S China (Yunnan) and continental SE Asia southwards to Indonesia.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: November-January; fruiting: January-March.

Vernacular.— ทนวดแมว Nuat maeo (Loei).

Voucher specimens.— *P. Srisanga* 1207.

11. GMELINA L.

Sp. Pl.: 626. 1753; Chen & Gilbert in Fl. China 17: 32. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 195. 2004.

Trees or shrubs, sometimes climbers or scrambling; stems sometimes armed with spine. **Leaves** simple, opposite. **Inflorescence** usually terminal, cymose, paniculate. **Calyx** tubular or campanulate, enlarged in fruit, truncate or 4-5-lobed, often with large glands. **Corolla** infundibular, (4-)5-lobed, 2-lipped; anterior lip 3-lobed with middle lobe larger; posterior lip 2-lobed or entire; tube widely funnel-shaped, narrow at base, greatly enlarged at throat. **Stamens** 4, didynamous, inserted at base of tube, only slightly exerted or included; thecae parallel or divergent. **Ovary** bicarpellate, syncarpous, 4-locular; ovule 1 in each loculus; style terminal; stigma

unequal 2-lobed, posterior branch much shorter. **Fruit** a drupe, with hard pyrene. **Seeds** (2)4.

About 33 species in Asia, Australia, New Guinea and New Caledonia (Harley et al., 2004). About 7 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Gmelina arborea* Roxb.**

Pl. Corom. 3: 41, t. 246. 1815; C.B. Clarke in Fl. Br. Ind. 4: 581. 1885; Dop in Fl. Gén. I.-C. 4: 843. 1935; Fletcher, Kew Bull. 1938: 422. 1938; Chen & Gilbert in Fl. China 17: 33. 1994; Long in Fl. Bhutan 2(2): 928, fig. 85: g-j. 1999.

Deciduous tree, up to 20 m high; branchlets slightly quadrangular when young, becoming terete, lenticellate; young branchlets densely yellowish brown tomentose. **Leaves** broadly ovate, thick papery, 8-20 cm long, 5-15 cm wide, puberulous, glabrescent on upper surface, tomentose and with 2-4 large glands near base on lower surface; base broadly cuneate to cordate; apex acuminate; margin entire; primary veins 3-5 pairs; petioles 3-10 cm long, tomentose. **Inflorescence** in terminal thyrses; peduncle 15-30 cm long, densely yellowish brown tomentose. **Calyx** campanulate, 3-5 mm long, densely yellowish brown tomentose and with several black discoid gland patches; lobes 5, triangular, 0.5-1 mm long. **Corolla** brownish yellow, 3-4 cm long, 2-lipped, sparsely glandular, pubescent; tube 1.5-2 cm long, pubescent; middle lobe of anterior lip yellow, obovate; other lobes rounded, reflexed. **Ovary** glabrous, glandular. **Drupe** ellipsoid to obovoid, 1.5-2.5 cm long, yellow when ripe, black when dry, subtended by persistent calyx.

Thailand.— Almost throughout the country.

Distribution.— India, Nepal, Bhutan, Bangladesh, S China (Yunnan), SE Asia.

Ecology.— Deciduous and lower montane forest, secondary forest, roadsides, alt. 600-1,400 m (Doi Phu Kha).

Phenology.— Flowering: February-April; fruiting: March-June; Leaves: May-January.

Uses.— Wood for handicraft.

Vernacular.— สร้อย (Northern).

Voucher specimens.— *P. Srisanga* 537.

12. *GOMPHOSTEMMA* Wall. ex Benth.

Edward's Bot. Reg. 15: sub t. 1292. 1830; Keng in Fl. Mal. I(8): 319. 1978; Li & Hedge in Fl. China 17: 70. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 215. 2004.

Perennial herbs, subshrubs or shrubs, with simple and stellate hairs. **Leaves** simple, opposite, petiolate. **Inflorescence** axillary, sometimes terminal or on separate short shoots; verticillasters few- to many-flowered, often forming densely sessile or laxly branched cymes, sometimes in spikes or panicles. **Calyx** 5-lobed, 10-nerved;

lobes equal or subequal, accrescent. **Corolla** 2-lipped, 4-lobed; posterior lip 1-lobed, shallowly hooded, emarginate or entire; anterior lip 3-lobed; tube straight or incurved, mostly strongly dilated in distal part. **Stamens** 4, not or very shortly exerted; thecae parallel or narrowly divergent. **Ovary** deeply 4-lobed; style gynobasic; stigma lobes subequal or unequal. **Fruit** a schizocarp of 4 nutlets; nutlets sometimes abortion, rounded at apex.

About 36 species in India, China to SE Asia (Harley et al., 2004). About 10 species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|--------------------------|
| 1. Inflorescence in axillary | |
| 2. Inflorescence in verticillasters, 2-10-flowered | 1. <i>G. javanicum</i> |
| 2. Inflorescence in branched cymes, 3-5 cm long | 2. <i>G. parviflorum</i> |
| 1. Inflorescence in terminal spike | 3. <i>G. strobilinum</i> |

1. *Gomphostemma javanicum* (Bl.) Benth.

Lab. Gen. Sp.: 650. 1835; Murata, SE Asian Studies 14(2): 188. 1976; Keng in Fl. Mal. I(8): 322. 1978. – *Prasium javanicum* Bl., Bijdr.: 840. 1826. – *Gomphostemma oblongum* Wall. ex Benth., Pl. As. Rar. 2: 12. 1830; Hook.f. in Fl. Br. Ind. 4: 697. 1885; Doan in Fl. Gén. I.-C. 4: 1032. 1936.

Erect perennial herb or subshrub, 0.5-2 m high; stems quadrangular, densely coarsely stellate tomentose. **Leaves** lanceolate, oblanceolate, elliptic, ovate to obovate, (8-)15-30 cm long, (2.5-)5-10 cm wide, hispid on upper surface, densely stellate pubescent on lower surface; base cuneate; apex acute to shortly acuminate; margin serrate; petioles 1-3 cm long, densely tomentose. **Inflorescence** in dense axillary verticillasters, 2-10-flowered. **Flowers** sessile or subsessile; bracts linear-lanceolate, 6-10 mm long. **Calyx** 1-1.3 cm long, often with prominently ribbed, densely tomentose outside; teeth lanceolate, shorter than the calyx tube, acuminate at apex. **Corolla** creamy yellow or creamy white, 3.5-4 cm long, incurved, tomentose. **Ovary** villous; style sparsely hirsute, glabrescent. **Nutlets** 1-4, ovoid, 5-6 mm long, 3-4 mm wide, smooth, hispid at apex (Fig. 47).

Thailand.— Northern: Chiang Mai, Lamphun, Lampang, Nan, Tak; North-eastern: Loei, Phetchabun; Eastern: Nakhon Ratchasima; South-eastern: Chanthaburi; Peninsular: Nakhon Si Thammarat, Songkhla.

Distribution.— Myanmar, Laos, Vietnam, Cambodia, Malaysia, Indonesia (Java-type), Borneo, Philippines.

Ecology.— Dry evergreen and lower montane forest, alt. 850-1,700 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering: June-July; fruiting: September-November.

Voucher specimens.— *P. Srisanga* 1953, 1974; *P. Srisanga et al.* 759.

2. *Gomphostemma parviflorum* Wall. ex Benth.

Pl. As. Rar. 2: 12. 1830; Hook.f. in Fl. Br. Ind. 4: 697. 1885; Doan in Fl. Gén. I.-C. 4: 1036. 1936; Murata, SE Asian Studies 14(2): 190. 1976; Keng in Fl. Mal. I(8): 321. 1978; Li & Hedge in Fl. China 17: 72. 1994; Clement in Fl. Bhutan 2(2): 949, fig. 86: g-h. 1999.

Erect subshrub, 1-2 m high; stems quadrangular, densely brownish stellate tomentose. **Leaves** elliptic to ovate, chartaceous, 12-25 cm long, 5-12 cm wide, hispid on upper surface, densely stellate tomentose on lower surface; base cuneate, attenuate onto the petiole; apex acute; margin serrate; petioles 1-3.5 cm long, tomentose. **Inflorescence** in axillary, branched cymes, 3-5 cm long, densely stellate tomentose. **Flowers** subsessile; bracts lanceolate-ovate, 1-1.5 cm long. **Calyx** narrowly campanulate, 1-1.5 cm long, densely tomentose outside; teeth narrowly lanceolate, as long as or slightly shorter than the calyx tube, acuminate at apex. **Corolla** orange to yellow, 2-2.5 cm long, straight or slightly incurved, puberulous outside. **Ovary** glabrous; style glabrous. **Nutlets** 1-2, ovoid, 6-8 mm long, 3-4 mm wide, red, smooth, glabrous (Fig. 48).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Bhutan, Sikkim, Myanmar, S China (Yunnan), Vietnam, Malaysia, Indonesia.

Ecology.— Dry evergreen and lower montane forest, by streams, also in limestone areas, alt. 1,000-1,200 m (Doi Phu Kha, Tham Pha Khaw).

Phenology.— Flowering: June-September; fruiting: September-November.

Voucher specimens.— *P. Srisanga* 1698, 1924.

3. *Gomphostemma strobilinum* Wall. ex Benth.

Pl. As. Rar. 2: 12. 1830; Hook.f. in Fl. Br. Ind. 4: 696. 1885; Doan in Fl. Gén. I.-C. 4: 1032. 1936; Murata, SE Asian Studies 14(2): 190. 1976.

Perennial herb, up to 1 m high; stems quadrangular, densely stellate tomentose. **Leaves** elliptic to ovate, chartaceous, 14-40 cm long, 9-15 cm wide, hispid on upper surface, densely stellate tomentose on lower surface; base cuneate, attenuate onto the petiole; apex obtuse or acute; margin crenate; petioles 1-2 cm long, tomentose. **Inflorescence** in terminal spike, dense-flowered, up to 20 cm long, densely stellate tomentose. **Flowers** subsessile; bracts lanceolate-ovate, 15-18 mm long. **Calyx** campanulate, 10-13 mm long, densely tomentose outside; teeth triangular, acuminate at apex. **Corolla** yellow, 2-2.5 cm long, incurved, puberulous outside. **Ovary** glabrous; style glabrous. **Nutlets** 1-4, ovoid, 4-5 mm long, 3-4 mm wide, orange, smooth, glabrous.

Thailand.— Northern: Chiang Mai, Lampang, Nan, Tak, Sukhothai; North-eastern: Loei, Khon Kaen; Central: Saraburi; South-western: Kanchanaburi, Phetchaburi.

Distribution.— Myanmar (type), Vietnam.

Ecology.— Deciduous dipterocarp forest, alt. 400-500 m (Wiang Peian Waterfall).

Phenology.— Flowering: July-September; fruiting: October-November.

Voucher specimens.— *P. Srisanga* 2288.

13. *ISODON* (Schrad. ex Benth.) Spach

Hist. Nat. Veg. 9: 162. 1840; Li & Hedge in Fl. China 17: 269. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 256. 2004. – *Plectranthus* L'Hérit. sect. *Isodon* Schrad. ex Benth., Lab. Gen. Sp.: 40. 1832. – *Rabdosia* (Bl.) Hassk., Flora 2: 25. 1842.

Erect herbs or subshrubs; stems quadrangular. **Leaves** simple, opposite, rarely ternate, usually serrate. **Inflorescence** terminal and axillary, thyrsoid with cymes pedunculate, 3- to several-flowered; bracts persistent; bracteoles small, usually linear. **Calyx** campanulate, funnel-shaped or tubular, sometimes slightly constricted or rarely curved at throat, actinomorphic or 2-lipped, 5-lobed, accrescent; teeth lanceolate to deltoid, posterior lip 3-lobed, anterior lip 2-lobed. **Corolla** white, blue, pink or purplish, strongly 2-lipped, 5-lobed; posterior lip 4-lobed, each lobe equal or subequal; anterior lip 1-lobed, horizontal, cucullate; tube tubular, straight or declinate, saccate to spurred at base. **Stamens** 4, included or exerted, posterior pair attached near base of corolla or between base and midpoint, anterior pair attached between midpoint of corolla and throat. Disk 4-lobed with anterior lobe slightly larger, lobes alternating with nutlets. **Ovary** deeply 4-lobed, glabrous; style gynobasic; stigma lobes divergent. **Fruit** a schizocarp of 4 nutlets; nutlets ovoid, glabrous, smooth or minutely tuberculate.

About 100 species mostly in tropical Asia, 2 species in Africa (Harley et al., 2004). About 4 species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|----------------------------------|
| 1. Corolla tube declinate. Stamens included in anterior corolla lip | 1. <i>I. coetsa</i> |
| 1. Corolla tube straight. Stamens exerted from anterior corolla lip | |
| 2. Calyx densely villous all over | 2. <i>I. hispidus</i> |
| 2. Calyx sparsely pubescent | 3. <i>I. lophathoides</i> |

1. *Isodon coetsa* (Buch.-Ham. ex D. Don) Kudo

Mem. Fac. Sci. Taihoku Imp. Univ. 2(2): 131. 1929; Li & Hedge in Fl. China 17: 286. 1994; Clement in Fl. Bhutan 2(2): 998. 1999. – *Plectranthus coetsa* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal.: 117. 1825; Hook.f. in Fl. Br. Ind. 4: 619. 1885; Doan in Fl. Gé n. I.-C. 4: 945. 1936.

Erect perennial herb or subshrub, up to 1.8 m high; stems pubescent. **Leaves** opposite, elliptic to ovate, 3-7 cm long, 1.5-4 cm wide, pubescent on both surfaces;

base obtuse to cuneate, attenuate onto the petiole; apex acute to acuminate; margin serrate; petioles 0.5-1.5 cm long, pubescent. **Inflorescence** terminal and axillary, panicles, 5-15 cm long, pubescent; cymes 3-7-flowered; pedicels 1-3 mm long, pubescent. **Calyx** tubular-campanulate, 2-3 mm long, accrescent, slightly 2-lipped, pubescent and glandular outside; teeth triangular-ovate, subequal, acute at apex; tube declinate. **Corolla** purple to purplish blue or white, 5-8 mm long, pubescent; posterior lip with subequal lobes, each lobe rounded or obtuse at apex; anterior lip broadly ovate to orbicular, cucullate; tube declinate, 2-4 mm long. **Stamens** included in anterior corolla lip. **Style** included or slightly exerted. **Nutlets** brown, ca. 1 mm long, smooth or minutely tuberculate.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— E Himalayas (Nepal-type), India, Sri Lanka, Myanmar, China, Laos, Vietnam.

Ecology.— Lower montane forest and lower montane scrub, by streams, also in open areas among grasses on limestone mountain, alt. 1,100-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: October-February.

Vernacular.— ปลวกน้ำ Pluak nam (Chiang Mai).

Voucher specimens.— *P. Srisanga* 409, 1135, 1252, 1871, 2256.

2. *Isodon hispidus* (Benth.) Murata

Acta Phytotax. Geobot. 24: 82. 1969; Li & Hedge in Fl. China 17: 278. 1994; Clement in Fl. Bhutan 2(2): 995. 1999. – *Plectranthus hispidus* Benth., Pl. As. Rar. 2: 17. 1830; Hook.f. in Fl. Br. Ind. 4: 618. 1885.

Erect perennial herb or subshrub, up to 1.5 m high; stems densely villous. **Leaves** opposite, elliptic to ovate, 3-8 cm long, 1.5-5 cm wide, densely pubescent on both surfaces; base cuneate to rounded; apex acute to acuminate; margin serrate-crenate; petioles (1-)4-8 mm long, pubescent. **Inflorescence** terminal and axillary, panicles, 4-10 cm long, densely brownish villous; cymes 8-15-flowered; pedicels 1-3 mm long, sparsely villous. **Calyx** tubular-campanulate, 2-3 mm long, accrescent, slightly 2-lipped, densely villous and glandular outside; teeth lanceolate, subequal, acuminate at apex; tube declinate. **Corolla** white, 5-6.5 mm long, pubescent; posterior lip with subequal lobes, each lobe rounded or obtuse at apex; anterior lip broadly ovate to orbicular, slightly cucullate; tube straight, 3-4 mm long. **Stamens** exerted from anterior corolla lip. **Style** exerted. **Nutlets** brown, ca. 1 mm long, smooth.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan.

Distribution.— India (type), Bhutan, Myanmar, S China, Laos.

Ecology.— Lower montane forest and lower montane scrub, in open areas among grasses on limestone mountain, alt. 1,700-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: October-January.

Voucher specimens.— *P. Srisanga* 408, 1145, 1872, 2649.

3. *Isodon lophanthoides* (Buch.-Ham. ex D. Don) H. Hara

J. Jap. Bot. 60: 235. 1985; Li & Hedge in Fl. China 17: 278. 1994; Clement in Fl. Bhutan 2(2): 995; fig. 89: h-i. 1999. — *Hyssopus lophanthoides* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal.: 110. 1825. — *Plectranthus striatus* Benth., Pl. As. Rar. 2: 17. 1830; Hook.f. in Fl. Br. Ind. 4: 618. 1885; Doan in Fl. Gén. I.-C. 4: 948. 1936.

Erect or ascending perennial herb, 10-50(-70) cm high; stems puberulous. **Leaves** opposite, elliptic to ovate, 2-8 cm long, 1-5 cm wide, sparsely pubescent on both surfaces; base cuneate, rounded to subtruncate or cordate; apex obtuse, acute to acuminate; margin serrate-crenate; petioles 5-30 mm long, pubescent. **Inflorescence** terminal and axillary, panicles, 6-15 cm long, glabrous to pubescent, cymes 3-15-flowered; pedicels 2-6 mm long, pubescent. **Calyx** tubular-campanulate, 1.5-2 mm long, accrescent, slightly 2-lipped, sparsely pubescent outside; teeth triangular-ovate, subequal, obtuse at apex; tube declinate. **Corolla** white, 4-7 mm long, glabrous or pubescent; posterior lip with subequal lobes, each lobe rounded or obtuse at apex; anterior lip broadly ovate to orbicular, flattened or slightly cucullate; tube straight, 2-5 mm long. **Stamens** exserted from anterior corolla lip. **Style** exserted. **Nutlets** brown, ca. 1 mm long, smooth.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Phitsanulok; North-eastern: Loei; South-western: Kanchanaburi.

Distribution.— E Himalayas (Nepal-type), India, Myanmar, China, Laos, Vietnam.

Ecology.— Dry evergreen forest, lower montane forest and lower montane scrub, sometimes in open areas among grasses on limestone mountain, alt. 900-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: September-December.

Voucher specimens.— *P. Srisanga* 275, 1797, 1810, 2138.

14. *LEUCAS* Burm. ex R. Br.

Prodr. Fl. Nov. Holl.: 504. 1810; Keng in Fl. Mal. I(8): 337. 1978; Li & Hedge in Fl. China 17: 141. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 227. 2004.

Annual or perennial herbs or undershrubs, pubescent with simple hairs. **Leaves** simple, opposite, petiolate. **Inflorescence** axillary or terminal, capitate clusters. **Calyx** 2-lipped or actinomorphic, 8-10(-12)-lobed; lobes usually unequal or rarely equal, mostly spinose. **Corolla** strongly 2-lipped, 4-lobed; posterior lip 1 lobe, hooded, bearded and densely pubescent outside; anterior lip 3-lobed, middle lobe largest. **Stamens** 4, didynamous, not or only shortly exserted; thecae confluent or weakly distinct. **Ovary** deeply 4-lobed; style gynobasic; stigma lobes equal or unequal. **Fruit** a schizocarp of 4 nutlets; nutlets ovoid, rounded or truncate at apex, with or without glands, glabrous or rarely shortly hairy.

About 100 species in Africa and Asia (Harley et al., 2004). About 5-7 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Calyx teeth 3-4 mm long, spreading, star-like in fruit. Posterior lip of the corolla densely yellowish brown villous outside **1. *L. ciliata***
 1. Calyx teeth ca. 1 mm long, erect. Posterior lip of the corolla densely white villous outside **2. *L. decemdentata***

1. *Leucas ciliata* Benth.

Pl. As. Rar. 1: 61. 1830; Hook.f. in Fl. Br. Ind. 4: 687. 1885; Doan in Fl. Gén. I.-C. 4: 1021. 1936; Li & Hedge in Fl. China 17: 142. 1994; Clement in Fl. Bhutan 2(2): 962; fig. 87: g. 1999.

Herb, 30-80 cm high; stem erect, branched, yellowish to golden-yellow hirsute. **Leaves** lanceolate, 4-9 cm long, 1-3 cm wide, hirsute on both surfaces; base cuneate; apex acute; margin remotely shallowly serrate; primary veins 3-5 pairs; petioles 6-10 mm long, densely hirsute. **Inflorescence** axillary; verticillasters many-flowered, globose; bracts linear, 10-14 mm long, hirsute. **Calyx** tubular, 10-14 mm long, straight or slightly curved, hispid; teeth 10, 3-4 mm long, spinose, spreading star-like in fruit. **Corolla** white, 1.5-1.8 cm long; tube glabrous, except for puberulent throat outside, bearded annulate inside; posterior lip densely yellowish brown villous outside, glabrous inside; anterior lip spreading, slightly longer than the posterior lip, median lobe trapeziform, 2-lobed, lateral lobes ovate. **Nutlets** ovoid, 2-2.5 mm long, brown.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— India, Nepal, Bhutan, Sikkim, Myanmar, China, Laos, Vietnam.

Ecology.— Lower montane forest, open areas, roadsides, alt. 1,500-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: September-November.

Vernacular.— หู้หัวเสือ Ya hua suea (Loei).

Voucher specimens.— *P. Srisanga* 1837.

2. *Leucas decemdentata* (Willd.) Sm.

In Rees Cycl. 20. 1819. – *Phlomis decemdentata* Willd., Sp. Pl. 3: 124. – *Leucas flaccida* R. Br., Prodr. Fl. Nov. Holl.: 505. 1810; Hook.f. in Fl. Br. Ind. 4: 684. 1885; Keng in Fl. Mal. I(8): 340. 1978. – *L. mollissima* Wall. ex Benth., Pl. As. Rar. 1: 62. 1830; Hook.f. in Fl. Br. Ind. 4: 682. 1885; Doan in Fl. Gén. I.-C. 4: 1023. 1936; Li & Hedge in Fl. China 17: 142. 1994; Clement in Fl. Bhutan 2(2): 962. 1999.

Herb, 30-150 cm high; stem erect or ascending, branched, brown pubescent. **Leaves** lanceolate to elliptic, 3.5-6 cm long, 1.3-2.5 cm wide, pubescent on both surfaces; base cuneate; apex acute; margin serrate-crenate; primary veins 3 pairs; petioles 2-8 mm long, pubescent. **Inflorescence** axillary; verticillasters (2-)4-8(-13)-flowered, globose; bracts linear, 2-3 mm long, pilose. **Calyx** tubular, 6-8 mm long, straight or slightly curved, pilose; teeth 10, ca. 1 mm long, erect. **Corolla** white, 1.1-1.3 cm long; tube glabrous, except for puberulent throat outside, villous annulate inside; posterior lip densely white villous outside, glabrous inside; anterior lip spreading, slightly longer than the posterior lip, median lobe obcordate, lateral lobes oblong. **Nutlets** ovoid, 1.5-2 mm long, brown (Fig. 49).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, Sikkim, Myanmar, China, Vietnam, Malaysia, Indonesia.

Ecology.— Lower montane forest, open areas, roadsides, alt. 1,400-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: October-December.

Voucher specimens.— *P. Srisanga* 1136, 1798.

15. *MICROTOENA* Prain

Hook. Ic. Pl. 19: t. 1872. 1889; Keng in Fl. Mal. I(8): 346. 1978; Li & Hedge in Fl. China 17: 189. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 221. 2004.

Erect perennial herbs, pubescent with glandular hairs. **Leaves** simple, opposite, petiolate. **Inflorescence** axillary or terminal, thyrsoid or cymes, long pedunculate. **Calyx** 5-lobed; lobes subequal or posterior lobe longer. **Corolla** strongly 2-lipped, 4-lobed; posterior lip 1-lobed, long, hooded, often deeply concave, broadened or with 2 teeth at base; anterior lip 3-lobed, with median lobe smaller to sometimes larger than lateral lobes. **Stamens** 4, subequal, included or only shortly exerted; anthers long and narrow; thecae confluent. **Ovary** deeply 4-lobed; style gynobasic; stigma lobes strongly unequal, posterior lobe minute. **Fruit** a schizocarp of 4 nutlets; nutlets ovoid, rounded at apex, glabrous.

About 24 species in India, Nepal, China to SE Asia (Harley et al., 2004). About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

Microtoena insuavis (Hance) Prain ex Briq.

In Nat. Pflanzenfam. 4, 3a: 269. 1896; Doan in Fl. Gén. I.-C. 4: 1017, fig. 106: 7-11. 1936; Keng in Fl. Mal. I(8): 346, fig. 17. 1978; Li & Hedge in Fl. China 17: 191. 1994. – *Gomphostemma insuave* Hance, J. Bot. 22: 231. 1884. – *Microtoena cymosa* Prain, Hook. Ic. Pl. 19: t. 1871. 1889.

Herbs, 1-2 m high; stems and branches densely villous. **Leaves** ovate, chartaceous, 5-9 cm long, 3.5-6 cm wide, pubescent on both surfaces; base cuneate, rounded to subcordate; apex acute to acuminate; margin serrate to crenate; petioles 1-7

cm long, pubescent. **Inflorescence** in terminal panicle, with 1-sided branches cymes, 10-30 cm long, pubescent; bracts linear to narrowly lanceolate, 2-5 mm long, pubescent. **Calyx** 3-4 mm long, accrescent, hirsute and glandular; lobes triangular, posterior lobe longer. **Corolla** yellow, sometimes with red tinge, 12-20 mm long, puberulous; posterior lip reddish brown hooded; anterior lip shallowly 3-lobed, median lobe narrowly elliptic, lateral lobes oblong, spreading. **Filaments** puberulous. **Nutlets** oblong-ovoid, 1-1.5 mm long, brown.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan.

Distribution.— India, Myanmar, S China, Vietnam, Indonesia.

Ecology.— Deciduous, dry evergreen and lower montane forest, alt. 750-1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: December-March.

Vernacular.— คำปอง Kham pong (Chiang Mai).

Voucher specimens.— *P. Srisanga* 583, 2689; *P. Srisanga et al.* 236.

16. *ORTHOSIPHON* Benth.

Edward's Bot. Reg. 15: sub t. 1300. 1830; Keng in Fl. Mal. I(8): 379. 1978; Li & Hedge in Fl. China 17: 298. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 261. 2004. — *Clerodendranthus* Kudo, Mem. Fac. Sci. Taihoku Imp. Univ. 2: 117. 1929; Li & Hedge in Fl. China 17: 299. 1994.

Erect herbs or subshrubs; stem quadrangular. **Leaves** simple, opposite, rarely ternate or quadrate. **Inflorescence** terminal, thyrsoid with sessile cymes, (1-)3-flowered; bracts persistent, often inconspicuous. **Calyx** shortly tubular, straight or curving upwards, strongly 2-lipped, 5-lobed; lobes unequal; posterior lip 1-lobed, decurrent, curving upwards; anterior lip 4-lobed, subulate, median lobes longer than lateral lobes. **Corolla** white, blue or pink, strongly 2-lipped, 5-lobed; posterior lip 4-lobed, ascending, median lobes exceeding lateral lobes; anterior lip 1-lobed, horizontal, concave; tube straight or slightly curved. **Stamens** 4, didynamous, included or exerted. Disk 4-lobed with anterior lobe larger, lobes alternating with nutlets. **Ovary** deeply 4-lobed, glabrous; style gynobasic; stigma lobes equal, rounded, connivent. **Fruit** a schizocarp of 4 nutlets; nutlets ovoid, glabrous.

About 40 species in tropical and subtropical Asia, tropical and S Africa and Madagascar (Harley et al., 2004). About 4 species in Thailand. One species recorded from Doi Phu Kha National Park.

Orthosiphon aristatus (Bl.) Miq.

Fl. Ind. Bat. 2: 943. 1858; Keng in Fl. Mal. I(8): 380, fig. 31. 1978. — *Ocymum aristatum* Bl., Bijdr.: 833. 1826. — *Clerodendrum spicatum* Thunb., Fl. Jav.: 22. 1825. — *Clerodendranthus spicatus* (Thunb.) C.Y. Wu ex H.W. Li, Acta Phytotax. Sin. 12 (2): 233. 1974; Li & Hedge in Fl. China 17: 299. 1994. — *Orthosiphon spicatus* (Thunb.) Back., Bakh.f. & Steenis, Blumea 6: 359. 1950, non Benth., 1848. — *O.*

stamineus Benth., Pl. As. Rar. 2: 15. 1830; Hook.f. in Fl. Br. Ind. 4: 615. 1885; Doan in Fl. Gén. I.-C. 4: 939. 1936.

Erect or ascending perennial herb, up to 70 cm high; stem puberulous. **Leaves** opposite, elliptic to ovate, 4-8 cm long, 2-4 cm wide, puberulous on both surfaces; base cuneate, attenuate onto the petiole; apex acute to acuminate; margin coarsely serrate; petioles 1-2.5 cm long, puberulous. **Inflorescence** terminal, thyrsoid, 10-20 cm long, puberulous; verticillasters 6-flowered; pedicels 2-4 mm long, puberulous. **Calyx** tubular-campanulate, curved, 4-6 mm long, accrescent, strongly 2-lipped, puberulous on nerves outside; posterior lip ovate to orbicular; anterior lip with lateral lobes much shorter than median lobes. **Corolla** bluish, 12-18 mm long, puberulous; posterior lip with unequal lobes, median lobes longer than lateral lobes; anterior lip oblong; tube straight, 9-12 mm long. **Stamens** long exserted. **Style** exserted, 5-6 cm long. **Nutlets** brown, 1-2 mm long, reticulate.

Thailand.— Almost throughout the country.

Distribution.— India, Sri Lanka, China, SE Asia (Java-type), Australia.

Ecology.— Dry evergreen and lower montane forest, on limestone rocks, alt. 900-1,100 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: Almost throughout the year.

Uses.— Medicinal purposes.

Vernacular.— หญ้าหนวดแมว Ya nuat maeo (General).

Voucher specimens.— *P. Srisanga et al.* 850.

17. *PARAPHLOMIS* (Prain) Prain

J. As. Soc. Beng. 74: 721. 1908; Keng in Fl. Mal. I(8): 348. 1978; Li & Hedge in Fl. China 17: 170. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 221. 2004.

Rhizomatous herbs or subshrubs, pubescent with simple hairs. **Leaves** simple, opposite, petiolate. **Inflorescence** axillary; verticillasters many-flowered, often forming globose clusters. **Calyx** 5-lobed; lobes equal or subequal, mostly broadly triangular at the base and mucronate at apex. **Corolla** yellow or white, strongly 2-lipped, 4-lobed; posterior lip 1-lobed, hooded, densely pubescent outside; anterior lip 3-lobed. **Stamens** 4, not or only shortly exserted; thecae parallel or narrowly divergent, sometimes hairy. **Ovary** deeply 4-lobed; style gynobasic; stigma lobes subequal or unequal. **Fruit** a schizocarp of 4 nutlets; nutlets rounded or truncate at apex, glabrous or hairy.

About 20 species in India to SE Asia (Harley et al., 2004). About 1 species in Thailand.

Paraphlomis javanica (Bl.) Prain ex Back. & Bakh.f.

Fl. Java 2: 619. 1965; Keng in Fl. Mal. I(8): 350, fig. 19: c. 1978; Li & Hedge in Fl. China 17: 172. 1994; Clement in Fl. Bhutan 2(2): 960. 1999. – *Leonurus javanicus*

Bl., Cat. 83. 1823. – *Phlomis rugosa* Benth., Pl. As. Rar. 1: 63. 1830; Hook.f. in Fl. Br. Ind. 4: 693. 1885. – *Paraphlomis rugosa* (Benth.) Prain, J. As. Soc. Beng. 74: 721. 1908; Doan in Fl. Gén. I.-C. 4: 1015. 1936.

Undershrub, 0.5-2 m high; stems quadrangular, minutely hirsute. **Leaves** oblong-lanceolate, elliptic to ovate, membranous, 15-30 cm long, 6-12 cm wide, glabrous or minutely hairs on the nerves on both surfaces; base cuneate to rounded; apex acuminate to caudate; margin serrate to crenate; petioles 4-10 cm long, puberulent. **Verticillasters** globose, sparsely hirsute. **Flowers** sessile. **Calyx** campanulate, 0.8-1.2 cm long, sparsely hirsute; lobes lanceolate, 2-4 mm long. **Corolla** creamy yellow or white, 2-2.5 cm long, pubescent; posterior lip narrow, rounded at apex; anterior lip: median lobe oblong; lateral lobes lanceolate. **Stigma** lobes subequal. **Nutlets** obovoid, 5.5-6 mm long, 3-3.5 mm wide, black, rounded at apex, glabrous.

Thailand.— Chiang Mai, Nan.

Distribution.— India, Bhutan, Myanmar, China, Laos, Vietnam, Malaysia, Indonesia (Java-type), Philippines.

Ecology.— Dry evergreen and lower montane forest (Doi Phu Kha).

Phenology.— Flowering:

Voucher specimens.— *P. Srisanga* 929; *P. Srisanga* & *C. Puff* 1096.

18. *PLECTRANTHUS* L'Hérit.

Stirp. Nov. Fasc. 4: t. 41, 42. 1788; Keng in Fl. Mal. I(8): 382. 1978; Harley et al. in Fam. Gen. Vasc. Pl. 7: 264. 2004. – *Coleus* Lour., Fl. Cochinch.: 372. 1790; Li & Hedge in Fl. China 17: 292. 1994.

Annual or perennial herbs or subshrubs, sometimes succulent; stem quadrangular. **Leaves** simple, opposite, rarely ternate. **Inflorescence** terminal, thyrsoid, condensed or lax, with sessile or pedunculate cymes, 1-many-flowered; bract caducous or persistent. **Calyx** funnel-shaped or shortly tubular, often ventrally gibbous, straight or curved, strongly 2-lipped, 5-lobed; lobes equal or unequal; posterior lip 1-lobed, lanceolate to obovate, sometimes decurrent; anterior lip 4-lobed, lanceolate to subulate. **Corolla** strongly 2-lipped, 5-lobed; posterior lip 4-lobed, median lobes exceeding lateral lobes; anterior lip 1-lobed, horizontal or sometimes finally deflexed, concave or cucullate; tube narrow, straight or curved. **Stamens** 4, very rarely 2, fused or free at base, held within anterior lip or exerted. Disk 4-lobed with anterior lobe larger, sometimes exceeding ovaries. **Ovary** deeply 4-lobed, glabrous. **Fruit** a schizocarp of 4 nutlets; nutlets ovoid, glabrous.

About 300 species in tropical Old World (Harley et al., 2004). About 5 species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

Plectranthus sp.

Erect herb, ca. 40 cm high, puberulous. **Leaves** ovate, 3-4 cm long, 1.5-2 cm wide, puberulous on both surfaces; base cordate; apex acute; margin crenate.

Inflorescence terminal, lax-flowered, puberulous. **Calyx** tubular, ca. 2 mm long, puberulous outside; fruiting calyx 4-5 mm long; posterior lip ovate; anterior lip with subequal teeth. **Corolla** blue, ca. 9 mm long, puberulous; tube recurved, much longer than lobes. **Stamens** included in anterior corolla lip. **Nutlets** not known.

Thailand.— Northern: Nan.

Ecology.— Lower montane scrub, on limestone rocks, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: November-December.

Voucher specimens.— *P. Srisanga* 2658.

Notes.— Due to insufficient materials, the affinity is uncertain.

19. *POGOSTEMON* Desf.

Mem. Mus. Hist. Nat. Paris 2: 154. 1815; Keng in Fl. Mal. I(8): 351. 1978; Li & Hedge in Fl. China 17: 258. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 214. 2004. — *Dysophylla* Bl., Bijdr: 826. 1826; Li & Hedge in Fl. China 17: 262. 1994.

Annual or perennial herbs or subshrubs. **Leaves** simple, opposite or in whorls of 3-12. **Inflorescence** thyrsoid; bracts and bracteoles small. **Calyx** 5-lobed, 2-lipped, accrescent; posterior lip 3-lobed; anterior lip 2-lobed; lobes subequal or anterior longer. **Corolla** purple or white, weakly 2-lipped, 4-lobed; posterior lip 3-lobed; anterior lip 1-lobed. **Stamens** 4, equal or posterior pair slightly longer, spreading or subdeclinate, exerted; filaments usually bearded along centre with moniliform hairs; anthers subglobose; thecae confluent. **Ovary** deeply 4-lobed; style gynobasic; stigma lobes equal to subequal. **Fruit** a schizocarp of 4 nutlets; nutlets sometimes abortion, rounded at apex, glabrous, often glossy.

About 80 species in China, S & SE Asia, few species in S tropical Africa and Australia (Harley et al., 2004). About 12 species in Thailand. Four species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1. Leaves opposite | |
| 2. Inflorescence terminal, dense-flowered, forming cylindrical spicate, 4-7 cm long, villous | 1. <i>P. auricularius</i> |
| 2. Inflorescence terminal or axillary, spike-like, 5-20 cm long; verticillasters 5-many-flowered, puberulous | |
| 3. Plants greenish | 2. <i>P. glaber</i> |
| 3. Plants purplish | 3. <i>P. menthoides</i> |
| 1. Leaves in whorls of 4 | 4. <i>P. quadrifolius</i> |

1. *Pogostemon auricularius* (L.) Hassk.

Tijd. Nat. Gesch. Phys. 10: 127. 1843; Keng in Fl. Mal. I(8): 356. 1978; Li & Hedge in Fl. China 17: 262. 1994; Clement in Fl. Bhutan 2(2): 985. 1999. — *Mentha*

auricularia L., Mant. 1: 81. 1767. – *Dysophylla auricularia* (L.) Bl., Bijdr.: 826. 1826; Hook.f. in Fl. Br. Ind. 4: 638. 1885; Doan in Fl. Gén. I.-C. 4: 964. 1936.

Herb, 20-80 cm high, prostrate at base and rooting at nodes, ascending; stem villous. **Leaves** opposite, elliptic to ovate, 2-6 cm long, 1.2-3 cm wide, sparsely villous on both surfaces, dark glandular on lower surface; base rounded to cordate; apex obtuse or acute; margin serrate-dentate; petioles 2-5 mm long, villous. **Inflorescence** terminal, dense-flowered, forming cylindrical spicate, 4-7 cm long, villous. **Calyx** campanulate, 1-1.5 mm long, pubescent; teeth subequal, triangular. **Corolla** white, 2-2.5 mm long, pubescent; lobes obtuse. **Stamens** lilac, much exserted, bearded. **Nutlets** ellipsoid, brown, ca. 0.5 mm long.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan.

Distribution.— India, Bhutan, Myanmar, China, Laos, Vietnam, Cambodia, Malaysia, Indonesia, Philippines.

Ecology.— Dry evergreen and lower montane forest, wet places, alt. 1,000-1,200 m (Doi Phu Kha, Nan Watershed).

Phenology.— Flowering and fruiting: August-October.

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2087.

2. *Pogostemon glaber* Benth.

Pl. As. Rar. 1: 31. 1830; Lab. Gen. Sp.: 154. 1833; Hook.f. in Fl. Br. Ind. 4: 633. 1885; Doan in Fl. Gén. I.-C. 4: 973. 1936; Li & Hedge in Fl. China 17: 260. 1994; Clement in Fl. Bhutan 2(2): 985. 1999.

Erect herb, up to 2 m high; stem quadrangular, pubescent, glabrescent. **Leaves** opposite, elliptic to ovate, 5-10 cm long, 2.5-6 cm wide, sparsely pubescent on both surfaces; base cuneate, attenuate onto the petiole; apex acute to acuminate; margin serrate-dentate; petioles 0.7-4 cm long, pubescent. **Inflorescence** terminal or axillary, spike-like, 5-20 cm long; verticillasters many-flowered, puberulous. **Calyx** narrowly campanulate, 2.5-3.5 mm long, puberulous; teeth equal, triangular. **Corolla** white or bluish, 4-5 mm long; posterior lip bearded outside; anterior lip glabrous. **Stamens** lilac, much exserted, bearded about the middle. **Nutlets** ovoid, brown, ca. 0.5 mm long.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan.

Distribution.— India, Nepal, Sikkim, Bangladesh, Myanmar, S China (Yunnan), Laos.

Ecology.— Lower montane forest, open places, alt. 1,500-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: November-March.

Vernacular.— ก้อมก้อดง Kom ko dong (Chiang Mai).

Voucher specimens.— *P. Srisanga* 464, 2378; *P. Srisanga et al.* 2445.

3. *Pogostemon menthoides* Bl.

Bijdr.: 825. 1826; Keng in Fl. Mal. I(8): 355. 1978; Doan in Fl. Gén. I.-C. 4: 972. 1936; Li & Hedge in Fl. China 17: 261. 1994.

Erect herb, up to 1.5 m high; stem subquadrangular, purplish, pubescent. **Leaves** opposite, broadly lanceolate, elliptic to ovate, purplish, 2.5-7 cm long, 1.5-3.5 cm wide, pubescent on both surfaces; base cuneate, attenuate onto the petiole, often slightly oblique; apex acute; margin serrate-dentate; petioles 0.5-3 cm long, pubescent. **Inflorescence** terminal, spike-like, 5-15 cm long; verticillasters 5-12-flowered; pedicels ca. 1 mm long, pubescent. **Calyx** narrowly campanulate to tubular, 3-4 mm long, strigose; teeth equal, linear to narrowly lanceolate. **Corolla** blue or purplish, 5-6 mm long; puberulous. **Stamens** much exserted, bearded below the middle. **Nutlets** subglobose, black, 0.5-1 mm long.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Myanmar, S China (Yunnan), Vietnam, Indonesia, Philippines.

Ecology.— Lower montane forest, open places, alt. 1,400-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: August-November.

Vernacular.— หอมขี้คอก Hom po doi (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1132, 1492, 1502, 1717, 1757.

4. *Pogostemon quadrifolius* (Benth.) Kuntze

Rev. Gen. Pl.: 530. 1891. – *Dysophylla quadrifolia* Benth., Pl. As. Rar. 1: 30. 1830; Lab. Gen. Sp.: 158. 1833; Hook.f. in Fl. Br. Ind. 4: 639. 1885; Doan in Fl. Gén. I.-C. 4: 966. 1936.

Erect herb, up to 1 m high; stem subterete, pubescent or tomentose. **Leaves** in whorls of 4, linear-lanceolate, 2.5-9 cm long, 0.2-0.8 cm wide, sessile, pubescent on both surfaces, golden yellow glandular on lower surface; base attenuate; apex obtuse or acute; margin coarsely serrate. **Inflorescence** terminal, dense-flowered, forming cylindrical spicate, 3.5-13 cm long, pubescent or tomentose. **Calyx** campanulate, 1-1.5 mm long, sparsely pubescent; teeth subequal, triangular. **Corolla** bluish, 2-2.5 mm long, glabrous; lobes obtuse. **Stamens** lilac, much exserted, bearded. **Nutlets** ellipsoid, black, ca. 0.5 mm long.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Bangladesh, Myanmar, Laos, Vietnam.

Ecology.— Deciduous dipterocarp forest, alt. 400-500 m (Wiang Peian Waterfall).

Phenology.— Flowering and fruiting: October-December.

Voucher specimens.— *P. Srisanga* 2285.

20. *PREMNA* L.

Mant. Pl. 2: 154. 1771; Chen & Gilbert in Fl. China 17: 16. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 194. 2004.

Trees or shrubs, rarely a stemless subshrub, sometimes epiphytic or climbers. Branchlets usually terete. **Leaves** simple, opposite. **Inflorescence** terminal, cymose. **Calyx** tubular or campanulate, truncate or tooth, often obscurely 2-lipped. **Corolla** white or purplish, infundibular, 4-lobed, 2-lipped, occasionally subactinomorphic. **Stamens** 4, often didynamous, inserted in middle to lower part of the corolla tube, slightly exserted; thecae parallel or divergent. **Ovary** bicarpellate, syncarpous, 4-locular; ovule 1 in each loculus; style terminal; stigma shortly 2-lobed. **Fruit** drupaceous, with hard pyrene. **Seeds** 4.

Between 50-200 species in tropical and subtropical Asia, Africa, Australia and Pacific Islands (Harley et al., 2004). About 20 species in Thailand. One species recorded from Doi Phu Kha National Park.

Premna villosa C.B. Clarke

In Fl. Br. Ind. 4: 573. 1885; Fletcher, Kew Bull. 1938: 418. 1938.

Deciduous tree, 5-15 m high; young branchlets densely brown tomentose. **Leaves** broadly ovate, 8-20 cm long, 5-15 cm wide, sparsely puberulous on upper surface, densely softly tomentose on lower surface; base broadly cuneate, slightly oblique; apex acuminate; margin entire or irregularly shallowly serrate; primary veins 5-7 pairs; petioles 2-7 cm long, brown tomentose. **Inflorescence** in terminal flat-topped corymbs, 7-12 cm long, brown tomentose. **Calyx** campanulate, cup-shaped, obscurely 2-lipped, 1-2 mm long, puberulous outside, glabrous inside; lobes 4, minute. **Corolla** white, 4-5 mm long, 2-lipped, sparsely puberulous; tube 2-3 mm long, pilose at throat; lobes ca. 1 mm long, ciliate. **Stamens** subequal, glabrous, exserted. **Ovary** glabrous, glandular. **Drupe** subglobose, 4-5 mm long, black, subtended by enlarged calyx.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— India (type), S China (Yunnan).

Ecology.— Deciduous and dry evergreen forest, secondary forest, open areas, alt. 800-1,000 m (Doi Phu Kha).

Phenology.— Flowering: April-June; fruiting: June-August; leaves: May-February.

Vernacular.— ซ้อเมว Sor maeo (Northern).

Voucher specimens.— *P. Srisanga et al.* 891.

21. *SCUTELLARIA* L.

Sp. Pl.: 598. 1753; Keng in Fl. Mal. I(8): 323. 1978; Li & Hedge in Fl. China 17: . 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 211. 2004.

Herbs or subshrubs, rarely shrubs, usually non aromatic. **Leaves** simple, opposite, entire, tooth or rarely pinnatifid, petiolate. **Inflorescence** terminal or axillary, racemes or spikes, decussately or helically arranged flowers, often flower solitary in axil of foliage leaves; bracts present, reduced or not; bracteoles present or absent. **Calyx** 2-lipped, accrescent; lips entire, rounded, becoming appressed at maturity, enclosing nutlets until posterior lip detaches to release them, rarely calyx indehiscent, inflated; posterior lip usually folded to produce a scutellum. **Corolla** zygomorphic; tube straight or curved, often basally geniculate, usually 2-lipped, 4-lobes; posterior lip galeate, unlobed; anterior lip 3-lobed, middle lobe broad, flattened, lateral lobes more or less jointed to posterior lip, sometimes spreading. **Stamens** 4, didynamous, usually included; thecae parallel to divergent; anther slit usually ciliate, anterior anthers dimidiate due to abortion of outer theca. **Ovary** lobes separate both above and below the style attachment or the style gynobasic; disk well developed, often with anterior side swollen at the base of a peg-like gynophore. **Fruit** a schizocarp of 4 nutlets; nutlets usually ellipsoid to obovoid or subglobose, pubescent or glabrous, attachment-scar lateral or basal.

About 360 species, subcosmopolitan but poorly represented in moist tropical lowlands (Harley et al., 2004). About 6 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|------------------------------|
| 1. Erect herb. Verticillasters (2-)3(-4)-flowered | 1. <i>S. discolor</i> |
| 1. Prostrate herb. Verticillasters 2-flowered | 2. <i>S. indica</i> |

1. ***Scutellaria discolor*** Wall. ex Benth.

Pl. As. Rar. 1: 66. 1830; Hook.f. in Fl. Br. Ind. 4: 667. 1885; Doan in Fl. Gén. I.-C. 4: 1000. 1936; Keng in Fl. Mal. I(8): 324. 1978; Li & Hedge in Fl. China 17: 80. 1994; Clement in Fl. Bhutan 2(2): 950. 1999.

Erect herb, 20-50 cm high; stem quadrangular, hirsute. **Leaves** ovate to broadly ovate, 4-8 cm long, 2.5-6.5 cm wide, sometimes purplish, sparsely puberulous on both surfaces; base cordate; apex rounded to obtuse; margin crenate; petioles 0.3-3 cm long, puberulous. **Inflorescence** in terminal, raceme-like, 5-15 cm long, puberulous; verticillasters (2-)3(-4)-flowered; pedicels 2-4 mm long, puberulous. **Calyx** cup-shaped, 2-2.5 mm long, puberulous; scutellum spreading, semicircular; fruiting calyx 4-5 mm long. **Corolla** blue or purple, trumpet-shaped, curved, 10-12 mm long, puberulous. **Nutlets** ellipsoid, ca. 1 mm long, black, echinate.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, Myanmar, China, Laos, Vietnam, Cambodia, Malaysia, Indonesia.

Ecology.— Lower montane forest, alt. 1, 500-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-December.

Voucher specimens.— *P. Srisanga* 930.

2. *Scutellaria indica* L.

Sp. Pl.: 600. 1753; Doan in Fl. Gén. I.-C. 4: 1003. 1936; Keng in Fl. Mal. I(8): 325. 1978; Li & Hedge in Fl. China 17: 87. 1994.

Prostrate herb; stem quadrangular, hirsute. **Leaves** ovate to broadly ovate, 1.5-3 cm long, 1.5-2 cm wide, hirsute on both surfaces; base cordate; apex rounded to obtuse; margin crenate; petioles 0.5-2 cm long, hirsute. **Inflorescence** in terminal, raceme-like, 2-10 cm long, puberulous; verticillasters 2-flowered; pedicels 2-3 mm long, puberulous. **Calyx** cup-shaped, 1.5-2.5 mm long, puberulous; scutellum erect, semicircular; fruiting calyx 3-4 mm long. **Corolla** blue or purple, trumpet-shaped, curved, 12-15 mm long, puberulous. **Nutlets** ovoid, ca. 1 mm long, dark brown, echinate.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— China, Japan, Taiwan, Myanmar, Laos, Vietnam, Cambodia, Malaysia, Indonesia, Philippines.

Ecology.— Lower montane forest, alt. 1, 500-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-December.

Voucher specimens.— *P. Srisanga* 2121.

22. *TEUCRIUM* L.

Sp. Pl.: 562. 1753; Keng in Fl. Mal. I(8): 317. 1978; Li & Hedge in Fl. China 17: 56. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 201. 2004.

Shrubs, undershrubs or herbs. **Leaves** simple, opposite, entire, toothed or pinnately lobed, sessile or petiolate. **Inflorescence** axillary or terminal, cymes, paniculiform to spiciform thyrses; verticillasters 2-6-flowered. **Calyx** actinomorphic to 2-lipped, accrescent or not, 5-lobed; lobes all similar or posterior lobe different from the others 4, or posterior, lateral and anterior lobes differentiated as distinct types; tube often gibbous. **Corolla** usually 1-lipped with anterior lip present, rarely 2-lipped, 5-lobed; anterior lobe much larger than others, usually concave. **Stamens** 4, didynamous, exserted; filaments straight or arched; thecae divaricate, usually confluent when dehiscent. **Ovary** shallowly 4-lobed; style subterminal; stigma lobes equal or unequal. **Nutlets** obovoid to oblate or subglobose, attachment-scar lateral.

About 250 species, subcosmopolitan, with centre of diversity in mediterranean region (Harley et al., 2004). About 2-3 species in Thailand. One species recorded from Doi Phu Kha National Park.

Teucrium quadrifarium Buch.-Ham. ex D. Don

Prodr. Fl. Nepal.: 108. 1825; Hook.f. in Fl. Br. Ind. 4: 701. 1885; Doan in Fl. Gén. I.-C. 4: 1037. 1936; Li & Hedge in Fl. China 17: 59. 1994; Clement in Fl. Bhutan 2(2): 947, fig. 86: e. 1999.

Subshrub, 20-80 cm high; stem erect, subterete or slightly quadrangular, densely golden yellow, rusty villous. **Leaves** elliptic to ovate, 3-7 cm long, 1.5-4 cm wide, rusty brown pubescent or tomentose on both surfaces; base truncate to subcordate; apex acute; margin serrate; petioles 2-10 mm long, rusty brown pubescent. **Inflorescence** axillary or terminal, cylindrical spike-like, 3-8 cm long; verticillasters 2-flowered, close together. **Calyx** purplish, narrowly campanulate, 4-5 mm long, pubescent outside, pilose annulate at throat; posterior teeth ovate; lateral teeth triangular; anterior teeth lanceolate. **Corolla** bluish white or pale lilac, 1-lipped, 11-13 mm long, sparsely pubescent. **Nutlets** subglobose, ca. 1 mm long, dark brown, glabrous.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— India, Nepal, Bhutan, Sikkim, Myanmar, China, Laos, Vietnam, Cambodia.

Ecology.— Lower montane scrub, open areas among grasses on limestone mountain, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: July-January.

Voucher specimens.— *P. Srisanga* 410, 1823, 2146, 2646; *P. Srisanga et al.* 880.

23. *VITEX* L.

Sp. Pl.: 638. 1753; Chen & Gilbert in Fl. China 17: 28. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 195. 2004.

Trees or shrubs. **Leaves** usually palmately compound with 3-8-foliolate, sometimes unifoliolate, opposite, rarely in whorls; leaflets petiolulate. **Inflorescence** axillary or terminal, a dichasial cyme or panicle. **Calyx** campanulate or tubular, 3-5-lobed, or truncate, actinomorphic to weakly 2-lipped. **Corolla** blue, yellow, white or purple, infundibular, zygomorphic, 5-lobed, 2-lipped; anterior lip 3-lobed with middle lobe more elongated; tube straight or curved. **Stamens** 4, didynamous, attached near the base of corolla tube, usually exserted; anthers dorsifixed; thecae divergent. **Ovary** bicarpellate, 2-locular; ovules 2 in each loculus; style terminal, filiform; stigma 2-lobed. **Fruit** drupaceous, subtended by enlarged calyx, globose, ovoid or obovoid, with hard pyrene. **Seeds** 4.

About 250 species mainly in tropical region (Harley et al., 2004). About 16 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Inflorescence axillary
1. Inflorescence terminal

1. *V. burmensis*
2. *V. quinata*

1. *Vitex burmensis* Mold.

Phytologia 8: 30. 1961; Chen & Gilbert in Fl. China 17: 31. 1994; Long in Fl. Bhutan 2(2): 927. 1999.

Tree, 7-12 m high; branchlets quadrangular, puberulous, with yellow glandular. **Leaves** 3-5-foliolate; leaflets lanceolate to elliptic, 10-20 cm long, 3.5-6 cm wide, sparsely stiffly puberulous on upper surface, puberulous on nerves and yellow glandular on lower surface; base cuneate, sometimes oblique, attenuate onto the petiole; apex acuminate; margin entire; primary veins 8-13 pairs; petioles 6-11 cm long, puberulous; median petiolules 0.5-1.5 cm long; lateral petiolules up to 0.5 cm long or absent. **Inflorescence** in axillary panicles, 6-10 cm long, puberulous. **Calyx** campanulate, 2-3 mm long, puberulous and with yellow glandular outside; lobes ca. 0.5 mm long. **Corolla** white with yellow tinge and purplish at base of lip, 8-9 mm long, pubescent. **Stamens** slightly exerted; filaments hairy at base. **Ovary** ovoid, glandular at top; style glabrous. **Fruit** subglobose, 8-10 mm long and wide, black, glabrous, subtended by enlarged calyx.

Thailand.— Northern: Nan.

Distribution.— Myanmar (type), China.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Wae).

Phenology.— Flowering: June; fruiting: July-August.

Voucher specimens.— *P. Srisanga et al.* 842.

2. *Vitex quinata* (Lour.) Williams

Bull. Herb. Boiss., ser. 2, 5: 431. 1905; Dop in Fl. Gén. I.-C. 4: 833. 1935; Fletcher, Kew Bull. 1938: 434. 1938; Chen & Gilbert in Fl. China 17: 29. 1994; Long in Fl. Bhutan 2(2): 926. 1999. – *Cornutia quinata* Lour., Fl. Cochinch.: 387. 1790. – *Vitex heterophylla* Roxb., Fl. Ind. 3: 75. 1832; C.B. Clarke in Fl. Br. Ind. 4: 585. 1885.

Tree, 8-12 m high; branchlets terete, puberulous, glabrescent. **Leaves** 3-5-foliolate; leaflets broadly oblong, elliptic to ovate, 10-18 cm long, 6-9 cm wide, sparsely puberulous on nerves on both surfaces, glandular on lower surface; base cuneate, usually oblique; apex shortly acuminate to caudate; margin entire; primary veins 8-13 pairs; petioles 8-13 cm long, puberulous; petiolules 0.5-2.5(-3) cm long, puberulous. **Inflorescence** in terminal panicles, 10-20 cm long, densely puberulous. **Calyx** campanulate, subtruncate, 2-3 mm long, densely puberulous; teeth minute. **Corolla** yellow with purplish tinge at lip inside, 7-9 mm long, densely pubescent outside. **Stamens** slightly exerted; filaments green, hairy; anthers dark purplish. **Ovary** ovoid, puberulous at top; style glabrous. **Fruit** obovoid to subglobose, 6-8 mm long and wide, black, glabrescent, subtended by enlarged calyx.

Thailand.— Almost throughout the country.

Distribution.— India, Bhutan, Sikkim, Myanmar, China (type), Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines.

Ecology.— Lower montane forest, secondary forest, open places, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: February-May; fruiting: May-July.

Vernacular.— ผ่าเสี้ยนคอกขย Pha sian doi (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1391, 1392; *P. Srisanga & S. Watthana* 620.

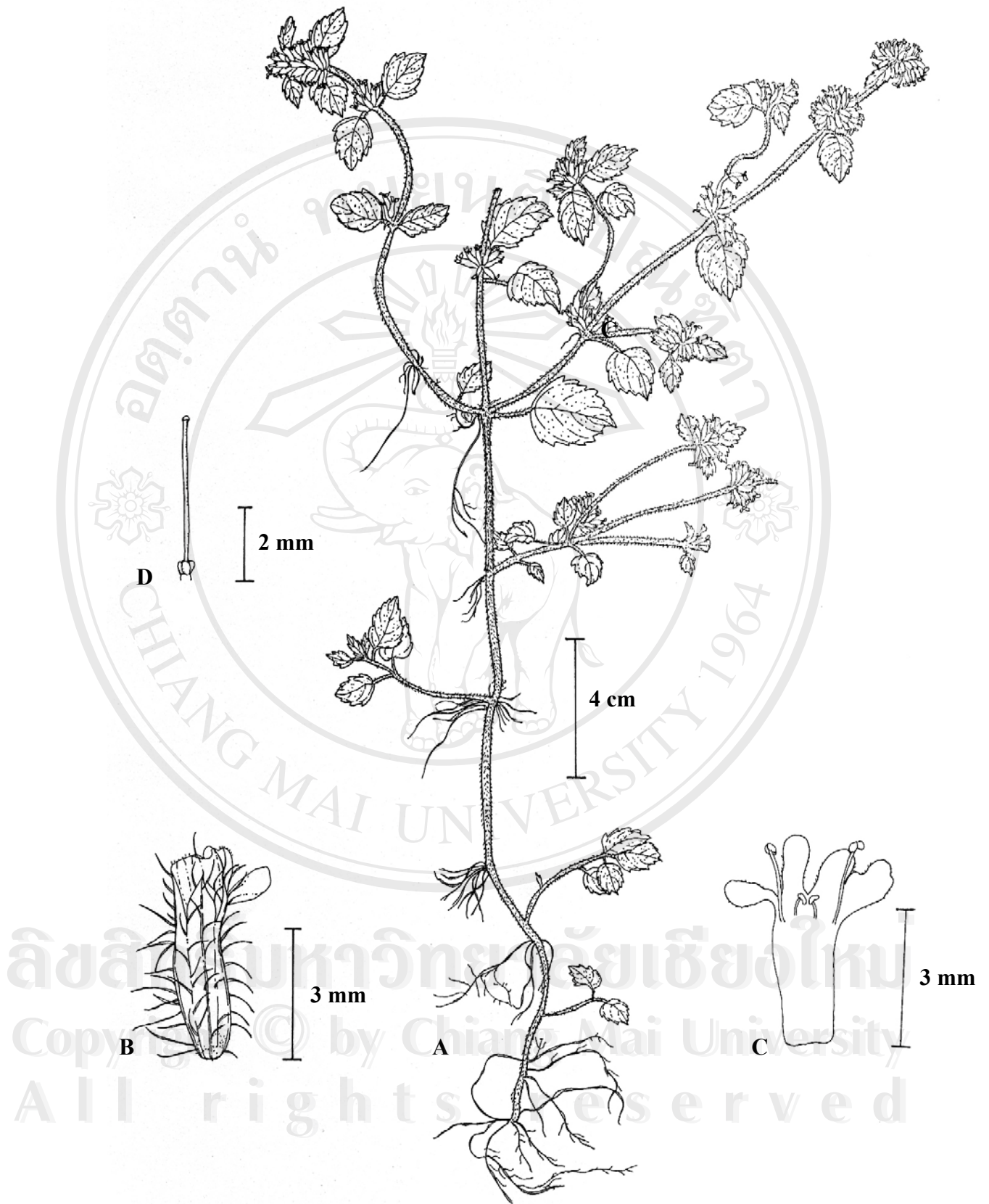




Figure 45. *Cymaria dichotoma* Benth.

A. habit; B. flower; C. opened corolla; D. gynoecium; E. fruiting calyx.

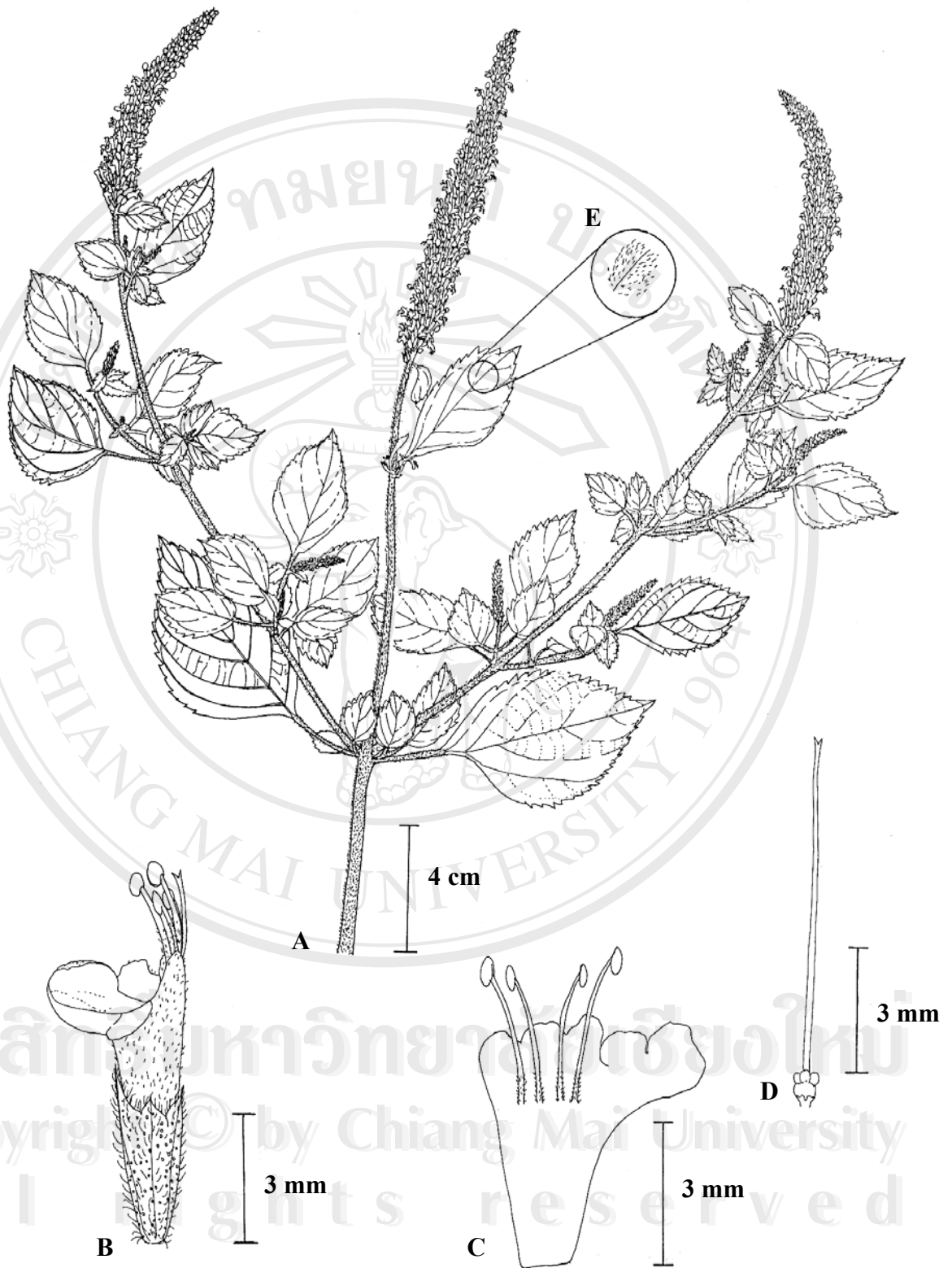


Figure 46. *Eurysolen gracilis* Prain

A. habit; B. flower; C. opened corolla; D. gynoecium; E. hairs on lower surface of leaf.

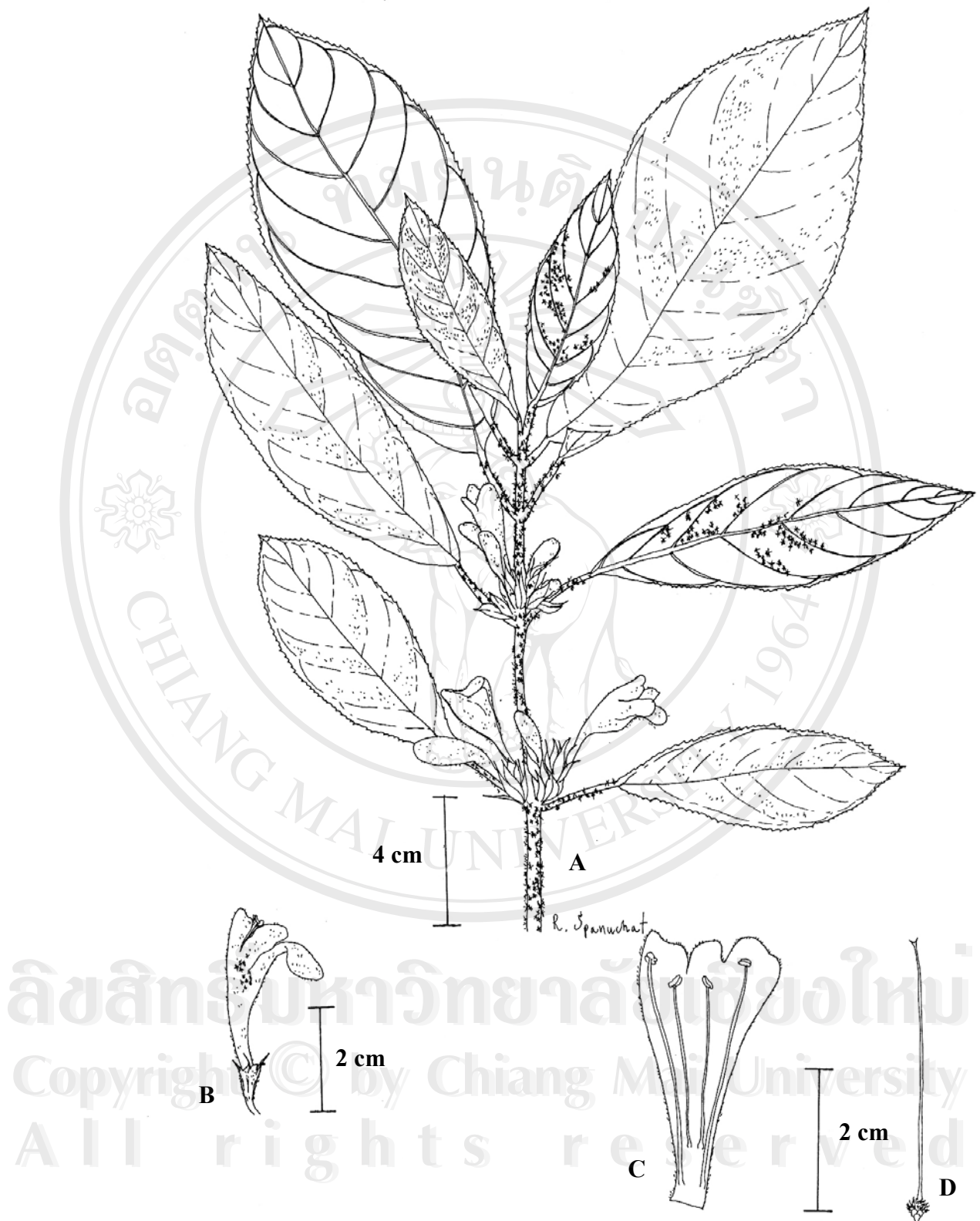


Figure 47. *Gomphostemma javanicum* (Bl.) Benth.

A. habit; B. flower; C. opened corolla; D. gynoecium.

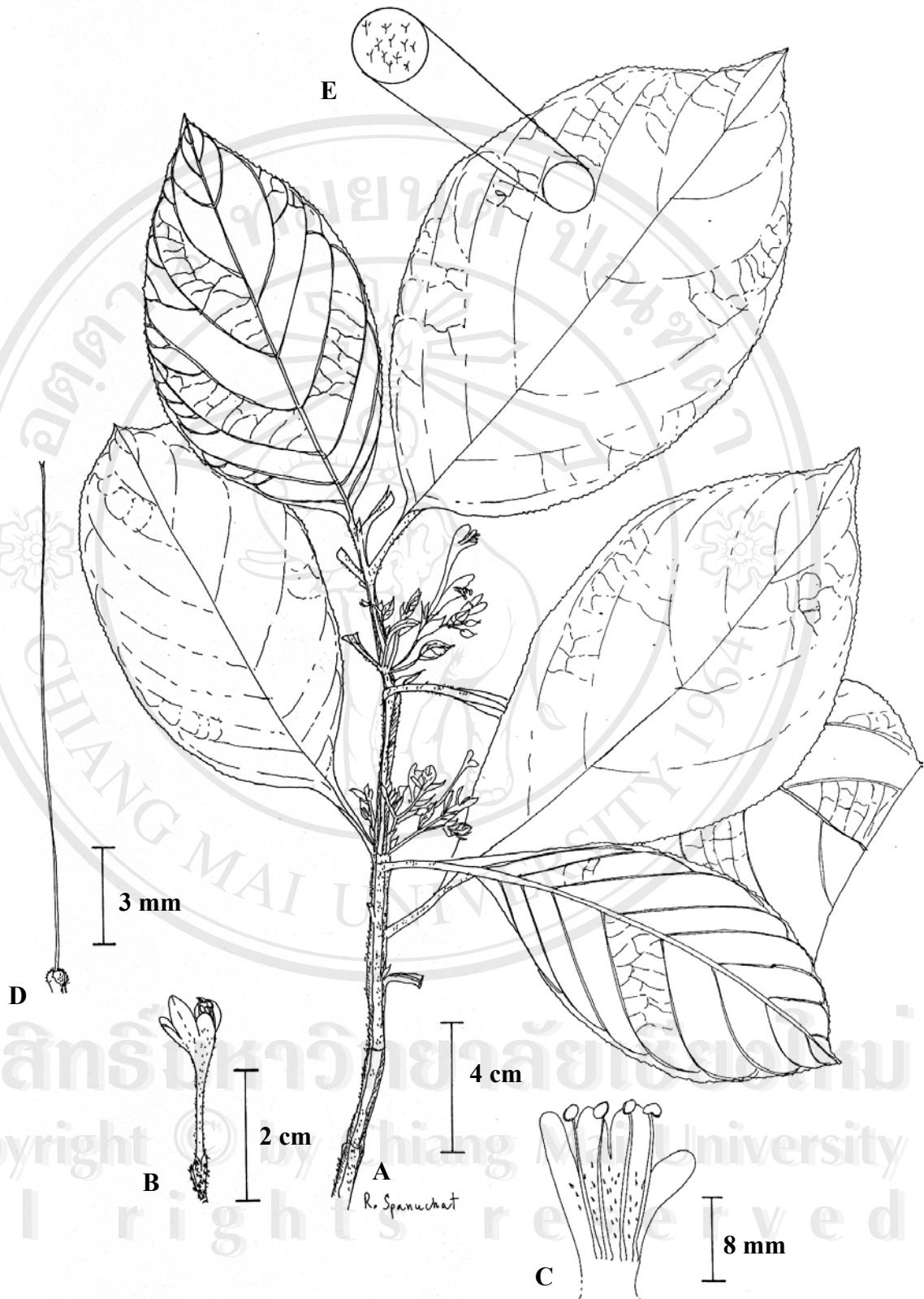


Figure 48. *Gomphostemma parviflorum* Wall. ex Benth.

A. habit; B. flower; C. opened corolla; D. gynoecium; E. hairs on lower surface of leaf.

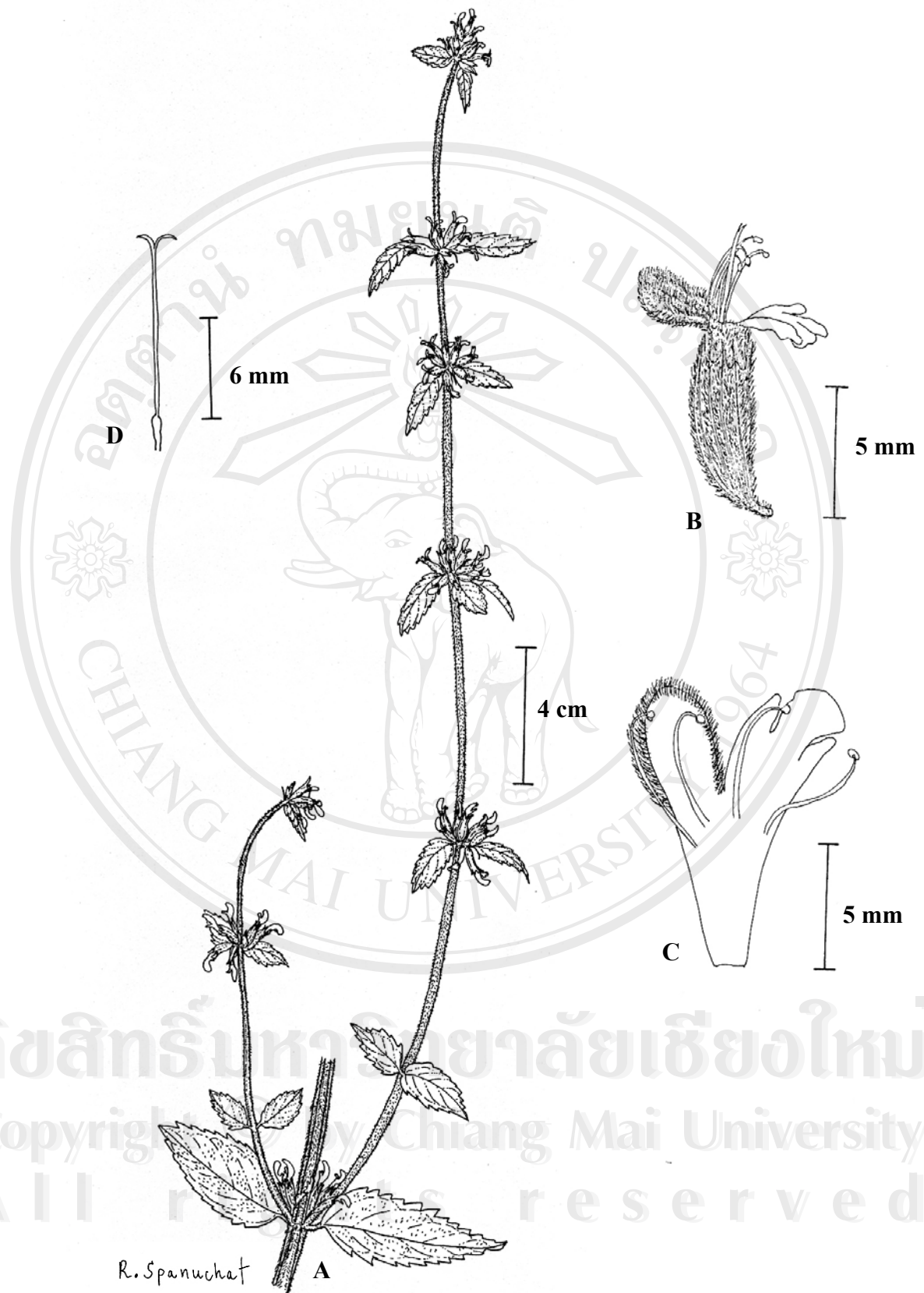


Figure 49. *Leucas decedentata* (Willd.) Sm.

A. habit; B. flower; C. opened corolla; D. gynoecium.

LAURACEAE

Trees or shrubs, very rarely twinning parasitic herbs, all parts with aromatic oil-glands. **Leaves** simple, alternate, rarely opposite or subopposite, coriaceous, evergreen or deciduous; stipule absent. **Inflorescence** cymose or racemose, terminal or axillary. **Flowers** bisexual, polygamous or dioecious, actinomorphic, small, greenish or yellowish. **Tepals** 6, in 2 whorls of 3, equal or subequal. **Stamens** in 4 whorls of 3, the innermost often sterile; filaments sometimes glandular at the base; anthers opening by (1-)2-4 valves from the base upwards. **Ovary** superior rarely inferior; carpel solitary, 1-locular; style terminal, simple; stigma small; ovule solitary, pendulous. **Fruit** baccate or drupaceous. **Seed** 1, pendulous; without endosperm; embryo large, straight.

A pantropical family with about 50 genera and between 2,500-3,500 species (Rohwer, 1993a). Sixteen genera and about 140 species in Thailand. At least 4 genera and 10 species recorded from Doi Phu Kha National Park.

Cinnamomum iners Reinw. ex Bl.

Ecology.— Lower montane forest, alt. 1,400 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: April-May.

Vernacular.— เขียด Chiat (Central).

Voucher specimens.— *P. Srisanga* 481

Litsea cubeba (Lour.) Pers.

Ecology.— Lower montane forest, edges of the forest, along roadsides, alt. 1,000-1,700 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: August-September.

Vernacular.— จะไค้ตัน Cha khai ton (Chiang Mai).

Voucher specimens.— *P. Srisanga* 486, 1500; *P. Srisanga et al.* 2492, 2493.

***Litsea* sp.**

Ecology.— Lower montane forest, edges of the forest, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering: May-June; fruiting: August-September.

Voucher specimens.— *P. Srisanga* 1389; *P. Srisanga & C. Maknoi* 2007.

***Neolitsea* sp.**

Ecology.— Lower montane forest, edges of the forest, alt. 1,400 m (Doi Phu Kha).

Phenology.— Flowering: December-January.

Voucher specimens.— *P. Srisanga* 1297.

***Phoebe lanceolata* (Wall. ex Nees) Nees**

Ecology.— Dry evergreen forest, secondary forest, along walksides in upland cultivation fields, alt. 900-1,000 m (Doi Phu Kha).

Phenology.— Flowering: October-November; fruiting: February-March.

Vernacular.— ตองหอม Tong hom (Chiang Mai).

Voucher specimens.— *P. Srisanga* 578.

***Phoebe* sp.**

Ecology.— Dry evergreen forest, secondary forest, along walksides, alt. 1,000 m (Doi Phu Kha).

Phenology.— Flowering: February-March.

Voucher specimens.— *P. Srisanga et al.* 2495.

Unidentified 1 (Cinnamomum sp.?)

Ecology.— Lower montane forest, alt. 1,000-1,100 m (Doi Phu Kha).

Phenology.— Flowering: July-August.

Voucher specimens.— *P. Srisanga* 257.

Unidentified 2

Ecology.— Lower montane forest, alt. 1,100-1,400 m (Doi Phu Kha).

Phenology.— Flowering: November-December.

Voucher specimens.— *P. Srisanga* 399, 2315.

Unidentified 3

Ecology.— Lower montane forest, alt. 1,400 m (Doi Phu Kha).

Phenology.— Flowering: March.

Voucher specimens.— *P. Srisanga* 527; *P. Srisanga et al.* 2481.

Unidentified 4

Ecology.— Lower montane forest, alt. 1,400 m (Doi Phu Kha).

Phenology.— Flowering: January.

Voucher specimens.— *P. Srisanga* 1284.

LEEACEAE

Monogeneric family. Description as in the genus (Ridsdale, 1974).

LEEAE van Royen ex L.

Syst. Nat. ed. 12, 2: 627. 1767, nom. cons.; Ridsdale, Blumea 22(1): 74. 1974 (revision); in Fl. Mal. I(7): 755. 1976.

Erect shrubs, small trees or herbs with a woody base; stem unarmed, rarely with spines. **Leaves** simple or pinnately compound, imparipinnate, alternate or opposite; leaflets usually with glands on the lower surface; margin glandular serrate-dentate. Petioles or base of petioles expanded to form a stipular structure surrounding the stem apex; stipules narrowly sheathing and somewhat persistent or large, obovate, caducous. **Inflorescence** leaf-opposed, cymose. **Flowers** bisexual, actinomorphic, 4-5-merous. **Calyx** campanulate; lobes triangular, glandular at apex. **Petals** basally adnate to the androecium forming a staminodial tube, choripetalous; lobes valvate, cohering by a ventrally apical keel, reflexed at maturity. **Stamens** inserted on staminodial tube, opposite to the petals; filaments flattened; anthers 2-locular, opening by longitudinal slits. **Ovary** superior, discoid, 4-6(-10)-locular; ovule 1 in each loculus, basal, erect. **Fruit** a berry, depressed-subglobose.

Thirty-four species: 32 in SE Asia, Malesia, Micronesia, Melanesia and Australia; 2 restricted to Africa and Madagascar (Ridsdale, 1974). About 10 species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

Leea indica (Burm.f.) Merr.

Philipp. J. Sci. 14: 245. 1919; Craib in Fl. Siam. Enum. 1: 318. 1926; Ridsdale, Blumea 22(1): 95, figs. 4: 6-8, 5: 1-7, 8: 5. 1974 (see also for complete synonymy); in Fl. Mal. I(7): 779, figs. 3: 24, 4: e, 23, 24. 1976. – *Staphylea indica* Burm.f., Fl. Ind.: 75, t. 23, fig. 2. 1768. – *Leea gigantea* Griff., Not. Pl. As. 4: 697. 1854; Craib in Fl. Siam. Enum. 1: 317. 1926. – *L. expansa* Craib, Kew Bull. 1926: 358. 1926; in Fl. Siam. Enum. 1: 317. 1926.

Shrub, 1.5-4 m high; stem terete, glabrous to pubescent. Stipules obovate, 2-2.5 cm long, glabrous, caducous. **Leaves** (1-)2-3-pinnate; petioles 10-20 cm long, glabrous to pubescent; leaflets (3-)5-15, oblong, lanceolate, elliptic to ovate, chartaceous, (6-)10-20(-25) cm long, 3-7(-9) cm wide, glabrous to pubescent; base cuneate to rounded; apex acuminate; primary veins 6-15 pairs; veins scalariform; lateral petiolules 5-10(-15) mm long, glabrous or pubescent. **Inflorescence** 10-25 cm long, usually broad and lax, glabrous to pubescent; peduncle up to 10 cm long; lateral and ultimate branches numerous and spreading. **Flowers** 5-merous, greenish white. **Calyx** 2-3 mm long, glabrous to pubescent; lobes 1-2 mm long. **Corolla** tube and staminodial lobes 2.5-3.5 mm long; corolla lobes 2.5-3.5 mm long. **Staminodial tube** 2-2.5 mm long; filaments ca. 1 mm long; anthers ca. 1 mm long. **Ovary** (4-)6(-8)-locular; style 1-2.5 mm long. **Berry** 5-10 mm in diam. **Seeds** usually 6.

Thailand.— Almost throughout the country.

Distribution.— India (type), Nepal, Sri Lanka, Bangladesh, China, SE Asia, Malesia eastwards to N Australia.

Ecology.— Dry evergreen and lower montane forest, alt. 800-1,700 m (Doi Phu Kha, Tham Pha Khaw, Bo Kleua).

Phenology.— Flowering and fruiting: June-August.

Vernacular.— เก๊กหน้ Kaew nae (Lua-Nan).

Voucher specimens.— *P. Srisanga* 909, 910, 1918, 2591; *P. Srisanga et al.* 807.

LENTIBULARIACEAE

Insectivorous herbs of wet or damp places, sometimes submerged aquatic or epiphytic. Roots frequently absent. **Leaves** simple, alternate or rosulate, entire or divided, sometimes heterophyllous; stipules absent. **Inflorescence** terminal or axillary, scapose, racemose, or rarely flower solitary. **Flowers** bisexual, zygomorphic. **Calyx** 2- or 4-5-lobed, slightly imbricate, persistent and often accrescent. **Corolla** 5-lobed, 2-lipped; upper lip entire or 2- or rarely more-lobed; lower lip entire or 2-5-lobed, sometimes with a prominent swelling at the base, usually conspicuously spurred. **Stamens** 2, inserted at the base of the corolla tube; staminodes present; anthers 2-locular, opening by longitudinal slits. **Ovary** superior, 1-locular, free central placentation; stigma bilobed, often sessile or subsessile; ovules usually numerous, rarely 2. **Fruit** a capsule, opening by 2-4 valves, pores, irregular, circumscissile or rarely indehiscent. **Seeds** numerous, rarely 1, minute.

A cosmopolitan family with 3 genera and about 320 species (Fischer et al., 2004). One genus and about 30 species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

UTRICULARIA L.

Sp. Pl.: 18. 1753; Taylor, Kew Bull. Add. Ser. 14: 75. 1989 (monograph); Fischer et al. in Fam. Gen. Vasc. Pl. 7: 281. 2004.

Annual or perennial herbs, terrestrial, epiphytic or aquatic, mostly glabrous or glandular, rarely pubescent. Vegetative parts not clearly differentiated but consisting of stems and modified leaves, sometimes horizontal, often subterranean rhizomes, stolons or sometimes tubers present. Roots absent; root-like stems and leaves usually present in terrestrial species but absent from floating species. **Leaves** rosulate or on the stolons, entire or divided into capillary, often setulose segments. Traps few to many, variously inserted, globose to ovoid, usually stalked. **Inflorescence** racemose, lax, usually with several scales on peduncle below inflorescence; bracts usually ovate to orbicular. **Calyx** 2- or rarely 4-lobed, 2-lipped; lobes equal or unequal. **Corolla** 2-lipped; tube very short or obsolete; upper lip entire or 2-lobed, usually smaller than the lower; lower lip entire or 2-5-lobed, usually with a well defined palate and often swollen at the base, spurred. **Filaments** straight or curved; anthers dorsifixed. **Ovary**

ovoid or globose. **Capsule** ovoid or globose, opening by 2 valves, pores, irregular, circumscissile or rarely indehiscent. **Seeds** numerous, rarely 1, minute.

A cosmopolitan genus with about 214 species but mostly in the tropical region (Taylor, 1989).

Utricularia striatula Sm.

In Rees, Cyclop. 37: no. 17. 1819; Pellegrin in Fl. Gén. I.-C. 4: 474. 1930; Taylor, Dansk Bot. Ark. 23(4): 532. 1968; in Fl. Mal. I(8): 289, figs. 2e, 13-14. 1977; Maxwell, Songklanakar J. Sci. Technol. 7: 421. 1985; Taylor, Kew Bull. Add. Ser. 14: 479, fig. 147. 1989 (see also for complete synonymy); in Fl. Ceylon 9: 192, fig. 1. 1995. — *U. orbiculata* Wall. ex A. DC., Prodr. 8: 18. 1844; C.B. Clarke in Fl. Br. Ind. 4: 334. 1884.

Small annual herb, terrestrial, epiphytic or lithophytic, up to 7 cm high, glabrous. Rhizoids few, capillary. Stolons few, capillary, radiating from the peduncle base. **Leaves** rosulate, obovate, orbicular to spatulate, 1-3 mm long and wide; base attenuate onto the petiole; apex rounded; petioles 2-4 mm long. Traps many, on the rhizoids and stolons, ovoid, ca. 0.5 mm long and wide, stalked; mouth lateral with a dorsal, deeply bifid appendage; distal margin fringed with multicellular stipitate glands. **Inflorescence** erect; scales few, similar to the bract, or absent; bracts medifixed, lanceolate, ca. 1 mm long; bracteoles similar to the bract, slightly smaller. **Flowers** 1-10, distant; pedicels 2-6 mm long, capillary. **Calyx** 2-lobed; lobes very unequal; upper lobes orbicular-obcordate, 1.5-2 mm long, rounded to emarginate at apex; lower lobes oblong-elliptic, less than half as long as the upper, rounded to emarginate at apex. **Corolla** bluish white with yellow spot at the base of the lower lip, 3-10 mm long; upper lip ovate, 2-lobed, smaller than the upper calyx lobes; lower lip orbicular, subequal 5-lobed; 3-6 mm long; palate fringed with hairs; spur subulate, 1-3 mm long, slightly curved. **Filaments** filiform, ca. 0.5 mm long, straight. **Ovary** ovoid or depressed globose. **Capsule** globose, about as long as the lower calyx lobes, opening by a ventral longitudinal slit. **Seeds** ovoid, glochidiate.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei; Eastern: Nakhon Ratchasima; South-eastern: Chanthaburi, Trat; Central: Nakhon Nayok.

Distribution.— Tropical Africa, India to China, throughout SE Asia and Malesia.

Ecology.— On wet or moist mossy rocks, alt. 1,700-1,900 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-September.

Voucher specimens.— *P. Srisanga* 934, 1522; *P. Srisanga* & *C. Maknoi* 2019.

LINACEAE

Trees, shrubs, herbs or woody climbers. **Leaves** alternate, rarely opposite, simple, entire or serrulate; stipules small or absent. **Inflorescence** cymose, clustered, spike- or raceme-like or flower solitary. **Flowers** bisexual, hypogynous, regular, (4-)

5-merous. **Sepals** free, imbricate. **Petals** free, often clawed. **Stamens** usually equal to the number of petals, rarely 10 or 15; filaments connate at base; staminodes usually present; nectiferous glands extrastaminal. **Ovary** superior, 2-5 carpels, plurilocular, often separated by incomplete septa, axile placentation; ovules 2 in each loculus; styles 2-5, free or connate at base. **Fruit** usually a septicidal capsule.

An almost cosmopolitan family with 14 genera and about 250 species (Mabberley, 1997), but mainly in the temperate and subtropical regions. Four genera including *Indorouchera* H. Hallier (Hugoniaceae *sensu stricto*) and 4 species in Thailand (Larsen, 1997). One species recorded from Doi Phu Kha National Park.

REINWARDTIA Dumort.

Comm. Bot.: 19. 1822; Larsen in Fl. Thailand 6(3): 195. 1997. – *Macrolinum* Reichb., Handb.: 306. 1737. – *Kittelocharis* Alef., Bot. Zeitschr. (Berlin) 21: 282. 1863.

Low shrubs. **Leaves** alternate, caducous; margin entire or serrulate; stipules small. **Inflorescence** axillary or terminal in few-flowered cymes or flower solitary. **Sepals** 5. **Petals** 5, yellow, contorted. **Stamens** 5; staminodes 5, setiform; nectiferous glands 2-3, adnate to the filament tube. **Ovary** 3-4-locular; styles 3-4, free or connate at base. **Capsule** ovoid, 6-8-seeded.

Monotypic genus (Mabberley, 1997) or 2-3 species (Larsen, 1997) distributed from India, throughout China and Indochina; 1 species in Thailand.

***Reinwardtia indica* Dumort.**

Comm. Bot.: 19. 1822; Larsen in Fl. Thailand 6(3): 195, pl. XVI: 2. 1997. – *Linum trigynum* Roxb., As. Res. 6: 357. 1799. – *L. repens* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal.: 217. 1825. – *Reinwardtia trigyna* (Roxb.) Planch. in Lond. J. Bot. 7: 522. 1848; Craib in Fl. Siam. Enum. 1: 199. 1931. – *R. sinensis* Hemsl. in Hook., Ic. Pl. Tab. 2594. 1899. – *Tirpitzia sinensis* (Hemsl.) Hall., Beih. Bot. Centralbl. 29, 2: 5. 1923.

Erect shrub up to 1 m high; branches terete. **Leaves** lanceolate to obovate, chartaceous, 1.5-7 cm long, 0.8-4 cm wide, glabrous; base cuneate; apex rounded or acute, sometimes mucronulate; petioles 2-10 mm long. **Inflorescence** axillary or terminal in few-flowered cymes or flower solitary. **Sepals** lanceolate, acute at apex, 7-13 mm long, 1.5-4 mm wide. **Petals** broadly obovate, clawed, 15-35 mm long, 4-12 mm wide. **Stamens** 15-20 mm long. **Ovary** 3-4-locular, glabrous; styles 3-4, 15-20 mm long, glabrous. **Capsule** ovoid, 5-8 mm long, surrounded by the persistent calyx.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Nan.

Distribution.— N India (type), Nepal, Bhutan, Myanmar, S China, Vietnam, Laos.

Ecology.— Open, often disturbed vegetation near villages, also in dry evergreen and open lower montane forest, alt. 1,000-1,400 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: November-January; fruiting: February-March.

Uses.— Cultivated for ornamental plants.

Vernacular.— คำป่า Kham pa (Chiang Mai).

Voucher specimens.— *P. Srisanga* 450, 2408.

LORANTHACEAE

Photosynthetic parasites, typically brittle shrublets on tree-branches, sometimes terrestrial shrubs, trees or climbers on host roots. **Leaves** simple, opposite or ternate, entire, rarely scale-like; stipules absent. **Inflorescence** axillary or terminal, in dichasia sometimes resembling heads, racemes or umbels. **Flowers** usually bisexual, actinomorphic, often very brightly coloured. **Sepals** (3-)5-6(-9), connate, toothed or lobed rim or cup at summit of the ovary. **Petals** (3-)5-6(-9), often with a basal tube equally or unequally cleft, valvate. **Stamens** the same number as, opposite and adnate to the petals; anthers normally 2-locular, sometimes 1-locular by the confluence of the loculi, opening by longitudinal slits, terminal pores or transverse slits, sometimes transversely locellate. Disk present or absent. **Ovary** inferior, usually 1-locular; ovules 4-12; style solitary or absent. **Fruit** a berry or drupe, usually with latex or mucilage. **Seed** solitary.

About 65 genera and 950 species mainly tropical and subtropical regions. Eleven genera and 36 species in Thailand (Barlow, 2002a). Four genera and 6 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- 1. Petals free **2. *Helixanthera***
- 1. Petals fused to the middle or higher, sometimes with the corolla tube deeply split on one side
 - 2. Corolla 4-merous; bract single under each flower **4. *Scurrula***
 - 2. Corolla 6-merous; bracts 3 under each flower
 - 3. Inflorescence axis decussately flattened, with the flowers borne in hollows **1. *Elytranthe***
 - 3. Inflorescence axis terete or quadrangular, with the flowers not borne in hollows **3. *Macrosolen***

1. *ELYTRANTHE* Bl.

In Schult. & Schult.f., Syst. Veg. 7: 1611. 1830; Danser, Blumea 2: 35. 1936; Bull. Jard. Bot. Buitenzorg 3, 16: 15. 1938; Barlow in Fl. Thailand 7(4): 676. 2002.

Parasitic shrubs. **Leaves** opposite. **Inflorescence** axillary, few-flowered spike; axis decussately flattened, with the flowers inserted in hollows; bracts 3 under each flower, foliaceous and together enclosing the flower bud. **Corolla** 6-merous, gamopetalous, regular or nearly so. **Anthers** basifixed. **Style** simple, conical at the base; stigma knob-like. **Fruit** almost globular.

Two species distributed from E India to W Malesia and Vietnam. One species in Thailand (Barlow, 2002a).

***Elytranthe albida* (Bl.) Bl.**

In Schult. & Schult.f., Syst. Veg. 7: 1611. 1830; Barlow in Fl. Thailand 7(4): 676, fig. 3. 2002. — *Loranthus albidus* Bl., Verh. Batav. Genootsch. Kunsten 9: 184. 1823.

Glabrous parasitic shrub on tree-branches. **Leaves** ovate, 6-14 cm long, 3-8 cm wide; base cuneate to truncate; apex broadly acute to acuminate; petioles 7-25 mm long. **Inflorescence** at the nodes, a pedunculate spike of 1-3 decussate pairs of flowers; peduncle (1-)5-10(-15) mm long, more or less terete; flower-bearing axis 5-20 mm long, with decussate hollows ca. 6 mm long; central bract 7-12 mm long, 4-6 mm wide, keeled, acute; lateral bracts as long as the central ones, keeled, obtuse. **Corolla** in mature bud 40-65 mm long, with a distinct chamber at the base, gradually widened upwards, weakly winged above the middle, narrowed to a neck, clavate and acute at the apex, red; tube in the open flower 25-45 mm long, split slightly deeper on one side, with the lobes reflexed or twisted 5-10 mm higher. **Anthers** 2.5-3.5 mm long, constricted at the base, acute, about half as long as the free part of the filament (Fig. 50).

Thailand.— Northern: Mae Hong Son, Chiang Mai, Lampang, Nan; South-western: Kanchanaburi; Peninsular: Chumphon, Ranong, Phangnga.

Distribution.— India eastwards to China and Vietnam, and in W Malesia (Sumatra, Borneo, Java-type).

Ecology.— Lower montane forest, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering: November-December.

Vernacular.— กาฝากแดง Kafak daeng (General).

Voucher specimens.— *P. Srisanga* 2638.

2. HELIXANTHERA Lour.

Fl. Cochinch. 1: 142. 1790; Danser, Bull. Jard. Bot. Buitenzorg 3, 11: 368. 1931; Barlow in Fl. Thailand 7(4): 678. 2002.

Parasitic shrubs. **Leaves** opposite, scattered or sometimes crowded to false whorls. **Inflorescence** axillary or rarely terminal, a simple raceme or spike; bract single under each flower. **Corolla** 4-6-merous, choripetalous, regular or nearly so. **Anthers** basifixed. **Style** simple or with a constriction separating upper and lower segments with different outlines; stigma knob-like. **Fruit** ovoid.

About 35 species in tropical Africa to S Asia and Malesia as far east as Celebes and Java. Eight species in Thailand (Barlow, 2002a). Only 1 species recorded from Doi Phu Kha National Park.

***Helixanthera pulchra* (DC.) Danser**

Bull. Jard. Bot. Buitenzorg 3, 10: 318. 1929; Barlow in Fl. Thailand 7(4): 683, pl. XXV: 3. 2002. – *Loranthus pulcher* DC., Prodr. 4: 295. 1830. – *Helixanthera pierrei* Danser, Bull. Jard. Bot. Buitenzorg 3, 16: 25. 1938.

Parasitic shrub on tree-branches. **Leaves** opposite or ternate, lanceolate to elliptic or ovate, 10-23 cm long, 3-11 cm wide, glabrous; base cuneate to truncate; apex acute to acuminate; venation obscure; petioles 10-25 mm long. **Inflorescence** many-flowered spike, sparsely tomentose, sometimes subtended by an involucre of a few narrow bracts up to 5 mm long; axis 10-20 cm long; pedicels absent or up to 4 mm long; bract strongly reflexed, usually with a dorsal spur-like sac, 1-2 mm long. **Calyx** campanulate or depressed barrel-shaped, 1-2 mm long; lobes erect, ca. 0.5 mm long. **Corolla** in mature bud 5-merous, 4-8 mm long, slender in the middle, weakly clavate and rounded at the apex, red. **Anthers** 1-1.5 mm long, reflexed, slightly shorter than the free part of the filament. **Style** 3-5 mm long, reaching to the base of the anthers, gradually widened upwards, lacking a constriction, angular; stigma as wide as the style (Fig. 51).

Thailand.— Northern: Chiang Mai, Lampang, Nan; North-eastern: Loei; Eastern: Nakhon Ratchasima; Central: Nakhon Nayok; Peninsular: Chumphon, Ranong, Surat Thani, Phangnga, Krabi, Trang, Satun, Songkhla.

Distribution.— Myanmar to Vietnam and southwards to Malaysia (type), Sumatra and Borneo.

Ecology.— Dry evergreen forest, alt. 1,050 m (Doi Phu Huat).

Phenology.— Flowering: January-February.

Voucher specimens.— *P. Srisanga* 509.

3. MACROSOLEN BI.

In Schult. & Schult.f., Syst. Veg. 7: 1731. 1830; Danser, Bull. Jard. Bot. Buitenzorg 3, 16: 4. 1938; Barlow in Fl. Thailand 7(4): 689. 2002.

Parasitic shrubs. **Leaves** opposite. **Inflorescence** axillary or inserted on the epicortical runners, a simple raceme or spike of decussate pairs of flowers, sometimes few-flowered and seemingly umbellate; bracts 3 under each flower, free or variously connate. **Corolla** 6-merous, gamopetalous, in mature bud with 6 keels or wings at the point of reflexion of the lobes, usually weakly zygomorphic or sometimes regular. **Anthers** basifixed. **Style** simple; stigma knob-like. **Fruit** ellipsoid to nearly globose.

About 30 species distributed from India and China to New Guinea. Five species in Thailand (Barlow, 2002a). Only 1 species recorded from Doi Phu Kha National Park.

Macrosolen brandisianus (Kurz) Tiegh.

Bull. Soc. Bot. France 41: 442. 1895; Barlow in Fl. Thailand 7(4): 690. 2002. — *Loranthus brandisianus* Kurz, J. As. Soc. Beng. 40, ii: 63. 1871. — *Elytranthe brandisiana* (Kurz) Engl., Nat. Pflanzenfam. 3, 1: 188. 1889.

Glabrous parasitic shrub on tree-branches. **Leaves** opposite, lanceolate to narrowly elliptic or ovate, 8-18 cm long, 3-7 cm wide; base cuneate; apex acute to acuminate; venation obscure; petioles 7-11 mm long. **Inflorescence** at the nodes, 1-3 in each axil, a raceme of 2-5 opposite pairs of flowers with the last two pairs subumbellate; axis 6-20 mm long; pedicels 3-5 mm long; bracts 1.5-2 mm long, the central one triangular and the laterals slightly shorter, more rounded and distinctly connate. **Corolla** in mature bud 20-30 mm long, robust, gradually widened and inflated upwards, winged near the middle, narrowed above and angular, clavate and obtuse at the apex, red; tube in the open flower broadly cylindrical to almost campanulate, 10-14 mm long with the lobes reflexed 5-6 mm higher. **Anthers** 3-4 mm long, acute, 1/3-2/3 as long as the free part of the filament.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Phetchabun; Peninsular: Songkhla.

Distribution.— Myanmar (type).

Ecology.— Lower montane forest, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering: November-December; fruiting: May-June.

Voucher specimens.— *P. Srisanga* 741.

4. SCURRULA L.

Sp. Pl.: 110. 1753; Danser, Bull. Jard. Bot. Buitenzorg 3, 11: 427. 1931; Barlow, Blumea 36(1): 63. 1991; in Fl. Thailand 7(4): 695. 2002.

Parasitic shrubs, more or less clothed in a tomentum of stellate and dendritic hairs. **Leaves** opposite. **Inflorescence** mostly a simple 3-10-flowered raceme of decussate or scattered flowers, rarely 2-flowered and then apparently umbellate; bract single under each flower. **Corolla** 4-merous, gamopetalous, zygomorphic, with the tube more or less curved prior to anthesis, deeply split on the inner side of the curve; lobes reflexed to the outer side at anthesis. **Anthers** basifixed. **Style** simple; stigma knob-like. **Fruit** obovoid, club-like, distinctly stipitate.

About 20 species distributed from India to Taiwan and southwards through Malesia. Seven species in Thailand (Barlow, 2002a). Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Indumentum usually cream, rarely greyish or tawny. Inflorescence axis more than 6 mm long **1. *S. atropurpurea***
1. Indumentum greyish or brown. Inflorescence axis less than 6 mm long

2. Corolla in mature bud more than 20 mm long
2. Corolla in mature bud less than 20 mm long

2. *S. gracilifolia*
3. *S. parasitica*

1. *Scurrula atropurpurea* (Bl.) Danser

Bull. Jard. Bot. Buitenzorg 3, 10: 349. 1929; Barlow, Blumea 36(1): 70. 1991; in Fl. Thailand 7(4): 696, fig. 9. 2002. – *Loranthus atropurpureus* Bl., Verh. Batav. Genootsch. Kunsten 9: 186. 1823. – *L. philippinensis* Champ. & Schltl., Linnaea 3: 204. 1828. – *Scurrula philippinensis* (Champ. & Schltl.) G. Don, Gen. Hist. 3: 422. 1834. – *Loranthus cultarum* Craib, Kew Bull. 1911: 452. 1911. – *Scurrula cultarum* (Craib) Danser, Bull. Jard. Bot. Buitenzorg 3, 10: 350. 1929.

Parasitic shrub on tree-branches; young parts with a dense cream or rarely greyish to tawny indumentum of stellate hairs, becoming sparse on adult stems, leaf upper surfaces and flowers. **Leaves** opposite, elliptic to obovate, 5-10 cm long, 2-6 cm wide; base cuneate to slightly cordate; apex rounded or acute; venation obscure except for the midrib and a few major laterals veins; petioles 6-12 mm long. **Inflorescence** several at the nodes, 4-6(-10)-flowered raceme; axis 6-12(-20) mm long; pedicels 2-3 mm long; bract deltoid, erect, 1-2 mm long. **Corolla** in mature bud 11-20(-24) mm long, slender, narrowly clavate and acute at the apex; tube 7-15 mm long, deeply split. **Anthers** ca. 1 mm long, about half as long as the free part of the filament. **Fruit** 8-10 mm long including a thick stipe 2-3 mm long, contracted at the apex.

Thailand.— Northern: Chiang Mai, Lampang, Nan; North-eastern: Loei; Eastern: Si Sa Ket; South-western: Uthai Thani.

Distribution.— Vietnam, Indonesia (type), Philippines.

Ecology.— Lower montane forest, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering: September-December; fruiting: December-March.

Voucher specimens.— *P. Srisanga* 1704.

2. *Scurrula gracilifolia* (Schult.) Danser

Blumea 2(1): 47. 1936; Barlow in Fl. Thailand 7(4): 699. 2002. – *Loranthus gracilifolius* Schult., Syst. Veg. 7, 1: 99. 1829. – *L. graciliflorus* DC., Prodr. 4: 300. 1830. – *L. scurrula* var. *graciliflorus* (DC.) Kurz, Fl. Burm. 2: 319. 1877.

Parasitic shrub on tree-branches; young parts with a greyish or sometimes tawny to light brown tomentum, soon disappearing from the stems and leaves but persisting sparsely on the inflorescences and flowers. **Leaves** opposite, elliptic, ovate to obovate, 4-8 cm long, 2-5 cm wide; base cuneate to slightly cordate; apex obtuse to rounded; venation obscure except for the midrib and a few major laterals veins; petioles 6-12 mm long. **Inflorescence** few at the nodes, 2-6-flowered raceme; axis up to 6 mm long; pedicels 1-3 mm long; bract ovate, 0.5-1 mm long. **Corolla** in mature bud 20-40 mm long, slender, slightly curved, gradually clavate and acute at the apex; tube 14-28 mm long, split to the middle or lower. **Anthers** 1-3 mm long, about equal

to the free part of the filament. **Fruit** 7-10 mm long including a stipe 4-6 mm long, rounded at the apex.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Nakhon Phanom; Central: Bangkok.

Distribution.— Myanmar (type), S China.

Ecology.— Lower montane forest, alt. 1,500 m (Doi Phu Wae).

Phenology.— Flowering: October-December; fruiting: December-March.

Voucher specimens.— *P. Srisanga* 1832.

3. *Scurrula parasitica* L.

Sp. Pl.: 110. 1753; Barlow, Blumea 36(1): 80. 1991; in Fl. Thailand 7(4): 700. 2002. — *Loranthus obtectus* DC., Prodr. 4: 299. 1830.

Parasitic shrub on tree-branches; young parts with a sparse to dense grey to dark brown or rarely paler indumentum of stellate hairs, soon becoming sparse on adult stems and leaves. **Leaves** opposite, narrowly ovate to obovate, 3-7(-9) cm long, 2-4.5 cm wide; base cuneate to truncate; apex obtuse to rounded; venation obscure except for the midrib and a few major laterals veins; petioles 3-10 mm long. **Inflorescence** several at the nodes, 2-6-flowered raceme; axis up to 6 mm long; pedicels 1-5 mm long; bract narrow, erect, 1-3 mm long. **Corolla** in mature bud 8-16 mm long, slender, weakly clavate and acute at the apex; tube 6-12 mm long, split to the middle or lower. **Anthers** 1-2 mm long, about 2/3 as long as the free part of the filament. **Fruit** 8-10 mm long including a stipe 2-4 mm long, rounded at the apex.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Phetchabun, Loei, Nakhon Phanom; South-western: Kanchanaburi, Ratchaburi, Prachuap Khiri Khan; Peninsular: Phangnga, Trang.

Distribution.— India eastwards to China and Vietnam, and southwards to Malesia as far as the Philippines, Moluccas and E Timor.

Ecology.— Lower montane forest, alt. 1,200-1,300 m (Doi Phu Kha).

Phenology.— Flowering: September-November; fruiting: December-January.

Voucher specimens.— *P. Srisanga* 1650.

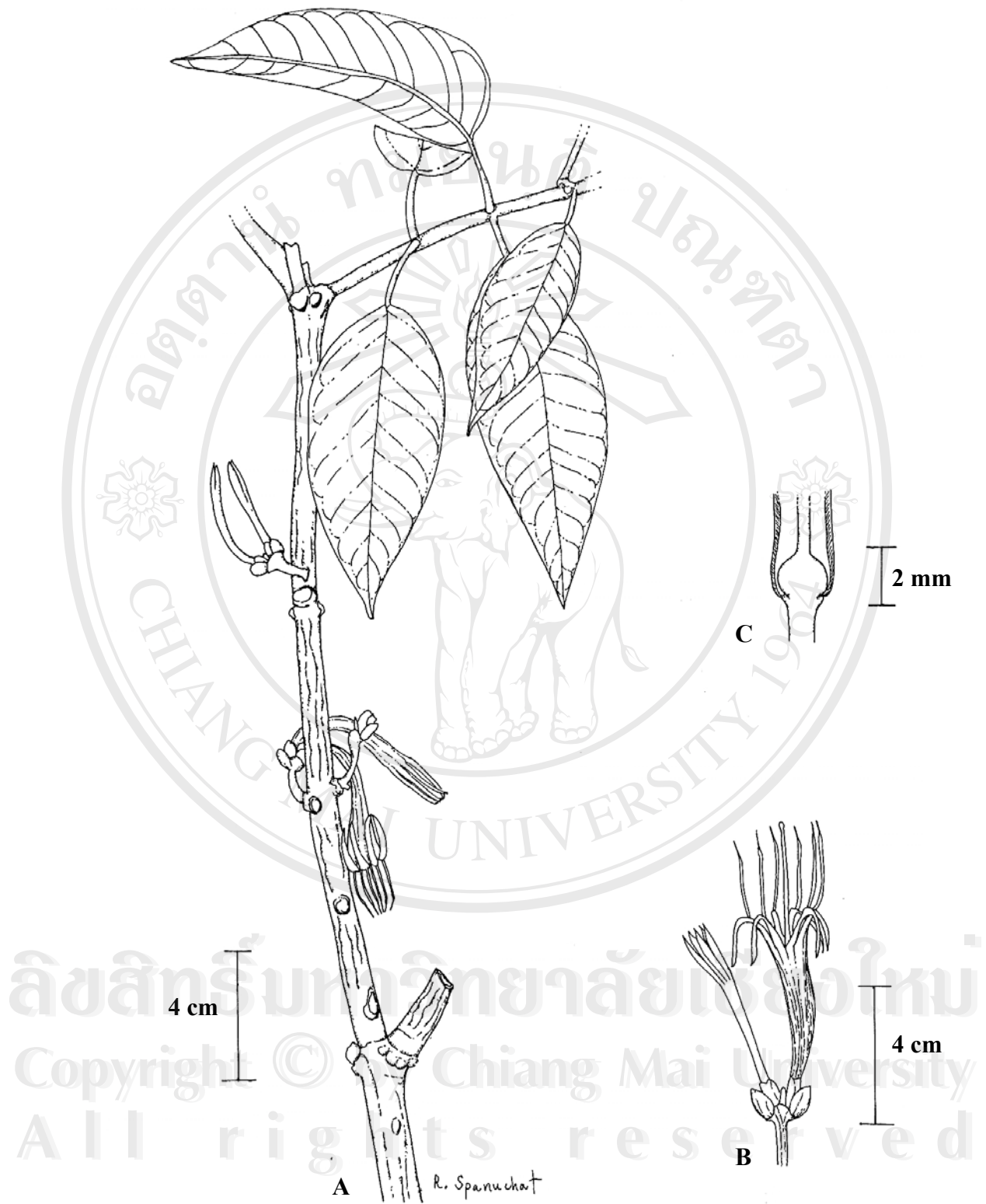


Figure 50. *Elytranthe albida* (Bl.) Bl.

A. flowering branch; B. inflorescence; C. ovary. All from *P. Srisanga* 2638.



Figure 51. *Helixanthera pulchra* (DC.) Danser

A. flowering branch; B. flower; C. mature flower bud; D. opened corolla.
All from P. Srisanga 509.

LYTHRACEAE

Trees, shrubs or herbs. **Leaves** simple, opposite, rarely whorled or alternate, entire; stipules absent or minute. **Inflorescence** terminal or axillary, racemes, spikes, panicles, fascicles or flower solitary. **Flowers** bisexual, actinomorphic, rarely slightly zygomorphic, (3-)4, 6, 8(-16)-merous, usually with conspicuous hypanthium, sometimes spurred or with epicalyx. **Sepals** valvate, often with small appendage between the lobes, persistent. **Petals** inserted on the top of the hypanthium, free, crumpled in bud, rarely absent. **Stamens** (1-)4, 8 or numerous, inserted within the calyx tube; filaments equal or unequal, usually inflexed in bud; anthers 2-locular, opening by longitudinal slits. **Ovary** superior, sessile or shortly stipitate, 2-4(-6)-locular; base attached to calyx tube and surrounded by an annular nectary, axile placentation; ovules mostly numerous; style 1, slender; stigma capitate. **Fruit** a capsule, dehiscent by a transverse slit, valves, bursting irregularly or indehiscent. **Seeds** mostly numerous, sometimes winged.

About 27 genera and 600 species, mainly in tropical region (Mabberley, 1997). Six genera and about 30 species in Thailand.

ROTALA L.

Mant.: 143, 175. 1771; Verdcourt in Fl. Ceylon 9: 221. 1995.

Annual or perennial, aquatic, amphibious or terrestrial, erect or creeping, glabrous herbs. **Leaves** opposite, rarely whorled, usually sessile. **Inflorescence** in terminal and axillary spike or flower solitary and axillary. **Flowers** actinomorphic, subtended by a bract and 2 bracteoles. **Calyx** tube campanulate to subglobose; lobes (3-)4, 6. **Petals** (3-)4, 6, rarely absent. **Stamens** opposite to and same numbers as the calyx lobes. **Ovary** sessile or shortly stipitate, 2-4-locular. **Capsule** dehiscent by 2-4-valved. **Seeds** ellipsoid to ovoid, minute, wingless.

About 44 species widely distributed in the tropical and subtropical regions. About 4 species in Thailand.

Rotala indica (Willd.) Koehne

Bot. Jahrb. Syst. 1: 172. 1880; Gagnep. in Fl. Gén. I.-C. 2: 973. 1921; Craib in Fl. Siam. Enum. 1: 716. 1931; Verdcourt in Fl. Ceylon 9: 226. 1995. – *Peplis indica* Willd., Sp. Pl. 2 (1): 244. 1799. – *Ammannia nana* Roxb. in Fl. Ind. ed. Carey & Wall. 1: 448. 1820. – *A. peploides* Spreng., Syst. Veg. ed. 16(1): 444. 1824; C.B. Clarke in Fl. Br. Ind. 2: 566. 1879.

Annual, amphibious or terrestrial, erect or decumbent herbs, 10-20 cm high; stem simple or branched, quadrangular, sometimes rooting at the nodes. **Leaves** opposite, oblanceolate, obovate to spatulate, 7-20 mm long, 3-7 mm wide, sessile or subsessile; base attenuate; apex obtuse to rounded; margin cartilaginous. **Inflorescence** in axillary spike or flower solitary. **Flowers** 4-merous, sessile; bract leaves-like; bracteoles linear, 2-3 mm long. **Calyx** red; tube campanulate, 1.5-2 mm long; lobes triangular, 0.5-1 mm long, acuminate at apex. **Petals** pink, oblong to

narrowly obovate, ca. 0.5 mm long. **Ovary** ellipsoid, ca. 1 mm long, sessile; style ca. 0.5 mm long. **Capsule** ellipsoid, 1.5-2 mm long, dehiscent by 2-valved, with persistent style and stigma. **Seeds** minute, curved, light brown.

Thailand.— Almost throughout the country.

Distribution.— Pantropical (India-type).

Ecology.— In marsh, open places, alt. 1,400-1,500 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: October-January.

Voucher specimens.— *P. Srisanga* 1828, 2631.

MAGNOLIACEAE

Trees or shrubs, aromatic, evergreen or deciduous. **Leaves** simple, spirally arranged, entire, rarely lobed in *Liriodendron* L., penninerved; stipules large, enclosing the young buds, deciduous and leaving a ring-scar on the branch, sometimes adnate to the petiole and leaving a scar on the upper surface. **Flower** solitary, mostly bisexual, large, terminal or axillary. **Tepals** 3-merous, 2 or more whorls, free, imbricate. **Stamens** many to numerous, free, spirally arranged; anthers linear, 2-locular, dehiscent by longitudinal slits. **Ovary** superior; carpels few to many, free or connate, 1-locular, spirally arranged on an elongated axis; ovules 2 or more in each carpel. **Fruit** mostly dry and dehiscent in group of follicle, rarely fleshy or samaroid. **Seeds** 1 or few per carpel, large, arillate.

Seven genera and about 223 species in temperate and tropical SE and E Asia and from N America southward through West Indies and C America to S Brazil (Nooteboom, 1993; Frodin & Govaerts, 1996). Recently, several taxonomists followed Figar (2000) who treated *Michelia* L. and *Elmerrillia* Dandy as a subgenus *Michelia* of *Magnolia* L. *Kmeria* (Pierre) Dandy is also treated as a subgenus *Kmeria* of *Magnolia* L (Chalermglin, 2002; Nooteboom & Chalermglin 2002). Accordingly, only 4 genera: *Liriodendron* L., *Magnolia* L., *Manglietia* Bl. and *Pachylarnax* Dandy are accepted. Many species are widely cultivated as garden ornamentals and some are useful timbers. Three or 5 (*Kmeria*, *Magnolia*, *Manglietia*, *Michelia* and *Pachylarnax*) genera and about 28 species in Thailand (Keng, 1975; Sawangchote et al., 1999; Nooteboom & Chalermglin, 2000, 2002; Chalermglin, 2002). Two genera and 3 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|--|---------------------------|
| 1. Branches with sympodial growth. Flowers terminal on the twigs | 1. <i>Magnolia</i> |
| 1. Branches with monopodial growth. Flowers on brachyblasts
in the axil of the leaves | 2. <i>Michelia</i> |

1. *MAGNOLIA* L.

Sp. Pl.: 535. 1753; Keng in Fl. Thailand 2(3): 253. 1975; Nooteboom in Fam. Gen. Vasc. Pl. 2: 399. 1993. – *Talauma* Juss., Gen. Pl. 281. 1789; Keng in Fl. Thailand 2

(3): 255. 1975. – *Aromadendron* Bl., Bijdr.: 10. 1825; Keng in Fl. Thailand 2(3): 258. 1975. – *Alcimandra* Dandy, Kew Bull. 1927: 260. 1927.

Trees or shrubs; stipules adnate to or free from the petiole. **Flowers** bisexual, large, terminal on the twigs. **Tepals** 9-21, subequal or more rarely the outer whorl forming a calyx. **Anthers** introrse to latrorse, connective produced into a longer or shorter appendage or rarely without appendage. **Gynoecium** sessile or stipitate; carpels few to many, free or connate; ovules 2, rarely 3-5 in each carpel. **Fruit** in group of follicle, usually dehiscent along the dorsal suture or circumscissile, rarely forming a fleshy syncarp. **Seeds** 1-2(-4) in each carpel.

About 120 species, of which ca. one third in the New World from southeastern N America to S Brazil, the remainder in temperate and tropical SE Asia from the Himalayas to China, Japan, Taiwan and Malesia (Nooteboom, 1993). About 8 species in Thailand (Keng, 1975; Chalermglin, 2002). Only 1 species recorded from Doi Phu Kha National Park.

***Magnolia henryi* Dunn**

J. Linn. Soc. Bot. 35: 484. 1903; Keng in Fl. Thailand 2(3): 253, fig. 39a. 1975. – *Talauma kerrii* Craib, Kew Bull. 1922: 226. 1922; in Fl. Siam. Enum. 1: 25. 1925.

Evergreen tree up to 15 m high. Stipules densely yellowish hairy, adnate to the petiole; scars up to the base of the blade, 3-6 cm long. **Leaves** oblong-elliptic to elliptic, coriaceous, 25-45 cm long, 8-15 cm wide, glabrous on both surfaces or sparsely pubescent on lower surface; base cuneate; apex acute to rounded; midrib prominent and raised on both surfaces; primary veins 14-20 pairs; venation distinct, especially on lower surface; petioles 3-6.5 cm long, glabrous. **Flowers** fragrant; flower bud ellipsoid to ovoid, 5-6 cm long; peduncle up to 10 cm long, glabrous, usually recurved; spatheaceous bracts 2-3, glabrous. **Tepals** 9, subsimilar, 5-6.5 cm long, 2-3.5 cm wide, 3 whorls, the outer 3 ovate-elliptic, pale green outside, white inside, the inner 6 obovate to spatulate, white, slightly smaller. **Stamens** numerous, 1.2-1.5 cm long; anthers introrsely dehiscent; connective appendage triangular, ca. 1 mm long; filaments 1-2 mm long. **Gynoecium** long ovoid, 4-5 cm long; carpels many; scars of perianth and stamens along the torus 1.5-2 cm long. **Fruit** ovoid-cylindric, 8-15 cm long, 3-4 cm wide; ripe carpels 1.5-2 cm long, shortly beaked at apex, dehiscent along the dorsal suture. **Seeds** (1-)2 in each carpel, irregularly shaped, 7-12 mm long and wide.

Thailand.— Northern: Nan (type of *Talauma kerrii*).

Distribution.— Myanmar, China (Yunnan-type), Laos.

Ecology.— Dry evergreen forest, by streams, alt. 600-800 m (Doi Phu Kha)

Phenology.— Flowering: April-May; fruiting: October-November and infructescence persistent almost throughout the year.

Vernacular.— จำปีป่า Champi pa, จำปีหลวง Champi luang (Northern).

Voucher specimens.— *P. Srisanga* 2528.

2. MICHELIA L.

Sp. Pl.: 536. 1753; Keng in Fl. Thailand 2(3): 260. 1975; Nootboom in Fam. Gen. Vasc. Pl. 2: 400. 1993. – *Champaca* Adans., Fam. Pl. 2: 365. 1763. – *Sampacca* Kuntze, Rev. Gen. Pl. 1: 6. 1891. – *Paramichelia* Hu, Sunyatsenia 4: 142. 1940; Keng in Fl. Thailand 2(3): 266. 1975. – *Tsoongi dendron* Chun, Acta Phytotax. Sin. 8: 281. 1963.

Trees or shrubs; stipules adnate to or free from the petiole. **Flowers** bisexual, on brachyblasts in the axil of the leaves. **Tepals** 6-21, subequal or more rarely the outer whorl different. **Anthers** latrorse or sublatrorse, rarely introrse, connective produced into a short or elongate appendage. **Gynoecium** stipitate; carpels few to many, rarely 1, free or connate; ovules 2 to many in each carpel. **Fruit** in group of follicle, usually dehiscing along the dorsal suture or forming a fleshy or woody syncarp. **Seeds** 1 or few in each carpel.

About 30 species, in tropical and subtropical Asia from India and Sri Lanka eastwards to China, Japan and Malesia (Nootboom, 1993). About 10 species in Thailand (Keng, 1975; Chalermglin, 2002). Only 2 species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Stipule adnate to petiole, leaving a scar. Leaves pubescent. Fruit syncarpous
1. *M. baillonii*
1. Stipule free from petiole. Leaves glabrous or almost glabrous. Fruit apocarpous
2. *M. sp.*

1. *Michelia baillonii* (Pierre) Finet & Gagnep.

Bull. Soc. Bot. France 52(4): 46. 1906. – *Magnolia baillonii* Pierre, Fl. Forest Cochinch. 1: t 2. 1880. – *Aromadendron baillonii* (Pierre) Craib in Fl. Siam. Enum. 1: 26. 1925. – *Paramichelia baillonii* (Pierre) Hu, Sunyatsenia 4: 144. 1940; Keng in Fl. Thailand 2(3): 266. 1975. – *Talauma spongocarpa* King, Ann. Roy. Bot. Gard. Calcutta 3(2): 205. 1891. – *Aromadendron spongocarpum* (King) Craib in Fl. Siam. Enum. 1: 25. 1925.

Evergreen tree up to 40 m high; young twigs densely pubescent. Stipules densely yellowish to brownish pubescent, adnate to the petiole; scars near the base or nearly to half of the petiole, 1-10 mm long. **Leaves** ovate to narrowly elliptic, chartaceous, 7-20 cm long, 2.5-8 cm wide, glabrescent above, pubescent beneath; base cuneate; apex acute to shortly acuminate; midrib impressed above, prominent and raised beneath; primary veins 10-15 pairs; venation distinct; petioles 0.8-2.7 cm long, pubescent. **Flowers** fragrant; flower bud ellipsoid, 1.8-2.5 cm long; peduncle up to 2 cm long, pubescent; spathaceous bract pubescent. **Tepals** (16-)18-20(-21), 4-6-merous, spatulate to obovate-linear, white, pale yellow or pale orange, glabrous to sparsely pubescent outside, subsimilar, 2-2.7 cm long, 0.3-0.6 cm wide, the inner whorls slightly smaller. **Stamens** numerous, 7-9 mm long; connective appendage

narrowly triangular, 1-2 mm long; filaments 1-2 mm long, glabrous. **Gynoecium** ovoid, 5-8 cm long, densely greyish pubescent; carpels many; scars of perianth and stamens along the torus 2-3 mm long. **Fruit** ovoid, syncarpous, densely lenticellate, 3-8 cm long, 2-4 cm wide; ripe carpels connate, falling off when maturing in irregular masses, midrib lignified and persistent in the form of an upcurved laterally compressed hook. **Seeds** subovoid to irregularly shaped, 6-9 mm long and wide.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei; South-eastern: Chanthaburi; Central: Saraburi.

Distribution.— India (Assam), Myanmar, S China (Yunnan), Vietnam (type), Cambodia.

Ecology.— Lower montane forest, alt. 1,200-1,500 m (Doi Phu Kha, Doi Phu Wae)

Phenology.— Flowering: January-July; fruiting: August-January and infructescence persistent almost throughout the year.

Uses.— Wood good for construction.

Vernacular.— จำปีป่า Champi pa (General), จุมปี Chumpi (Northern).

Voucher specimens.— *P. Srisanga* 2343; *P. Srisanga et al.* 855.

2. *Michelia* sp.

Evergreen tree up to 40 m high; young twigs sparsely hairy. Stipules glabrous except silvery hairy along the edged, free from the petiole. **Leaves** ovate to broadly ovate, coriaceous, 14-20 cm long, 7-12 cm wide, glabrous on both surfaces except sparsely hairy along midrib on upper surface; base cuneate; apex acute to mucronate; midrib impressed above, prominent and raised beneath; primary veins 10-14 pairs; venation distinct, especially on lower surface; petioles 2-3 cm long, sparsely hairy. **Flowers** fragrant; flower bud ellipsoid to ovoid, 1.7-2.2 cm long; peduncle up to 1.3 cm long, pubescent; spathaceous bract sparsely hairy. **Tepals** 9(-12), 3-merous, creamy white or pale yellow, glabrous, 2-2.5 cm long, 0.3-0.6 cm wide, the outer whorl oblanceolate, thin, the inner whorls spatulate to narrowly obovate, thick. **Stamens** 19-23, 8-11 mm long; connective appendage narrowly triangular, 0.5-1 mm long; filaments 1-2 mm long, glabrous. **Gynoecium** ovoid, 8-10 mm long, shortly pubescent; carpels 9-12(-15); scars of perianth and stamens along the torus 2-3 mm long. **Fruit** apocarpous, densely lenticellate, (10-)15-20 cm long, very strong scent like lemon grass; ripe carpels 5-8, free, ellipsoid to ovoid, 6-8 cm long, 4-5 cm wide. **Seeds** subovoid to irregularly shaped, 2-2.5 cm long and wide (Figs. 52, 134).

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha)

Phenology.— Flowering: April-May; fruiting: July-October.

Vernacular.— จำปีช้าง Champi chang (General), จุมปีช้าง Chumpi chang (Lua-Nan).

Voucher specimens.— *P. Srisanga* & *S. Watthana* 673.

Notes.— New species. To be described by Dr. P. Chalermglin. This species is similar to *M. masticata* Dandy, but differs by the following characters: tepals much smaller (2-2.5 cm long, 0.3-0.6 cm wide vs. 5-9(-11) cm long, 1-2.5 cm wide (the inner ones)); stamens shorter (8-11 mm long vs. ca. 20 mm long); ripe carpels fewer and larger.

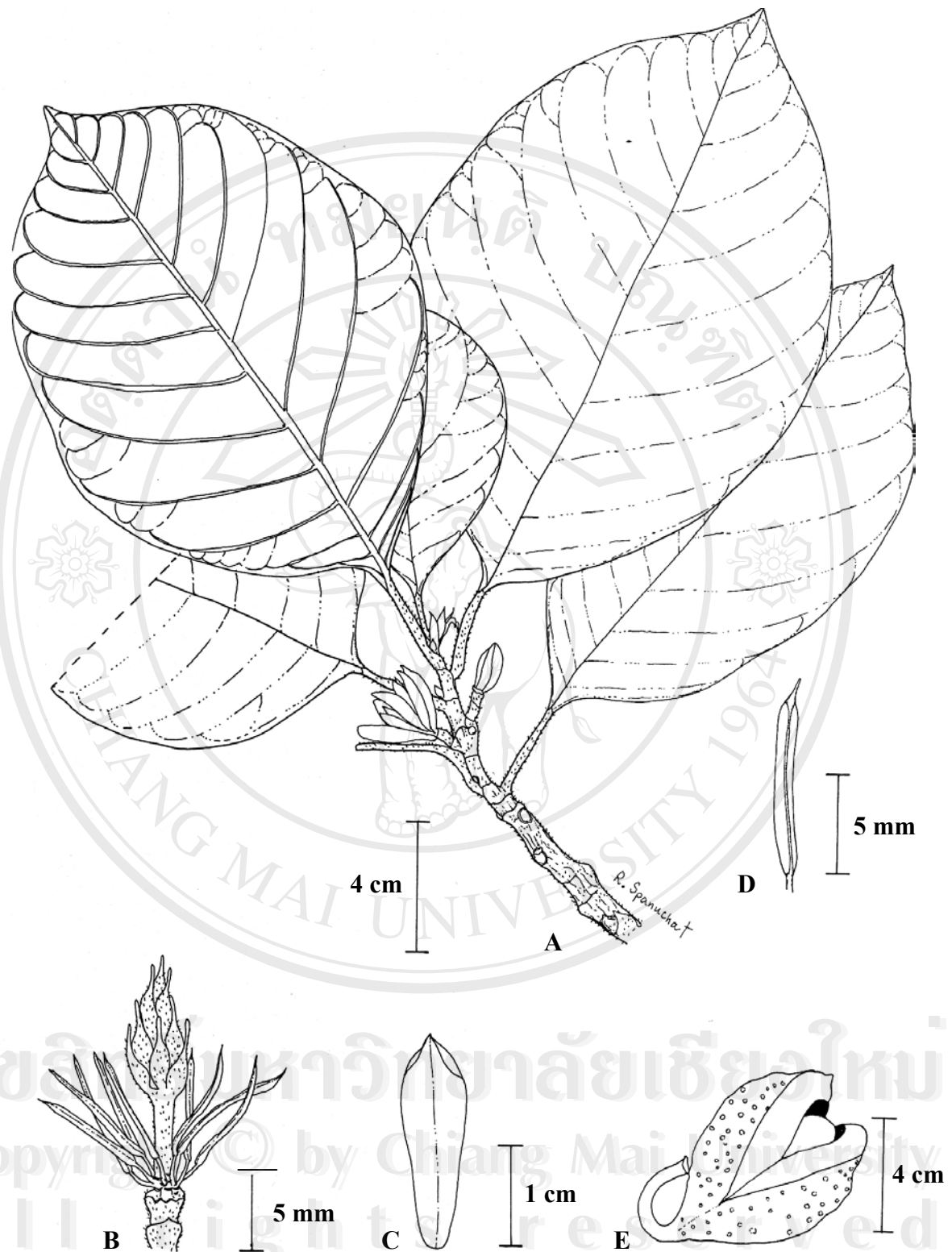


Figure 52. *Michelia* sp.

A. flowering branch; B. stamens and pistils; C. tepal; D. stamen; E. fruit.
All from P. Srisanga & S. Watthana 673.

MALPIGHIACEAE

Shrubs, small trees or woody climbers, usually with an indumentum of characteristic medifixed hairs. **Leaves** simple, opposite, entire, mostly petiolate. Stipules present. **Inflorescence** racemose or paniculate or flowers solitary or paired; pedicels articulate. Bracts and bracteoles present. **Flowers** bisexual, 5-merous. **Calyx** 5, persistent, sometimes with 1-10 glands. **Petals** 5, sometimes unequal, mostly with a claw. **Stamens** 10, unequal; filaments often broadened and connate at the base. **Ovary** superior, 3-locular, 3-lobed; styles 3, if 1 the other 2 abortive; ovule 1 in each loculus. Disk inconspicuous. **Fruit** a schizocarp, splitting into samaras, more or less winged or drupaceous mericarps.

About 60 genera and 700 species, mostly in the tropical region. Six genera and 22 species in Thailand (Siriruga, 1991). Two genera and 2 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Leaves without glands. Flowers actinomorphic. Fruits with 3 wings, more or less equal **1. *Aspidopterys***
1. Leaves with 2 basal glands or lower surface of lamina with gland dots. Flowers zygomorphic. Mericarps with 3 wings, the middle one often the longest **2. *Hiptage***

1. *ASPIDOPTERYS* Juss.

Ann. Sci. Nat. Bot. sér. 2. 13: 266. 1840; Niedenzu in Pflanzenr. 91: 19. 1928; Siriruga in Fl. Thailand 5(3): 287. 1991.

Woody climbers; young parts hairy. **Leaves** and petioles glandless. Stipules minute on the branch between the opposite leaves, caducous. **Inflorescence** axillary or terminal, paniculate; bracts hairy; bracteoles on the pedicels below the articulation, hairy; upper portion of pedicel often lengthening in fruit. **Flowers** actinomorphic. **Sepals** glandless, mostly ciliate. **Petals** white or pale yellow, not clawed, sometimes keeled, thin, glabrous, usually entire, rarely ciliate. **Stamens** glabrous, filaments slightly unequal, slender; base broadened, sometimes connate; connective inconspicuous. **Ovary** usually with 3 flat, more or less winged sides; styles 3, free; stigma capitate. Disk inconspicuous, later developing into cup-shaped, trimerous, with acute lobes. **Fruit** a schizocarp with 3 mericarps, often attached to a carpophore; mericarp wings more or less equal, orbicular, ovate to oblong, translucent membranous or coriaceous with radial venation. **Seeds** linear or triangular.

About 15-20 species in tropical Asia. Six species in Thailand (Siriruga, 1991).

Aspidopterys glabriuscula (Wall.) Juss.

Ann. Sci. Nat. Bot. sér. 2. 13: 267. 1840; Hutch., Kew Bull. 1917: 96. 1917; Niedenzu in Pflanzenr. 91: 29. 1928; Grierson in Fl. Bhutan 2(1): 42, fig. 4: f-k. 1991. – *Hiraea*

glabriuscula Wall. [Cat. No. 6626 (1828)]. – *Aspidopterys roxburghiana* Juss. var. 2, Hook.f. in Fl. Br. Ind. 1: 420. 1874.

Woody climber; branchlets terete, pubescent. **Leaves** lanceolate to elliptic, chartaceous, (5-)7-12 cm long, (2.5-)4-6 cm wide, sparsely pubescent on both surfaces, glabrescent; base rounded to cordate; apex acuminate; midrib raised on both surfaces; primary veins 4-5 pairs, prominent on lower surface; petioles 4-8 mm long, pubescent. **Inflorescence** axillary or terminal corymbs, 15-25 cm long, pubescent; pedicels 7-13 mm long, pubescent. **Sepals** elliptic, 1.5-2 mm long, 0.5-1 mm wide, connate at base, rounded at apex, brown pubescent on both sides. **Petals** creamy yellow to light brown, obovate, 4-5.5 mm long, 2-3 mm wide, keeled, rounded at apex, glabrous. **Filaments** 1.5-2 mm long, unequal, glabrous; anthers ca. 1 mm long, glabrous. **Ovary** sericeous, ca. 1 mm long; styles 3, 2.5-3 mm long, glabrous. **Mericarps** oblong to elliptic, rounded or truncate at both ends, 2-3 cm long, 1-1.5 cm wide, brown, pubescent. **Seeds** linear, ca. 10 mm long, 1-1.5 mm wide.

Thailand.— Northern: Nan.

Distribution.— India (Assam-type), Sikkim, Bhutan, S China (Yunnan).

Ecology.— Lower montane forest, alt. 1,300-1,640 m (Doi Phu Kha).

Phenology.— Flowering: August-November; fruiting: September-December.

Voucher specimens.— *P. Srisanga* 1137, 1505, 1513, 1728, 1729, 2239; *P. Srisanga* & *C. Maknoi* 2110.

Notes.— New recorded for Thailand.

2. HIPTAGE Gaertn.

Fruct. 2: 169, t. 116. 1790; Juss., Ann. Sci. Nat. Bot. sér. 2. 13: 268. 1840; Niedenzu in Pflanzenfam. ed. 1. 3. 4: 54. 1897; in Pflanzenr. 91: 67. 1928; Sirirugsa in Fl. Thailand 5(3): 273. 1991.

Woody climbers or shrubs. **Leaves** mostly coriaceous, often with 2 basal glands, sometimes on the lower surface with marginal and laminal gland dots; petioles sometimes with 2, mostly sulcate glands. Stipules minute, triangular, caducous. **Inflorescence** axillary or terminal, racemose, mostly hairy. Bracts lanceolate or triangular, hairy, caducous. Bracteoles mostly acute, hairy, adnate to the pedicels, below the articulation, caducous. **Flowers** zygomorphic, white, pale yellow or pink. **Calyx** with one large external gland, basally adnate to the lobes, sometimes decurrent on the pedicels, or with 2 small glands, basally adnate to the margin of each lobe, sometimes inconspicuous or absent. **Petals** clawed, unequal, outside hairy, inside glabrous. **Stamens** glabrous, more or less unequal, curved, mostly 1 distinctly the longest, almost as long as the style. **Ovary** hairy; style 1. **Fruit** a schizocarp with 3 globular mericarps; mericarp coriaceous; each with 3 wings; middle one often the longest; 2 lateral wings, more or less similar to each other, sometimes hardly developed; dorsal crest sometimes present.

About 25 species in tropical Asia. Ten species in Thailand (Sirirugsa, 1991).

***Hiptage benghalensis* (L.) Kurz subsp. *candicans* (Hook.f.) Sirirugsa**

In Fl. Thailand 5(3): 279. 1991. – *H. candicans* Hook.f. in Fl. Br. Ind. 1: 419. 1874. – *H. candicans* var. *parvifolia* Pierre, Fl. For. Cochinch. 17, t. 271. 1892. – *H. candicans* var. *latifolia* Pierre, Fl. Forest Cochinch. 17: t. 271. 1892. – *H. candicans* var. *cuneiformis* Arènes, Not. Syst. Paris 11: 68. 1943. – *H. candicans* var. *lanata* Arènes, Not. Syst. Paris 11: 69. 1943.

Shrub or small tree up to 10 m high; young branches pale brownish hairy, glabrescent. **Leaves** lanceolate, elliptic to ovate, 8-15 cm long, 3-7 cm wide; pale brownish pubescent, glabrescent; base cuneate to rounded; apex acuminate; lower surface mostly with 2 basal glands and marginal gland dots; primary veins 4-7 pairs; petioles 6-10 mm long, pubescent, glabrescent. **Inflorescence** 10-20 cm long, pubescent; peduncle, 1.5-4 cm long; pedicels 1-2 cm long, pubescent, articulate at the middle; bract lanceolate, 2-4 mm long; bracteoles minute, ca. 1 mm long, acute at apex. Calyx gland usually 1, elliptic to oblong, 2-4 mm long, ca. 1 mm wide. **Sepals** elliptic to ovate, 2-2.5 mm long, rounded at apex. **Petals** white with yellow blotches, ovate to orbicular with a short claw, 8-10 mm long, rounded and fimbriate at apex. **Stamens** 4-6 mm long, except the longest one up to 12 mm long. **Ovary** ca. 2 mm in diam.; style 10-12 mm long, glabrous. **Mericarps** brownish pink, hairy; the middle wing oblong to obovate, 3-5 cm long, 1-1.5 cm wide; the lateral wings 1.5-3 cm long.

Thailand.— Northern: Chiang Mai, Lamphun, Lampang, Nan, Kamphaeng Phet; North-eastern: Phetchabun, Khon Kaen, Loei; South-eastern: Chon Buri; South-western: Kanchanaburi, Phetchaburi.

Distribution.— India, Myanmar (type), S China (Yunnan).

Ecology.— Deciduous and dry evergreen forest, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting; March-April.

Vernacular.— กำลังช้างเผือก Kamlang chang phueak (Chiang Mai).

Voucher specimens.— *P. Srisanga* 589.

MALVACEAE

Herbs, shrubs or sometimes trees, often with fibrous barks and stellate or lepidote indumentum; stipules present. **Leaves** simple, alternate, entire or variously lobed, mostly palmately nerved. **Inflorescence** axillary or terminal, in cymes or flower solitary. **Flowers** usually bisexual, rarely dioecious or polygamous, actinomorphic; epicalyx often present. **Sepals** 3-5, more or less united, valvate. **Petals** 5, free from each other, but often adnate at the base to the staminal column, contorted or imbricate. **Stamens** (5-)numerous, monadelphous; the staminal column divided at the apex by the division of the filaments; anthers 1-locular, opening by longitudinal slits; pollen muricate or spinulose. **Ovary** superior, (1-)5(-numerous) locular, with as many as styles and carpels (twice in Ureneae), axile placentation;

styles branched above; ovules 1 or more from the inner angle of each loculus. **Fruit** a loculicidal capsule, schizocarp, rarely berry or samara.

About 111 genera and 1,800 species cosmopolitan especially tropical region (Mabberley, 1997). A family contains many ornamentals, fibre plants especially cotton (*Gossypium* spp.) and some food plants. About 13 genera and 50 species in Thailand. Five genera, 7 species and 2 varieties recorded from Doi Phu Kha National Park. Recently, Bombacaceae, Tiliaceae and Sterculiaceae are included within Malvaceae which raised the number up to 243 genera and probably more than 4,300 species (Bayer & Kubitzki, 2003).

KEY TO THE GENERA

- | | |
|--|------------------------------|
| 1. Epicalyx present | |
| 2. Herb or shrub. Flowers bisexual. Ovary 5-locular | |
| 3. Leaves lacking foliar nectaries. Calyx spathaceous. Styles 5-branched | 1. <i>Abelmoschus</i> |
| 3. Leaves with one or more prominent nectaries on lower surface. | |
| Calyx 5-lobed. Styles 10-branched | 5. <i>Urena</i> |
| 2. Tree. Flowers unisexual. Ovary 3-locular | 3. <i>Kydia</i> |
| 1. Epicalyx absent | |
| 4. Seeds (2-)3-6(-9) in each mericarp | 2. <i>Abutilon</i> |
| 4. Seed 1 in each mericarp | 4. <i>Sida</i> |

1. *ABELMOSCHUS* Medicus

Malv.: 46. 1787; van Borssum Waalkes, *Blumea* 14(1): 89. 1966; Paul & Nayar in *Fasc. Fl. Ind.* 19: 67. 1988; Bayer & Kubitzki in *Fam. Gen. Vasc. Pl.* 5: 285. 2003.

Annual or perennial herbs or shrubs, often tomentose or hispid. **Leaves** palmately lobed, crenate or dentate, lacking foliar nectaries. **Flower** solitary in the leaf axils, bisexual. Epicalyx 4-16, usually caducous. **Calyx** spathaceous, splitting asymmetrically at anthesis and falling with the corolla. **Corolla** large, showy. **Staminal tube** apically 5-tooth. **Ovary** 5-locular; style with 5 stylar branches; stigmas capitate. **Fruit** a loculicidal capsule, elongate, pubescent or hispid. **Seeds** many, reniform.

About 15 species in tropical Old World (Bayer & Kubitzki, 2003). About 4 species in Thailand. One species recorded from Doi Phu Kha National Park.

Abelmoschus manihot (L.) Medicus subsp. *tetraphyllus* (Roxb. ex Hornem.) Borss. var. *pungens* (Roxb.) Hochr.

Candollea 2: 87. 1924; van Borssum Waalkes, *Blumea* 14(1): 99. 1966; Paul & Nayar in *Fasc. Fl. Ind.* 19: 77. 1988. – *Hibiscus pungens* Roxb. in *Fl. Ind.* ed. Carey 3: 213. 1832; Craib in *Fl. Siam.Enum.* 1: 158. 1925.

Erect perennial herb or undershrub, 1-3 m high; all parts except corolla hispid by stiff simple hairs; stipules filiform, linear to narrowly lanceolate, 5-13 mm long, acute to acuminate at apex. **Leaves** variable in size and shape, orbicular to widely ovate in outline, 5-20 cm long and wide, 3-7 deeply lobed, 5-9-nerved at base; base cordate, occasionally hastate; lobes oblong, lanceolate to narrowly elliptic, acuminate at apex; margin serrate to dentate; petioles 2-10 cm long. Pedicels 1-5 cm long. Epicalyx 4-6, free, oblong, lanceolate to narrowly ovate, 1-2.5 cm long. 0.3-1 cm wide. **Calyx** 2-3 cm long, 1.5-2 cm wide. **Petals** yellow, obovate, 3.5-8 cm long, 2.5-6 cm wide, glabrous. **Staminal column** yellow, 1.5-3 cm long, glabrous; filaments and anthers 0.5-1 mm long. **Styles** dark red, 3-5 mm long; stigma dark red. **Capsule** oblong-ovoid, pentagonous, 3.5-6 cm long, 2-2.5 cm wide, densely hispid. **Seeds** 3-4 mm long and wide, dark brown or blackish.

Thailand.— Northern: Chiang Mai, Lamphun, Lampang, Nan; Peninsular: Nakhon Si Thammarat.

Distribution.— India (type), China, Philippines, Indonesia, N Australia.

Ecology.— Lower montane scrub, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering: August-September; fruiting: October-December.

Vernacular.— ปอฝ้าย Po fai (Northern).

Voucher specimens.— *P. Srisanga* 2140.

2. *ABUTILON* Mill.

Gard. Dict. ed. 4: 1. 1754; van Borssum Waalkes, *Blumea* 14(1): 159. 1966; Paul & Nayar in *Fasc. Fl. Ind.* 19: 79. 1988; Bayer & Kubitzki in *Fam. Gen. Vasc. Pl.* 5: 293. 2003.

Herbs, undershrubs, shrubs or small trees, sometimes glandular pubescent. **Leaves** sometimes lobed, mostly cordate at base, usually crenate or serrate, rarely subentire. **Flowers** usually solitary in the leaf axils, more rarely in raceme or umbel-like inflorescence. Epicalyx absent. **Calyx** usually campanulate; lobes 5. **Corolla** rotate, campanulate. **Staminal column** shorter than the petals, strongly widened at the base. **Carpels** 5-40; style branches as many as carpels, filiform to clavate; stigmas capitate. **Fruit** a schizocarp, globular to cylindric, campanulate, rarely discoid; mericarps 5-40, flattened, rounded, acuminate or biaristate at apex, often falling leaving a truncate, slender columella. **Seeds** (2-)3-6(-9) in each mericarp, reniform.

About 160 species, mostly in neotropical region (Bayer & Kubitzki, 2003). About 6 species in Thailand. One species recorded from Doi Phu Kha National Park.

Abutilon sp.

Undershrub ca. 1.5 m high; all parts except corolla softly short densely stellate hairs and with scattered long simple hairs. **Leaves** variable in size and shape, orbicular to widely ovate in outline, 3-15 cm long, 2-12 cm wide, 9-nerved at base; base cordate; apex acuminate; margin crenate to dentate; petioles 2-10 cm long.

Inflorescence in terminal and axillary few-flowered clusters; pedicels 1-5 cm long. **Sepals** lanceolate to elliptic, 8-12 mm long, 3-6 mm wide, 3-nerved. **Petals** yellow with red purplish centre, obovate, 1.6-2.3 cm long, 1.3-1.6 cm wide, glabrous except along the margin at the base inside. **Staminal column** 4-6 mm long, lower half glabrous, upper half stellate pubescent. **Styles** 10-13. **Schizocarp** cylindrical; mericarps 10-13, 14-17 mm long, 3-5 mm wide, distinctly long stellate on ridges, aristate at apex. **Seeds** 2-3 mm long and wide, brown, puberulous.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: November-December.

Voucher specimens.— *P. Srisanga* 395.

Notes.— Possibly new recorded for Thailand.

3. *KYDIA* Roxb.

Hort. Beng.: 50. 1814, nom. nud.; Pl. Corom. 3: 11, t. 215-216. 1819; Paul & Nayar in Fasc. Fl. Ind. 19: 159. 1988; Bayer & Kubitzki in Fam. Gen. Vasc. Pl. 5: 283. 2003.

Dioecious trees; stipules inconspicuous, caducous. **Leaves** palmately 5-9-veined from base. **Inflorescence** panicle. Epicalyx 4(-6), persistent. **Calyx** 5, persistent. **Corolla** adnate to the staminal tube at the base. **Staminal column** apically divided into 5 branches each with a cluster of 3-5 sessile anthers. **Ovary** 3-locular; ovules 2-3 in each loculus; styles 3-branched or -clefted; stigmas large, globose. **Fruit** a loculicidal capsule, 3-valved, subglobose, depressed. **Seeds** 2-3 in each loculus, reniform.

About 3 species, in tropical and subtropical regions of India, Bhutan, China to Malaysia. One species; *K. brasiliensis* Rodr. is only reported from Brazil (Paul & Nayar, 1988). One species in Thailand.

Kydia calycina Roxb.

Hort. Beng.: 50. 1814, nom. nud.; Pl. Corom. 3: 11, t. 215. 1819; Craib in Fl. Siam. Enum. 1: 151. 1925; Paul & Nayar in Fasc. Fl. Ind. 19: 159. 1988. – *K. fraterna* Roxb., Pl. Corom. 3: 12, t. 216. 1819. – *K. roxburghiana* Wight, Ic. 3(2): t. 881. 1844.

Tree up to 15 m high; young stems and branches densely pubescent with minute grayish brown stellate hairs. **Leaves** ovate to suborbicular, 4-17 cm long and wide, hispid by minutely stellate on both surfaces; base rounded or cordate; apex acute or obtuse; margin entire or irregularly serrate, sometimes tri- or penta-cuspidate, 5-9-nerved at base; petioles 2-7 cm long, densely stellate pubescent. **Inflorescence** terminal and axillary; pedicels 0.5-1.5 cm long, densely stellate pubescent. Epicalyx 4-6, oblong to narrowly obovate, connate at base, 4-15 mm long, 4-6 mm wide, minutely stellate pubescent. **Calyx** green to greenish red; lobes narrowly triangular-ovate, 4-5 mm long, 3-3.5 mm wide, minutely stellate pubescent. **Corolla** pink or red, obovate, 9-11 mm long, 6-7 mm wide, fimbriate. **Staminal column** 3-3.5 mm long.

Ovary ovoid. **Capsule** subglobose, 5-6 mm long and wide. **Seeds** 2-3 mm long and wide, brown, glabrous (Fig. 135).

Thailand.— Northern: Chiang Mai, Phrae, Nan.

Distribution.— India (type), Pakistan, Myanmar, S China, Vietnam.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Wae).

Phenology.— Flowering: September-November; fruiting: November-February.

Vernacular.— ปอเลียงฝ้าย Po liang fai (Northern).

Voucher specimens.— *P. Srisanga* 292, 1631; *P. Srisanga* & *C. Puff* 1084.

4. *SIDA* L.

Sp. Pl.: 683. 1753; van Borssum Waalkes, *Blumea* 14(1): 177. 1966; Paul & Nayar in *Fasc. Fl. Ind.* 19: 201. 1988; Bayer & Kubitzki in *Fam. Gen. Vasc. Pl.* 5: 296. 2003.

Annual or perennial herbs or undershrubs. **Leaves** simple, rarely lobed. **Flowers** usually solitary in the leaf axils or cluster of short racemes. Epicalyx absent. **Calyx** usually campanulate and angular, plicate in bud; lobes 5. **Corolla** rotate, usually yellow or orange. **Staminal column** usually shorter than the petals. **Carpels** 5-14; style branches as many as carpels; stigmas capitate. **Fruit** a schizocarp, globular to oblate; mericarps 5-14, often trigonous, muticous or biaristate at apex, indehiscent or dehiscent at the apex, often falling leaving a truncate, slender columella. **Seeds** 1 in each mericarp, ovoid-oblong to reniform, glabrous or hairy.

About 100 species, pantropical and extending into temperate region (Bayer & Kubitzki, 2003). About 7 species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Stipules of each pair different, one linear to lanceolate, the other linear to filiform
1. *S. acuta*
1. Stipules of each pair not different
 2. Corolla 1.5-1.7 cm across. Mericarp with or without awns, but awns never retrorsely hairy 2. *S. rhombifolia*
 2. Corolla 2-3.5 cm across. Mericarp with retrorsely hairy awns 3. *S. subcordata*

1. *Sida acuta* Burm.f.

Fl. Ind.: 147. 1768; Craib in *Fl. Siam. Enum.* 1: 149. 1925; van Borssum Waalkes, *Blumea* 14(1): 186. 1966; Paul & Nayar in *Fasc. Fl. Ind.* 19: 202, fig. 49. 1988. – *S. carpinifolia* L.f. var. *acuta* (Burm.f.) Kurz, *J. As. Soc. Beng.* 45: 119. 1876. – *S. orientalis* Cav., *Diss.* 1: 21, t. 21, fig. 1. 1785. – *S. lanceolata* Retz., *Obs.* 4: 28. 1786. – *S. carpinifolia* Mast. in *Fl. Br. Ind.* 1: 323. 1874 non L.f.

Erect undershrub, 0.5-1.75 m high; stem, pedicels and petioles pubescent with minute stellate hairs along with simple hairs, glabrescent later; stipules of each pair different, 4-11 mm long, 0.75-1.5 mm wide, one linear to lanceolate, 3-6-nerved, the other linear to filiform, 1-4-nerved, shorter. **Leaves** linear, lanceolate to narrowly elliptic, 1-7 cm long, 0.5-2.5 cm wide, sparsely hairy with stellate hairs, soon glabrescent; base obtuse, rounded or subcordate; apex acute; margin coarsely and remotely serrate, 3-nerved at base; petioles 2-5 mm long. **Flowers** axillary, solitary or in cluster of 2-3-flowered; pedicels 2-6 mm long, usually jointed at or below the middle. **Calyx** campanulate, angular, 6-8 mm long; lobes acuminate, few minute stellate hairs or glabrous outside, glabrous inside, slightly accrescent. **Corolla** orange or yellow, 8-12 mm across; petals obliquely obovate, sparsely covered with glandular hairs outside. **Staminal column** 3-4 mm long, with simple or glandular hairs. **Ovary** globular to ovoid, ca. 1.5 mm long. **Mericarps** 5-10, 4-4.5 mm long, including 2 awns, reticulate striate, glabrous. **Seeds** triangularly ovoid, 1.5-2 mm long, dark brown, glabrous except for the short hairy hilum.

Thailand.— Throughout the country.

Distribution.— Pantropical (Java-type).

Ecology.— Mixed deciduous and dry evergreen forest, open places, secondary growth and along roadsides, alt. 600-900 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: almost throughout the year.

Vernacular.— หญ้าขี้ดใบยาว Ya khat bai yao (General).

Voucher specimens.— *P. Srisanga* 2617.

2. *Sida rhombifolia* L.

Sp. Pl.: 684. 1753; Craib in Fl. Siam. Enum. 1: 151. 1925; van Borssum Waalkes, Blumea 14(1): 193, fig. 21: a-d. 1966; Paul & Nayar in Fasc. Fl. Ind. 19: 212, fig. 52. 1988.

Erect undershrub, 0.5-1.75 m high; stem, pedicels and petioles pubescent with whitish brown minute stellate hairs, glabrescent later; stipules filiform, 3-8 mm long. **Leaves** oblong, lanceolate to narrowly ovate, 1-7 cm long, 0.3-2.5 cm wide, densely with whitish brown minute stellate hairs on lower surface, sparsely hairy with stellate or simple hairs on upper surface; base obtuse, rounded or truncate; apex obtuse to acute; margin coarsely and remotely serrate, 3-nerved at base; petioles 2-12 mm long. **Flowers** axillary, solitary or in cluster of 2-5-flowered; pedicels longer than the petioles, up to 3 cm long, jointed. **Calyx** campanulate, angular, 6-8 mm long; lobes acuminate, minute stellate hairs outside, glabrous inside, accrescent. **Corolla** orange or yellow, 15-17 mm across; petals obliquely obovate, glabrous or nearly so. **Staminal column** ca. 3 mm long, short hairy or glabrous. **Ovary** conical, ca. 1.5 mm long. **Mericarps** (6-)7-12, 3-4 mm long, with or without awns, but awns never retrorsely hairy, glabrous or stellate hairy dorsally and on the awns. **Seeds** triangularly ovoid to reniform, 1.5-2 mm long, dark brown or black, glabrous except for the short hairy hilum.

Thailand.— Throughout the country.

Distribution.— Pantropical (India-type).

Ecology.— Lower montane forest, open places, secondary growth and along roadsides, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering: August-October; fruiting: September-December.

Vernacular.— หญ้าขี้ด Ya khat (General).

Voucher specimens.— *P. Srisanga* 1644.

3. *Sida subcordata* Span.

Linnaea 15: 172. 1841; van Borssum Waalkes, Blumea 14(1): 201. 1966. – *S. corylifolia* Wall. ex Mast. in Fl. Br. Ind. 1: 324. 1874; Craib in Fl. Siam. Enum. 1: 150. 1925.

Erect undershrub, 1-2 m high; stem, pedicels and petioles pubescent with minute stellate hair, glabrescent later; stipules linear to filiform, 3-5 mm long. **Leaves** lanceolate, elliptic to narrowly ovate, 2-9 cm long, 0.5-4 cm wide, sparsely with minute stellate hairs on both surfaces, glabrescent; base obtuse, rounded or truncate; apex obtuse to acute; margin coarsely and remotely crenate to serrate, 3-nerved at base; petioles 0.5-2.5 cm long. **Flowers** axillary, solitary or in 2-8-flowered racemes by soon fallen of subtended leaves; pedicels longer than the petioles, 1-3 cm long, jointed. **Calyx** campanulate, angular, 8-13 mm long; lobes acuminate, stellate hairs outside, glabrous inside except along the margins, accrescent. **Corolla** orange or yellow, 2-3.5 cm across; petals obliquely obovate, glabrous. **Staminal column** 5-6 mm long, stellate hairy at base. **Ovary** conical. **Mericarps** 7-10, 7-10 mm long, including 2 retrorsely hairy awns, stellate hairy dorsally. **Seeds** triangularly ovoid to reniform, 1.5-2 mm long, dark brown or black, glabrous except for the short hairy hilum.

Thailand.— Northern: Lamphun, Nan.

Distribution.— Myanmar, Vietnam, Malaysia, Indonesia, Philippines, Timor (type).

Ecology.— Dry evergreen forest, open places, secondary growth and along roadsides, alt. 700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-December.

Vernacular.— หญ้าขี้ดหลวง Ya khat luang (Northern).

Voucher specimens.— *P. Srisanga* 346.

5. *URENA* L.

Sp. Pl.: 692. 1753; van Borssum Waalkes, Blumea 14(1): 137. 1966; Paul & Nayar in Fasc. Fl. Ind. 19: 227. 1988; Bayer & Kubitzki in Fam. Gen. Vasc. Pl. 5: 287. 2003.

Undershrubs, stellate pubescent. **Leaves** often palmately lobed, crenate or dentate, with one or more prominent nectaries on lower surface. **Flowers** solitary or

in few-flowered clusters in the leaf axils or in terminal racemes, bisexual. Epicalyx campanulate to tubular, 5-lobed. **Calyx** campanulate to tubular, 5-lobed. **Corolla** usually pink. **Staminal tube** apically 5-tooth; free filaments short or anthers subsessile. **Ovary** 5-locular; ovule 1 in each loculus; style with 10 stylar branches; stigmas capitate, papillose. **Fruit** a schizocarp, globular; mericarps 5, prominently glochidiate or smooth, essentially indehiscent. **Seeds** glabrous.

Monotypic genus with several varieties (van Borssum Waalkes, 1966) or 6-8 species, pantropical (Bayer & Kubitzki, 2003). One species with 2 varieties recorded from Doi Phu Kha National Park.

1.1 *Urena lobata* L. subsp. *lobata* var. *lobata*

Sp. Pl.: 692. 1753; Craib in Fl. Siam. Enum. 1: 153. 1925; van Borssum Waalkes, Blumea 14(1): 140, fig. 7e. 1966; Paul & Nayar in Fasc. Fl. Ind. 19: 228, fig. 59. 1988. – *U. tomentosa* Bl., Bijdr. 2: 66. 1825.

Erect undershrub, 0.5-2 m high; stem, pedicels and petioles more or less densely covered with minute stellate hairs; stipules linear to lanceolate, 2-5 mm long. **Leaves** variable in shape and size, lanceolate, elliptic, ovate to orbicular, 1-12 cm long, 0.5-13 cm wide, angular, shallowly or deeply 3-5-lobed at apex or unlobed, densely stellate hairs on both surfaces, especially below; base obtuse, rounded or cordate; apex obtuse to acute; margin serrate to crenate, rarely entire, 3-9-nerved at base; petioles 0.5-12 cm long. **Flowers** solitary or in few-flowered clusters in the leaf axils or in terminal racemes; pedicels 1-5 mm long, accrescent. Epicalyx segments linear to lanceolate, 3-5 mm long, 1-3 mm wide, minute stellate hairs, appressed to the calyx. **Calyx** campanulate to tubular; lobes 4-6 mm long, 1.5-2 mm wide, minute stellate hairs outside, sericeous at apex by simple hairs inside, accrescent. **Corolla** pink, 2-3 cm across; petals 1.5-3 cm long, obovate, glabrous or nearly so. **Staminal column** 10-14 mm long. **Schizocarp** 5-8 mm long and wide; mericarps covered with glochidiate hairs. **Seeds** triangularly ovoid to reniform, 2-3 mm long and wide, brown, minutely hairy, glabrescent.

Thailand.— Throughout the country.

Distribution.— Pantropical (China-type).

Ecology.— Lower montane forest, open places, secondary growth and along roadsides, alt. 1,500-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: August-December.

Vernacular.— ชี้ครอก Khi khrok, หญ้าผมยุง Ya phom yung (General).

Voucher specimens.— *P. Srisanga* 1520.

1.2 *Urena lobata* L. subsp. *lobata* var. *viminea* (Cav.) Gürke

Bot. Jahrb. 16: 375. 1892; van Borssum Waalkes, Blumea 14(1): 141. 1966; Paul & Nayar in Fasc. Fl. Ind. 19: 230. 1988. – *U. viminea* Cav., Diss. 6: 335, t. 184, fig. 1. 1788.

This variety differs from var. *lobata* in often slightly scabrous stem and leaves.

Thailand.— Throughout the country.

Distribution.— Pantropical (Brazil-type).

Ecology.— Deciduous dipterocarp forest, open places, secondary growth and along roadsides, alt. 400-600 m (Doi Phu Kha, Wiang Peian Waterfall).

Phenology.— Flowering and fruiting: August-December.

Vernacular.— ชี้ครอก Khi khrok, หูย่าผมยุง Ya phom yung (General).

Voucher specimens.— *P. Srisanga* 2278.

MELASTOMATACEAE

Trees, shrubs, herbs or climbers, terrestrial or epiphytic. **Leaves** simple, opposite, rarely alternate or verticillate, usually with one or several pairs of lateral primary veins that originate at or near the blade base and extend all the way to the leaf apex, occasionally pinnately veined, usually exstipulate. **Inflorescence** terminal, axillary or cauline, in compound or reduced cymes, rarely flower solitary. **Flowers** bisexual, 3-5(-6)-merous. **Hypanthium** campanulate or urceolate. **Calyx** lobes triangular and persistent to indistinct or absent or calyx calyptrate. **Petals** commonly obovate with a short claw, often showy, free. **Stamens** usually in two whorls, rarely in one whorl, or the outer or inner whorl staminodial or lacking; anthers opening with 1 or 2 apical pores or rarely with short longitudinal slits; connective often prolonged below the anthers and dorsally and/or ventrally appendaged. **Ovary** inferior, (1-)4-5(-6)-locular; ovules mostly numerous. **Fruit** a berry or capsule. **Seeds** mostly numerous, small, cuneate, ovoid or cochleate.

Pantropical family comprises 150-156 genera and about 4,500 species. Seventeen genera including *Memecylon* L. and *Lijndenia* Zoll. & Moritzi (Memecylaceae) and about 93 species in Thailand (Renner et al., 2001). Six genera and 12 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Tree or shrub, includes scrambler or epiphytic, rarely herb. Flower 4-5(-6)-merous
2. Leaves with pinnately veined. Seeds 1(-2) **2. *Memecylon***
2. Leaves with 1 or several pairs of lateral primary veins that originate at or near the blade base and extend all the way to the leaf apex. Seeds numerous
3. Hypanthium covered with bristle hairs **3. *Osbeckia***
3. Hypanthium glabrous or covered with minute brown hairs
4. Inflorescence terminal. Fruit a capsule **4. *Oxyspora***
4. Inflorescence terminal or axillary. Fruit a berry
5. Terrestrial shrub. Leaf margin usually apically serrulate **5. *Pseudodissochaeta***
5. Epiphytic shrub. Leaf margin entire **1. *Medinilla***
1. Herb. Flower 3-merous **6. *Sonerila***

1. *MEDINILLA* Gaudich.

Voy. Uranie: 484. 1830; Maxwell, Gard. Bull. Singapore 31: 146. 1978; Regalado, Blumea 35(1): 5. 1990; Blumea 40(1): 113. 1995; Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 434. 2001. – *Hypenanth* Bl., Ann. Mus. Bot. Lugduno-Batavum 1: 21. 1849. – *Medinillopsis* Cogn. in Monogr. Phan. 7: 603. 1891. – *Cephalomedinilla* Merr., Philipp. J. Sci. 5: 204. 1910.

Epiphytic shrubs, rarely root climbers (*M. radicans* (Bl.) Bl.) or terrestrial (not in Thailand); branches terete, winged or angular, smooth or pustulate. **Leaves** opposite or in whorls of 3-5, or one leaf reduced or absent, coriaceous or succulent, entire, glabrous, with 1-5 pairs of lateral primary veins, sometimes slightly plinerved, secondary and tertiary veins often indistinct. **Inflorescence** terminal or axillary, sometimes cauliflorous, paniculate or umbellate, many-flowered cymes, often fascicled in leaf axils or on defoliated nodes, sometimes reduced to few-flowered cymes or flower solitary. **Flowers** 4-6-merous. **Hypanthium** cylindrical, campanulate or urceolate, normally glabrous; calyx rim very shortly dentate or truncate. **Petals** generally obovate. **Stamens** in 2 whorls, usually isomorphic; anthers linear or slightly curved, opening by a single apical pore; connective not or barely prolonged below the anthers, ventrally minutely bilobed and dorsally shortly spurred. **Ovary** 4-6-locular, axile placentation. **Fruit** a berry with a thin or thick pericarp. **Seeds** mostly numerous, ovoid or pyramidal, 0.5-2 mm long.

Between 150-400 species in Asia especially in Borneo and Philippines, N Australia, tropical Africa and Madagascar (Mabberley, 1997; Renner et al., 2001). Some species cultivated as ornamentals especially *M. magnifica* Lindl. Five indigenous species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

Medinilla rubicunda (Jack) Bl.

Flora 14: 512. 1831; Maxwell, Gard. Bull. Singapore 31: 174, fig. 10, pl. 3. 1978; Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 437. 2001. – *Melastoma rubicundum* Jack, Trans. Linn. Soc. London 14: 18. 1823. – *Medinilla emarginata* Craib, Kew Bull. 1930: 322. 1930; in Fl. Siam. Enum. 1: 700. 1931.

Epiphytic shrub up to 2 m high; branches quadrangular, fleshy, glabrous, smooth or pustulate. **Leaves** opposite, elliptic or oblanceolate, coriaceous, 7-13 cm long, 3-5 cm wide; base cuneate, decurrent, sometimes auricled; apex acute to shortly acuminate; primary vein 1 pair, departing above the base; petioles up to 4 mm long. **Inflorescence** in axillary, few-flowered fasciculate cymes, 1.5-2.5 cm long or flowers solitary or in pairs; peduncle 0-3 mm long. **Flowers** 4-5-merous; pedicels 3-4 (-6) mm long; bracts minute, lanceolate. **Hypanthium** campanulate, 3-4 mm long; calyx rim ca. 1 mm high, obscurely 4-5-dentate. **Petals** white to pale pink, oblong to obovate, 5-7 mm long, 4-5 mm wide, acute at apex. **Stamens** 8 or 10, equal; anthers straight, 4-5 mm long; connective dorsally crested, ventrally with two small auricles. **Berry** orange, urceolate or subglobose, 5-6 mm across, with a fleshy pulp and a thin pericarp.

Thailand.— Northern: Nan, Phitsanulok; North-eastern: Loei; Peninsular: Ranong, Satun, Pattani, Yala (type of *M. emarginata*), Narathiwat.

Distribution.— India, Nepal, Myanmar, China, Malay Peninsula (type).

Ecology.— Lower montane forest, alt. 1,600-1,900 m (Doi Phu Kha).

Phenology.— Flowering: July-September; fruiting: September-November.

Vernacular.— เกล่งหิน Kleng hin (General).

Voucher specimens.— *P. Srisanga* 905, 1159; *P. Srisanga* & *C. Puff* 1078; *P. Srisanga* & *C. Maknoi* 2016.

Notes.— New locality recorded from Nan, in Thailand.

2. MEMECYLON L.

Sp. Pl.: 349. 1753; Maxwell, Gard. Bull. Singapore 33: 44. 1980.

Trees or shrubs. **Leaves** opposite, entire, glabrous, pinnately veined. **Inflorescence** cymose, arising from leafy or leafless nodes, rarely terminal. **Flowers** 4-merous. **Hypanthium** campanulate to funnellform, with 8 ridges or lines inside, constricted or not above the ovary; calyx rim truncate or with 4 minute lobes. **Petals** more or less coriaceous. **Stamens** 8, isomorphic; anthers frequently curved, 2-locular, opening by a longitudinal slits; connective often thickened. **Ovary** 1-locular, basal to free central placentation; ovules 2-20. **Fruit** a berry. **Seeds** 1(-2).

About 250 species in tropical old world (Mabberley, 1997). Twenty-two species in Thailand (Renner et al., 2001). Only 1 species recorded from Doi Phu Kha National Park.

Memecylon edule Roxb. var. *ovatum* (Sm.) C.B. Clarke

In Fl. Br. Ind. 2: 564. 1879; Guillaumin in Fl. Gén. I.-C. 2: 935. 1921; Maxwell, Gard. Bull. Singapore 33: 74, fig. 10, 33. 1980. – *M. ovatum* Sm., Rees Cyclop.: 23. 1813; Kurz in Fl. Br. Burma 1: 512. 1877.

Tree up to 8 m high; branchlets cylindric. **Leaves** elliptic, coriaceous, 9-16 cm long, 3.5-5.5 cm wide; base cuneate, attenuate onto the petiole; apex acute, acuminate to caudate; primary veins 7-11 pairs, venation obscure; petioles 4-8 mm long. **Inflorescence** in leaf axils, 1-3 cm long; pedicels 2-3 mm long. **Hypanthium** green, campanulate, 2.5-3.5 mm long; calyx lobes slightly truncate, with 4 minute broadly lobes. **Petals** white with violet at base, elliptic, 2.5-3 mm long, 1.5-2 mm wide, acute at apex. **Stamens** violet; filaments 1.5-2 mm long; anthers curved, 1.5-2 mm long, with a gland at the centre. **Style** 3-4 mm long, glabrous. **Berry** globose, slightly rugose, 7-8 mm long and wide. **Seed** 1.

Thailand.— Northern: Nan; Eastern: Nakhon Ratchasima, Surin; South-western: Prachuap Khiri Khan; Peninsular: Surat Thani.

Distribution.— India, Sri Lanka, Myanmar, Vietnam, Malaysia, Indonesia.

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: April-June; fruiting: September-November.

Vernacular.— พลองเหมือด Plong mueat (Central).

Voucher specimens.— *P. Srisanga* 1475, 1541.

3. *OSBECKIA* L.

Sp. Pl.: 345. 1753; Hansen, Ginkgoana 4: 1. 1977; Renner, Clausing, Cellinese & Meyer in Fl. Thailand 7(3): 450. 2001. – *Ceramicalyx* Bl., Ann. Mus. Bot. Lugduno-Batavum 1: 50. 1849.

Shrubs, annual or perennial herbs, rarely small trees or creepers. **Leaves** opposite, isomorphic, entire, with 1-3(-4) pairs of lateral primary veins, usually petiolate. **Inflorescence** terminal paniculate cymes or axillary glomerulate few-flowered heads or rarely flower solitary. **Flowers** 4-5-merous; bracts ovate, variable in size. **Hypanthium** campanulate or urceolate; calyx rim with persistent or caducous lobes, often with intersepal emergences. **Petals** broadly obovate. **Stamens** in 2 whorls, typically isomorphic; anthers opening by a single apical pore; connective basally not or only slightly prolonged and somewhat expanded around the filament insertion. **Ovary** adnate to the hypanthium, 4-5-locular, apically conical and often covered with bristles, axile placentation. **Fruit** a capsule. **Seeds** minute (<1 mm), cochleate.

Fifty species in Asia, Australia, Africa and Madagascar. Seven species in Thailand (Renner et al., 2001). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|-------------------------------|
| 1. Erect perennial herb. Hypanthium and capsule 3-8 mm long | 1. <i>O. chinensis</i> |
| 1. Shrub. Hypanthium and capsule 14-20 mm long | 2. <i>O. stellata</i> |

1. *Osbeckia chinensis* L.

Sp. Pl.: 345. 1753; Craib in Fl. Siam. Enum. 1: 674. 1931; Hansen, Ginkgoana 4: 49. 1977 (see also for complete synonymy); Renner, Clausing, Cellinese & Meyer in Fl. Thailand 7(3): 451, pl. XVI: C. 2001. – *O. angustifolia* D. Don, Prodr. Fl. Nepal.: 221. 1825. – *O. chinensis* var. *angustifolia* (D. Don) C.Y. Wu & C. Chen in Fl. Yunnan. 2: 80. 1979. – *O. parva* Geddes, Kew Bull. 1928: 70. 1928; Craib in Fl. Siam. Enum. 1: 676. 1931. – *O. watanai* Craib, Kew Bull. 1930: 171. 1930; in Fl. Siam. Enum. 1: 678. 1931.

Erect perennial herb, 0.3-1(-1.5) m high. **Leaves** narrowly oblong to lanceolate, (1-)3-5(-7) cm long, 0.2-0.8(-1.8) cm wide, densely pubescent with short ascending hairs on both surfaces, subsessile; base rounded to broadly cordate; apex acute; primary veins 1-2(-3) pairs. **Inflorescence** few-flowered in axillary fascicles or flower solitary. **Flowers** 4-merous. **Hypanthium** (3-)5-7 mm long, glabrous or with

scattered hairs, normally with emergences at least between the calyx lobes; calyx lobes triangular, (1-)6-7 mm long. **Petals** purple, 12-17 mm long. **Stamens** 8, isomorphic; anthers 4-7 mm long, yellow, oblong to ovate, narrowed into a short beak, straight. **Ovary** as long as or shorter than the hypanthium, apically with a crown of bristles. **Capsule** campanulate or urceolate, 3-5(-8) mm long.

Thailand.— Almost throughout the country. Chiang Mai (type of *O. parva*), Prachin Buri (type of *O. watanae*).

Distribution.— China (type), SE Asia, New Guinea, N Australia.

Ecology.— Dry evergreen forest, open areas, alt. 900-1,000 m (Doi Phu Wae).

Phenology.— Flowering: October-December; fruiting: November-January.

Vernacular.— อ้าน้อย Aa noi (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1870.

2. *Osbeckia stellata* Buch.-Ham. ex Ker-Gawl.

Bot. Reg. 8, pl. 674. 1822; Hansen, Ginkgoana 4: 23, pl. 5. 1977 (see also for complete synonymy); Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 454. 2001. – *Ceramicalyx stellatus* (Buch.-Ham. ex Ker-Gawl.) Bl., Ann. Mus. Bot. Lugduno-Batavum 1: 50. 1849. – *Osbeckia marginulata* C.B. Clarke in Fl. Br. Ind. 2: 518. 1879. – *O. stellata* var. *marginulata* (C.B. Clarke) Hansen, Ginkgoana 4: 27. 1977. – *O. crinita* Benth. ex Naudin, Ann. Sci. Nat. Bot., sér. 3. 14: 72. 1850. – *O. stellata* var. *crinita* (Benth. ex Naudin) Hansen, Ginkgoana 4: 31. 1977. – *O. cinera* Cogn. in Monogr. Phan. 7: 1177. 1891; Craib in Fl. Siam. Enum. 1: 675. 1931. – *O. racemosa* Craib, Kew Bull. 1911: 51, 86. 1911; in Fl. Siam. Enum. 1: 677. 1931. – *O. garrettii* Craib, Kew Bull. 1916: 262. 1916; in Fl. Siam. Enum. 1: 676. 1931. – *O. paludosa* Craib, Kew Bull. 1916: 262. 1916; in Fl. Siam. Enum. 1: 676. 1931. – *O. sikkimensis* Craib, Notes Roy. Bot. Gard. Edinb. 10: 57. 1917. – *O. pulchra* Geddes, Kew Bull. 1930: 171. 1930; Craib in Fl. Siam. Enum. 1: 677. 1931. – *O. pulchra* var. *rubra* Craib in Fl. Siam. Enum. 1: 677. 1931.

Shrub, 1-2(-3) m high; branches angular, densely pubescent with simple hairs.

Leaves ovate to elliptic or slightly lanceolate, 9-11 cm long, 4-5 cm wide, strigose on both surfaces; base rounded; apex acute; primary veins 2-3 pairs; petioles 3-5 mm long. **Inflorescence** paniculate cymes of few- to many-flowered, in distal leaf axils or terminal. **Flowers** 4-merous. **Hypanthium** 14-18 mm long, with few to several 2-5 mm long emergences, each crowned by tan bristles; calyx lobes triangular, 3-5 mm long. **Petals** pink, 16-28 mm long. **Stamens** 8, isomorphic; anthers 10-15 mm long, yellow, long-beaked, S-shaped. **Ovary** shorter than the hypanthium, glabrous or apically with short appressed hairs. **Capsule** urceolate, 15-20 mm long (Fig. 136).

Thailand.— Northern: Mae Hong Son, Chiang Mai (type of *O. racemosa*, *O. garrettii*, *O. paludosa*, *O. pulchra*, *O. pulchra* var. *rubra*), Chiang Rai, Nan, Phitsanulok; North-eastern: Phetchabun, Loei, Sakhon Nakhon, Khon Kaen; Eastern: Nakhon Ratchasima, Surin; South-eastern: Chon Buri; Central: Nakhon Nayok; South-western: Kanchanaburi; Peninsular: Satun.

Distribution.— Nepal (lectotype), Bhutan, India, Myanmar, S China, Taiwan, Laos, Cambodia, Vietnam.

Ecology.— Lower montane forest, open areas, alt. 1,300-1,750 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: October-December; fruiting: November-January.

Vernacular.— เอนอ้าขน En aa khon (Loei).

Voucher specimens.— *P. Srisanga* 291, 1130, 1894, 2639.

4. *OXYSPORA* DC.

Prodr. 3: 123. 1828; Maxwell, Gard. Bull. Singapore 35: 216. 1982 [1983]; Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 456. 2001. – *Allomorphia* Bl., Flora 14: 522. 1831. – *Hylocharis* Miq., Sum. 2: 319. 1861; Nayar, Jap. J. Bot. 53: 332. 1978. – *Campimia* Ridl., J. Straits Branch Roy. Asiat. Soc. 57: 40. 1911; Hansen, Willdenowia 17: 147. 1988. – *Cyphotheca* Diels, Bot. Jahrb. Syst. 65: 103. 1933; H.L. Li, J. Arn. Arb. 25: 1. 1944; Hansen, Nord. J. Bot. 10: 21. 1990. – *Styrophyton* S.Y. Hu, J. Arn. Arb. 33: 174. 1952. – *Tayloriophyton* Nayar, Bull. Bot. Surv. India 2: 90. 1968.

Shrubs or small trees. **Leaves** opposite, entire to serrulate, with 1-3 pairs of lateral primary veins, rarely 3-plinerved, lateral cross-veins distinct, membranaceous or chartaceous. **Inflorescence** terminal paniculate cymes. **Flowers** 4-5-merous. **Hypanthium** campanulate or cylindrical, terete or ribbed, glabrous or with minute brown glands and/or hairs; calyx rim truncate and with short teeth. **Petals** obovate and glabrous except for a few glandular hairs at the apex. **Stamens** in 2 whorls, isomorphic or dimorphic; anthers opening by a single apical pore; connective barely prolonged below the anthers, typically with a minute dorso-basal spur, sometimes also ventrally minutely bilobed. **Ovary** 3-5-locular, almost entirely adnate to the hypanthium, apically rounded or beaked, glabrous or with glandular hairs, axile placentation. **Fruit** an ovoid, campanulate, urceolate, or 8- or 10-ribbed capsule, dehiscing first apically and then also longitudinally. **Seeds** cuneate or wedge-shaped, 0.7-1 mm long.

About 50 species from N India and China to Malaysia, Indonesia and Melanesia (Fiji). Seven species in Thailand (Renner et al., 2001). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|------------------------------|
| 1. Branchlets, petioles and peduncles minutely furfuraceous | 1. <i>O. balansae</i> |
| 1. Branchlets, petioles and peduncles conspicuously hispid | 2. <i>O. howellii</i> |

1. *Oxyspora balansae* (Cogn.) J.F. Maxwell

Gard. Bull. Singapore 35: 216. 1983; Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 456. 2001. – *Allomorphia balansae* Cogn. in Monogr. Phan. 7: 1183.

1891. – *A. baviensis* Guillaumin, Not. Syst. Paris 2: 324. 1913. – *A. sylvarum* Geddes, Kew Bull. 1930: 316. 1930; Craib in Fl. Siam. Enum. 1: 687. 1931. – *A. urophylla* Diels, Bot. Jahrb. Syst. 65: 102. 1933.

Shrub, 1-3 m high; young branchlet subterete or angular, reddish-brown furfuraceous. **Leaves** lanceolate to oblong, 8.5-16 cm long, 4-6 cm wide; base acute or cuneate; apex long acuminate, with 2-3 cm long tip; margin entire or finely serrulate; primary veins 1-2 pairs, outer pair faint, smooth and glabrous above, finely puberulous on the veins below; petioles 1.5-3.5 cm long, minutely furfuraceous. **Inflorescence** few-branched or spicate, 8-12 cm long, minutely furfuraceous. **Flowers** 4-merous; pedicels 1-2 mm long. **Hypanthium** cylindrical or slightly urceolate, 4-6 mm long; calyx teeth ca. 0.5 mm long. **Petals** pink, 3-4 mm long. **Stamens** 8, subisomorphic; anthers 3-3.5 mm long. **Capsule** ovoid, 5-7 mm long, conspicuously 8 ribbed, calyx tube and teeth persistent (Fig. 53).

Thailand.— Northern: Chiang Rai, Nan (Doi Phu Kha, 1,200-1,600 m-type of *Allomorpha sylvarum*: Kerr 4921: BK, K); North-eastern: Loei.

Distribution.— Vietnam (Tonkin-type).

Ecology.— Lower montane forest, alt. 1,300-1,700 m (Doi Phu Kha).

Phenology.— Flowering: July-November; fruiting: September-January.

Vernacular.— มังเร่ทราย Mang re sai (Northern).

Voucher specimens.— *P. Srisanga* 271, 974, 1642, 1760, 1899; *R. Pooma* 573 (BKF, CMU), 1259 (BKF, CMU).

2. *Oxyspora howellii* J.F. Jeffrey & W.W. Sm.

Notes Roy. Bot. Gard. Edinb. 9: 114. 1916; Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 459, fig. 34. 2001. – *Allomorpha howellii* (J.F. Jeffrey & W.W. Sm.) Diels, Bot. Jahrb. Syst. 65: 102. 1933. – *A. setosa* Craib, Kew Bull. 1913: 68. 1913; in Fl. Siam. Enum. 1: 686. 1931. – *Oxyspora balansae* var. *setosa* (Craib) J.F. Maxwell, Gard. Bull. Singapore 35: 216. 1983 [non *O. setosa* Craib (1930)].

Shrub or small tree, 2-6 m high; branchlets and petioles terete and densely covered with 2-4 mm long spreading reddish hispid hairs. **Leaves** ovate to oblong, 8.5-18 cm long, 4-9 cm wide; base obtuse to subcordate; apex long acuminate, with 2-3 cm long tip; margin serrulate, with a fine hair on each tooth; primary veins 2 pairs, outer pair faint, secondary and tertiary veins prominent below, sparsely appressed 1-2 mm long hairs above, more densely pilose below especially on the veins; petioles 3-5 cm long, reddish hispid. **Inflorescence** few-branched, 9-12 cm long; bracts and bracteoles minute and caducous. **Flowers** 4-merous; pedicels 1.5-2 mm long. **Hypanthium** urceolate, 4-6 mm long, puberulous; calyx teeth ca. 0.5 mm long. **Petals** pink, 4-5 mm long. **Stamens** 8, subisomorphic, 3-5 mm long. **Capsule** ovoid to urceolate, 5-6 mm long, conspicuously 8-ribbed, calyx tube and teeth persistent (Fig. 54).

Thailand.— Northern: Chiang Mai, Nan (Doi Wao, type of *Allomorpha setosa*: Kerr 2456: BK, K).

Distribution.— S China (Yunnan-type), Vietnam (Tonkin).

Ecology.— Dry evergreen forest, by streams; alt. 700-1,000 m (Nan Watershed, Sapan Waterfall, Doi Phu Kha).

Phenology.— Flowering: October-December; fruiting: November-January.

Voucher specimens.— *P. Srisanga* 307, 1240.

5. *PSEUDODISSOCHAETA* Nayar

J. Bombay Nat. Hist. Soc. 65: 557. 1969; Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 475. 2001.

Terrestrial shrubs; branchlets terete or angular. **Leaves** opposite, isomorphic, with 2-3 pairs of lateral primary veins, glabrous or only sparsely pilose; margin usually apically serrulate, petiolate or sessile. **Inflorescence** axillary or terminal, paniculate cymes. **Flowers** 4-merous; bracts subulate and small. **Hypanthium** campanulate to cylindrical; calyx rim subtruncate or shallowly lobed. **Stamens** 8, in 2 whorls, isomorphic or subsomorphic, opening by a single pore; connective dorsally minutely spurred and expanded around the filament insertion, ventrally minutely bilobed. **Ovary** 4-locular, apically rounded or sometimes depressed around the style base, adnate to the hypanthium, axile placentation. **Fruit** a berry. **Seeds** numerous, cuneate, 0.5-0.75 mm long.

Seven species from India (Assam) to Indochina (Renner et al., 2001). Three species in Thailand and also recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|------------------------------|
| 1. Leaves petiolate; base rounded to cuneate | |
| 2. Inflorescence axillary, few flowered | 1. <i>P. septentrionalis</i> |
| 2. Inflorescence cauliflorous, many flowered | 3. <i>P. sp.</i> |
| 1. Leaves sessile; base rounded to cordate | 2. <i>P. subsessilis</i> |

1. *Pseudodissochaeta septentrionalis* (W.W. Sm.) Nayar

J. Bombay Nat. Hist. Soc. 65: 565, fig. 4. 1969; Veldk. & Nayar, Blumea 24: 435. 1978; Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 475. 2001. – *Oritrephes septentrionalis* W.W. Sm., J. As. Soc. Beng., Pt. 2, Nat. Hist. 7: 69. 1911. – *Medinilla caerulescens* Guillaumin in Fl. Gén. I.-C. 2: 921. 1921. – *M. caerulescens* var. *nuda* Craib in Fl. Siam. Enum. 1: 699. 1931.

Shrub up to 5 m high, spreading or sometimes scrambling; young branchlets terete, glabrous. **Leaves** lanceolate to ovate, 6-10 cm long, 1.5-3 cm wide; base broadly cuneate to rounded; apex acuminate; margin serrulate to subentire; primary veins 2 pairs, glabrous on both surfaces; petioles 4-9 mm long. **Inflorescence** axillary or terminal, 1-5-flowered cymes, 2-5 cm long; pedicels ca. 1 cm long. **Hypanthium** campanulate, ca. 5 mm long; calyx rim with 4 shallow lobes. **Petals** pink, obovate,

ca. 6 mm long. **Stamens** subequal, outer ones ca. 13 mm long, inner ones ca. 11 mm long; connective ventrally minutely bilobed. **Ovary** 2/3 as long as the hypanthium, apically depressed-concave. **Berry** ovoid to urceolate, 6-8 mm long, black.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Lampang, Phitsanulok; North-eastern: Loei (type of *Medinilla caerulescens* var. *nuda*); Eastern: Nakhon Ratchasima; Central: Nakhon Nayok.

Distribution.— Myanmar (type), S China (type of *Anplectrum yunnanensis*), Vietnam, Laos (type of *Medinilla caerulescens*).

Ecology.— Lower montane forest, alt. 1,100-1,600 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: August-September; fruiting: November-January.

Vernacular.— เครื่องปลาสีขาว Khruea pla sew (Nong Khai).

Voucher specimens.— *P. Srisanga* 1286, 1885, 2199; *R. Pooma* 1103 (BKF, CMU).

2. *Pseudodissochaeta subsessilis* (Craib) Nayar

J. Bombay Nat. Hist. Soc. 65: 561, fig. 2. 1969; Veldk. & Nayar, Blumea 24: 432. 1978; Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 476. 2001. — *Allomorpha subsessilis* Craib, Kew Bull. 1913: 69. 1913; in Fl. Siam. Enum. 1: 686. 1931. — *Anerinoleistus sessilifolius* Guillaumin in Fl Gén. I.-C. 2: 905. 1921.

Shrub, 2-4 m high, sometimes scrambling; young branchlets quadrangular, subglabrous. **Leaves** lanceolate to ovate, 14-18 cm long, 3-4 cm wide; base rounded to cordate; apex acuminate; margin loosely denticulate; primary veins 2 pairs, glabrous above except for a few hairs along the midrib and main veins and near the base, sparsely pilose with simple brown hairs below, subsessile. **Inflorescence** terminal, paniculate cymes, dark purplish, many-flowered, 15-28 cm long; pedicels ca. 2 mm long. **Hypanthium** campanulate, 3-4 mm long; calyx rim with minute triangular lobes, finely puberulous. **Petals** white, obovate to suborbicular with a basal claw, 2.7-3 mm long, rounded at apex. **Stamens** subequal, 4-5 mm long; connective dorsally minutely spurred. **Ovary** 2/3 as long as the hypanthium. **Berry** globose to subglobose, 5-6 mm long and wide.

Thailand.— Northern: Chiang Mai, Lampang, Phayao, Nan (Doi Wao-type: *Kerr* 2427: K); North-eastern: Nong Khai.

Distribution.— Laos (type of *Anerinoleistus sessilifolius*).

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: May-June; fruiting: July-August.

Voucher specimens.— *P. Srisanga* 1470.

3. *Pseudodissochaeta* sp.

Shrub, 4-5 m high; stem corky; young branchlets terete, sparsely puberulous. **Leaves** lanceolate, 13-20 cm long, 3-5 cm wide; base rounded to cuneate; apex acuminate; margin entire to subentire with minutely teeth apically; primary veins 1-2

pairs, glabrous to sparsely puberulous above, more sparsely puberulous below; petioles 6-15 mm long. **Inflorescence** cauliflorous, paniculate cymes, red-purplish, many-flowered, up to 45 cm long; pedicels 2-3 mm long. **Hypanthium** white-purplish, tubular-campanulate to cylindrical, 4-6 mm long; calyx rim subtruncate, puberulous. **Petals** white, ovate, 6-8 mm long, broadly acute at apex. **Stamens** subequal, 8-11 mm long; connective dorsally distinctly spurred. **Ovary** 2/3 as long as the hypanthium. **Berry** ovoid to ellipsoid, 7-10 mm long.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: August-September; fruiting: September-February.

Voucher specimens.— *P. Srisanga* 1273, 1546.

Notes.— Possibly new species.

6. *SONERILA* Roxb.

[Hort. Beng.: 5. 1814, nom. nud.] Fl. Ind. ed. Carey & Wall. 1: 180. 1820; Fl. Ind. ed. Carey 1: 176. 1832; Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 482. 2001.

Terrestrial or low epiphytic or epilithic herbs, rarely semi-woody subshrubs, erect or creeping and rhizomatous, occasionally acaulescent. **Leaves** opposite or internodes short and leaves then appearing verticillate; lateral primary veins 1-4 pairs, or plinerved or pinnately veined, usually membranous, petiolate or sessile. **Inflorescence** scorpioid cymes or umbels. **Flowers** 3-merous. **Hypanthium** campanulate, cylindrical or ovoid; calyx lobes triangular or teeth. **Petals** thin, glabrous, pink or purple. **Stamens** 3 or rarely 6, 1(-2) whorls, mostly isomorphic; anthers opening by 1-2 pores; connective not prolonged below the pollen sacs and usually unappendaged. **Ovary** 3-locular, adnate to the hypanthium, often crowned by scales surrounding the style base, axile placentation. **Fruit** a capsule, ribbed or smooth. **Seeds** oblong, clavate, or wedge-shaped.

About 240 described species in tropical Asia. Thirteen species in Thailand (Renner et al., 2001). Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|-----------------------|
| 1. Leaf base cuneate | |
| 2. Herb 5-15 cm high. Leaves 0.6-3 cm long, 0.3-2 cm wide | 1. <i>S. erecta</i> |
| 2. Herb 20-60 cm high. Leaves 2.5-13 cm long, 2-5.5 cm wide | 2. <i>S. maculata</i> |
| 1. Leaf base rounded to obliquely cordate | 3. <i>S. sp.</i> |

1. *Sonerila erecta* Jack

Mal. Misc. 1: 7. 1820; Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 484, fig. 43. 2001. – *S. tenera* Royle, Illustr. Bot. Himalaya 215, fig. 2, pl. 45. 1839; Craib in Fl. Siam. Enum. 1: 695. 1931. – *S. tenera* var. *robustior* Guillaumin, Not. Syst.

Paris 2: 329. 1913. – *S. epilobioides* Stapf & King, J. As. Soc. Beng., Pt. 2, Nat. Hist. 69: 22. 1900; Craib in Fl. Siam. Enum. 1: 690. 1931. – *S. erecta* var. *discolor* Stapf & King, J. As. Soc. Beng., Pt. 2, Nat. Hist. 69: 24. 1900. – *S. erecta* var. *flexuosa* Stapf & King, J. As. Soc. Beng., Pt. 2, Nat. Hist. 69: 24. 1900. – *S. nisbetiana* Craib, Kew Bull. 1915: 429. 1915; in Fl. Siam. Enum. 1: 693. 1931.

Erect herb, 5-15 cm high; stem more or less quadrangular, glandular pilose or puberulous. **Leaves** opposite, thinly membranous, elliptic-oblong, lanceolate to linear, 0.6-3 cm long, 0.3-2 cm wide, glabrous on both surfaces or sparsely setose above and more densely below; base acute, cuneate or attenuate; apex acute or rounded; margin finely serrate or remotely ciliate; lateral primary veins 1(-2) pairs, departing from the base; petioles 2-4 mm long. **Inflorescence** a terminal cincinnus, up to 11 cm long, 3-7-flowered with the flowers arranged in two rows; peduncle 0.5-1.5 cm long, hairy; pedicels 1-3 mm long. **Hypanthium** cylindrical, 3.5-6 mm long, sparsely glandular setose; calyx lobes ovate-triangular, 1-1.5 mm long. **Petals** pink, ovate, 4-5(-7) mm long. **Stamens** 3; anthers ca. 2.5 mm long. **Capsule** cylindrical and slender, 5-10 mm long, 1.5-2 mm wide, obtusely ribbed, smooth, sometimes sparsely pilose.

Thailand.— Northern: Chiang Mai (type of *S. nisbetiana*), Lampang, Nan, Phitsanulok; North-eastern: Loei, Eastern: Chaiyaphum, Buri Ram; Central: Saraburi; South-western: Kanchanaburi; Peninsular: Ranong, Satun (type of *S. epilobioides*).

Distribution.— India, Myanmar, S China, Malaysia (Penang-type).

Ecology.— Dry evergreen and lower montane forest and lower montane scrub among limestone rocks, alt. 700-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: August-December.

Voucher specimens.— *P. Srisanga* 348, 1821, 2180.

2. *Sonerila maculata* Roxb.

[Hort. Beng.: 5. 1814, nom. nud.] Fl. Ind. ed. Carey & Wall. 1: 180. 1820; Fl. Ind. ed. Carey 1: 177. 1832; Renner, Clausen, Cellinese & Meyer in Fl. Thailand 7(3): 488, fig. 44, pl. XVIII: D. 2001. – *S. maculata* var. *emaculata* Benn., Pl. Jav. Rar.: 215. 1844. – *S. picta* Korth., Verh. Nat. Gesch. Ned. Bezitt., Bot. 249, pl. 52. 1844. – *S. maculata* var. *angustifolia* Kurz, J. As. Soc. Beng., Pt. 2, Nat. Hist. 46: 78. 1877. – *S. maculata* var. *glabrata* Stapf, Trans. Linn. Soc. London, Bot. 2, 4: 157. 1894. – *S. flaccida* Stapf & King, J. As. Soc. Beng., Pt. 2, Nat. Hist. 69: 25. 1900. – *S. picta* var. *pusilla* Ridl., J. Fed. Malay. States Mus. 4: 17. 1909. – *S. picta* var. *concolor* Ridl., J. Fed. Malay. States Mus. 4: 17. 1909. – *S. quadrangularis* Guillaumin, Not. Syst. Paris 2: 328. 1913; Craib in Fl. Siam. Enum. 1: 694. 1931. – *S. ciliata* [*'alata'*] Ridl., J. Fed. Malay. States Mus. 10: 92. 1920; Craib in Fl. Siam. Enum. 1: 689. 1931. – *S. picta* var. *maculata* Ridl., Fl. Mal. Pen. 1: 785. 1922. – *S. angulata* Craib, Kew Bull. 1930: 318. 1930; in Fl. Siam. Enum. 1: 689. 1931. – *S. notata* Craib, Kew Bull. 1930: 319. 1930; in Fl. Siam. Enum. 1: 693. 1931. – *S. sylvicola* Craib, Kew Bull. 1930: 320. 1930; in Fl. Siam. Enum. 1: 695. 1931. – *S. picta* var. *clarkeana* Craib in Fl. Siam. Enum. 1: 693. 1931. – *S. collina* R.N. Parker, Kew Bull. 1931: 42. 1931. – *S. gibbsiae* Ridl., Kew Bull. 1933: 494. 1933.

Erect herb, 20-60 cm high; stem quadrangular, often winged, covered with 2-3 mm long whitish hairs or furfuraceous-puberulous, often reddish. **Leaves** crowded and in a rosette or distributed along the stem, those of a pair subequal, membranous, elliptic, oblong or lanceolate, 2.5-13 cm long, 2-5.5 cm wide, glabrous or with some hairs on the veins, often with white spots on the lamina or with white streaks along the midrib; base cuneate, acute, sometimes asymmetrically attenuate; apex acute to acuminate; margin coarsely serrate or serrulate, minutely ciliate; lateral primary veins 2-3 pairs; petioles 1-5 cm long, minutely pilose or subglabrous. **Inflorescence** a terminal or axillary scorpioid cymes with up to 15 flowers; peduncle 3-9 cm long, scattered short hairs; pedicels 3-4 mm long. **Hypanthium** obconical, 4-7 mm long, covered with minute glands; calyx lobes triangular, 1-1.5 mm long. **Petals** pink, ovate or oblong, 8-10 mm long. **Stamens** 3; anthers 5-10 mm long, bilobed at the base. **Capsule** obpyramidal or funnel-shaped, obtusely 6-ribbed, 4-7 mm long, glabrous or rarely setose (Fig. 55).

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Tak; North-eastern: Loei, Sakon Nakhon; Eastern: Nakhon Ratchasima; South-western: Kanchanaburi (type of *S. notata*), Phetchaburi; South-eastern: Sa Kaeo, Chachoengsao, Chanthaburi, Trat; Peninsular: Chumphon (type of *S. ciliata*), Ranong, Surat Thani, Phangnga (type of *S. picta* var. *clarkeana*), Nakhon Si Thammarat, Songkhla, Yala (type of *S. angulata*), Narathiwat.

Distribution.— India (type), Myanmar, China, Laos, Cambodia, Vietnam, Malaysia, Indonesia.

Ecology.— Lower montane forest, alt. 1,300-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-January.

Vernacular.— แป๊ะน้ำเงิน Prae nam ngoen (Chanthaburi).

Voucher specimens.— *P. Srisanga* 1134, 2348.

3. *Sonerila* sp.

Erect herb, 12-15 cm high; stem terete, pubescent, often reddish. **Leaves** opposite and crowded in the upper part of the stem, elliptic to ovate, 3.5-10 cm long, 2-5.5 cm wide, sparsely pilose on both surfaces, red-purplish; base rounded to obliquely cordate; apex acute to acuminate; margin finely serrulate, long ciliate; lateral primary veins 4-6 pairs; petioles 0.7-4 cm long, densely pilose. **Inflorescence** a terminal or axillary scorpioid cymes with up to 13 flowers; peduncle 2-3.5 cm long, sparsely glandular hairy; pedicels 1-3 mm long. **Hypanthium** obconical, 3-5 mm long, sparsely glandular hairy; calyx lobes triangular, ca. 0.5 mm long. **Petals** pink, elliptic, 7-8 mm long, sparsely glandular hairy along the mid-vein of the petals. **Stamens** 3; anthers 3-4 mm long, bilobed at the base. **Capsule** obpyramidal or funnel-shaped, 5-7 mm long, sparsely glandular hairy.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, in shaded and moist areas, alt. 800-900 m (Sapan Waterfall).

Phenology.— Flowering and fruiting: June-July.

Voucher specimens.— *P. Srisanga* 1969.

Notes.— Possibly new species. Very distinct species characterized by elliptic to ovate leaves with rounded to obliquely cordate base and finely serrulate margin and hypanthium, pedicels and mid-vein of the petals sparsely glandular hairy.

MELIACEAE

Trees or shrubs, mostly with hard scented wood. **Leaves** pinnately or bipinnately compound, rarely simple or unifoliolate, alternate; leaflets mostly entire; stipules absent. **Inflorescence** axillary or cauliflorous, spikes, panicles or thyrses. **Flowers** bisexual or unisexual, actinomorphic. **Sepals** (2-)3-5(-7), often small, imbricate, rarely valvate. **Petals** 3-7(-14), in 1(-2) whorls, free or partially connate, contorted or imbricate, or adnate to the staminal-tube and valvate. **Stamens** (3-)8-10(-30), mostly with connate filaments and anthers often sessile in the tube; anthers 2-locular, opening by longitudinal slits. Disk present. **Ovary** superior, (1-)3-5(-20)-locular, axile placentation; ovules mostly 2 in each loculus, rarely 1 or more; styles often disciform or capitate. **Fruit** a berry, capsule or drupe, often with a large angular central axis. **Seeds** sometimes winged, with corky outer layers or with fleshy sarcotesta or aril.

About 51 genera and 565 species mainly in tropical region (Mabberley, 1997). About 16 genera and 55 species in Thailand. Five genera and 5 species recorded from Doi Phu Kha National Park.

Aglaia simplicifolia (Bedd.) Harms

In Engl. & Prantl, Nat. Pflanzenfam. 3(4): 300. 1896; Pannell, Kew Bull. Add. Ser. 16: 306, f. 92. 1992; Mabberley et al. in Fl. Mal. I(12): 298. 1995. — *A. meliosmoides* Craib, Kew Bull. 1913: 68. 1913; in Fl. Siam. Enum. 1: 256. 1926.

Thailand.— Northern: Lampang, Phrae, Nan; North-eastern: Udon Thani.

Distribution.— India, Laos, Malaysia, Indonesia.

Ecology.— Dry evergreen forest, alt. 800 m (Sapan Waterfall).

Phenology.— Fruiting: June-July.

Vernacular.— หอมค้อย Hom khoi (Lampang).

Voucher specimens.— *P. Srisanga* 2577.

Chisocheton sp.

Ecology.— Dry evergreen and lower montane forest, alt. 600-1,400 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering: October-November; fruiting: January-April.

Voucher specimens.— *P. Srisanga* 322, 1283; *P. Srisanga* & *S. Watthana* 678.

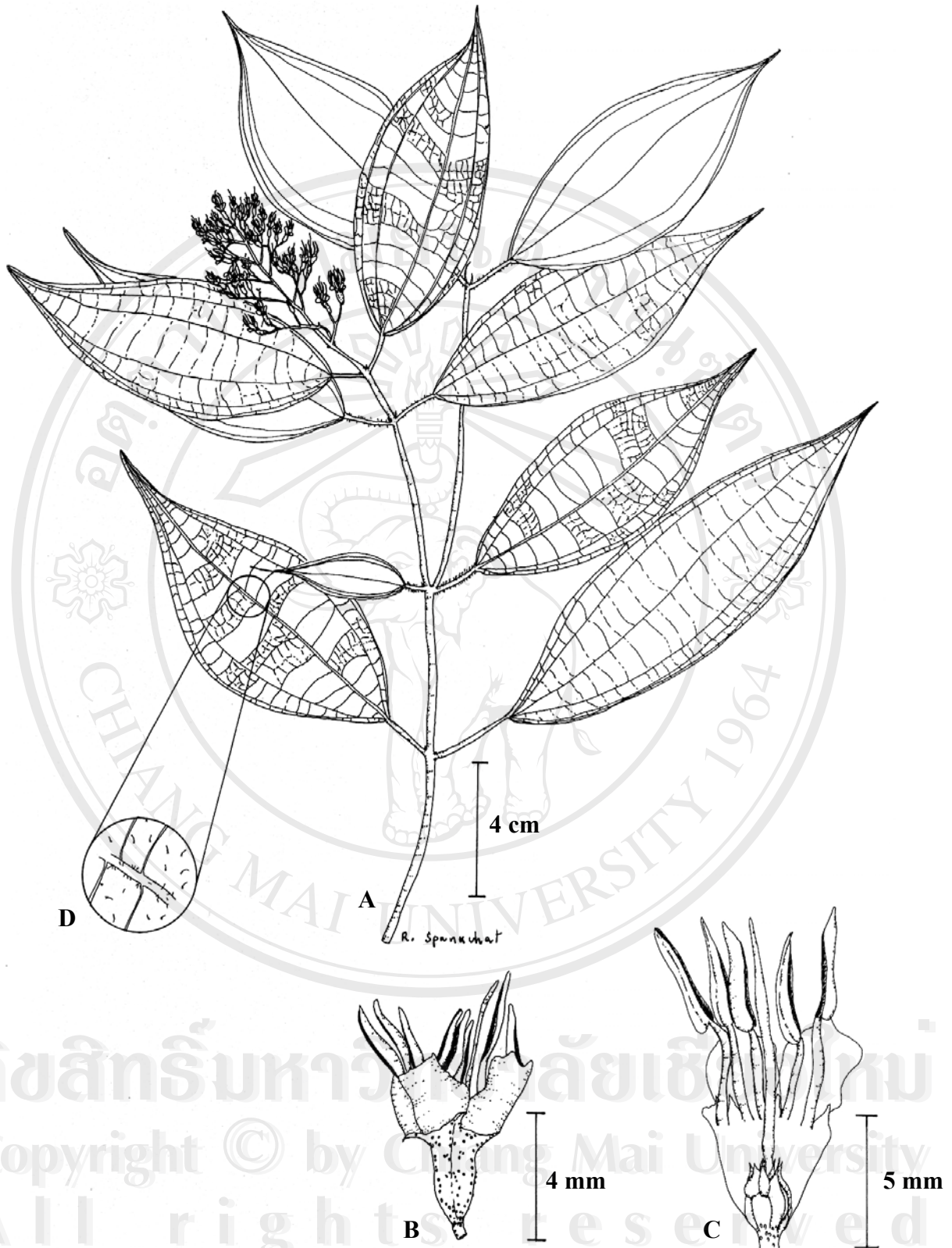


Figure 53. *Oxyspora balansae* (Cogn.) J.F. Maxwell

A. flowering branch; B. flower; C. opened flower; D. hairs on lower surface of leaf.

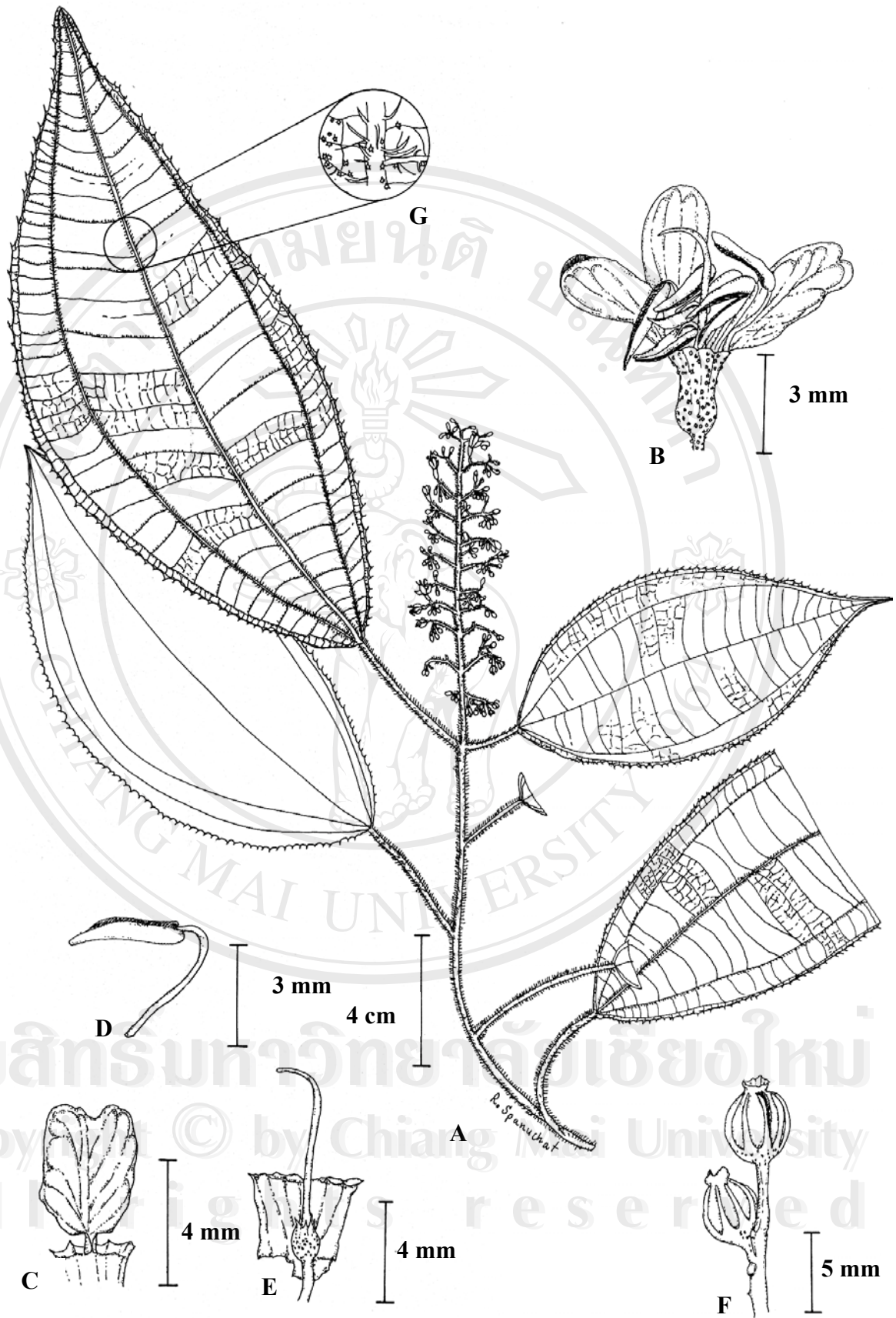


Figure 54. *Oxyspora howellii* J.F. Jeffrey & W.W. Sm.

A. flowering branch; B. flower; C. calyx teeth and petal; D. stamen; E. opened hypanthium and pistil; F. fruits; G. hairs on lower surface of leaf.

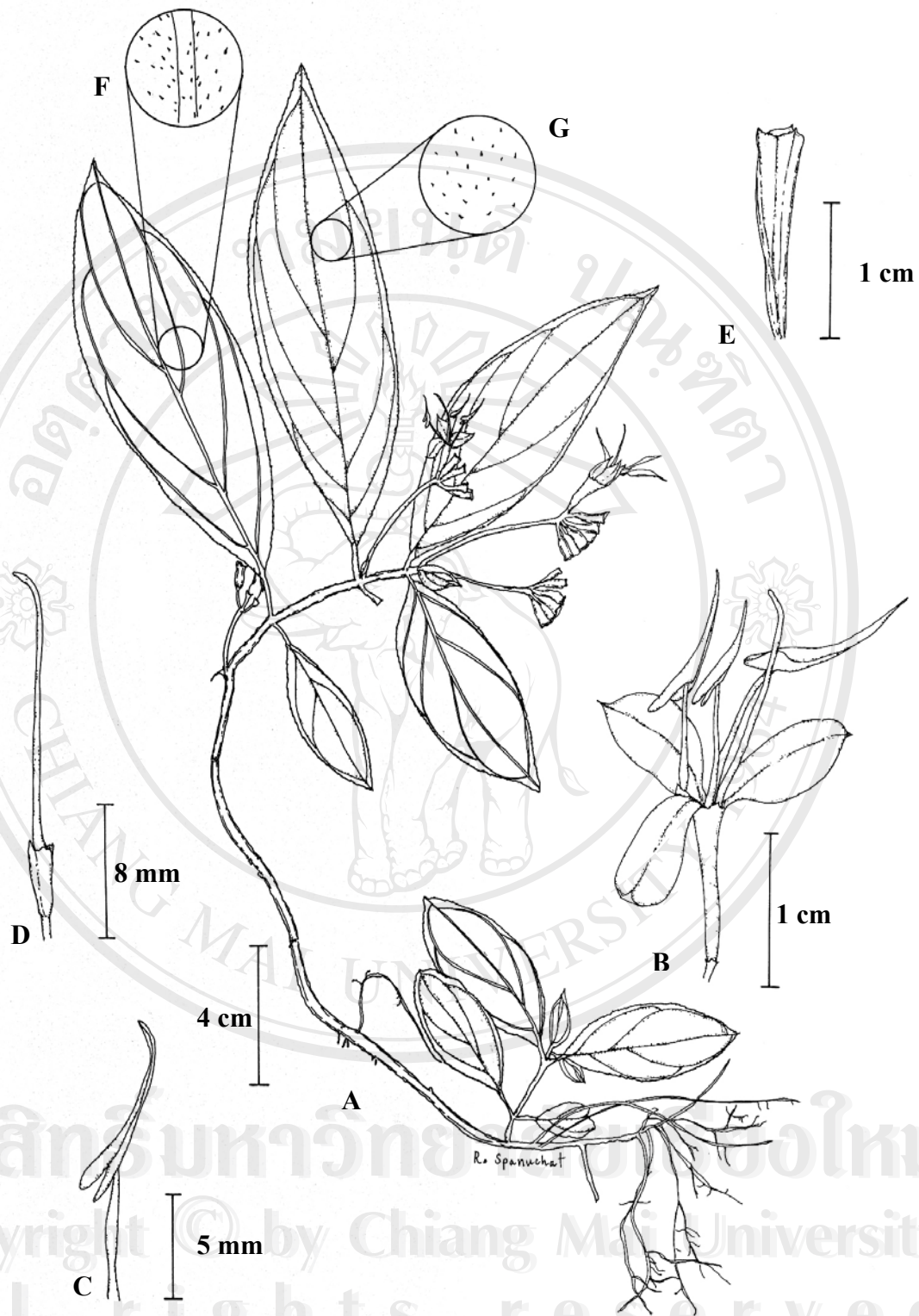


Figure 55. *Sonerila maculata* Roxb.

A. habit; B. flower; C. stamen; D. pistil; E. fruit; F. hairs on lower surface of leaf; G. hairs on upper surface of leaf.

***Chukrasia tabularis* A. Juss.**

Bull. Sci. Nat. Geol. 23: 241. 1830; Craib in Fl. Siam. Enum. 1: 266. 1926; Mabberley et al. in Fl. Mal. I(12): 355, fig. 53. 1995. — *C. velutina* (M. Roem.) C. DC. in DC., Monogr. Phan. 1: 727. 1878.

Thailand.— Northern: Chiang Mai, Lampang, Nan; South-eastern: Chanthaburi.

Distribution.— India, Sri Lanka, S China, SE Asia.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: June-September; fruiting: January-June.

Vernacular.— ยมหิน Yom hin (Central).

Voucher specimens.— *P. Srisanga et al.* 820.

***Dysoxylum* sp.**

Ecology.— Lower montane forest, alt. 1,400-1,600 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: July-August.

Voucher specimens.— *P. Srisanga* 916; *P. Srisanga & S. Watthana* 669.

***Heynea trijuga* Sims**

Curtis Bot. Mag. 41: t. 1738. 1815; Craib in Fl. Siam. Enum. 1: 264. 1926; Mabberley et al. in Fl. Mal. I(12): 41, figs. 6-7. 1995.

Thailand.— Northern: Chiang Mai, Nan, Kamphang Phet.

Distribution.— India, S China, SE Asia.

Ecology.— Lower montane forest, edges of forest clearing, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: March-October.

Vernacular.— ดอกแดง Dok daeng (Chiang Mai).

Voucher specimens.— *P. Srisanga* 280, 532, 533, 1973; *P. Srisanga et al.* 764.

MENISPERMACEAE

Dioecious climbers, rarely erect plants. Stipules absent. **Leaves** simple, alternate or spiral arranged, often palmatinerved at base; petioles often swollen at base. **Inflorescence** racemes, panicles, cymes or umbelliform cymes, many-flowered, rarely solitary or paired, axillary or borne on leafless twigs. **Flowers** usually 3-merous, small, actinomorphic, rarely zygomorphic. **Male flowers:** **sepals** 3-12 or more, usually in whorls of 3, rarely 1, free or connate, imbricate or valvate. **Petals** 1-6 or absent, free or connate, usually imbricate. **Stamens** 3-6 or more, rarely 2, free or united. **Female flowers:** **sepals** and **petals** generally as in male flowers. **Staminodes**

present or absent. **Carpels** usually 1-6, free; ovules 2, only 1 developing to seed. **Fruit** consisting of usually 1-6-drupe with style scar sometimes close to base or lateral; endocarp woody or bony; sometimes horseshoe-shaped, outside rugose, tuberculate, echinate or ridged, usually with ventral intrusion into the seed-cavity (condyle).

Pantropical family with about 71 genera and 450 species. Twenty-two genera and 52 species in Thailand (Forman, 1991; Pongamornkul & Pongsattayapipat, 2001). Five genera and 8 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Inflorescence composed of umbelliform cymes or disciform capitula **5. *Stephania***
1. Inflorescence cymose, thyrsoïd, racemose, pseudoracemose or paniculate
 2. Leaves oblong-elliptic, triplinerved, the main basal pair of nerves extending almost to the leaf apex. Drupe oblong-ellipsoidal, more than 4 cm long **3. *Haematocarpus***
 2. Leaves not triplinerved, palmatinerved at base. Drupe less than 3 cm long
 3. Seed straight. Inflorescence paniculate. Male flowers: sepals 6-12 in 2-4 whorls of 3, free; petals 6, free; stamens completely united into a peltate synandrium; anthers in a horizontal ring. Female flowers: sepals and petals as in male flowers **1. *Aspidocarya***
 3. Seed strongly curved, horseshoe-shaped
 4. Inflorescence thyrsoïd or pseudoracemose. Male flowers: sepals 4(-5), free or connate; petals 4, free or connate into cup-shaped or absent; stamens completely united into a peltate synandrium; anthers in a horizontal ring. Female flowers: sepals and petals 1-3, rarely petals absent **2. *Cyclea***
 4. Inflorescence cymose. Male flowers: sepals 9, the outermost 3 narrow and minute, the inner 6 imbricate and concave, the innermost 3 broader than the others; petals 6; stamens 6, free or partly connate. Female flowers: sepals and petals as in male flowers **4. *Pericampylus***

1. *ASPIDOCARYA* Hook.f. & Thoms.

Fl. Ind.: 180. 1855; Forman, Kew Bull. 39: 101. 1984; in Fl. Thailand 5(3): 333. 1991; Kessler in Fam. Gen. Vasc. Pl. 2: 413. 1993.

Woody climber. **Leaves** slightly pelate, entire, rarely lobed, palmatinerved at base. **Inflorescence** axillary, narrowly paniculate. **Male flowers: sepals** 6-12, in 2-4 whorls of 3. **Petals** 6, with lateral edged inrolled. **Stamens** connate into a peltate synandrium; anthers 6, dehiscing transversely. **Female flowers: sepals and petals** as in male flowers. **Staminodes** 6, linear. **Carpels** 3; stigma reflexed, lobed. **Drupe** with a flattened, scutiform endocarp with a median dorsal ridge and thin lateral wings; style-scar terminal; condyle absent; seed-cavity flattened. **Seed** straight, flat.

A monotypic genus in E Himalayas, Myanmar, S China (Yunnan) and N Thailand (Forman, 1991).

Aspidocarya uvifera Hook.f. & Thoms.

Fl. Ind.: 180. 1855; Forman, Kew Bull. 39: 101, fig. 1: A-B. 1984; in Fl. Thailand 5 (3): 333. 1991.

Stem tomentose when young, pubescent to glabrescent later, striate with prominent corky longitudinal ridges when old. **Leaves** ovate to broadly ovate, thinly papyraceous, 9-19 cm long, 7-17 cm wide, pubescent on both surfaces especially around base and along nerves; base cordate to truncate, slightly peltate, petiole insertion up to 2 mm from basal margin; apex caudate-acuminate; palmately 5(-7)-nerved at base; lateral nerves 2(-3) pairs; petioles 7-12 mm long, densely pubescent. **Inflorescence** up to 35 cm long, lateral branches 1-3 cm long, pubescent. **Male flowers** on pubescent pedicels, 1-3 mm long. **Sepals** 6-12; outer 3-6, green, narrowly elliptic, 2-3.5 mm long, puberulous; inner 3-6, yellow, obovate to broadly elliptic, 3-4 mm long, glabrous. **Petals** 6, yellowish green, cuneate-obovate with lateral edges inrolled, ca. 2 mm long, truncate at apex. **Synadrium** ca. 2 mm long; column thick. **Female flowers: sepals** as in male flowers. **Petals** narrower. **Staminodes** ca. 1.5 mm long. **Carpels** narrowly subovoid, ca. 1.5 mm long. **Drupe** dark red, oblong-ovate, 1.7-2.5 cm long, 1.3-1.7 cm wide, glabrous.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— E Himalayas (Sikkim-type), Myanmar, S China (Yunnan).

Ecology.— Dry evergreen forest, along streams, alt. 900-1,000 m (Doi Phu Kha).

Phenology.— Flowering: March-May; fruiting: August-September.

Vernacular.— เครื่องหนัง Khruua nang (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1563.

Notes.— New locality recorded from Nan, in Thailand.

2. *CYCLEA* Arn. ex Wight

Ill. Ind. Bot. 1: 22. 1840; Forman, Kew Bull. 22: 360. 1968; Kew Bull. 43: 386. 1988; in Fl. Thailand 5(3): 325. 1991; Kessler in Fam. Gen. Vasc. Pl. 2: 416. 1993.

Slender woody climbers. **Leaves** often peltate, palmately nerved. **Inflorescence** axillary, terminal or cauliflorous, pseudo-racemose or thyrsoid. **Male flowers: sepals** 4(-5), free or connate into a 4(-5)-lobed calyx. **Petals** 4, free or connate into a cup-shaped corolla or rarely absent. **Stamens** connate into a peltate synandrium; anthers 4-5, dehiscent transversely. **Female flowers: sepals** and **petals** 1-3, rarely petal absent. **Staminodes** absent. **Carpel** 1; stigma 3-5-fid. **Drupe** curved with style-scar near base, obovate to rotund in outline, sometimes pubescent; endocarp bony with the condyle a central cavity, around which the seed is curved, perforate ventrally between style-scar and base; often perforate laterally, dorsally ornamented with 3-6 rows of tubercles. **Seeds** horseshoe-shaped.

About 29 species in India to C & S China, Thailand, Indochina and W & C Malesia. Five species in Thailand (Forman, 1991). Only 1 species recorded from Doi Phu Kha National Park.

Cyclea polypetala Dunn

J. Linn. Soc. 35: 485. 1903; Craib in Fl. Siam. Enum. 1: 71. 1925; Forman, Kew Bull. 43: 387. 1988; in Fl. Thailand 5(3): 327, fig. 73: A-H, pl. XXII: 25. 1991.

Woody climber; stems hispid when young, later developing a fissured bark. **Leaves** slightly peltate or subpeltate, triangular-ovate to broadly cordate, papyraceous, 11-19 cm long, 7.5-16 cm wide, glabrous above, pubescent to hispid below; base mostly cordate; apex acuminate; reticulation fine and raised on both surfaces; petioles 3-8 cm long, hispid, attached up to 2 mm above the base of lamina. **Inflorescence** borne on old, leafless stems, broadly thyrsoid, pubescent, 10-18 cm long; lateral branches up to 8 cm long. **Male flowers** on pedicels articulated towards the apex. **Calyx** red, depressed globose-urceolate, obscurely crenulate at the constricted mouth, ca. 1.5 mm long, 2.5 mm broad, glabrous, fleshy. **Petals** 4, subulate, ca. 1 mm long. **Synandrium** slightly exsert, 1.5 mm long. **Female flowers: sepals** 2, opposite, deeply concave, sacciform, ca. 1 mm long, fleshy, glabrous. **Petals** 2, each within a sepal, minute, ca 0.3 mm long, concave-cucullate. **Carpels** ovoid, ca. 1 mm long; stigma shortly 3-lobed. **Drupe** rotund in outline, 5 mm in diam., glabrous; endocarp bearing 6 dorsal to lateral rows of prominent, peg-like or papilliform tubercles.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— S China (Yunnan-type).

Ecology.— Lower montane forest, alt. 1,300-1,700 m (Doi Phu Kha).

Phenology.— Flowering: September-November; fruiting March-May.

Voucher specimens.— *P. Srisanga* 1656, 1678, 1740.

Notes.— New locality recorded from Nan, in Thailand.

3. HAEMATOCARPUS Miers

Ann. Mag. Nat. Hist. Ser. 3, 13: 124. 1864; Forman, Kew Bull. 26: 419. 1972; in Fl. Thailand 5(3): 306. 1991; Kessler in Fam. Gen. Vasc. Pl. 2: 410. 1993.

Woody climbers. **Leaves** oblong-elliptic, not peltate or very slightly peltate, triplinerved. **Inflorescence** axillary, terminal or cauliflorous, paniculate or racemose. **Male flowers** with sepals and petals streaked with dark red lines and spots. **Sepals** 12-15, in whorls of 3, composed of 2 large inner whorls and 2-3 much smaller outer whorls. **Petals** 6, the inner 3 auriculate at the base and clasping the opposite stamen. **Stamens** 6, free, connective enlarged, projecting inwards. **Female flowers: sepals and petals** as in male flowers. **Staminodes** 6, minute. **Carpels** 6; style reflexed. **Drupe** oblong-ellipsoidal, narrowed at the base into a stalk; style-scar near the base; endocarp smooth with a thin inner longitudinal septum.

Two species: one in India (Assam), Thailand, Andaman Islands and Indonesia (Sumatra & Java), the other in Borneo, Celebes and the Philippines (Forman, 1991).

***Haematocarpus validus* (Miers) Bakh.f. ex Forman**

Kew Bull. 26: 420. 1972; Kew Bull. 43: 374. 1988; in Fl. Thailand 5(3): 306. 1991. — *Baterium validum* Miers, Ann. Mag. Nat. Hist. Ser. 3, 13: 124. 1864.

Woody climber; branchlets slightly puberulous or glabrous. **Leaves** oblong-elliptic, subcoriaceous, 10-20 cm long, 4-7 cm long, glabrous; base rounded, obtuse to subcordate; apex rounded, acute to acuminate; petioles 1-3.5 cm long. **Inflorescence** axillary or cauliflorous, paniculate or racemose, puberulous or glabrous, up to 50 cm long, with lateral branches up to 9 cm long. **Male flowers** on pedicels 2-4 mm long. **Sepals**: the outer ones minute, less than 1 mm long, ciliate; the inner ones larger, elliptic, ca. 3 mm long, glabrous. **Petals** broadly elliptic, 1.5-2 mm long. **Stamens** ca. 1 mm long; connective much swollen on the adaxial side. **Female flowers**: **sepals** and **petals** as in male flowers. **Staminodes** rod-like, ca. 0.5 mm long. **Carpels** ovoid-ellipsoidal, ca. 1 mm long; style sharply reflexed. **Drupe** red, oblong-ellipsoidal, 4-5 cm long, 2-3 cm wide, glabrous.

Thailand.— Northern: Nan; Peninsular: Trang.

Distribution.— India (Assam-type), Andaman Islands and Indonesia (Sumatra & Java).

Ecology.— Dry evergreen forest, by streams, alt. 800 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering: March-May; fruiting June-July.

Voucher specimens.— *P. Srisanga* 2568.

Notes.— New locality recorded from Nan, in Thailand.

4. PERICAMPYLUS Miers

Ann. Mag. Nat. Hist. Ser. 2, 7: 36. 1851; Forman, Kew Bull. 22: 365. 1968; in Fl. Thailand 5(3): 350. 1991; Kessler in Fam. Gen. Vasc. Pl. 2: 417. 1993.

Woody climbers. **Leaves** peltate or not, palmately nerved. **Inflorescence** axillary, cymose and subumbelliform, pedunculate; cymes solitary or fasciculate. **Male flowers**: **sepals** 9; the outermost 3, narrow and minute; the inner 6, imbricate and concave; the innermost 3, broader than the others. **Petals** 6, cuneate. **Stamens** 6, free or partly connate; anthers dehiscing longitudinally. **Female flowers**: **sepals** and **petals** as in male flowers. **Staminodes** 6, filamentose. **Carpels** 3; stigma deeply bifid, recurved. **Drupe** curved with style-scar near base; endocarp rotund in outline, dorsally covered with short pointed processes, laterally concave; condyle septiform, imperforate. **Seeds** horseshoe-shaped.

About 2-3 species in tropical and subtropical Asia. Two species in Thailand (Forman, 1991; Pongamornkul & Pongsattayapipat, 2001). Both species also recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves with usually broadly and shallowly crenate margin, tomentose or softly pubescent below, papyraceous. Filaments free or only coherent **1. *P. glaucus***
 1. Leaves with entire margin, sparsely pubescent to subglabrous below, coriaceous. Filaments completely connate below, free and divergent above **2. *P. macrophyllus***

1. *Pericampylus glaucus* (Lam.) Merr.

Int. Rumph.: 219. 1917; Craib in Fl. Siam. Enum. 1: 68. 1925; Forman, Kew Bull. 22: 366. 1968; Kew Bull. 43: 398. 1988; in Fl. Thailand 5(3): 351. 1991. – *Menispermum glaucum* Lam., Enc. 4: 100. 1797. – *Cocculus incanus* Colebr., Trans. Linn. Soc. Lond. 13: 57. 1822. – *Pericampylus incanus* (Colebr.) Hook.f. & Thoms. in Fl. Ind.: 194. 1855.

Woody climber; young stems yellowish tomentose, older stems glabrescent, longitudinally ridged. **Leaves** broadly triangular-ovate, palmately 5-nerved, papyraceous, 5-10 cm long and wide, tomentose or softly pubescent on lower surface, sparsely pubescent on upper surface; base cordate or truncate; apex apiculate, usually broadly rounded or obtuse sometimes acute; margin usually broadly and shallowly crenate; petioles 3-7 cm long, yellowish tomentose. **Inflorescence** 2-4 cm long, yellowish tomentose. **Male flowers** white or yellow with pedicels ca. 1 mm long. **Sepals** hairy outside; outer 3 narrow, minute ca. 0.5 mm long; middle 3 oblanceolate; inner 3 obovate, all ca. 1 mm long. **Petals** obcuneate, ca. 0.5 mm long, glabrous. **Stamens** 7-8 mm long; filaments free or only coherent. **Female flowers: sepals and petals** as in male flowers. **Carpels** ca. 0.5 mm long. **Drupe** purple black, subglobose, 4-6 mm long and wide, glabrous; endocarp dorsally bearing 2 rows of ca. 15 pointed projections (Fig. 56).

Thailand.— Northern: throughout; North-eastern: Loei; South-eastern: Chon Buri, Rayong, Chanthaburi; South-western: Kanchanaburi; Peninsular: throughout.

Distribution.— E Himalayas, S China, Taiwan, Myanmar, Laos, Cambodia, Vietnam and throughout Malesia (Ambon-type).

Ecology.— Lower montane forest, along walk-sides and open clearings, alt. 1,400-1,500 m (Doi Phu Kha, Bo Kluea).

Phenology.— Flowering: February-April; fruiting: June-July.

Vernacular.— เครื่องหม Kruea khom (Northern).

Voucher specimens.— *P. Srisanga* 734; *P. Srisanga* & *S. Watthana* 642; *P. Thongson* 15.

2. *Pericampylus macrophyllus* Forman

Kew Bull. 37: 376. 1982; Pongamornkul & Pongsattayapipat, Thai For. Bull. (Bot.) 29: 32, fig. 1-2. 2001.

Woody climber; young stems striate, sparsely pubescent to subglabrous. **Leaves** broadly ovate, palmately 5-nerved, coriaceous, 17-20 cm long, 15-16 cm wide, sparsely pubescent to subglabrous on lower surface, glabrous on upper surface; base cordate; apex abruptly acuminate; margin entire; petioles 11-14 cm long, striate, pubescent. **Inflorescence** 6-9 cm long, tomentose. **Male flowers** with pedicels 2-3 mm long, tomentose. **Sepals**: outermost bracteoliform, ca. 1 mm long, densely puberulous outside; middle 3 and inner 3 obovate, all ca. 3 mm long, glabrous inside, puberulous outside. **Petals** ca. 1 mm long, glabrous; outer 3, obovate; inner 3, rhomboid-elliptic. **Stamens** ca. 2.5 mm long; filaments completely connate below, free and divergent above. **Female flowers** green: **sepals** and **petals** as in male flowers. **Carpels** ca. 1 mm long, glabrous. **Drupe** not known (Fig. 57).

Thailand.— Northern: Mae Hong Son, Nan.

Distribution.— Myanmar (type).

Ecology.— Dry evergreen forest, along streams, alt. 700 m (Doi Phu Kha, Tham Pha Khong).

Phenology.— Flowering: January-March.

Voucher specimens.— *P. Srisanga* 2387.

Notes.— New locality recorded from Nan, in Thailand.

5. *STEPHANIA* Lour.

Fl. Cochinch. 2: 608. 1790; Forman, Kew Bull. 43: 376. 1988; in Fl. Thailand 5(3): 311. 1991; Kessler in Fam. Gen. Vasc. Pl. 2: 415. 1993.

Climbers, rarely erect herbs; stems woody or herbaceous; tuberous rootstock sometimes present, often above ground. **Leaves** peltate, usually ovate to suborbicular, palmately nerved. **Inflorescence** axillary or arising from old leafless stems usually composed of peduncled umbelliform cymes, which are solitary or racemose arranged, at least the 1(-2) order(s) of branching umbellate, the ultimate branching sometimes irregular or sometimes the cymes condensed to disciform capitula. **Male flowers** symmetrical. **Sepals** 6 or 8 in two equal or unequal whorls, or rarely 2-3, free, imbricate, usually obovate. **Petals** 3 or 4, rarely 1-2 or absent, free, usually broadly obovate with lateral margins often involute. **Stamens** connate into a peltate synandrium; anther cells 4-8, dehiscing transversely. **Female flowers** symmetrical or asymmetrical. **Sepals** 1-8. **Petals** 2-4, both similar to male flowers. **Carpel** 1; style very short or absent; stigma shortly lobed or divaricately lacinate. **Drupe** obovoid with style-scar near base, glabrous; endocarp bony, dorsally bearing a horseshoe-shaped band of 2 or 4 longitudinal rows of processes or transverse ridges; condyle often perforate. **Seeds** horseshoe-shaped.

About 45 species in tropical Old World. Fifteen species in Thailand, but there are a few further species represented as yet by inadequate materials (Forman, 1991). Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves triangular-ovate, gradually tapered to an acute apex,
glabrous on both surfaces **1. *S. elegans***
1. Leaves suborbicular to broadly ovate
2. Leaves glabrous above, puberulous below **2. *S. japonica* var. *discolor***
2. Leaves glabrous on both surfaces **3. *S. oblata***

1. *Stephania elegans* Hook.f. & Thoms.

Fl. Ind. 1: 195. 1855; Forman, Kew Bull. 43: 382. 1988; in Fl. Thailand 5(3): 320. 1991.

Slender climber, glabrous, without tuberous rootstock. **Leaves** triangular-ovate, papyraceous, 6-11 cm long, 3-6.5 cm wide; base truncate; apex acute; reticulation visible especially below; petioles 2-7 cm long. **Inflorescence** axillary umbelliform cyme, up to 7 cm long. **Male flowers** pedicellate. **Sepals** 6-8, violet or greenish white, obovate, ca. 1.5 mm long, the inner 3 slightly broader, externally sometimes minutely papillose. **Petals** 3-4, broadly obovate, ca. 0.75 mm long. **Synandrium** ca. 1.5 mm long. **Female flowers** symmetrical. **Sepals** 3. **Petals** 3, very early caducous. **Drupe** obovate, reddish; endocarp 5-6 mm long, with 2 dorsal rows of 7-8 irregular transverse ridges, the surface between them papillose (Fig. 58).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Himalayas (type), S China (Yunnan).

Ecology.— Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: June-July; fruiting: December-February.

Voucher specimens.— *P. Srisanga* 2715; *P. Srisanga et al.* 803.

Notes.— New locality recorded from Nan, in Thailand.

2. *Stephania japonica* (Thunb.) Miers var. *discolor* (Bl.) Forman

Kew Bull. 11: 49. 1956; Kew Bull. 43: 380. 1988; in Fl. Thailand 5(3): 315. 1991. – *Cissampelos hernandiifolia* Willd., Sp. Pl. 4: 861. 1806 (*hernandifolia*). – *Clypea discolor* Bl., Bijdr.: 26. 1825. – *Stephania hernandiifolia* (Willd.) Walp., Repert. 1: 96. 1842; Craib in Fl. Siam. Enum. 1: 69. 1925.

Slender climber, glabrous or crispatly puberulous, without tuberous rootstock. **Leaves** suborbicular to broadly ovate, papyraceous, 6-12 cm long, 4-10 cm wide, glabrous on upper surface, crispatly puberulous on lower surface; base truncate to broadly rounded; apex acute to acuminate or obtuse; reticulation visible especially below; petioles 3-10 cm long, crispatly puberulous. **Inflorescence** axillary compound umbelliform cyme, 4-9 cm long, bearing flowers in dense subcapitate cymose clusters, puberulous. **Male flowers** green, white or yellow, sessile or subsessile. **Sepals** 6 or 8, oblanceolate to spatulate, ca. 1 mm long, glabrous or puberulous outside. **Petals** 3-4, suborbicular, 0.5-1 mm long, glabrous. **Synandrium**

0.5-1 mm long. **Female flowers:** **sepals** and **petals** as in male flowers, but number of sepals often reduced. **Carpels** ovoid, ca. 1 mm long. **Drupe** obovate to suborbicular, red; endocarp 4-8 mm long, usually perforate, with 2 dorsal rows of 8-10 transverse ridges, the surface between them usually smooth, rarely rough (Fig. 59).

Thailand.— Almost throughout the country.

Distribution.— India, Nepal, S China, SE Asia (except Philippines; Java-type) to E Australia.

Ecology.— Lower montane forest, in open areas and by roadsides, alt. 1,100-1,200 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: June-October; fruiting: August-December.

Vernacular.— ก้อนปัด Kon pit (General).

Voucher specimens.— *P. Srisanga* 747.

3. *Stephania oblata* Craib

Kew Bull. 1922: 230. 1922; in Fl. Siam. Enum. 1: 70. 1925; Forman, Kew Bull. 43: 383. 1988; in Fl. Thailand 5(3): 321. 1991. — *S. kerrii* Craib, Kew Bull. 1922: 229. 1922; in Fl. Siam. Enum. 1: 70. 1925.

Slender climber, glabrous, with small underground tuber. **Leaves** suborbicular to broadly ovate, thinly papyraceous, 5-15 cm long and wide, glaucous on lower surface; base rounded; apex obtuse, sometimes abruptly acuminate; reticulation lax; petioles 3-12 cm long. **Inflorescence** axillary umbelliform cyme, 1.5-6 cm long, sometimes racemosely arranged along an axillary shoot. **Male flowers** with pedicels 1-2 mm long. **Sepals** 6, yellowish green; outer 3 obovate to oblanceolate, 1.5-2 mm long; inner 3 broader and abruptly narrowed to the base. **Petals** 3, broadly obovate, ca. 1 mm long. **Synandrium** ca. 1 mm long. **Female flowers** asymmetrical on pedicels elongating to 5 mm in fruit. **Sepals** 1(-2), similar to male. **Petals** 2, similar to male. **Carpels** ovoid, 0.75-1 mm long. **Drupe** rounded, red; endocarp 6-7 mm long and wide, imperforate, with 2 dorsal rows of 11-12 transverse ridges.

Thailand.— Northern: Mae Hong Son, Chiang Mai (type), Lampang, Phrae, Nan; South-eastern: Chon Buri; Central: Saraburi, Phra Nakhon Si Ayutthaya.

Distribution.— Cambodia.

Ecology.— Dry evergreen forest, by streams, alt. 700-800 m (Doi Phu Kha, Huay Pong).

Phenology.— Flowering: June-July; fruiting: August-September.

Vernacular.— ไผ่ฝั้น Bai paen (General).

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2065.

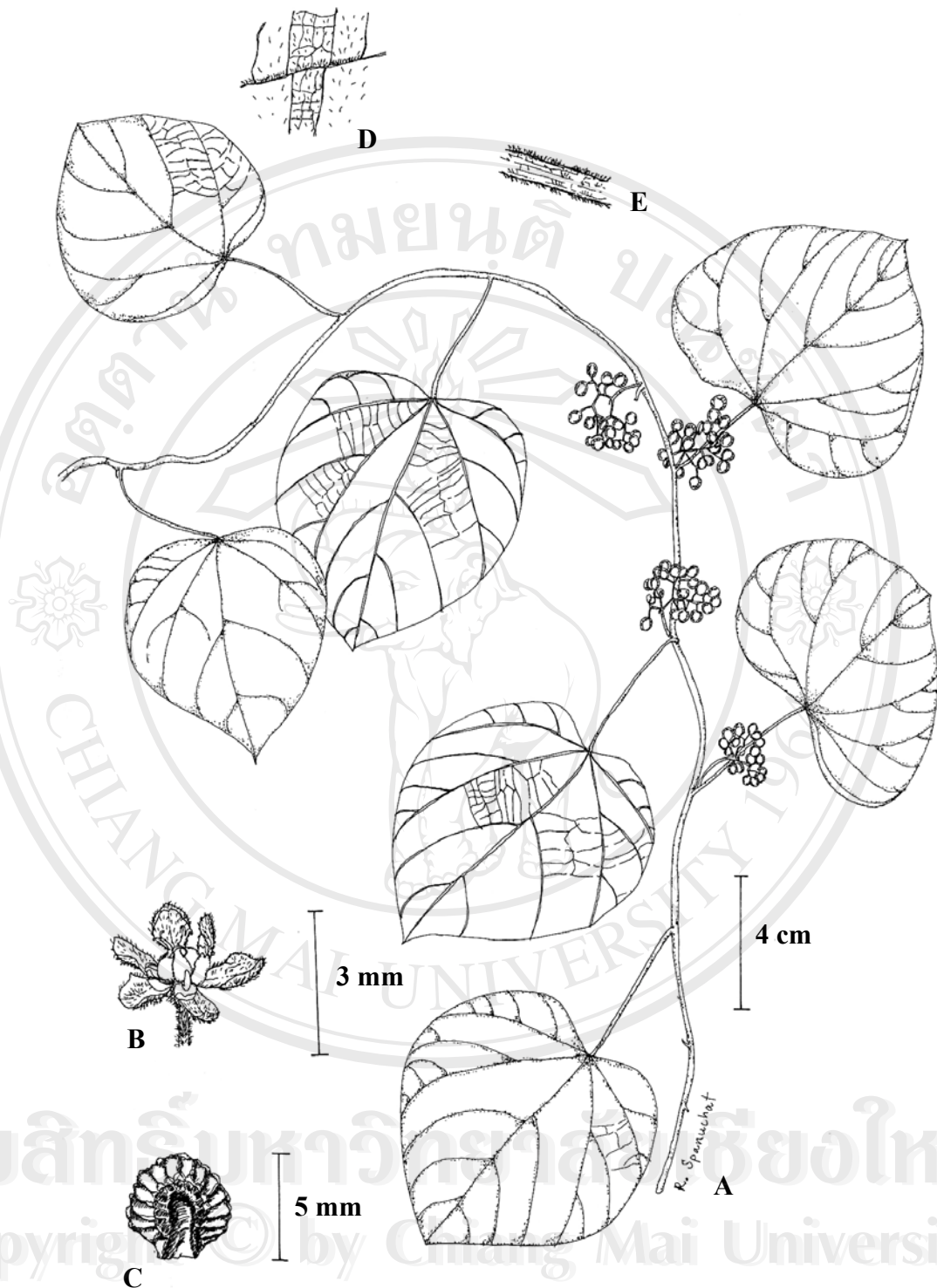


Figure 56. *Pericampylus glaucus* (Lam.) Merr.

A. habit; B. female flower; C. drupe; D. hairs on lower surface of leaf; E young stem.

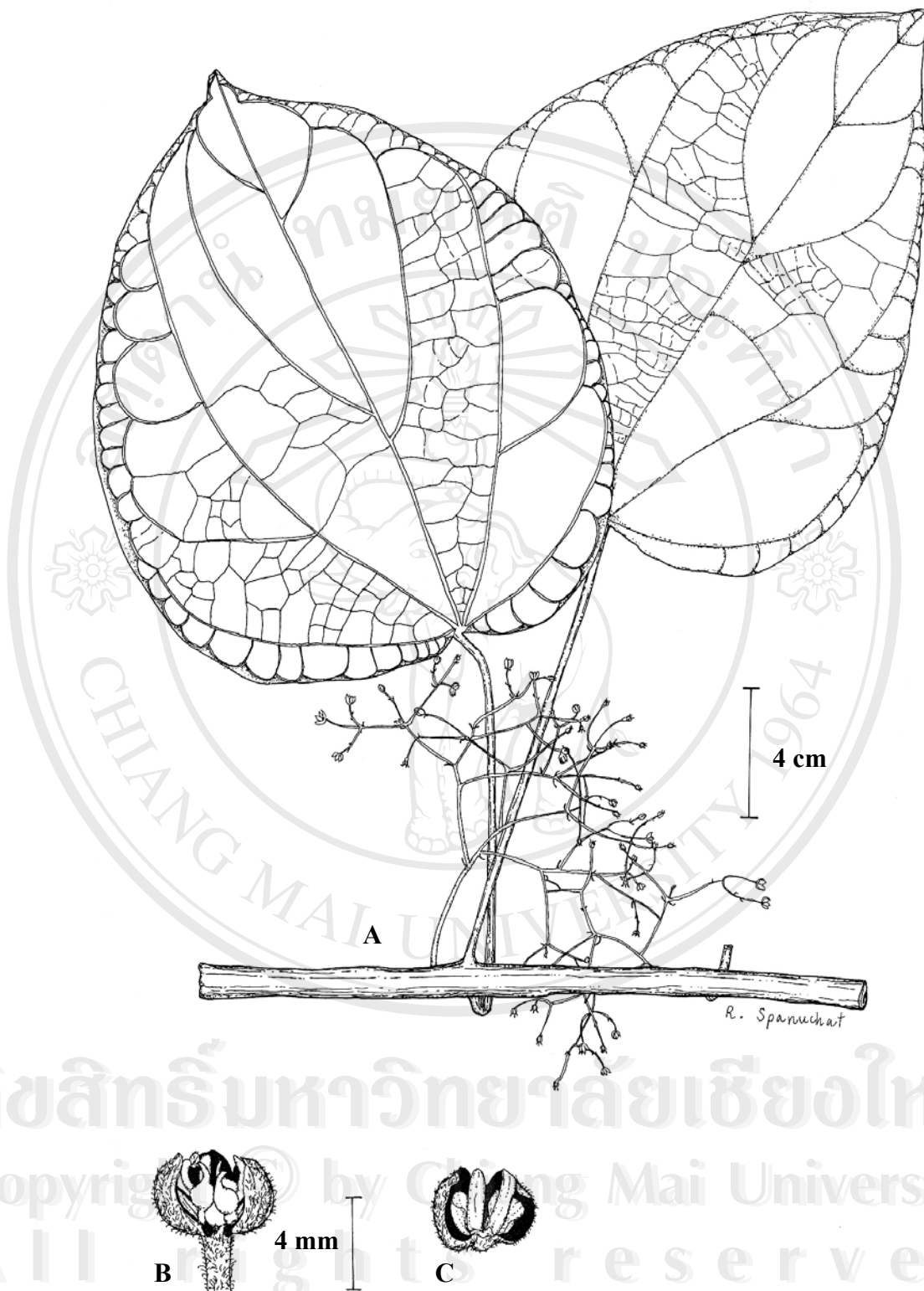


Figure 57. *Pericampylus macrophyllus* Forman

A. habit; B. female flower; C. male flower.

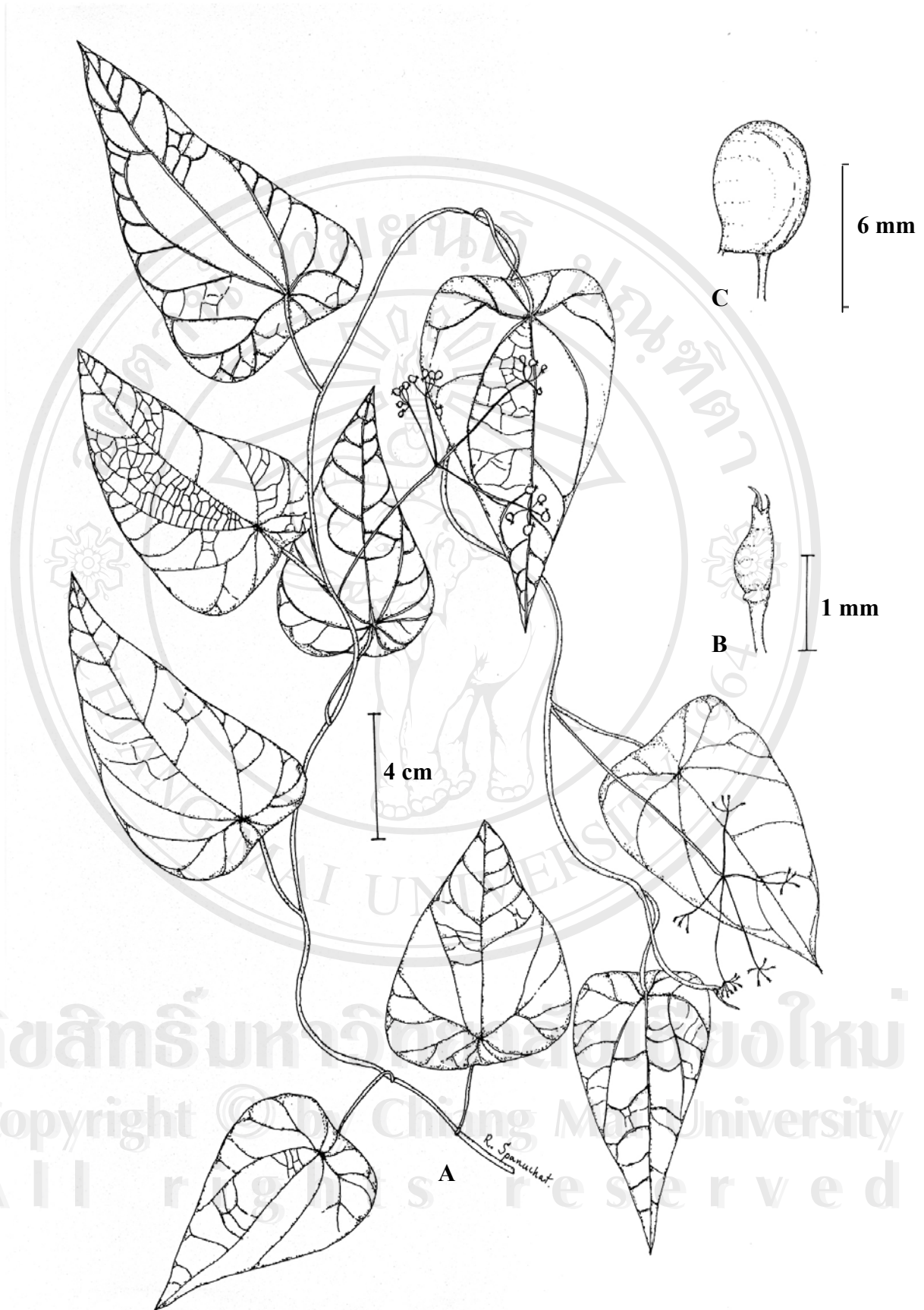


Figure 58. *Stephania elegans* Hook.f. & Thoms.

A. habit; B. pistil; C. drupe.

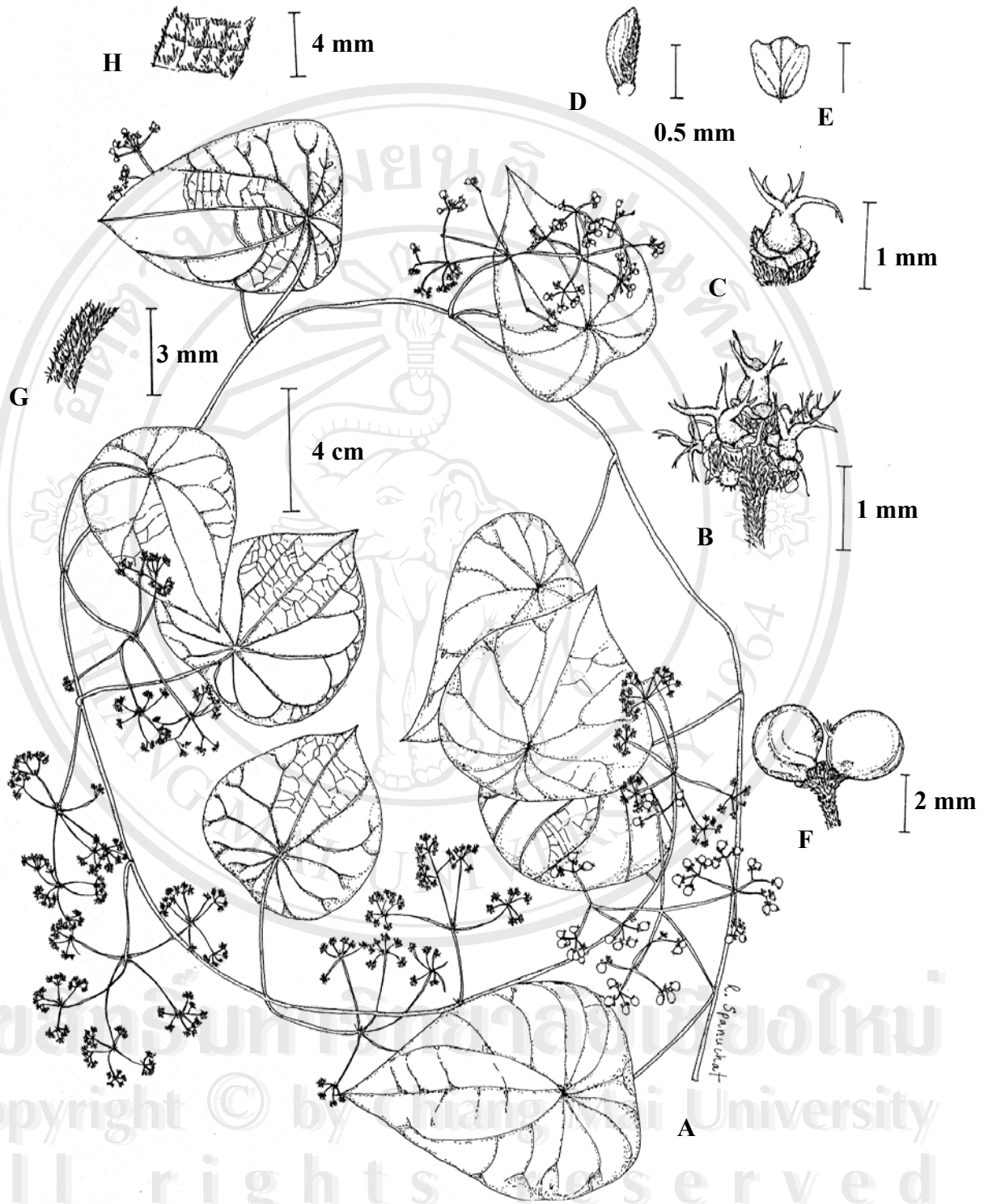


Figure 59. *Stephania japonica* (Thunb.) Miers var. *discolor* (Bl.) Forman

A. habit; B. female inflorescence; C. female flower; D. sepal; E. petal; F. drupe; G. stem; H. hairs on lower surface of leaf.

MORACEAE

Trees, shrubs, herbs or woody climbers, mostly with milky latex, dioecious or monoecious. **Leaves** simple, alternate, rarely opposite; stipules present, enclosing the young buds, caducous and leaving a scar. **Inflorescence** head or syconium (*Ficus* L.), axillary. **Flowers** small, unisexual, actinomorphic. **Sepals** (1-)4-5(-10), basally connate, valvate or imbricate, or absent. **Petals** absent. **Stamens** usually same number as sepals and opposite them; anthers 2-locular, opening by longitudinal slits. **Ovary** inferior or superior; carpels 2(-3) with one often not developed, usually 1-locular; ovule solitary, pendulous from the apex, rarely basal and erect; styles mostly 2, filiform. **Fruit** an achene or drupe, often the whole inflorescence forming a syncarp; sepals and receptacle often becoming fleshy.

Thirty-seven genera and about 1,100 species, worldwide, mainly in tropical, with some representatives in subtropical and temperate regions (Rohwer, 1993b). Ten genera and about 100-110 species in Thailand. Three genera and 10 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|---|--------------------------|
| 1. Inflorescence syconium, completely enclosing the flowers | 1. <i>Ficus</i> |
| 1. Inflorescence not as above | |
| 2. Plants with spines | 2. <i>Maclura</i> |
| 2. Plants without spines | 3. <i>Morus</i> |

1. *FICUS* L.

Sp. Pl.: 1059. 1753; Rohwer in Fam. Gen. Vasc. Pl. 2: 452. 1993.

Trees, shrubs, climbers, stranglers or woody epiphytes, dioecious or monoecious. **Leaves** alternate, rarely opposite or subverticillate. **Inflorescence** syconium, completely enclosing the flowers, axillary or sometimes cauliflorous. **Flowers** with three kinds: staminate, functional pistillate (seed flowers) and sterile pistillate (gall flowers), the latter destined to hatch the larvae of the pollinator. Staminate flowers: sepals 1-6; stamens 1-6; pistillode present or absent. Functional pistillate flowers: sepals 1-8 or absent; styles 2, unequal, or 1. **Fruit** a syncarp, developing mainly from the inflorescence wall.

About 750 species, pantropical, ca. 500 in Asia/Australasia, ca. 150 in the neotropics, ca. 100 in Africa/Madagascar (Rohwer, 1993b). About 80-90 species in Thailand. Eight species recorded from Doi Phu Kha National Park.

1. *Ficus capillipes* Gagnep.

Ecology.— Lower montane forest, alt. 1,400 m (Doi Phu Kha).

Phenology.— Flowering: March-April.

Vernacular.— ขางขาว Khang khao (Lampang).

Voucher specimens.— *P. Srisanga* & *S. Watthana* 670.

2. *Ficus curtipes* Corner

Ecology.— Lower montane scrub, open places among limestone rocks, alt. 1,750 m (Doi Phu Wae).

Phenology.— Flowering: February-April.

Vernacular.— ไฮหลวง Hai luang (Chiang Mai).

Voucher specimens.— *P. Srisanga et al.* 2415.

3. *Ficus heterophylla* L.f.

Ecology.— Dry evergreen and lower montane forest, by streams, alt. 700-1,700 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering and fruiting: Almost throughout the year.

Vernacular.— มะนอคน้ำ Manot nam (Chiang Rai).

Voucher specimens.— *P. Srisanga* 980, 1246, 1674; *P. Srisanga* & *S. Watthana* 651.

4. *Ficus hirta* Vahl

Ecology.— Dry evergreen forest, disturb areas, alt. 900-1,000 m (Nan Watershed).

Phenology.— Flowering and fruiting: Almost throughout the year.

Vernacular.— เดื่อขน Dua khon (Northern).

Voucher specimens.— *P. Srisanga* 301, 309.

5. *Ficus oligodon* Miq.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: June-August.

Vernacular.— เดื่อหัว Dua wa (Northern).

Voucher specimens.— *P. Srisanga* 248.

6. *Ficus parietalis* Bl.

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: April-July.

Vernacular.— มะไฮ Ma hi (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1457.

7. *Ficus subincisa* Buch.-Ham. ex J.E. Sm.

Ecology.— Dry evergreen and lower montane forest, by streams, alt. 600-1,200 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering and fruiting: Almost throughout the year.

Vernacular.— มะน้อยค้ำน้ำ Manot nam (Northern).

Voucher specimens.— *P. Srisanga* 337, 563, 1338, 1582, 1703.

8. *Ficus* sp.

Ecology.— Lower montane forest, alt. 1,500-1,800 m (Doi Phu Kha).

Phenology.— Flowering: November-January.

Voucher specimens.— *P. Srisanga* 1205, 1235, 1295.

2. *MACLURA* Nutt.

Gen. N. Am. Pl. 2: 233. 1818, nom. cons.; Rohwer in Fam. Gen. Vasc. Pl. 2: 446. 1993.

Trees, shrubs or woody climbers, dioecious, armed with straight to curved spines. **Leaves** alternate, penninerved; stipules free, lateral. **Staminate inflorescence** racemose, spicate or globose capitate. **Staminate flowers**: sepals 4, free or basally connate; stamens 4. **Pistillate inflorescence** globose capitate. **Pistillate flowers**: sepals 4, free or connate; ovary free or the lower part adnate to the sepals; stigmas 2, unequal, or 1. **Fruit** a syncarp; sepals and exocarp fleshy, indehiscent.

About 11 species, mainly in tropical region, one in N America (Rohwer, 1993b). About 3-4 species in Thailand. One species recorded from Doi Phu Kha National Park.

Maclura amboinensis Bl.

Ecology.— Lower montane forest and lower montane scrub, alt. 1,500-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: September-December; fruiting: December-April.

Voucher specimens.— *P. Srisanga* 391, 548, 1625, 2643, 2679; *P. Srisanga* & *S. Watthana* 690.

3. *MORUS* L.

Sp. Pl.: 986. 1753; Rohwer in Fam. Gen. Vasc. Pl. 2: 446. 1993.

Trees, dioecious or monoecious, unarmed, deciduous or evergreen. **Leaves** alternate, sometimes lobed, 3-5-nerved at base; stipules free, lateral. **Staminate inflorescence** spicate. **Staminate flowers**: sepals 4, free, imbricate; stamens 4.

Pistillate inflorescence shortly spicate to capitate. **Pistillate flowers:** sepals 4, free; stigmas 2, equal or subequal. **Fruit** a syncarp; sepals and exocarp fleshy, indehiscent.

Between 10-15 species, mainly in temperate and subtropical regions of the N hemisphere (Rohwer, 1993b). About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

Morus macroura Miq.

Ecology.— Dry evergreen and lower montane forest, alt. 700-1,500 m (Doi Phu Kha).

Phenology.— Flowering: November-January; fruiting: February-April; leaves: February-December, leafless only short times before or when flowering.

Uses.— Fruit edible, sweet taste.

Vernacular.— หม่อนหลวง Mon luang, หม่อนฮอก Mon hok (Northern), ไม้มอน Mai mon (Lua-Nan).

Voucher specimens.— *P. Srisanga* 530, 2262, 2386.

MYRICACEAE

Small trees or shrubs, evergreen or deciduous, aromatic. **Leaves** simple, alternate; stipules present or absent. **Inflorescence** in dense catkin or spike. **Flowers** small and inconspicuous, usually unisexual; perianth absent, subtended by bracts. **Male flowers** sometimes provided with a pair of bracteoles; stamens mostly (2-)4(-6); anthers 2-locular, dehiscing by longitudinal slits. **Female flowers** with 2 or more small bracteoles in addition to the bract; gynoecium of 2 carpels forming a unilocular ovary; styles free or united at base; ovule solitary. **Fruit** a drupe or nutlet sometimes enveloped by the accrescent bracteoles.

The family is subcosmopolitan, mostly in temperate to subtropical and tropical montane regions with 3 genera: *Canacomyrca monticola* Guillaumin (New Caledonia), *Comptonia peregrina* (L.) J. Coulter (eastern N America) and *Myrica* L. with about 45-55 species (Kubitzki, 1993c; Mabberley, 1997).

MYRICAL.

Sp. Pl. 2: 1024. 1753; Kubitzki in Fam. Gen. Vasc. Pl. 2: 456. 1993; Larsen in Fl. Thailand 7(2): 268. 2000. — *Morella* Lour., Fl. Cochinch. 2: 548. 1790.

Trees or shrubs. **Leaves** sessile or short petiolated, serrate or pinnatisect, penninerved; usually dotted with yellow glands. Stipules wanting or early caducous. **Inflorescence** axillary. **Flowers** subtended by a bract. **Male flowers** with 2-4(-20) stamens; anthers erect; rudimentary pistil wanting. **Female flowers** without staminodes; ovary sessile; style deeply bifid. **Fruit** a drupe, globose or subglobose.

Only one species in Thailand (Larsen, 2000).

Myrica esculenta Buch.-Ham. ex D. Don

Prodr. Fl. Nepal.: 56. 1825; Larsen in Fl. Thailand 7(2): 268, fig. 9. 2000. – *M. farquhariana* Wall., Tent. Fl. Nep.: 61. 1826. – *M. sapida* Wall., Tent. Fl. Nep.: 59, t. 45. 1826. – *M. longiflora* Teijsm. & Binn. ex Miq., Fl. Ind. Bat. 1, 1: 872. 1858. – *M. lobbii* Teijsm. & Binn. ex Miq., Fl. Ind. Bat. 1, 1: 872. 1858. – *M. auriculata* Ridl., Fl. Mal. Pen. 3: 371. 1924.

Evergreen tree up to 20 m high; young branches usually densely hairy and with scattered yellow glands. **Leaves** subcoriaceous, oblanceolate, 5-17 cm long, 2-5 cm wide, pubescent or almost glabrous and shining on upper surface, and with numerous yellowish glands, particularly on the lower surface; base cuneate; apex usually acute, sometimes rounded; petioles 2-8 mm long, sparsely hairy. **Male inflorescence** erect, rather lax, 3-5 cm long on a short peduncle; stamens 2-4. **Female inflorescence** dense, 4-8 cm long. Both type of inflorescences hairy and with yellow glands. **Drupe** ellipsoid-subglobose, ca. 1 cm in diam., reddish black.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei; South-western: Kanchanaburi; Peninsular: Phangnga, Trang, Satun, Songkhla, Narathiwat.

Distribution.— India, Nepal (type), SE Asia.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: November; fruiting: March-April.

Uses.— Fruit edible, sour taste.

Vernacular.— เสี้ยวไม้ Se kho pho (Karen-Mae Hong Son).

Voucher specimens.— *P. Srisanga* 552, 1864; *P. Srisanga* & *S. Watthana* 658.

MYRSINACEAE

Evergreen trees or shrubs, sometimes woody climbers or undershrubs, rarely herbs. **Leaves** simple, alternate, rarely opposite or subverticillate, usually glandular punctate or with lineolate resin ducts. **Inflorescence** terminal or axillary, generally in fascicles, racemes, corymbs or umbels, simple or compound and forming panicles. **Flowers** bisexual or unisexual (dioecious or polygamo-dioecious), 3-5(-9)-merous. **Sepals** persistent, often glandular punctate. **Corolla** rotate or salverform; lobes mostly connate at base, variously imbricate, convolute or rarely valvate. **Stamens** adnate to the corolla tube and opposite to the lobes, rarely almost free; filaments distinct or sometimes fused into a short tube at base; anthers 2-locular, dehiscing introrsely by longitudinal slits or seldom by apical pores. **Ovary** superior, rarely half-inferior (*Maesa* Forssk.), unilocular, free central or basal placentation; ovules few to numerous. **Fruit** usually a drupe or berry. **Seeds** 1-many.

About 32 genera and more than 1,000 species widely distributed in tropical and subtropical regions of both hemispheres. Seven genera and about 100 species in Thailand (Larsen & Hu, 1996; 2001). Three genera, 17 species and 2 varieties recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Ovary superior. Fruit 1-seeded
 2. Tree, shrub or semi-herbaceous undershrub. Flowers bisexual; stigma punctiform
1. *Ardisia*
 2. Woody climber or straggling shrub. Flowers unisexual or, if bisexual; stigma discoid or ligulate
2. *Embelia*
1. Ovary half-inferior. Fruit many-seeded
3. *Maesa*

1. *ARDISIA* Sw.

Prodr. 3: 48. 1788, nom. cons.; Mez in Pflanzenr. 9: 57. 1902; Larsen & Hu in Fl. Thailand 6(2): 82. 1996; Ståhl & Anderberg in Fam. Gen. Vasc. Pl. 6: 275. 2004. – *Afrardisia* Mez in Pflanzenr. 9: 183. 1902; Ståhl & Anderberg in Fam. Gen. Vasc. Pl. 6: 275. 2004. – *Tetrardisia* Mez in Pflanzenr. 9: 189. 1902; Ståhl & Anderberg in Fam. Gen. Vasc. Pl. 6: 275. 2004.

Trees, shrubs or semi-herbaceous undershrubs, with or without an indumentum, generally all parts with pellucid or coloured glands. **Leaves** alternate, rarely subopposite or subverticillate, entire, crenate or serrate. **Inflorescence** generally racemose, corymbose or subumbellate, simple or compound, rarely flower solitary. **Flowers** bisexual, (4-)5-merous. **Calyx** deeply split or not; lobes valvate or imbricate. **Corolla** tube usually very short; lobes contorted, overlapping to the right in bud. **Stamens** inserted at base of corolla tube; filaments very short; anthers dehiscing by longitudinal slits, very rarely by apical pores. **Ovary** ovoid or pyramidal; style slender; stigma punctiform; ovules few or many, immersed in a globose placenta. **Fruit** a drupe, usually globose, red, purple or black; endocarp bony or crustaceous.

A pantropical genus with about 270 species. About 72 species in Thailand (Larsen & Hu, 1996; 2001). Eight species, one with 2 varieties recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES*

1. Leaves entire
 2. Calyx lobes imbricate at anthesis
1. *A. attenuata*
 2. Calyx lobes spreading at anthesis
6. *A. quinquegona*
1. Leaves crenate with a gland in each marginal sinus
 3. Calyx and corolla distinctly black punctuate
 4. Leaves more or less hairy on lower surface
 5. Leaves sparsely pubescent and then glabrescent on lower surface
2.1. *A. corymbifera* var. *corymbifera*
 5. Leaves villous on lower surface
2.2. *A. corymbifera* var. *euryoides*
 4. Leaves glabrous on both surfaces
 6. Leaves 2-3(-4) cm wide; gland in each marginal sinus generally colourless
3. *A. crenata*

6. Leaves (3-)4-6 cm wide; gland in each marginal sinus generally black

5. *A. polysticta*

3. Calyx and corolla not or scarcely black punctate

7. Gland in each marginal sinus generally black. Venation obscure 4. *A. maculosa*

7. Gland in each marginal sinus generally colourless. Venation distinct 7. *A. sp.*

*8. *Ardisia dawnaea* C.E. Parkinson is excluded, see below.

1. *Ardisia attenuata* Wall. ex A. DC.

Trans. Linn. Soc. 17: 119. 1834; Larsen & Hu in Fl. Thailand 6(2): 129, fig. 73: 1-5. 1996. – *A. garrettii* Fletcher, Kew Bull. 1937: 30. 1937; in Fl. Siam. Enum. 2: 342. 1938. – *A. arborescens* auct. non A. DC.: Walker, Philipp. J. Sci. 3: 57. 1940.

Shrub or small tree, 1.5-5 m high, glabrous; branchlets terete, greyish brown. **Leaves** lanceolate to narrowly elliptic or oblanceolate, chartaceous, (4-)6-12(-15) cm long, 2-4(-5) cm wide, glabrous but with black glandular dots scattered in the areoles of reticulate venation; base cuneate; apex acute to acuminate; margin entire, rarely obscurely denticulate near apex, without marginal glands; primary veins 9-16 pairs; reticulation of veins distinct on lower surface; petioles 5-10 mm long. **Inflorescence** corymbose or subumbellate racemes, 2-8-flowered, in axils of caducous reduced leaves; peduncle 2.5-4.5 cm long; pedicels 1-2 cm long. **Flowers** 5-merous. **Calyx** green, 2-3 mm long, deeply split; lobes broadly ovate, obtuse at apex, dotted with dark glands, imbricate at anthesis; margin scarious, minutely ciliate. **Corolla** pink, thick, waxy; tube 1.5-2 mm long; lobes elliptic-ovate, 4-6 mm long, 3.5-4 mm wide, acute at apex, dotted with purplish or black, rounded and lineolate glands. **Anthers** lanceolate, 4.5-5.5 mm long, acute, punctate on back. **Ovary** glabrous; style 6-7 mm long. **Drupe** globose, 5-6 mm long and wide, densely punctate.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— Myanmar (type), China, Vietnam.

Ecology.— Lower montane forest, sometimes by streams, alt. 1,200-1,600 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: August-September.

Vernacular.— ผักจ้ำ Pak cham, มะก่อง Makong (Northern).

Voucher specimens.— *P. Srisanga* 1335, 1509, 2696.

2.1 *Ardisia corymbifera* Mez var. *corymbifera*

Mez in Pflanzenr. 9: 149. 1902; Fletcher in Fl. Siam. Enum. 2: 339. 1938; Larsen & Hu in Fl. Thailand 6(2): 133. 1996.

Shrub or small tree, 1-3(-5) m high; branchlets pubescent when young. **Leaves** oblong-lanceolate, chartaceous, 8-14 cm long, 2-3 cm wide, glabrous on upper surface, sparsely pubescent and then glabrescent on lower surface; glandular dots

many, black, scattered, chiefly visible on lower surface; base broadly cuneate to obtuse; apex acuminate; margin obscurely crenate with distinct marginal glands; primary veins 15-20 pairs; petioles 5-8 mm long. **Inflorescence** in terminal compound umbellate; peduncle 2-3 cm long; primary rays 1-3 cm long, each bearing 2-4-flowered; pedicels 0.7-1.5 cm long. **Flowers** 5-merous. **Calyx** green, 2.5-3 mm long, deeply split; lobes oblong-ovate, obtuse or acute at apex, glabrous or slightly puberulous outside, dotted with dark glands, spreading at anthesis. **Corolla** pink; tube 2-3 mm long; lobes ovate, 4-5 mm long, acute at apex, dotted with purplish or black glands. **Anthers** ovate to broadly lanceolate, 4-5 mm long, acute, punctate on back. **Ovary** glabrous; style 5-6 mm long. **Drupe** globose, 7-8 mm long and wide, red, black glandular dots.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; South-western: Kanchanaburi.

Distribution.— China (type), Vietnam.

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: September-November.

Vernacular.— ชี้ผักคอกอย Chi puk doi (Northern).

Voucher specimens.— *P. Srisanga* 461.

2.2 *Ardisia corymbifera* Mez var. *euryoides* K. Larsen & C.M. Hu

Nord. J. Bot. 12(3): 311, fig. D-G. 1992; in Fl. Thailand 6(2): 134, fig. 64: 4-7. 1996.

This variety differs from var. *corymbifera* in the indumentum of branchlets and lower surface of leaves persistently covered with villous multicellular hairs.

Thailand.— Northern: Nan, Phitsanulok (type).

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: November-December.

Voucher specimens.— *P. Srisanga* & *S. Watthana* 627.

Notes.— New locality recorded from Nan, in Thailand.

3. *Ardisia crenata* Sims

Curtis' Bot. Mag. 45: Pl. 1950. 1818; Larsen & Hu in Fl. Thailand 6(2): 135, pl. XII: 2. 1996. — *A. crenata* Roxb. (Hort. Beng.: 85. 1814, nom. nud.) Fl. Ind. ed. Carey 2: 276. 1824. — *A. crispa* A. DC., Trans. Linn. Soc. 17: 124. 1834; Fletcher in Fl. Siam. Enum. 2: 339. 1938, p.p. maj., excl. specim. *Kerr* 6059.

Shrub, 1-3 m high; branchlets terete or slightly angular, glabrous. **Leaves** oblong-lanceolate to oblanceolate, chartaceous to subcoriaceous, 6-15 cm long, 2-3(-4) cm wide, glabrous on both surfaces; glandular dots many, black or sometimes colourless, scattered, chiefly visible on lower surface; base cuneate; apex acuminate;

margin crenate with distinct marginal glands, generally colourless; primary veins 12-18 pairs; petioles 4-10 mm long. **Inflorescence** in terminal subumbellate or corymbose, simple or compound, glabrous or puberulous; peduncle 1-2 cm long; primary rays 1.5-3 cm long, each bearing 2-4-flowered; pedicels 0.7-1.5 cm long. **Flowers** 5-merous. **Calyx** green, 2.5-3 mm long, deeply split; lobes ovate, obtuse or acute at apex, dotted with dark glands, spreading at anthesis. **Corolla** pink, thick, waxy; tube 1-2 mm long; lobes ovate, 3-4 mm long, acute at apex, dotted with purplish or black glands. **Anthers** lanceolate, 3-4 mm long, acute, punctate on back. **Ovary** glabrous; style 5-6 mm long. **Drupe** globose, 6-8 mm long and wide, red, black glandular dots.

Thailand.— Almost throughout the country.

Distribution.— India, S China, Japan, SE Asia.

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: April-May; fruiting: September-November.

Uses.— Ornamental plants.

Vernacular.— ตาไก่ใบกว้าง Ta kai bai kwang (General).

Voucher specimens.— *P. Srisanga* & *S. Watthana* 693.

4. *Ardisia maculosa* Mez

In Pflanzenr. 9: 146. 1902; Fletcher in Fl. Siam. Enum. 2: 345. 1938; Larsen & Hu in Fl. Thailand 6(2): 138, fig. 76: 1-4. 1996. — *A. crispata* auct. non A. DC.: Fletcher in Fl. Siam. Enum. 2:339. 1938, p.p. quoad specim. *Kerr* 6059.

Shrub, 1-2.5 m high; branchlets terete or slightly angular, glabrous or glabrescent. **Leaves** oblong-lanceolate to elliptic, chartaceous, 10-19 cm long, 3-6 cm wide, glabrous on both surfaces; glandular dots many, generally colourless, scattered; base cuneate, slightly oblique; apex acuminate; margin undulate crenate with distinct marginal glands, generally black; primary veins 10-16 pairs; venation obscure; petioles 6-10 mm long. **Inflorescence** in terminal compound umbellate, covered with ferruginous short hairs; peduncle 5-10mm long; primary rays 1-3 cm long, each bearing 3-7-flowered; pedicels 1-1.5 cm long. **Flowers** 5-merous. **Calyx** green, 2-3 mm long, deeply split; lobes ovate, glabrous, acute to obtuse at apex, generally not punctate, rarely with 1-2 brown glandular dots, spreading at anthesis. **Corolla** pink; tube ca. 1 mm long; lobes ovate-lanceolate, 4-5 mm long, acute at apex, usually without coloured glandular dots. **Anthers** lanceolate, 3-4 mm long, usually not punctate. **Ovary** glabrous; style 5-6 mm long. **Drupe** globose, 7-9 mm long and wide, red.

Thailand.— Northern: Chiang Mai, Lamphun, Nan; North-eastern: Phetchabun; South-western: Kanchanaburi.

Distribution.— Myanmar, China (type), Vietnam.

Ecology.— Dry evergreen and lower montane forest; alt. 890-1,700 m (Doi Phu Kha).

Phenology.— Flowering: May-July; fruiting: May-January.

Vernacular.— จำเขือ Cham khrua (Lamphun).

Voucher specimens.— *P. Srisanga* 1265, 1430, 1456, 1667, 1731; *P. Srisanga et al.* 819, 823.

5. *Ardisia polysticta* Miq.

Fl. Ind. Bat. Suppl. 1; 576. 1861; Hu, *Blumea* 44(2): 395. 1999. — *A. virens* Kurz, For. Fl. Burma 2: 575. 1877; Fletcher in Fl. Siam. Enum. 2: 351. 1938; Larsen & Hu in Fl. Thailand 6(2): 134. 1996. — *A. lenticellata* Fletcher, Kew Bull. 1937: 32. 1937; in Fl. Siam. Enum. 2: 344. 1938.

Shrub, 2-4 m high; branchlets terete or obtusely quadrangular, glabrous. **Leaves** oblanceolate to elliptic, chartaceous to subcoriaceous, 8-18 cm long, (3-)4-6 cm wide, glabrous on both surfaces; glandular dots many, black, scattered, chiefly visible on lower surface; base cuneate; apex acuminate; margin crenate with distinct marginal glands, generally black; primary veins 15-20 pairs; petioles 7-13 mm long. **Inflorescence** in terminal compound subumbellate or corymbose, glabrous; peduncle 1-2 cm long; primary rays 3-7 cm long, each bearing 4-8-flowered; pedicels 1-2 cm long. **Flowers** 5-merous. **Calyx** green, 2.5-3.5 mm long, deeply split; lobes oblong-ovate, obtuse at apex, dotted with dark glands, spreading at anthesis. **Corolla** pink; tube 1-2 mm long; lobes ovate, 4-5 mm long, acute or obtuse at apex, dotted with purplish or black glands. **Anthers** ovate-lanceolate, 4.5-5 mm long, acute, punctate on back. **Ovary** glabrous; style 5-6 mm long. **Drupe** globose, 7-9 mm long and wide, red, black glandular dots.

Thailand.— Almost throughout the country.

Distribution.— India (Assam-type), S China, SE Asia.

Ecology.— Lower montane forest, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering: May-July; fruiting: October-December.

Vernacular.— จำขาว Cham khao, ตาน่านเขือ Ta han khao (Chiang Mai).

Voucher specimens.— *P. Srisanga* 2198.

6. *Ardisia quinquegona* Bl.

Bijdr.: 689. 1826; Larsen & Hu in Fl. Thailand 6(2): 91. 1996.

Shrub, 1-3 m high, glabrous; branchlets terete, young parts densely covered with rusty scales. **Leaves** lanceolate, chartaceous, 5-11 cm long, 1-3 cm wide, glabrous on both surfaces, generally covered with rusty scales on lower surfaces; base cuneate; apex acuminate; margin entire; primary veins numerous, fine, parallel, meeting in an intramarginal vein near edge; petioles 3-7 mm long. **Inflorescence** cymose or subumbellate, lateral or pseudoterminal, 2-12-flowered; peduncle 5-15 mm long; pedicels 4-8 mm long. **Flowers** 5-merous. **Calyx** green, 1-2 mm long, deeply split; lobes triangular-ovate, acute at apex, dotted with dark glands, spreading at anthesis, minutely ciliate. **Corolla** pink; tube 0.5-1 mm long; lobes elliptic-ovate, 3-4

mm long, acute at apex, dotted with black glands. **Anthers** ovate, 2-2.5 mm long, acute, punctate on back. **Ovary** glabrous; style 3-4 mm long. **Drupe** globose, 6-7 mm long and wide, black.

Thailand.— Northern: Nan; North-eastern: Loei, Phetchabun; Eastern: Nakhon Ratchasima; South-eastern: Chanthaburi; Peninsular: Surat Thani.

Distribution.— China (type), Vietnam.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: July-August; fruiting: April-May.

Vernacular.— ตีนจ้ำดง Tin cham dong (Phetchabun).

Voucher specimens.— *P. Srisanga* 968; *P. Srisanga* & *S. Watthana* 698, 699; *P. Srisanga* & *C. Maknoi* 2045.

7. *Ardisia* sp.

Shrub, 1-2 m high; branchlets terete or slightly angular, glabrous or glabrescent. **Leaves** elliptic, membranous, 13-19 cm long, 5-7 cm wide, glabrous on both surfaces; glandular dots many, generally black, scattered; base cuneate, slightly oblique; apex acuminate; margin undulate crenate with distinct marginal glands, generally colourless; primary veins 14-20 pairs, parallel; venation distinct; petioles 6-12 mm long. **Flowers** not known. **Infructescence** in terminal compound umbellate; peduncle 7-13 mm long; primary rays 1-3 cm long, each bearing 3-7-fruited; fruiting pedicels 1.5-2.5 cm long. Fruiting calyx ca. 3 mm long, deeply split; lobes triangular-lanceolate, glabrous, acute at apex, scarcely punctate. **Drupe** globose, 7-9 mm long and wide, red.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest; alt. 1,700 m (Doi Phu Kha).

Phenology.— Fruiting: November-January.

Voucher specimens.— *P. Srisanga* 381.

Notes.— Due to lacking the flower materials, the affinity is uncertain.

8. *Ardisia dawnaea* C.E. Parkinson

Ind. Forest. 60: 226. 1934; Larsen & Hu, Nord. J. Bot. 21(2): 147. 2001.

This species, previously known only from Myanmar, is recently recorded for Thailand from Doi Phu Kha, Nan by Larsen & Hu (2001). The first publication nor voucher specimens cited (*Larsen et al.* 43708 (AAU)) could not be traced. Thus, the description is omitted.

Thailand.— Northern: Nan.

Distribution.— Myanmar (type).

Ecology.— Lower montane forest (Doi Phu Kha).

2. *EMBELIA* Burm.f.

Fl. Ind.: 62, pl. 23. 1768, nom. cons.; Mez in Pflanzenr. 9: 295. 1902; Larsen & Hu in Fl. Thailand 6(2): 152. 1996; Ståhl & Anderberg in Fam. Gen. Vasc. Pl. 6: 273. 2004. – *Ribesoides* L., Fl. Zeyl.: 190. 1747. – *Samara* L., Mant. Pl. ed. 2: 144. 1771. – *Calispermum* Lour., Fl. Cochinch. 1: 156. 1790. – *Choripetalum* A. DC., Trans. Linn. Soc. 17: 131. 1834.

Woody climbers or straggling shrubs, very rarely erect or arborescent. **Leaves** alternate, entire or serrate. **Inflorescence** terminal or lateral, paniculate, racemose or subumbellate. **Flowers** generally unisexual (plant dioecious or polygamo-dioecious), 4-5-merous. **Calyx** and **corolla** deeply lobed; lobes free or shortly united at base, imbricate or quincuncial. **Stamens** usually adnate to corolla, rarely free; filaments distinct, slender; anthers opening by longitudinal slits. **Ovary** often pilose; style cylindrical; stigma discoid or ligulate. **Fruit** a drupe, 1-seeded, with crustaceous or rarely bony endocarp.

A pantropical genus with about 130 species (Ståhl & Anderberg, 2004b). Thirteen species in Thailand (Larsen & Hu, 1996). Five species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|------------------------------------|
| 1. Leaves distichous, 1.5-4 cm long. Inflorescence less than 1 cm long | 1. <i>E. pulchella</i> |
| 1. Leaves not distichous, much larger. Inflorescence longer than 1 cm long | |
| 2. Leaves glabrous or nearly so | |
| 3. Inflorescence racemose, lateral | |
| 4. Inflorescence puberulous | 2. <i>E. scandens</i> |
| 4. Inflorescence glandular granulose | 5. <i>E. undulata</i> |
| 3. Inflorescence paniculate, terminal | 3. <i>E. sessiliflora</i> |
| 2. Leaves distinctly villous or tomentose | 4. <i>E. tsjeriamcottam</i> |

1. *Embelia pulchella* Mez

In Pflanzenr. 9: 324. 1902; Fletcher in Fl. Siam. Enum. 2: 332. 1938; Larsen & Hu in Fl. Thailand 6(2): 156. 1996. – *E. disticha* Fletcher, Kew Bull. 1936: 45. 1936; in Fl. Siam. Enum. 2: 331. 1938.

Scandent shrub or climber, up to 3 m long; branchlets slender, generally distichous, densely ferruginous villous. **Leaves** distichous, oblong to lanceolate, chartaceous, 1.5-4 cm long, 0.7-1.3 cm wide, glabrous on both surfaces, except puberulous on midrib, densely dotted with dark glands on lower surface; base broadly obtuse to truncate or subcordate, slightly oblique; apex acute to obtuse; margin entire; petioles 1-2 mm long, villous. **Inflorescence** axillary, subumbellate or cymose, 2-5 mm long, 5-7-flowered. **Flowers** 5-merous, 2-2.5 mm long; pedicels 1-3 mm long, ferruginous pubescent. **Calyx** ca. 1 mm long, deeply split; lobes oblong-ovate or oblong-lanceolate, ciliate, pubescent outside, punctate near apex. **Corolla** white or

yellowish, shortly united at base, ovate or oblong, 1-2 mm long, obtuse at apex, puberulous outside, densely papillose inside. **Stamens** adnate almost to middle of corolla lobes; anthers elliptic to ovate, punctate on back. **Ovary** 0.5-1 mm long, pubescent; style ca 0.5 mm long. **Drupe** globose, 4-5 mm long and wide, pubescent, punctate.

Thailand.— Northern: Chiang Mai, Nan (Doi Phu Kha-type of *E. disticha*: Kerr 4922); Eastern: Nakhon Ratchasima.

Distribution.— India (type), Myanmar, China.

Ecology.— Lower montane forest; alt. 1,600-1,700 m. (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: August-November.

Vernacular.— ยานี้อด Ya pot (Nan).

Voucher specimens.— *P. Srisanga & C. Maknoi* 2012.

2. *Embelia scandens* (Lour.) Mez

In Pflanzenr. 9: 317. 1902; Larsen & Hu in Fl. Thailand 6(2): 158, fig. 79: 1-2. 1996. – *Calispermum scandens* Lour., Fl. Cochinch. 1: 156. 1790. – *Embelia* sp. Fletcher in Fl. Siam. Enum. 2: 334. 1938.

Straggling shrub or woody climber, 2-5(-8) m long; branchlets slender, glabrous, lenticellate. **Leaves** lanceolate to narrowly elliptic, rigidly chartaceous, 7-14 cm long, 2-5 cm wide, glabrous on both surfaces; base broadly cuneate; apex acute to acuminate, tip blunt; margin entire or obscurely and remotely serrate near apex; primary veins 7-11 pairs; petioles 5-10 mm long, canaliculate. **Inflorescence** in axillary raceme, 1-5 cm long, puberulous. **Flowers** (4-)5-merous; pedicels 2-3 mm long, puberulous. **Calyx** 0.75-1 mm long, split to middle; lobes triangular-ovate, puberulous outside, glandular punctate. **Corolla** green, free or shortly united at base, oblong, 2.5-3 mm long, rounded or obtuse at apex, glabrous outside, densely papillose inside, glandular punctate. **Stamens** adnate to the base of corolla lobes; filaments 2-2.25 mm long; anthers ovate, ca. 0.5 mm long. **Ovary** pear-shaped, glabrous; style ca 0.5 mm long, curved; stigma capitate. **Drupe** globose, 4-5 mm long and wide.

Thailand.— Northern: Nan; Eastern: Chaiyaphum, Nakhon Ratchasima.

Distribution.— China, Vietnam (type).

Ecology.— Dry evergreen forest, by streams; alt. 800-900 m. (Doi Phu Kha).

Phenology.— Flowering: December-February; fruiting: March-May.

Voucher specimens.— *P. Srisanga* 2722.

Notes.— New locality recorded from Nan, in Thailand.

3. *Embelia sessiliflora* Kurz

J. As. Soc. Beng. 40: 66. 1871; Fletcher in Fl. Siam. Enum. 2: 332. 1938; Larsen & Hu in Fl. Thailand 6(2): 155. 1996. – *E. stricta* Craib, Kew Bull. 1911: 407. 1911; Fletcher in Fl. Siam. Enum. 2: 333. 1938.

Scandent shrub or climber, 3-6 m long; branchlets slender, light brown, minutely puberulous when young, rapidly becoming glabrous. **Leaves** lanceolate to narrowly elliptic, chartaceous or subcoriaceous, 5-10 cm long, 2-4 cm wide, glabrous on both surfaces; base rounded to cuneate; apex broadly cuneate, tip blunt; margin entire, slightly recurved; primary veins 18-27 pairs; petioles 3-8 mm long, canaliculate. **Inflorescence** in terminal panicle, 10-15 cm long, much branched, densely puberulous. **Flowers** 5-merous, sessile or subsessile. **Calyx** ca. 0.75 mm long, split to middle; lobes ovate, acute at apex, papillose, distinctly ciliate. **Corolla** greenish or white; lobes free, narrowly elliptic, 1.5-2.5 mm long, obtuse at apex, densely papillose on both sides. **Stamens** adnate to middle of corolla lobes; filaments 0.5-0.75 mm long; anthers ovoid, 0.5-0.75 mm long. **Ovary** glabrous; style short; stigma capitate. **Drupe** globose, 4-5 mm long and wide, wrinkled when dry.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Lamphun, Nan.

Distribution.— India, Myanmar (type), China, Vietnam.

Ecology.— Dry evergreen and lower montane forest, alt. 900-1,400 m (Doi Phu Kha).

Phenology.— Flowering: March-September; fruiting: April-June.

Vernacular. — มะขาม Ma khui (Chiang Mai).

Voucher specimens.— *P. Srisanga* 595, 1709; *P. Srisanga* & *S. Watthana* 680.

4. *Embelia tsjeriamcottam* (Roem. & Schult.) A. DC.

Trans. Linn. Soc. 17: 131. 1834; Larsen & Hu in Fl. Thailand 6(2): 157. 1996. – *Ardisia tsjeriamcottam* Roem. & Schult., Syst. Veg. 5: 518. 1819. – *Embelia robusta* Roxb. (Hort. Beng.: 16. 1814, nom. nud.) Fl. Ind. ed. Carey 2: 287. 1824. – *E. villosa* Wall. in Roxb., Fl. Ind. ed. Carey 2: 289. 1824; Fletcher in Fl. Siam. Enum. 2: 333. 1938.

Large straggling shrub or arborescent, up to 5 m high; branchlets covered with soft rusty brown villous or velvety tomentose indumentum, lenticellate. **Leaves** elliptic to obovate, chartaceous, 3.5-12 cm long, 2-5 cm wide, puberulous on upper surface, densely to sparsely ferruginous villous or tomentose on lower surface; base obtuse to cuneate; apex rounded, obtuse to broadly acute, tip blunt; margin entire or minutely and remotely dentate near apex; primary veins 6-8 pairs; reticulation of secondary veins usually visible on the lower surface; petioles 4-10 mm, ferruginous villous or tomentose. **Inflorescence** axillary, racemose, solitary or 2-3-clustered, ferruginous villous or tomentose; the male usually longer, 4-13 cm long, occasionally paniculate; the female ones shorter 1-5(-7) cm. **Flowers** 4-5-merous; pedicels 1-2 mm long, ferruginous villous or tomentose. **Calyx** ca. 1 mm long, deeply split; lobes lanceolate, acute at apex, densely puberulous outside. **Corolla** green, slightly connate at base; lobes lanceolate to oblong-lanceolate, 2-3 mm long, obtuse at apex, puberulous outside, densely papillose inside, dotted with small black glands. **Stamens** adnate to the base of corolla lobes; filaments 0.5-1 mm long; anthers ovate, ca. 0.5 mm long. **Ovary** glabrous; style ca. 1 mm long. **Drupe** globose, 4-5 mm long and wide, wrinkled when dry.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Lamphun, Nan, Phitsanulok, Nakhon Sawan, Tak; North-eastern: Phetchabun, Khon Kaen; Eastern: Chaiyaphum; South-eastern: Chon Buri; South-western: Kanchanaburi, Ratchaburi, Phetchaburi.

Distribution.— Nepal, India, Sri Lanka, Myanmar, Laos, Vietnam.

Ecology.— Dry evergreen and lower montane forest, open areas; alt. 1,000-1,300 m (Doi Phu Wae, Baan Huay Pud).

Phenology.— Flowering: June-July; fruiting: August-October.

Vernacular.— ขางแดง Khang daeng (Northern).

Voucher specimens.— *P. Srisanga et al.* 890, 895.

5. *Embelia undulata* (Wall.) Mez

In Pflanzenr. 9: 327. 1902. — *Myrsine undulata* Wall. in Roxb., Fl. Ind. ed. Carey 2: 299. 1824.

Scandent shrub or woody climber, 2-5(-8) m long; branchlets glabrous, lenticellate. **Leaves** elliptic to narrowly obovate, chartaceous to subcoriaceous, (4.5-) 7-11.5(-14) cm long, (2.5-)3.5-5(-7) cm wide, glabrous on both surfaces; base cuneate or subrounded; apex acute; margin entire; primary veins 8-15(-18) pairs, with some short intermediates; petioles 5-10 mm long, glabrous, canaliculate. **Inflorescence** in axillary raceme, 1-2 cm long, glandular granulose. **Flowers** 4-merous; pedicels 2.5-3 mm long, glandular granulose. **Calyx** 0.75-1 mm long, connate at base; lobes broadly ovate to orbicular, glabrous to sparsely glandular granulose, punctate. **Corolla** pale green, free, elliptic to ovate, 2.5-3.5 mm long, rounded or obtuse at apex, glabrous to sparsely glandular granulose outside, densely glandular granulose inside, glandular punctate. **Stamens** adnate to the base of corolla lobes; filaments 1-2 mm long; anthers oblong, 0.75-1 mm long. **Ovary** globose, glabrous; style straight; stigma capitate. **Drupe** globose, 8-10 mm long and wide (Fig. 60).

Thailand.— Northern: Nan.

Distribution.— India (type), China, Vietnam.

Ecology.— Lower montane forest; alt. 1,500-1,600 m. (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: October-December.

Voucher specimens.— *P. Srisanga* 1360.

Notes.— New locality recorded from Nan, in Thailand.

3. *MAESA* Forssk.

Fl. Aegypt.-Arab.: 66. 1775; Mez in Pflanzenr. 9: 15. 1902; Larsen & Hu in Fl. Thailand 6(2): 167. 1996; Ståhl & Anderberg in Fam. Gen. Vasc. Pl. 6: 255. 2004.

Erect or straggling shrubs. **Leaves** alternate, frequently with glandular striations at teeth. **Inflorescence** axillary or terminal, racemose or paniculate. **Flowers** (4-)5-merous, bisexual or unisexual, subtended by a pair of bracteoles on

pedicels or at base of calyx. **Calyx** tube adnate halfway to ovary; lobes valvate, persistent. **Corolla** white or light yellow, campanulate or rarely urceolate, connate at base or sometimes beyond middle; lobes imbricate or quincuncial, glandular lined. **Stamens** adnate to corolla tube, included; anthers ovate or reniform, about equaling the filaments, opening by longitudinal slits. **Ovary** half-inferior, with ovules immersed in a globose central placenta; style cylindrical; stigma capitate or shortly 3-5-lobed. **Fruit** a berry, many-seeded, subglobose.

About 150 species in tropical and subtropical regions of the Old World. Recently, the genus has been raised as their own monogeneric family, Maesaceae (Ståhl & Anderberg, 2004a). Ten species in Thailand (Larsen & Hu, 1996). Four species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Inflorescence or infructescence shorter than petioles. Corolla tube longer than lobes
 2. Leaves oblong, lanceolate to elliptic. Branchlets, petioles, leaves underneath and calyx sparsely puberulous. Petioles 1-2 cm long **1. *M. glomerata***
 2. Leaves broadly elliptic, ovate to obovate. Branchlets, petioles, leaves underneath and calyx more pilose or hirsute. Petioles 2-3.5 cm long **3. *M. permollis***
1. Inflorescence or infructescence longer than petioles. Corolla tube as long as lobes
 3. Leaves coarsely serrate except for a short distance near base. Inflorescence raceme or 2-3-branched panicle **2. *M. perlaricus***
 3. Leaves entire or nearly so. Inflorescence much branched panicle **4. *M. ramentacea***

1. *Maesa glomerata* K. Larsen & C.M. Hu

Nord. J. Bot. 11(1): 78, fig. 11: 4-6. 1991; in Fl. Thailand 6(2): 170, fig. 81: 4-6. 1996.

Shrub or small tree, 2-5 m high; branchlets sparsely puberulous. **Leaves** oblong, lanceolate to elliptic, rigidly chartaceous, 8-17 cm long, 3-7.5 cm wide, glabrescent on upper surface, sparsely puberulous on lower surface, glabrescent later except along midrib and veins; base rounded to cuneate; apex acuminate; margin coarsely serrate except for a short distance near base; primary veins 8-12 pairs; reticulation invisible; petioles 1-2 cm long, sparsely puberulous. **Inflorescence** crowded panicle, axillary, many-flowered, 0.5-2 cm long, puberulous. **Flowers** 5-merous; pedicels 0.5-1 mm long. **Calyx** 1.5-2 mm long, puberulous; lobes triangular, ca. 0.5 mm long. **Corolla** white, 2-2.5 mm long; lobes broadly ovate to suborbicular, 0.5-1 mm long. **Ovary** glabrous; style ca. 0.5 mm long; stigma slightly 3-4-lobed. **Fruit** not known.

Thailand.— Northern: Chiang Mai (type), Nan.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering: February-March.

Vernacular.— บ่าบุกตันเดี้ยว Ba buk ton diao (Northern).

Voucher specimens.— *P. Srisanga* 534.

2. *Maesa perlarius* (Lour.) Merr.

Amer. Philos. Soc. n. ser. 24: 298. 1935; Larsen & Hu in Fl. Thailand 6(2): 173. 1996. – *Dartus perlarius* Lour., Fl. Cochinch. 1: 124. 1790. – *Maesa sinensis* A. DC., Ann. Sci. Nat. ser. 2. 16: 80. 1841; Fletcher in Fl. Siam. Enum. 2: 328. 1938. – *M. tonkinensis* Mez in Pflanzenr. 9: 34. 1902.

Shrub or small tree, 3-5 m high; branchlets hirsute or puberulous. **Leaves** lanceolate to elliptic, chartaceous, 7-17 cm long, 3-5 cm wide, glabrescent on upper surface except puberulous along midrib and veins, sparsely puberulous and then rapidly glabrescent on lower surface; base cuneate, slightly oblique; apex acuminate; margin coarsely serrate except for a short distance near base; primary veins 8-12 pairs; reticulation invisible; petioles 7-10 mm long, puberulous. **Inflorescence** raceme or 2-3-branched panicle, axillary, many-flowered, 1.5-3.5 cm long, puberulous. **Flowers** 5-merous; pedicels 1-1.5 mm long. **Calyx** ca. 1 mm long, puberulous; lobes triangular, about as long as tube. **Corolla** white, 2-2.5 mm long; lobes broadly ovate to suborbicular, about as long as tube. **Ovary** glabrous; style 0.5-0.75 mm long; stigma obscurely 4-lobed. **Fruit** globose, 4-5 mm long and wide, orange.

Thailand.— Northern: Chiang Mai, Nan; South-western: Prachuap Khiri Khan.
Distribution.— China, Vietnam (type).

Ecology.— Lower montane forest, sometimes in open areas and along roadsides, alt. 1,400-1,800 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: November-January.

Voucher specimens.— *P. Srisanga* 466, 1734, 2317, 2708; *P. Srisanga et al.* 230.

3. *Maesa permollis* Kurz

J. As. Soc. Beng. 11: 66. 1871; Fletcher in Fl. Siam. Enum. 2: 327. 1938; Larsen & Hu in Fl. Thailand 6(2): 170. 1996. – *M. mollissima* auct. non Wall., nec A. DC.: Kurz, For. Fl. Burma 2: 100. 1877. – *M. mollis* auct. non A. DC.: C.B. Clarke in Fl. Br. Ind. 3: 510. 1882.

Shrub, 0.5-3 m high; branchlets rufous pilose or hirsute. **Leaves** broadly elliptic, ovate to obovate, chartaceous, (7-)12-22(-30) cm long, (4-)8-13(16) cm wide, glabrous or glabrescent on upper surface, pilose or hirsute on lower surface; base broadly cuneate to subrounded; apex abruptly and shortly acuminate; margin coarsely dentate; primary veins 7-10 pairs; reticulation invisible; petioles 2-3.5 cm long, pilose or hirsute. **Inflorescence** crowded panicle, axillary, dense-flowered, 1-2.5 cm long, pilose or hirsute. **Flowers** 5-merous; pedicels 1-2 mm long. **Calyx** 1.5-2 mm long, pilose or hirsute; lobes triangular, ca. 0.5-0.75 mm long. **Corolla** white or creamy

yellow, 1.5-2 mm long; lobes suborbicular, 0.75-1 mm long. **Ovary** hirsute; style 0.75-1 mm long; stigma 3-5-lobed. **Fruit** ovoid to subglobose, 4-6 mm long, orange.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan, Tak; South-western: Kanchanaburi.

Distribution.— Myanmar (type), China, Laos, Vietnam.

Ecology.— Lower montane forest, sometimes in open areas and along roadsides, alt. 1,400-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: November-March.

Vernacular.— กำลังช้างเผือก Kam lang chang phueak (Chiang Mai).

Voucher specimens.— *P. Srisanga* 570, 1328, 1344, 2216, 2219.

4. *Maesa ramentacea* (Roxb.) A. DC.

Prodr. 8: 77. 1844; Fletcher in Fl. Siam. Enum. 2: 327. 1938; Larsen & Hu in Fl. Thailand 6(2): 171, pl. XV: 1. 1996. – *Baeobotrys ramentacea* Roxb. (Hort. Beng.: 16. 1814, nom. nud.) Fl. Ind. ed. Carey 2: 231. 1824.

Shrub or small tree, 3-6 m high; branchlets glabrous. **Leaves** lanceolate to elliptic, chartaceous, 7-16 cm long, 2-5 cm wide, glabrous on both surfaces; base cuneate to broadly obtuse; apex acuminate to long acuminate; margin entire or nearly so; primary veins 5-8 pairs; reticulation invisible; petioles 6-10 mm long, glabrous. **Inflorescence** much-branched panicle, axillary or subterminal, many-flowered, 4-12 cm long, glabrous or puberulous. **Flowers** 5-merous; pedicels 0.5-1 mm long. **Calyx** 0.75-1 mm long, glabrous or puberulous; lobes ovate, about as long as tube. **Corolla** white, ca. 1.5 mm long; lobes suborbicular, about as long as tube. **Ovary** glabrous; stigma obscurely 4-lobed. **Fruit** globose, 3-4 mm long and wide, yellowish orange.

Thailand.— Almost throughout the country.

Distribution.— India (type), Bangladesh, China, SE Asia.

Ecology.— Dry evergreen forest, sometimes in open areas and along roadsides, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: November-March.

Vernacular.— ข้าวสารหลวง Khao san luang (Northern).

Voucher specimens— *P. Srisanga* 342.



Figure 60. *Embelia undulata* (Wall.) Mez

A. flowering branch; B-C. male flower; D. stamen. Scale bars 1 cm in A; 1 mm in B-D.
All from *P. Srisanga* 1360.

MYRTACEAE

Trees or shrubs. **Leaves** simple, usually opposite, rarely alternate or whorled, often leathery, mostly entire, glandular punctate; stipules absent or rarely very small. **Inflorescence** usually cymose, occasionally racemose or panicle, rarely flower solitary. **Flowers** usually bisexual, rarely unisexual, actinomorphic. **Calyx** tube more or less adnate to the ovary; lobes (3-)4-5(-6), imbricate, valvate or irregularly split. **Petals** (3-)4-5(-6), inserted on the margin of the disk lining the calyx tube, imbricate, valvate or irregularly split. **Stamens** numerous, rarely few, inserted on the margin of the disk, 1 or more seriate, inflexed in bud or twice folded or straight; filaments free or connate at the base into a short tube or in bundles opposite the petals; anthers usually dorsifixed, 2-locular, opening by longitudinal slits or rarely by terminal pores; the connective often tipped by a gland. **Ovary** inferior, rarely half-inferior, syncarpous, 1- to many-locular, mostly axile placentation; style solitary; ovules 2-numerous in each loculus. **Fruit** a berry, capsule, drupe or nut.

About 129 genera and 4,620 species mainly in tropical region and Australia (Mabberley, 1997). Twelve native and 2 introduced genera with 115 species in Thailand (Parnell & Chantaranothai, 2002). Three genera and 4 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|--|--------------------------|
| 1. Leaves opposite. Fruit a berry | |
| 2. Young shoots and flower buds hairy | 1. <i>Decaspermum</i> |
| 2. Young shoots and flower buds glabrous | 2. <i>Syzygium</i> |
| 1. Leaves alternate. Fruit a capsule | 3. <i>Tristaniaopsis</i> |

1. *DECASPERMUM* Forst.

Char. Gen.: 73, t. 37. 1776; Parnell & Chantaranothai in Fl. Thailand 7(4): 790. 2002. – *Nelitris* Spreng, Syst. 2: 488. 1825.

Trees or shrubs; branches opposite; young shoots hairy. **Leaves** opposite; intramarginal vein present, entire, glandular punctate; stipules minute, caducous. **Inflorescence** in dichasia, racemes, clusters or flower solitary. **Flowers** bud pubescent. **Calyx** 4-5, persistent. **Petals** 4-5, orbicular, caducous. **Stamens** free, numerous; anthers opening by longitudinal slits. **Fruit** a berry. **Seeds** strongly curved.

Between 20-25 species in Asia, Australasia and Pacific regions. Two species in Thailand (Parnell & Chantaranothai, 2002). One species recorded from Doi Phu Kha National Park.

***Decaspermum parviflorum* (Lam.) A.J. Scott**

Kew Bull. 34: 66. 1979; Parnell & Chantaranothai in Fl. Thailand 7(4): 791, fig. 5. 2002. – *Eugenia parviflora* Lam., Enc. 3: 200. 1789. – *Decaspermum paniculatum* (Lindl.) Kurz, J. As. Soc. Beng. 46: 61. 1877; Craib in Fl. Siam. Enum. 1: 624. 1931.

Tree or shrub, up to 10 m high. **Leaves** elliptic to ovate, (3-)5-10 cm long, (1-) 2-4 cm wide, glabrous to glabrescent; base rounded to cuneate; apex acuminate; primary veins 10-20 pairs, obscure; intramarginal vein 1, faint, ca. 1 mm from margin; petioles 2-5 mm long, pubescent. **Inflorescence** axillary dichasia, many-flowered. **Flowers** bisexual or staminate; pedicels 2-3 mm long, sericeous. **Calyx** 5, orbicular, 1-2 mm long, sericeous. **Petals** 5, white, 3-5 mm long, ciliate. **Filaments** 4-5 mm long, curved. **Style** 3-4 mm long; stigma capitate. **Fruit** dark purple-black, globose, 4-6 mm long and wide, sericeous, crowned by persistent calyx. **Seeds** 2-3 mm long, tuberculate, strongly curved.

Thailand.— Northern: Chiang Mai, Nan; Eastern: Chaiyaphum, Nakhon Ratchasima; South-eastern: Prachin Buri; Peninsular: Chumphon, Surat Thani, Phangnga.

Distribution.— India, Myanmar, China, Indonesia (Java-type), Philippines, Micronesia, Polynesia (Fiji, Samoa).

Ecology.— Lower montane forest, alt. 1,500-1,800 m (Doi Phu Kha).

Phenology.— Flowering: January-February; fruiting: July-September.

Uses.— Branches make a broom.

Vernacular.— เซมีพอ Se mee po (Karen-Chiang Mai).

Voucher specimens.— *P. Srisanga* 947, 1519, 2706; *P. Srisanga et al.* 804.

2. SYZYGIVM Gaertn.

Fruct. Sem. Pl. 1: 166, t. 33. 1788; Chantaranothai & Parnell, Thai For. Bull. (Bot.) 21: 24. 1994; Parnell & Chantaranothai in Fl. Thailand 7(4): 811. 2002.

Trees or shrubs; young shoots glabrous. **Leaves** opposite, rarely whorled or spiral; intramarginal veins 1(-3) or absent, entire, glandular punctate; stipules absent. **Inflorescence** terminal, axillary or cauline, usually paniculate or racemose, sometimes few-flowered and cymose. **Flowers** sessile or pedicellate; bud glabrous. Hypanthial cup broadly funnel-shaped, clavate, rarely cylindrical. Pseudostipe usually present. **Calyx** 4-5, usually persistent; lobes not calyptrate. **Petals** 4-5, free, sometimes pseudo-calyptrate. **Stamens** free, numerous; anthers opening by longitudinal slits. **Style** often approximating the stamens in length or shorter than the stamens. **Fruit** a berry, globose or pyriform.

About 1,000 species in Africa, Asia and Australia. Eighty-four species in Thailand (Parnell & Chantaranothai, 2002). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves 7-14 cm long, 2-5 cm wide; base cuneate; apex caudate-acuminate.
 Hypanthial cup 5-7 mm long. Sepals 1-1.5 mm long. Petals 4-6 mm long.
 Outer stamens 6-7 mm long. Style 7-8 mm long **1. *S. angkae***
1. Leaves 20-28 cm long, 6.5-9 cm wide; base caudate, sometimes rounded;
 apex acute to acuminate. Hypanthial cup 15-23 mm long, ridged. Sepals
 8-10 mm long. Petals 15-20 mm long. Outer stamens 24-33 mm long.
 Style 30-45 mm long **2. *S. megacarpum***

1. *Syzygium angkae* (Craib) P. Chantaranothai & J. Parn.

Kew Bull. 48: 592. 1993; Thai For. Bull. (Bot.) 21: 35. 1994; Parnell & Chantaranothai in Fl. Thailand 7(4): 830. 2002. – *Eugenia angkae* Craib, Kew Bull. 1929: 115. 1929; in Fl. Siam. Enum. 1: 633. 1931.

Tree, up to 25 m high; twigs terete. **Leaves** oblong, elliptic to ovate, 7-14 cm long, 2-5 cm wide, glabrous; base cuneate; apex caudate-acuminate; midrib impressed on the upper surface; primary veins 27-36 pairs, distinct; intramarginal veins 2; petioles 6-9 mm long. **Inflorescence** axillary and terminal dichasia, few-flowered, up to 2.5 cm long; peduncle 0.8-2.5 mm long. **Flowers** bisexual; pedicels 1-3 mm long. Hypanthial cup 5-7 mm long, funnel-shaped. Pseudostipe 1-3 mm long. **Sepals** 4, suborbicular, 1-1.5 mm long, hyaline. **Petals** 4, white, orbicular, 4-6 mm long, 30-50 gland dots per petal. **Outer stamens** 6-7 mm long; anthers elliptic-oblong, 0.7-0.8 mm long. **Ovary** 2-locular; ovules 6-9 in each loculus; style 7-8 mm long. **Fruit** globose to oblong-ovoid.

Thailand.— Northern: Chiang Mai (type), Nan; North-eastern: Loei.

Distribution.— Myanmar, Laos.

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: August-October; fruiting: January.

Vernacular.— หัวอ่างกา Wa ang kha (Northern).

Voucher specimens.— P. Srisanga 267, 1497, 1508, 1618, 1722.

2. *Syzygium megacarpum* (Craib) Rathakr. & N.C. Nair

Econ. Taxon. Bot. 4: 287. 1983; Chantaranothai & Parnell, Thai For. Bull. (Bot.) 21: 86. 1994; Parnell & Chantaranothai in Fl. Thailand 7(4): 875, pl. XXX: 1. 2002. – *Eugenia megacarpa* Craib in Fl. Siam. Enum. 1: 652. 1931. – *E. macrocarpa* Roxb., Fl. Ind. ed. 2, 2: 497. 1832, non Schlechtd.

Tree, up to 20 m high; twigs terete or angled. **Leaves** oblong, lanceolate to elliptic, 20-28 cm long, 6.5-9 cm wide, glabrous; base caudate, sometimes rounded; apex acute to acuminate; midrib impressed on the upper surface; primary veins 14-18 pairs, distinct; intramarginal veins 2; petioles 5-10 mm long. **Inflorescence** axillary

and terminal panicle, 1-18-flowered, up to 5 cm long; peduncle 10 mm long. **Flowers** bisexual, the outer two flowers of a triad with pedicel 7-8 mm long, the central flower sessile. Hypanthial cup 15-23 mm long, funnel-shaped, ridged. Pseudostipe ca. 5 mm long. **Sepals** 4, suborbicular, 8-10 mm long, 12-13 mm wide, the inner lobes larger than the outer lobes, hyaline. **Petals** 4, white or pinkish white, suborbicular, 15-20 mm long, 20-24 mm wide, thick at base, more than 200 gland dots per petal. **Outer stamens** white, 24-33 mm long; anthers linear-oblong, 1-1.5 mm long. **Ovary** 2-locular; ovules 30-50 in each loculus; style 30-45 mm long. **Fruit** pink, globose, 4-6 cm long and wide, spongy.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lampang, Phrae, Nan, Tak, Phitsanulok, Khamphaeng Phet; North-eastern: Loei; Eastern: Chaiyaphum; South-western: Uthai Thani, Kanchanaburi; Peninsular: Phangnga, Satun, Narathiwat.

Distribution.— India, Bangladesh (Chittagong-type), Myanmar, China.

Ecology.— Deciduous and dry evergreen forest, by streams, alt. 700-900 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: July-October.

Vernacular.— ชมพู่ป่า Chomphu pa (General).

Voucher specimens.— *P. Srisanga* 568, 1310.

3. *TRISTANIOPSIS* Brongn. & Gris

Bull. Soc. Bot. France 10: 371. 1863; Parnell & Chantaranothai in Fl. Thailand 7(4): 912. 2002. – *Tristania* auct. non R. Br. emend. Schott, Wiener Z. Kunst 3: 772. 1830.

Trees or shrubs; branches alternate. **Leaves** alternate; intramarginal vein present, entire, glandular punctate; stipules minute, caducous. **Inflorescence** cymose. **Flowers** 5-merous; bracts and bracteoles usually small, caducous. Hypanthium deeply cup-shaped. **Calyx** turbinate, persistent. **Petals** orbicular, free, caducous. **Filaments** fused at the base forming discrete fasciculate bundles. **Ovary** half-inferior. **Fruit** a 3-valved capsule. **Seeds** flat, winged.

Thirty species in SE Asia, Malesia and Australasia. Two species in Thailand (Parnell & Chantaranothai, 2002). One species recorded from Doi Phu Kha National Park.

Tristaniopsis burmanica (Griff.) P.G. Wilson & J.T. Waterh. var. *rufescens* (Hance) J. Parn. & Nic Lughadha

Kew Bull. 47: 705. 1992; Parnell & Chantaranothai in Fl. Thailand 7(4): 913, pl. XXX: 2. 2002. – *Tristania rufescens* Hance, J. Bot. 14: 259. 1876; Craib in Fl. Siam. Enum. 1: 627. 1931. – *T. burmanica* var. *rufescens* (Hance) Gagnep. in Fl. Gén. I.-C. 2: 793. 1920. – *Tristaniopsis rufescens* (Hance) P.G. Wilson & J.T. Waterh., Aus. J. Bot. 30: 440. 1982.

Tree or shrub, up to 8 m high; young shoots densely white sericeous. **Leaves** elliptic to ovate, 3-10 cm long, 1-3.5 cm wide, pubescent; base cuneate, attenuate onto the petiole; apex acute to obtuse; margin revolute; midrib impressed on the upper surface; primary veins 10-20 pairs, distinct; intramarginal vein 1, distinct, 0.5-1 mm from margin; petioles 5-15 mm long, sericeous. **Inflorescence** axillary clusters, densely white sericeous; pedicels 2-4 mm long. **Calyx** 5, infundibuliform, yellowish green, 3-4 mm long, subglabrous to densely white sericeous. Pseudostipe absent. **Petals** 5, creamy white, 2-2.5 mm long. **Stamens** numerous, grouped in 5 antipetalous fascicles, each of 4-9 stamens; filaments 2-2.5 mm long, sparsely pubescent at base, connective with a small apical gland. **Ovary** sparsely sericeous at apex; style ca. 0.5 mm long; stigma truncate. **Capsule** subglobose, 4-6 mm long and wide. **Seeds** 3-4 mm long, 1-1.5 mm wide; wing minutely rugulose.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Udon Thani; Eastern: Surin, Si Sa Ket, Ubon Ratchathani; South-eastern: Trat; Peninsular: Phuket (type).

Distribution.— Myanmar, Cambodia, Vietnam.

Ecology.— Dry evergreen and pine forest, alt. 900-1,100 m (Phu Huat).

Phenology.— Flowering: February-March; fruiting: April-May.

Vernacular.— เขาะ Kho (Chiang Mai).

Voucher specimens.— *P. Srisanga* 507.

OLACACEAE

Trees, shrubs or woody climbers. **Leaves** simple, usually alternate, entire, exstipulate. **Inflorescence** axillary, rarely on old wood, cymes, racemes, panicles or fascicles, rarely flower solitary. **Flowers** bisexual, rarely unisexual, actinomorphic. **Sepals** 3-7, often small, usually partly united or formed a cupuliform structure with entire or lobed margin, often accrescent in fruit, sometimes adnate to the ovary. **Petals** 3-7, free or connate below, valvate, caducous. **Stamens** 4-12(-15), free or adnate to the petals; staminodes sometimes present; anthers 2-locular, opening by longitudinal slits. Disk usually present. **Ovary** superior, half-inferior or inferior, 1-5 (-7)-locular, sometimes several locular below but 1-locular above; ovules 2-3(-7) pendent from the apex of a free central placenta in 1 locular ovaries or 1 and pendulous in each loculus in several locular ovaries. **Fruit** a berry or drupe, often surrounded by the accrescent free or adnate calyx. **Seed** 1.

About 27 genera and 180 species in tropical region (Mabberley, 1997). Six genera and about 10 species in Thailand. Two genera and 2 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Calyx distinct, much enlarged in fruit. Epicalyx absent. Staminodes present.
Ovary superior **1. *Olax***
1. Calyx indistinct, merely a rim with minute teeth. Flowers and fruits supported by an epicalyx consisting of 3 concrescent bract and bracteoles.

Staminodes absent. Ovary half-inferior

2. *Schoepfia*

1. *OLAX L.*

Sp. Pl.: 34. 1753; Sleumer in Fl. Mal. I(10): 6. 1984; Verdcourt in Fl. Ceylon 10: 295. 1996.

Trees, shrubs or woody climbers, occasionally armed. **Leaves** alternate, distichous. **Inflorescence** racemes or panicles, rarely flower solitary. **Flowers** bisexual, rarely unisexual. **Calyx** cupuliform, truncate or slightly undulate or lobed at the margin, much accrescent in fruit. **Petals** 3, entire or all or in part bipartite and thus seemingly (5-)6, free or connate in pairs. **Stamens** 3-6; staminodes 3-6, often bifid. Disk present. **Ovary** superior, 1-locular or imperfectly 3-locular below; style short; stigmas capitellate, 3-lobed; ovules 3. **Fruit** a drupe, completely or half-included in the accrescent free or adnate calyx.

About 25 species in the Old World tropics (Mabberley, 1997). About 3 species in Thailand. One species recorded from Doi Phu Kha National Park.

Olox imbricata Roxb.

In Fl. Ind. ed. Carey & Wall. 1: 169. 1820; Craib in Fl. Siam. Enum. 1: 269. 1926; Sleumer, Blumea 26(1): 156. 1980 (see also for complete synonymy); in Fl. Mal. I (10): 8. 1984; Verdcourt in Fl. Ceylon 10: 297. 1996. – *O. wightiana* Wall. ex Wight & Arn., Prodr. 1: 89. 1834.

Woody climber or rarely shrub, unarmed; branchlets glabrous. **Leaves** oblong to elliptic, subcoriaceous, 4-15 cm long, 2-7.5 cm wide, glabrous; base cuneate to rounded; apex acute to acuminate; primary veins 5-9 pairs, inconspicuous; petioles 5-10 mm long, wrinkled. **Inflorescence** in racemes, many-flowered, 1-3(-5) cm long. **Calyx** ca. 0.5 mm long, slightly undulate. **Petals** 3, white, linear-oblong, 1-1.2 cm long. **Stamens** 3; staminodes 5-6, bifid. **Ovary** ovoid, glabrous. **Drupe** orange, subglobose to ovoid, 1.7-2.5 cm long, almost completely covered by the accrescent orange calyx.

Thailand.— Northern: Chiang Mai, Lamphun, Lampang, Nan; North-eastern: Mukdahan.

Distribution.— India, Sri Lanka, Bangladesh (type), China, Taiwan, SE Asia, New Guinea, Micronesia.

Ecology.— Dry evergreen forest, alt. 900-1,000 m (Doi Phu Kha, Thon Thong Waterfall).

Phenology.— Flowering: April; fruiting: August-September.

Vernacular.— หลุมบก Lum nok (Peninsular).

Voucher specimens.— *P. Srisanga & C. Maknoi* 2091.

2. *SCHOEPFIA* Schreb.

Gen.: 129. 1789; Sleumer in Fl. Mal. I(10): 27. 1984.

Trees or shrubs, often root-parasites. **Leaves** alternate. **Inflorescence** racemes or corymbs. **Flowers** bisexual, fragrant. Bract and bracteoles united at apex of pedicel into a small, 3-lobed, persistent epicalyx. **Calyx** indistinct, merely a rim with minute teeth. **Petals** 4-5(-6), white or yellow, connate. **Stamens** 4-5(-6), epipetalous; staminodes absent. Disk present. **Ovary** half-inferior, 1-locular above, 3-locular below, style slender; stigma 3-lobed; ovules 3, pendulous. **Fruit** a drupe, subtended at base by the persistent epicalyx, crowned by the remains of calyx, disk and corolla.

About 24 species, of which ca. 20 in (sub)tropical America and ca. 4 in SE Asia (Sleumer, 1984). One species in Thailand.

Schoepfia fragrans Wall.

In Fl. Ind. ed. Wall. & Carey 2: 188. 1824; Craib in Fl. Siam. Enum. 1: 272. 1926; Sleumer, Blumea 26(1): 162. 1980 (see also for complete synonymy); in Fl. Mal. I (10): 27, fig. 15. 1984. — *S. acuminata* Wall. ex DC., Prodr. 4: 320. 1830; Craib in Fl. Siam. Enum. 1: 272. 1926.

Shrub or small tree, 3-6 m high; branchlets glabrous. **Leaves** lanceolate to elliptic, chartaceous to subcoriaceous, 5-12 cm long, 2-5 cm wide, glabrous; base cuneate to rounded; apex acute to acuminate; primary veins 5-7(-9) pairs, inconspicuous; petioles 4-6 mm long. **Inflorescence** in racemes, 3-7(-10)-flowered, 2-4 cm long; pedicels (5-)8-10(-12) mm long, distally with an epicalyx formed by 1 bract and 2 bracteoles, ca. 0.5 mm long. **Calyx** small, obconical, truncate, adherent to the ovary and accrescent in fruit. **Corolla** white to yellow, tubular; tube 8-10 mm long; lobes oblong, 4-5 mm long, acute at apex, with a tuft of hairs at their inner base above the insertion of the anthers. **Filaments** cohering to corolla tube; anthers subbilobed, free in the throat. **Ovary** 5-6 mm long; style as long as or shorter than the corolla tube. **Drupe** creamy white to yellow, ellipsoid, 1-1.2 cm long.

Thailand.— Northern: Chiang Mai, Lamphang, Nan.

Distribution.— India, Nepal (type), Bhutan, China, SE Asia.

Ecology.— Lower montane forest, alt. 1,100-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: July-September; fruiting: August-December.

Vernacular.— ขี้หนอน Khi non (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1495, 1865.

OLEACEAE

Trees, shrubs or woody climbers, evergreen or deciduous. **Leaves** opposite, very rarely alternate in *Jasminum* L., simple, trifoliolate or imparipinnate, exstipulate.

Inflorescence terminal or axillary, cymose, paniculate, racemose-decussate, subumbellate or fasciculate. **Flowers** bisexual, unisexual or androdioecious. **Calyx** 4- to several-lobed or absent. **Corolla** 4- to several-lobed or absent, sympetalous or divided to the base in paired lobes. **Stamens** 2(4), epipetalous, dehiscent by longitudinal slits; connective often developed into a small terminal appendage. **Ovary** superior, 2-locular, each with (1-)2(-several) apical or basal ovules; style terminal; stigma bilobed or subcapitate. **Fruit** a drupe, berry, woody capsule or samara.

An almost cosmopolitan family with about 25 genera and 615 species but with concentrations in SE Asia and Australasia. Eight genera and 63 species in Thailand (Green, 2000). Four genera and 15 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Woody climber or suffrutescent. Corolla hypocrateriform (salver-shaped).
Fruit a bilobed berry (often single by abortion) **3. *Jasminum***
1. Tree or shrub. Corolla not hypocrateriform or absent. Fruit a drupe, drupaceous berry or samara
 2. Leaves imparipinnate. Fruit a samara **2. *Fraxinus***
 2. Leaves simple. Fruit a drupe or drupaceous berry
 3. Corolla divided to the base or almost so with paired lobes **1. *Chionanthus***
 3. Corolla with a distinct tube, 1 mm or more long **4. *Olea***

1. *CHIONANTHUS* L.

Sp. Pl.: 8. 1753; Green in Fl. Thailand 7(2): 281. 2000; in Fam. Gen. Vasc. Pl. 7: 303. 2004. – *Linociera* Sw., Fl. Ind. Occid. 1: 49. 1797 & 3: t. 2. 1806.

Evergreen trees or shrubs, except deciduous in temperate species. **Leaves** simple, opposite, entire, coriaceous or chartaceous. **Inflorescence** axillary or terminal, cymose, paniculate or racemose-decussate. **Flowers** bisexual, actinomorphic. **Calyx** small, 4-toothed or -lobed, persistent. **Corolla** white or yellow; tube short or obsolete; lobes 4, usually divided to the base and united by the bases of the filaments, linear or shortly oblong, induplicate-valvate. **Stamens** 2; filaments very short, inserted at base of the corolla lobes; anthers elliptic or oblong, connective sometimes extended into a short appendage. **Ovary** globose to bottle-shaped; ovules 2 in each loculus, apically or laterally inserted. **Fruit** a drupe, ovoid, ellipsoid, subspherical or obovoid; endocarp bony or crustaceous. **Seed** usually single, with or without endosperm.

About 60 species, mainly distributed in the tropics and subtropics of Asia, Australia, Africa and America. Some cultivated for ornamentals. Fifteen species in Thailand (Green, 2000). Five species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Petioles 0.5-1 cm long **1. *C. mala-elengi* subsp. *terniflorus***

- | | |
|--|-------------------------|
| 1. Petioles 1.5-4 cm long | |
| 2. Primary veins 8-9 pairs | 2. <i>C. ramiflorus</i> |
| 2. Primary veins 10-16 pairs | |
| 3. Leaves chartaceous to thinly coriaceous | 3. <i>C. thorelii</i> |
| 3. Leaves coriaceous | |
| 4. Venation obscure | 4. <i>C. sp. 1</i> |
| 4. Venation distinct | 5. <i>C. sp. 2</i> |

1. *Chionanthus mala-elengi* (Dennst.) P.S. Green subsp. *terniflorus* (Wall. ex G. Don) P.S. Green

Kew Bull. 51: 767. 1996; in Fl. Thailand 7(2): 286. 2000. – *Linociera terniflora* Wall. ex G. Don, Gen. Hist. 4: 53. 1837; Kerr in Fl. Siam. Enum. 2: 415. 1939. – *L. caudata* Coll. & Hemsl., J. Linn. Soc.: 28: 84. 1890; Kerr in Fl. Siam. Enum. 2: 411. 1939. – *L. pierrei* Gagnep., Bull. Soc. Bot. France 79: 786. 1933; in Fl. Gén. I.-C. 3: 1071. 1933.

Tree, 7-15 m high; young shoots glabrous. **Leaves** elliptic-oblong, slightly coriaceous, (7-)9-13(-16) cm long, 3-6 cm wide, glabrous; base acute to obtuse, slightly attenuate onto the petiole; apex acuminate; primary veins 9-11 pairs, raised below, plane or slightly sunk above; venation usually obscure; petioles 4-10 mm long, glabrous. **Inflorescence** terminal and axillary, paniculate, racemose-decussate. **Flowers** numerous, in groups of three, sessile or subsessile. **Calyx** cupuliform, glabrous to scattered pilose; tube ca. 1 mm long; lobes ca. 0.5 mm long, rounded at apex, pilose-fimbriate. **Corolla** white; lobes tapering, narrowly caudate, 6-9 mm long. **Anthers** ellipsoid, ca. 1.5 mm long, almost sessile; connective scarcely developed. **Ovary** flask-shaped, pilose, 1.5-2 mm long; stigma shortly bilobed. **Drupe** ellipsoid-ovoid, 1-1.2 cm long, 0.5-0.8 cm wide.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Phrae, Nan, Sukhothai, Phitsanulok; North-eastern: Loei; Eastern: Nakhon Ratchasima; South-eastern: Chon Buri, Chanthaburi, Trat; Central: Saraburi; South-western: Uthai Thani; Peninsular: Ranong.

Distribution.— India, Bangladesh, Myanmar (type), Laos, Cambodia, Vietnam.

Ecology.— Dry evergreen forest, by streams, alt. 700-1,000 m (Doi Phu Kha).

Phenology.— Flowering: October-April; fruiting: October-January.

Vernacular.— ข้าวสารหลวง Khao san luang (Lampang).

Voucher specimens.— *P. Srisanga* 340.

2. *Chionanthus ramiflorus* Roxb.

In Fl. Ind. ed. Carey & Wall. 1: 106. 1820; Green in Fl. Thailand 7(2): 283, fig. 14, pl. X: 2. 2000. – *Linociera ramiflora* (Roxb.) Wall. [Cat. No. 2824. 1831] ex G. Don, Gen. Hist. 4: 52. 1837; Kerr in Fl. Siam. En. 2: 413. 1939. – *L. macrophylla* Wall. ex G. Don, Gen. Hist. 4: 53. 1837. – *Chionanthus macrophyllus* (Wall. ex G. Don) Bl., Mus. Bot. 1: 317. 1850. – *Linociera macrophylla* var. *attenuata* (Wall. ex G. Don)

C.B. Clarke in Fl. Br. Ind. 3: 611. 1882; Kerr in Fl. Siam. Enum. 2: 413. 1939. – *L. pauciflora* (Wall. ex G. Don) C.B. Clarke in Fl. Br. Ind. 3: 609. 1882.

Small tree, 5-12 m high; young shoots glabrous. **Leaves** oblong-elliptic, slightly coriaceous, (7-)9-15(-21) cm long, (2.5-)4-6(-8) cm wide, glabrous; base obtuse to acute, narrowed and attenuate onto the petiole; apex acuminate to shortly acuminate; primary veins 8-9 pairs; venation usually obscure; petioles (1.5-)2-3 cm long, glabrous. **Inflorescence** paniculate, (4-)7-12(-15) cm long, glabrous. **Flowers** numerous, slightly fragrant; pedicels 1-2 mm long. **Calyx** glabrous; tube ca. 0.25 mm long; lobes 0.5-0.75 mm long, triangular. **Corolla** white, creamy white or yellowish; lobes strap-shaped, 2-4 mm long, ca. 0.75 mm wide, obtuse at apex. **Anthers** broadly ellipsoid, ca. 0.75 mm long, almost sessile; connective developed into a very slight appendage. **Ovary** broadly flask-shaped, 1-1.5 mm long; style short, scarcely differentiated; stigma slightly bilobed. **Drupe** ellipsoid, 1.5-2 cm long, 0.8-1.5 cm wide, bluish black.

Thailand.— Almost throughout the country.

Distribution.— E India, Myanmar, SE China, Laos, Vietnam, Cambodia, Malaysia, Indonesia (Java), Philippines, Moluccas (type cult. ex Moluccas), New Guinea, Australia (Queensland).

Ecology.— Dry evergreen and lower montane forest, often near streams, alt. 800-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting throughout the year.

Vernacular.— น้ำนอง Nam nong (Northern).

Voucher specimens.— *P. Srisanga* 1524.

3. *Chionanthus thorelii* (Gagnep.) P.S. Green

Kew Bull. 51: 769. 1996; in Fl. Thailand 7(2): 287. 2000. – *Linociera thorelii* Gagnep., Bull. Soc. Bot. France 79: 788. 1933; in Fl. Gén. I.-C. 3: 1069. 1933; Kerr in Fl. Siam. Enum. 2: 415. 1939. – *L. procera* Kerr, Kew Bull. 1938: 131. 1938; in Fl. Siam. Enum. 2: 413. 1939.

Tree, 3-15 m high; young shoots glabrous to finely pilose. **Leaves** oblanceolate to elliptic-oblong, chartaceous to thinly coriaceous, (7-)11-18(-30) cm long, 4-8 cm wide, glabrous; base acute, attenuate onto the petiole; apex acuminate, often shortly so; primary veins 10-16 pairs; petioles 1.5-3.5 cm long, glabrous. **Inflorescence** paniculate, 4-13 cm long. **Flowers** numerous, in groups of three at the ends of the rachis branches, fragrant. **Calyx** puberulous; tube 0.25-0.5 mm long; lobes triangular, 0.75-1 mm long. **Corolla** white, 2-3 mm long. **Anthers** ellipsoid, ca. 1 mm long; connective slightly developed. **Ovary** bottle-shaped, ca. 1 mm long; stigma small, bilobed. **Drupe** ellipsoid-ovoid, 1.8-3.5 cm long, 1.3-2 cm wide, bluish black.

Thailand.— Northern: Chiang Mai, Nan; Eastern: Chaiyaphum, Nakhon Ratchasima; South-eastern: Chon Buri, Trat; South-western: Uthai Thani; Peninsular: Nakhon Si Thammarat.

Distribution.— Laos, Cambodia (type), Vietnam.

Ecology.— Dry evergreen and lower montane forest, often near streams, alt. 700-1,200 m (Doi Phu Kha).

Phenology.— Flowering: October-December; fruiting: December-April.

Vernacular.— ช้าตะเกา Cha ta pao (General).

Voucher specimens.— *P. Srisanga* 1164, 1245, 2217, 2223.

4. *Chionanthus* sp. 1

Tree, up to 12 m high; young shoots glabrous. **Leaves** oblanceolate, coriaceous, (13-)18-26 cm long, (3.5-)5.5-8 cm wide, glabrous; base acute, attenuate onto the petiole; apex acute; primary veins 11-13 pairs; venation obscure; petioles 1.5-2 cm long, glabrous. **Flowers** not known. **Drupe** ellipsoid. 4.5-6 cm long, 1.7-2 cm wide, immature green.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, by streams, alt. 870 m (Doi Phu Kha).

Phenology.— Fruiting: January.

Voucher specimens.— *P. Srisanga* 2725.

Notes.— Due to lacking the flower materials, the affinity is uncertain.

5. *Chionanthus* sp. 2

Tree, up to 20 m high; young shoots glabrous. **Leaves** elliptic-oblong, coriaceous, 15-20 cm long, 5-8 cm wide, glabrous; base acute, attenuate onto the petiole; apex acute; primary veins 9-11 pairs; venation distinct; petioles 1.5-2.5 cm long, glabrous. **Flowers** not known. **Drupe** very immature green.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,700 m (Doi Phu Kha).

Phenology.— Fruiting: August-September.

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2011.

Notes.— Due to lacking the flower materials, the affinity is uncertain.

2. *FRAXINUS* L.

Sp. Pl.: 1057. 1753; Green in Fl. Thailand 7(2): 300. 2000; in Fam. Gen. Vasc. Pl. 7: 302. 2004.

Trees or rarely shrubs, deciduous, dioecious, polygamodioecious or monoecious. **Leaves** opposite, imparipinnate or rarely simple, usually more or less chartaceous, entire or toothed. **Inflorescence** axillary or terminal, clustered or paniculate, often appearing before the leaves. **Calyx** small, cupulate or cylindrical, more or less 4-toothed, or absent. **Corolla** absent or of (2)4 very shortly basally

united, more or less linear lobes. **Stamens** 2(4); anthers exserted, oblong to linear; connective sometimes expanded into a small appendage. **Ovary** with 2 pendulous ovules in each loculus; style with 2 stigmatic lobes. **Fruit** a narrow samara, winged in the upper part, 1-seeded.

Fraxinus (Ash) is valuable timber trees and about 45-50 species mainly in the north temperate region but with a few extending into tropical region on mountains. Three species in Thailand (Green, 2000). Only 1 species recorded from Doi Phu Kha National Park.

***Fraxinus floribunda* Wall. ex Roxb.**

In Fl. Ind. ed. Carey & Wall. 1: 150. 1820; Kerr in Fl. Siam. Enum. 2: 410. 1939; Green in Fl. Thailand 7(2): 303, fig. 21, pl. XI: 2. 2000.

Tree up to 30 m high; young shoots glabrous. **Leaves** 15-25(-30) cm long; leaflets 5-7, lanceolate, rarely narrowly slender, (5-)7-10(-16) cm long, (1.5-)2.5-4(-7) cm wide, glabrous; base obtuse, very asymmetrical; apex acuminate; margin serrate; primary veins 7-9 pairs, raised below, immersed above; venation raised reticulate below, obscure to reticulate above; petioles 4-10 cm long, glabrous; petiolules slender, the lateral 7-20 mm long, the terminal 20-25 mm long. **Inflorescence** axillary or terminal, paniculate, glabrous, 10-15(-20) cm long; many-flowered; bracts small, very early caducous; pedicels 2-4 mm long. **Calyx** obconic to campanulate, glabrous; tube 0.5-0.75 mm long; lobes virtually absent or ca. 0.2 mm long and broadly triangular. **Corolla** white; lobes elliptic, 2.5-3 mm long, ca. 0.5 mm wide. **Stamens** exserted; filaments ca. 1 mm long; anthers 2-2.5 mm long; connective developed into a small, acute appendage. **Ovary** ellipsoid, ca. 1 mm long; style 2-2.5 mm long, stigma 1-1.5 mm long. **Samara** narrowly oblanceolate to subspathulate, 3-3.5 cm long, rounded at apex. **Seed** ca. 1 cm long, not winged (Figs. 61, 137).

Thailand.— Northern: Chiang Mai, Nan, Phitsanulok; North-eastern: Loei.

Distribution.— India, Nepal (type), Myanmar, S China, Japan (Ryu-Kyu Is.), Vietnam.

Ecology.— Lower montane forest, alt. 1,200-1,800 m (Doi Phu Kha).

Phenology.— Flowering: February; fruiting: April-October; leaves: February-December.

Uses.— Wood for indoor construction.

Vernacular.— ไม้คูน Mai Kum (Lua-Nan), จันทร์ทอง Chan thong (General).

Voucher specimens.— *P. Srisanga* 283, 482, 948; *P. Srisanga* & *S. Watthana* 640; *P. Srisanga et al.* 783.

Notes.— New locality recorded from Nan, in Thailand.

3. *JASMINUM* L.

Sp. Pl.: 7. 1753; Green in Fl. Thailand 7(2): 306. 2000; in Fam. Gen. Vasc. Pl. 7: 301. 2004.

Evergreen woody climbers and scramblers, rarely erect shrubs. **Leaves** opposite, very rarely alternate, simple, trifoliolate or imparipinnate; petioles often articulate. **Inflorescence** basically cymose, commonly paniculate, few- to many-flowered. **Flowers** heterostylous, usually fragrant. **Calyx** small, more or less campanulate with 5-9-lobed, inconspicuous to narrowly lanceolate or filiform. **Corolla** white, often tinged red on the outside, or yellow; lobes 5 or more, imbricate in bud. **Stamens** 2, borne within the corolla tube; filaments short or very short; anthers narrowly oblong-elliptic; connective usually produced into a short, acute appendage. **Ovary** barrel-shaped, with 2 more or less basal ovules in each loculus; stigma of 2 elongated terminal areas. **Fruit** a didymous berry, often single by abortion, black or purple-black when ripe.

An Old World genus with approximately 200 species, especially in the tropics but with a few in warm temperate regions. Many species are cultivated in gardens for their sweetly scented flowers. Thirty-one species in Thailand (Green, 2000). Seven species recorded from Doi Phu Kha National Park

KEY TO THE SPECIES

- | | |
|---|--|
| 1. Leaves trifoliolate | 4. <i>J. lanceolaria</i> subsp. <i>scortechinii</i> |
| 1. Leaves simple | |
| 2. Leaves with 1 or 2 prominent basal veins on each side of the midrib, sometimes penninerved above | |
| 3. Inflorescence 1-5-flowered, loose | 5. <i>J. nervosum</i> |
| 3. Inflorescence 5- to many-flowered, dense | 3. <i>J. decipiens</i> |
| 2. Leaves penninerved, the basal primary nerve not distinctly more prominent than those above | |
| 4. Calyx lobes much shorter than the tube | 1. <i>J. attenuatum</i> |
| 4. Calyx lobes equal to or longer than the tube | |
| 5. Bracts of inflorescence filiform or linear | 7. <i>J. rufohirtum</i> |
| 5. Bracts of inflorescence ovate to lanceolate, leaf-like, green or white | |
| 6. Young shoots and leaves glabrous | 6. <i>J. perissanthum</i> |
| 6. Young shoots and leaves velutinous, at least at the midrib and veins below | 2. <i>J. coarctatum</i> var. <i>vanprukii</i> |

1. *Jasminum attenuatum* Roxb. ex G. Don

Gen. Hist. 4: 62. 1837; Kerr in Fl. Siam. Enum. 2: 396. 1939; Green in Fl. Thailand 7 (2): 332, fig. 29. 2000. – *J. subglandulosum* Kurz, J. Bot. 13: 329. 1875. – *J. sempervirens* Kerr, Kew Bull. 1938: 30. 1938; in Fl. Siam. Enum. 2: 406. 1939. – *J. wangii* Kobuski, J. Arn. Arb. 20: 69. 1939. – *J. robustifolium* Kobuski, J. Arn. Arb. 20: 69. 1939.

Woody climber; young shoots glabrous. **Leaves** oblong, lanceolate to broadly ovate, subcoriaceous, (7-)10-22 cm long, 3-10 cm wide, glabrous; base obtuse to rounded; apex acuminate; primary veins 6-9 pairs; petioles 10-15 mm long, glabrous. **Inflorescence** axillary, rarely apparently terminal, decussate racemose, 5-15 cm long.

Flowers 3-23, fragrant; bracts linear, 1-2 mm long; pedicels 5-25 mm long. **Calyx** 1.5-2.5 mm long, obconic; lobes very short or up to 0.5 mm long. **Corolla** white with tinged pink; tube 15-25 mm long; lobes 5-7, 10-15 mm long, 2.5-6 mm wide. **Fruit** ellipsoid, usually pair, 8-15 mm long, 5-10 mm wide, black (Fig. 62).

Thailand.— Northern: Mae Hong Son, Chiang Mai (type of *J. sempervirens*), Lampang, Nan.

Distribution.— India (type), Myanmar, S China (Yunnan—type of *J. wangii* and *J. robustifolium*).

Ecology.— Lower montane forest, alt. 1,400-1,700 m (Doi Phu Kha).

Phenology.— Flowering: November-April; fruiting: January-May.

Voucher specimens.— *P. Srisanga* 360, 1266, 1760, 2698; *P. Srisanga* & *S. Watthana* 686; *P. Srisanga et al.* 2475.

Notes.— New locality recorded from Nan, in Thailand.

2. *Jasminum coarctatum* Roxb. var. *vanprukii* (Craib) P.S. Green

Kew Bull. 50: 569. 1995; in Fl. Thailand 7(2): 321. 2000. — *J. vanprukii* Craib, Kew Bull. 1913: 200. 1913; Kerr in Fl. Siam. Enum. 2: 407. 1939.

Woody climber or straggling shrub; young shoots velutinous. **Leaves** oblong-elliptic to broadly ovate, chartaceous, 6-15 cm long, 3-7 cm wide, velutinous at least at the midrib and veins below; primary veins 4-7 pairs; petioles 5-10 mm long, velutinous. **Inflorescence** terminal, dense head, (3-)5- to many-flowered; bracts white or creamy-white, leaf-like, 5-25 mm long; pedicels 0-4 mm long. **Calyx** tube ca. 2 mm long; lobes filiform, 5-14 mm long, velutinous. **Corolla** white; tube 20-22 mm long; lobes 6-8, 8-10 mm long, 2-5 mm wide. **Fruit** ellipsoid, 9-10 mm long, 6-7 mm wide, black.

Thailand.— Northern: Chiang Rai, Lampang, Phrae (type), Nan; North-eastern: Loei, Khon Kaen.

Distribution.— Laos.

Ecology.— Dry evergreen forest, alt. 700 m (Tham Pha Kong, Doi Phu Kha).

Phenology.— Flowering and fruiting: March-June.

Vernacular.— มะลิป่า Mali pa (General).

Voucher specimens.— *P. Srisanga* 2515.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

3. *Jasminum decipiens* P.S. Green

Kew Bull. 50: 570, fig. 1. 1995; in Fl. Thailand 7(2): 337. 2000. — *J. subtriplinerve* sensu Kerr in Fl. Siam. Enum. 2: 407. 1939, pro parte, non Bl.

Woody climber or straggling shrub; young shoots glabrous or rarely finely puberulous. **Leaves** ovate to lanceolate or elliptic, (4-)7-10(-12) cm long, (2-)3.5-5(-

6.5) cm wide, glabrous; base obtuse to sometimes acute, attenuate onto the petiole; apex acute to acuminate; prominent primary veins 1(-2) pairs at the base, forming a submarginal vein, 1-2 primary veins above, primary veins only visible, raised below, slightly sunk above; petioles 10-20 mm long, glabrous. **Inflorescence** terminal on side shoots; cymose-corymbose, somewhat open to fairly dense, 15- to many-flowered, fragrant, puberulous; basal bracts leaf-like, the upper linear; pedicels 1-5 mm long. **Calyx** tube ca. 2 mm long; lobes (5-)6, narrowly acuminate-triangular, (1.5-)2(-3) mm long, exterior puberulous, pubescent within. **Corolla** white; tube 7-8 mm long; lobes 7, 5-6 mm long, 3-5 mm wide. **Fruit** ellipsoid, ca. 15 mm long, 10 mm wide (Fig. 63).

Thailand.— Northern: Nan; North-eastern: Loei; Eastern: Nakhon Ratchasima (type); Central: Nakhon Nayok.

Distribution.— Myanmar.

Ecology.— Lower montane forest, alt. 1,200-1,400 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: September-January.

Voucher specimens.— *P. Srisanga* 1174, 1878; *P. Srisanga* & *C. Puff* 1089.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

4. *Jasminum lanceolaria* Roxb. subsp. *scortechinii* (King & Gamble) P.S. Green

Kew Bull. 50: 576. 1995; in Fl. Thailand 7(2): 312. 2000. — *J. scortechinii* King & Gamble, J. As. Soc. Beng. 74(2): 264. 1906; Kerr in Fl. Siam. Enum. 2: 404. 1939.

Woody climber; young shoots glabrous. **Leaves** trifoliolate, subcoriaceous, elliptic-oblong, glabrous, terminal leaflet 7-13 cm long, 3.5-6 cm wide, the lateral 5-8 cm long, 3-4 cm wide; base obtuse to rounded; apex acute to shortly acuminate; primary veins 4-6 pairs; secondary veins indistinct; petioles 1-3 cm long; terminal petiolule 1-3 cm long, the lateral 1-2 cm long. **Inflorescence** axillary and terminal; cymose-paniculate to corymbose, 6-15 cm long, glabrous, 8- to many-flowered; pedicels absent or up to 3 mm long. **Calyx** tube ca. 2 mm long; lobes triangular, minute. **Corolla** white; tube 10-15 mm long; lobes 7-12 mm long. **Anthers** ca. 3 mm long; connective appendage acute, ca. 0.5 mm long. **Ovary** ca. 0.5 mm long; style 10-14 mm long; stigma ca. 2 mm long. **Fruit** ellipsoid, 18-20 mm long, 12-14 mm wide.

Thailand.— Northern: Chiang Mai, Nan; Eastern: Chaiyaphum, Nakhon Ratchasima, Si Sa Ket; South-eastern: Prachin Buri, Sa Kaeo, Trat; South-western: Kanchanaburi; Peninsular: Nakhon Si Thammarat.

Distribution.— Vietnam, Malaysia (type).

Ecology.— Lower montane forest, alt. 1,600 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-September.

Vernacular.— มะลิน้อย Mali noi (General).

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2038.

5. *Jasminum nervosum* Lour.

Fl. Cochinch.: 20. 1790; Kerr in Fl. Siam. Enum. 2: 402. 1939; Green in Fl. Thailand 7(2): 339. 2000. – *J. anastomosans* Wall. ex DC., Prodr. 8: 305. 1844; Craib, Contrib. Fl. Siam 2: 127. 1912.

Woody climber; young shoots glabrous to sometimes very finely puberulent at first. **Leaves** ovate to narrowly ovate or broadly lanceolate to lanceolate, (2.5-)3.5-7(-12) cm long, (1-)1.5-3.5(-4.5) cm wide, glabrous except minute hairs at the midrib and veins below; base obtuse to rounded; apex acute to acuminate; prominent primary veins 1 pair at the base, forming a submarginal vein; 1-4 primary veins above, raised reticulate below, slightly sunk above. **Inflorescence** axillary, almost sessile, 1- to rarely 3-flowered, glabrous; pedicels 2-5 mm long. **Calyx** tube 2-3 mm long; lobes subulate, 5-12 mm long, glabrous. **Corolla** white with tinged pink; tube 12-20 mm long; lobes 7-8, 12-20 mm long, 1.5-2 mm wide. **Fruit** ellipsoid-spheroid, 10-12 mm long, 8-9 mm wide, black.

Thailand.— Almost throughout the country.

Distribution.— India (Assam), Bhutan, Myanmar, S China, Taiwan, Vietnam, Laos, Cambodia.

Ecology.— Dry evergreen and lower montane forest, alt. 800-1,600 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: May-July.

Vernacular.— มะลิสีน้ำ Mali sai kai (Northern).

Voucher specimens.— *P. Srisanga* 1348, 1415, 2394; *P. Srisanga et al.* 805.

6. *Jasminum perissanthum* P.S. Green

Kew Bull. 50: 578, fig. 2. 1995; in Fl. Thailand 7(2): 321. 2000. – *J. subtriplinerve* sensu Kerr in Fl. Siam. Enum. 2: 407. 1939, pro parte, non Bl.

Woody climber; young shoots glabrous. **Leaves** lanceolate, chartaceous, 4-5 cm long, 2.5-4 cm wide, glabrous; base obtuse, slightly attenuate onto the petiole; apex acute to acuminate; primary veins 5 pairs, slightly raised on both surfaces; secondary veins obscure; petioles 8-10 mm long. **Inflorescence** axillary or terminal, dense, cymose-corymbose, 10-20-flowered, fragrant, glabrous; bracts ovate, leaf-like, 1.5-2 cm long, 1-1.5 cm wide; pedicels 1-2 mm long. **Calyx** tube ca. 2 mm long; lobes linear, 5-7 mm long, glabrous. **Corolla** white; tube 25-30 mm long; lobes 8-9, 12-15 mm long, 5-6 mm wide. **Fruit** not known.

Thailand.— Northern: Nan (Doi Phu Kha-type: *Kerr* 4924: K, BK, BM, E, L).

Distribution.— Endemic to Doi Phu Kha, only known from the type collection.

Ecology.— Lower montane forest, alt. 1,600-1,700 m.

Phenology.— Flowering: February.

Vernacular.— มะลิภูคา Mali Phukha (Nan).

Notes.— Possibly endangered. The species could not be traced. Description is based on Green (1995; 2000).

7. *Jasminum rufohirtum* Gagnep.

Bull. Soc. Bot. France 80: 77. 1933; in Fl. Gén. I.-C. 3: 1057. 1933; Chang et al. in Fl. China 15: 317. 1996; in Fl. China Illustrations 15: 274, fig. 274: 1. 2000; Srisanga, Trisonthi & Green, Thai For. Bull. (Bot.) 32: 146, fig. 1. 2004. — *J. yunnanense* Jien ex P.Y. Bai, Acta Bot. Yunnan. 5(1): 66, fig. 2. 1983; Miao in Fl. Reipubl. Pop. Sin. 61: 211, fig. 55: 1. 1992.

Woody climber; young shoots rusty villous. **Leaves** lanceolate, elliptic to ovate, chartaceous, (7-)10-15 cm long, (2.5-)5-8 cm wide; base rounded or cordate; apex acute, shortly acuminate or caudate, rusty villous on both surfaces, especially below and on the veins; midrib impressed above, raised and prominent below; primary veins 6-8 pairs, prominent below; petioles 3-6 mm long, rusty villous. **Inflorescence** terminal cymes, congested, 5- or many-flowered, rusty villous; bracts filiform, 3-6 mm long, rusty villous. **Flowers** fragrant; pedicels 0.5-2 mm long, rusty villous; bracteoles 2, filiform, ca. 5 mm long, rusty villous. **Calyx** rusty villous; tube 1-2 mm long; lobes 6-7, filiform, 3-8 mm long. **Corolla** white, glabrous; tube 2.5-3 cm long; lobes 6-8, lanceolate, ca. 10 mm long, 3 mm wide, acute at apex. **Anthers** 4-4.5 mm long, glabrous; connective appendage acute. **Ovary** glabrous, 0.5-1 mm long; style ca. 4 mm long, glabrous; stigma ca. 2.5 mm long. **Fruit** ellipsoid, ca. 10 mm long, 6 mm wide, black (Figs. 64, 138).

Thailand.— Northern: Nan.

Distribution.— S China (Yunnan—type of *J. yunnanense*), Laos and Vietnam (syntypes).

Ecology.— Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: March-May; fruiting: May-June.

Voucher specimens.— *P. Srisanga* 1345.

Notes.— A very rare species with few specimens collected and new recorded for Thailand.

4. *OLEA* L.

Sp. Pl.: 8. 1753; Green in Fl. Thailand 7(2): 272. 2000; in Fam. Gen. Vasc. Pl. 7: 303. 2004. — *Tetrapilus* Lour., Fl. Cochinch. 2: 611. 1790.

Evergreen trees or shrubs, monoecious or polygamo-dioecious. **Leaves** opposite, simple, entire or toothed, coriaceous or chartaceous. **Inflorescence** terminal or axillary, cymose-paniculate, racemose-decussate or subumbellate. **Flowers** small, regular, bisexual or unisexual, white or pale yellow. **Calyx** short, 4-lobed or subtruncate. **Corolla** tube usually short; lobes 4, induplicate-valvate. **Stamens** 2(4); filaments short or absent, attached to the corolla tube; anthers rounded, ovate to

elliptic. **Ovary** conical, 2-locular; ovules 2 and pendulous in each loculus; style capitate or bilobed. **Fruit** a drupe.

About 32 species distributed in the tropic, subtropic and warm temperate regions of the Old World. Olive (*Olea europea* L.) is an important widely cultivated economic plant. Five species native to Thailand (Green, 2000). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves pilose-velutinous below, especially on the midrib; petioles pilose **1. *O. rosea***
 1. Leaves glabrous; petioles glabrous or finely puberulent **2. *O. salicifolia***

1. *Olea rosea* Craib

Kew Bull. 1911: 411. 1911; Kerr in Fl. Siam. Enum. 2: 417. 1939; Green in Fl. Thailand 7(2): 276, fig. 12. 2000. – *O. oblanceolata* Craib, Kew Bull. 1911: 410. 1911; Kerr in Fl. Siam. Enum. 2: 417. 1939.

Shrub or small tree, up to 10 m high, dioecious; young shoots pilose. **Leaves** lanceolate to oblong-elliptic, rarely slightly oblanceolate, subcoriaceous, (5-)8-13(-16) cm long, 2-4(-6) cm wide, pilose-velutinous below, especially along the midrib; base acute or sometimes obtuse; apex acuminate to long acute; margin entire or dentate-serrate, especially in the upper half; primary veins 6-9 pairs, raised below, usually sunk above; petioles 5-10 mm long, pilose. **Inflorescence** axillary, paniculate, subumbellate, many-flowered, 2-8 cm long, finely velutinous to pilose; pedicels absent or up to 2 mm long. **Calyx** ca. 1 mm long, divided to about half way, glabrous to pilose, ciliolate. **Corolla** white, yellow, greenish-yellow or pink; lobes ca. 1 mm long, rounded, hooded; the male obpyriform, tube ca. 1 mm long; female cylindrical, tube ca. 3 mm long. **Anthers** ellipsoid, ca. 1 mm long. **Ovary** conical, 1.5-2 mm long; style short; stigma small, bilobed. **Drupe** obliquely ellipsoid, 10-12 mm long, 5-6 mm wide.

Thailand.— Northern: Chiang Mai (type: *Hosseus* 515a: K), Nan.

Distribution.— S China (Yunnan), Laos, Vietnam, Cambodia.

Ecology.— Dry evergreen forest, along streams, alt. 700-1,200 m (Sapan Waterfall).

Phenology.— Flowering: December-July; fruiting: October.

Voucher specimens.— *P. Srisanga* 1241.

Notes.— New locality recorded from Nan, in Thailand.

2. *Olea salicifolia* Wall. ex G. Don

Gen. Hist. 4: 48. 1837; Kerr in Fl. Siam. Enum. 2: 417. 1939; Green in Fl. Thailand 7 (2): 274, fig. 11, pl. IX: 1. 2000. – *O. dentata* Wall. ex DC., Prodr. 8: 286. 1844; Kerr

in Fl. Siam. Enum. 2: 417. 1939. – *Linociera cambodiana* Hance, J. Bot. 15: 335. 1877. – *Olea dentata* var. *salicifolia* (Wall. ex G. Don) C.B. Clarke in Fl. Br. Ind. 3: 613. 1882. – *O. penangiana* Ridl., J. Fed. Mal. States Mus. 10: 148. 1920. – *O. dioica* auct. non Roxb.: Kerr in Fl. Siam. Enum. 2: 416. 1939.

Tree up to 15 m high, dioecious; young shoots glabrescent or pubescent. **Leaves** lanceolate, coriaceous, (5-)9-15(-24) cm long, 2-5(-6.5) cm wide, glabrous; base acute to usually obtuse; apex acute to acuminate; margin entire or dentate-serrate in the upper half; primary veins 6-8 pairs; petioles 3-15 mm long, glabrous or puberulent. **Inflorescence** axillary or terminal on side shoots, paniculate, 6-15 cm long, ultimate branches subumbellate, glabrous or puberulent; pedicels 0.5-3 mm long. **Calyx** ca. 1 mm long, lobed to half length, glabrous or puberulent, ciliolate. **Corolla** yellow or white; tube 1-4 mm long; lobes ca. 1 mm long, rounded, hooded. **Anthers** broadly ellipsoid, 0.5-1 mm long, subsessile at base of corolla tube. **Ovary** rounded-conical, 1-2 mm long; style short; stigma bilobed. **Drupe** ovoid to ellipsoid, 10-12 mm long, 5-6 mm wide, bluish black.

Thailand.— Throughout the country.

Distribution.— NE India (type), Myanmar, S China (Yunnan), Laos, Vietnam, Cambodia, Malaysia (Penang).

Ecology.— Dry evergreen forest, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: November-July.

Vernacular.— มวกกอ Muak ko (Loei).

Voucher specimens.— *P. Srisanga* 343, 345.

ONAGRACEAE

Annual or perennial herbs, occasionally woody at base, sometimes aquatic, or shrubs. **Leaves** simple, alternate or opposite; stipules absent or reduced, deltoid. **Inflorescence** in terminal racemose or flower solitary, axillary. **Flowers** 4-5-merous, bisexual, actinomorphic, usually with a long hypanthium, subtended by reduced leaves or bracts. **Sepals** valvate, erect, persistent. **Petals** valvate, imbricate or convolute, sometimes clawed. **Stamens** 4, 5, 8 or 10, often in 2 whorls; anthers usually versatile, sometimes seemingly basifixed by reduction, opening by longitudinal slits. **Ovary** inferior, 4-5-locular, axile placentation; ovules numerous; style 1; stigma capitate, clavate or globose. **Fruit** a loculicidal or irregularly rupturing capsule. **Seeds** numerous, sometimes in powdery or woody endocarp.

About 18 genera and 650 species in tropical and temperate regions, especially in the N hemisphere in the New World. About 4 genera and 10 species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

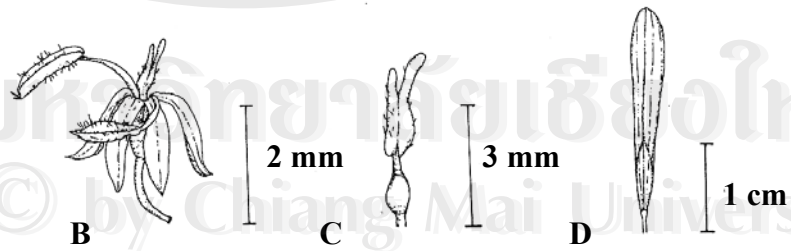


Figure 61. *Fraxinus floribunda* Wall. ex Roxb.

A. flowering branch; B. flower; C. pistil; D. fruit.

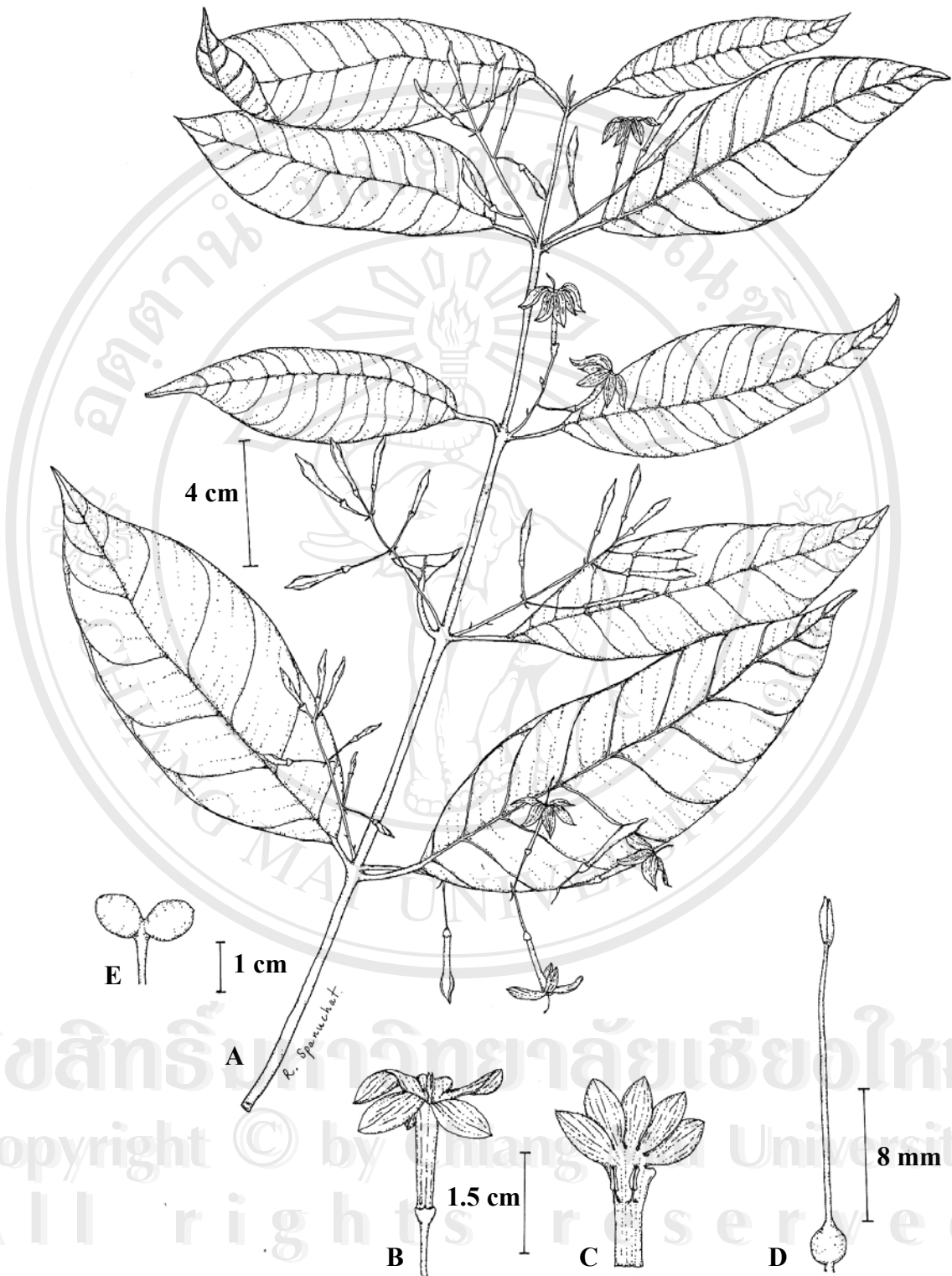


Figure 62. *Jasminum attenuatum* Roxb. ex G. Don

A. flowering branch; B. flower; C. opened corolla; D. pistil; E. fruit.

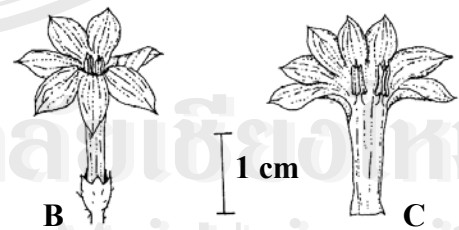
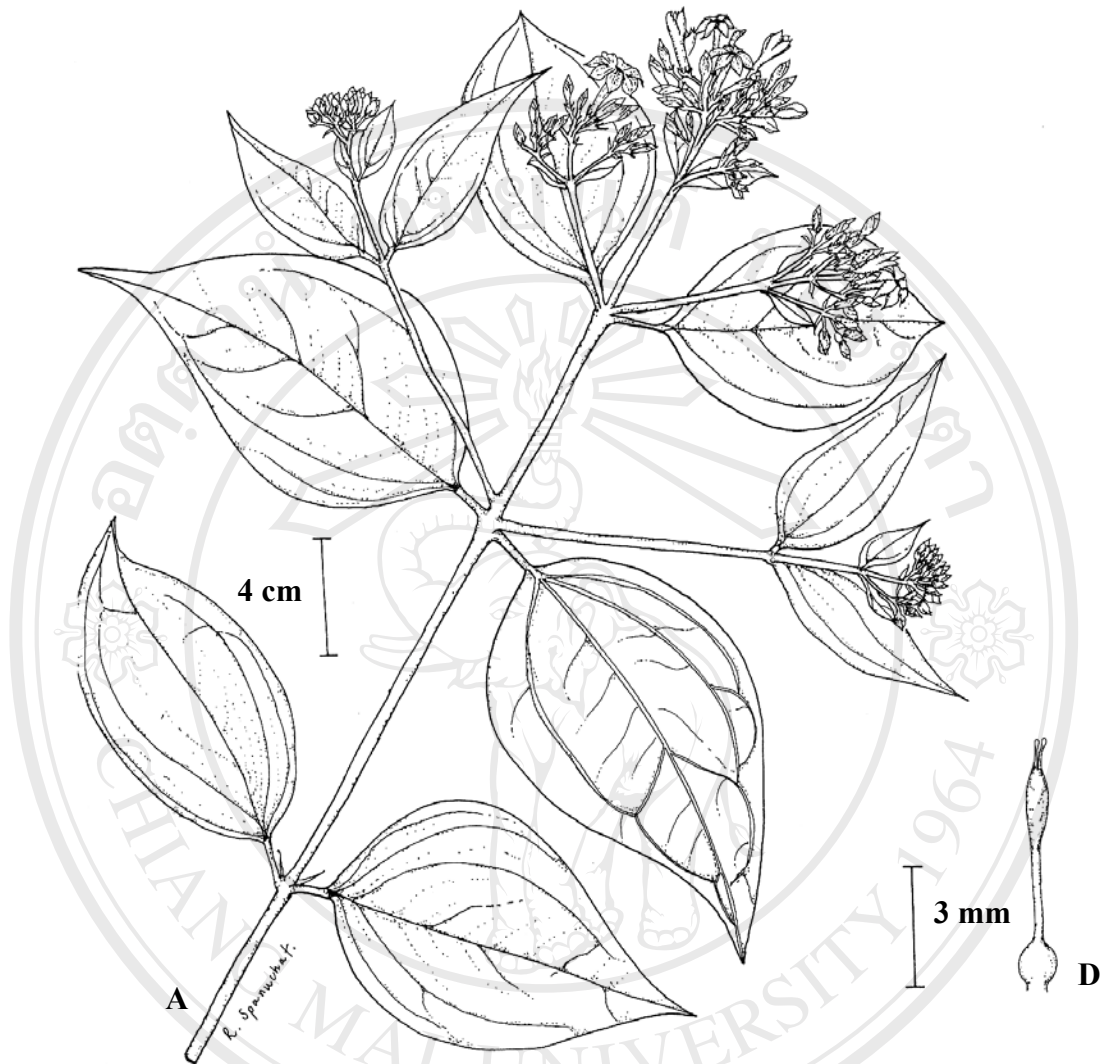


Figure 63. *Jasminum decipiens* P.S. Green

A. flowering branch; B. flower; C. opened corolla; D. pistil.

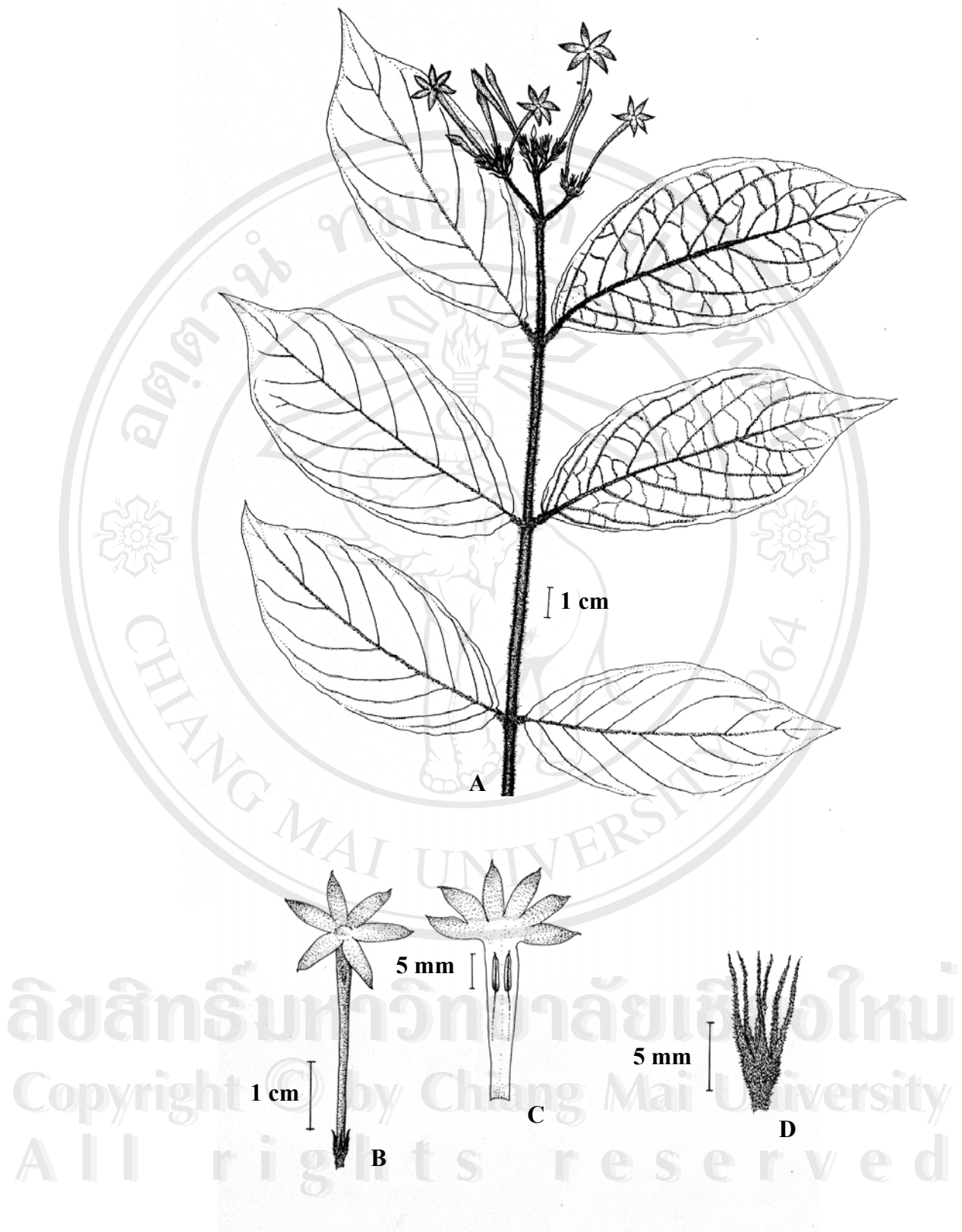


Figure 64. *Jasminum rufohirtum* Gagnep.

A. flowering branch; B. flower; C. opened corolla; D. calyx. All from *P. Srisanga* 1345.

LUDWIGIA L.

Sp. Pl.: 118. 1753; Raven, Reinwardtia 6: 327. 1963; in Fl. Mal. I(8): 99. 1977. – *Jussiaea* L., Sp. Pl.: 388. 1753. – *Nematopyxis* Miq., Fl. Ind. Bat. 1(1): 600. 1855.

Erect or creeping herbs, sometimes rooting at the nodes, or shrubs. Underwater parts often swollen and spongy or bearing inflated white spongy aerophores. **Leaves** alternate or opposite, mostly entire; stipules absent or reduced, deltoid. **Inflorescence** in terminal racemose or flower solitary, axillary. **Flowers** 4-5-merous. **Petals** yellow or white, as many as the sepals or absent, caducous. **Stamens** as many as the sepals or twice numbers; anthers usually versatile, sometimes seemingly basifixed by reduction. **Ovary** 4-5-locular, ovules uniseriate or pluriseriate in each locular; stigma capitate or globose, often lobed. **Capsule** terete or 4-angled.

About 82 species, cosmopolitan, especially in tropical America (Mabberley, 1997). About 5 species in Thailand.

***Ludwigia perennis* L.**

Sp. Pl.: 119. 1753; Raven, Reinwardtia 6: 367. 1963; Cuong & Vidal in Fl. C.L.V. 14: 27, Pl. 4: 12-16. 1973; Raven in Fl. Mal. I(8): 103, fig. 2. 1977. *Jussiaea caryophyllea* Lam., Enc. 3: 331. 1789. – *Ludwigia parviflora* Roxb. in Fl. Ind. 1: 440. 1820; C.B. Clarke in Fl. Br. Ind. 2: 588. 1879; Craib in Fl. Siam. Enum. 1: 734. 1931. – *L. lythroides* Bl., Bijdr.: 1134. 1826. – *L. gracilis* Miq., Fl. Ind. Bat. 1(1): 629. 1855. – *Jussiaea perennis* (L.) Brenan, Kew Bull. 8: 163. 1953.

Erect herbs, up to 1 m high, often woody at base; stem angular, glabrous or minutely puberulous. **Leaves** alternate, lanceolate to narrowly elliptic, 1-10 cm long, 0.3-2.5 cm wide, glabrous or minutely puberulous; base cuneate, attenuate onto the petiole; apex subacute; primary veins 6-12 pairs; petioles 2-15 mm long, slightly winged. **Flower** solitary, axillary, sessile or subsessile. **Sepals** 4(-5), deltoid, 2-3 mm long, ca. 1 mm wide, glabrous or minutely puberulous. **Petals** yellow, 4(-5), elliptic, 2-3 mm long, 1-2 mm wide. **Stamens** 4(-5); filaments ca. 0.5 mm long; anthers ovoid to subglobose, ca. 0.5 mm long and wide. **Ovary** glabrous or minutely puberulous, 5-6 mm long, ca. 2 mm wide; style 1-1.5 mm long; stigma globose. **Capsule** narrowly clavate, terete, (10-)15-20 mm long, ca. 2 mm wide, thin-walled, glabrous or minutely puberulous, brown. **Seeds** pluriseriate in each cell, ellipsoid, ca. 0.5 mm long, light brown, glabrous.

Thailand.— Almost throughout the country.

Distribution.— Tropical Africa, S & SE Asia to Malesia, tropical Australia and New Caledonia.

Ecology.— In marsh, open places, alt. 1,500 m (Doi Phu Wae).

Phenology.— Almost throughout the year.

Voucher specimens.— *P. Srisanga* 2630.

OPILIACEAE

Small, evergreen trees, shrubs, or woody climbers, some species are known to be root parasites. **Leaves** simple, alternate, exstipulate. **Inflorescence** axillary, terminal or cauliflorous, spikes, racemes or panicles. **Flowers** usually bisexual, rarely plant dioecious. **Tepals** 4-6, free or united, valvate. **Stamens** as many as and opposite to the tepals. Disc cupular, annular or lobed. **Ovary** superior, unilocular. **Fruit** drupaceous, 1-seeded, yellowish, orange, or red. **Seed** large, conform to the drupe.

A small tropical family with 10 genera and 32 species (Mabberley, 1997). Six genera and 7 species in Thailand (Hiepko, 1987). Only 1 species recorded from Doi Phu Kha National Park.

UROBOTRYA Stapf

J. Linn. Soc. London 37: 89. 1905; Hiepko, Ber. Deutsch. Bot. Ges. 84: 662. 1972; Willdenowia 9: 29. 1979; in Fl. Thailand 5(1): 97. 1987. – *Opilia* subgen. *Urobotrya* (Stapf) Engler, Bot. Jahrb. Syst. 43: 171. 1909.

Shrubs or small trees, usually glabrous, sometimes the youngest twigs with short hairs. **Leaves** glabrous, thinly coriaceous. **Inflorescence** in racemes, usually 3-flowered per bract; rachis glabrous. Bracts broad, green, with hyaline ciliate margin, densely imbricate, caducous before anthesis. **Flowers** bisexual, 4-merous, pedicellate. **Tepals** free, oblong, acute, recurved. **Stamens** exceeding the perianth. Disc annular, fleshy. **Ovary** conical to cylindrical; stigma sessile. **Drupe** ellipsoid.

Seven species: 2 species in Africa, and 5 species in SE Asia, Borneo and Flores. Two species in Thailand (Hiepko, 1987).

Urobotrya latisquama (Gagnep.) Hiepko

Ber. Deutsch. Bot. Ges. 84: 662. 1972; Nat. Hist. Bull. Siam Soc. 27: 122, fig. 6. 1978; Willdenowia 9: 29. 1979; in Fl. Thailand 5(1): 97. 1987. – *Lepionurus latisquamus* Gagnep., Not. Syst. Paris 1: 201. 1910. – *L. macrostachyus* Gagnep., Not. Syst. Paris 1: 202. 1910. – *L. oxylepis* Gagnep., Not. Syst. Paris 13: 135. 1947.

Shrub or small tree up to 4 m high. **Leaves** lanceolate to broadly elliptic, (7-) 11-18(-23) cm long, 3-6(-8.5) cm wide; base cuneate; apex acute to acuminate; petioles 1-3 mm long. **Inflorescence** axillary, sometimes on older branches or at the main trunk; rachis 7-11 cm long. Bracts greenish white, broadly ovate to orbicular, abruptly acuminate, 6-7 mm long and wide. **Flowers** usually 3 per bract, without bracteoles, rarely 4-flowered per bract and then with 2 small bracteoles; pedicels 3-5 mm long. **Tepals** greenish yellow, ca. 3 mm long. **Stamens** white; filaments 4-5 mm long; anthers elliptic, ca 1 mm long. Disc broadly protruding-annular. **Ovary** cylindrical, 1-1.5 mm long. **Drupe** red, 13-15 mm long, 7-9 mm wide.

Thailand.— Northern: Nan; North-eastern: Loei.

Distribution.— S China, N Laos (type), N Vietnam.

Ecology.— Deciduous and dry evergreen forests, alt. 700-800 m (Doi Phu Kha).

Phenology.— Flowering: March-July; fruiting: August-September.

Vernacular.— □□□□□ Ha e n tum (Loei).

Voucher specimens.— *P. Srisanga* 560.

Notes.— New locality recorded from Nan, in Thailand.

OROBANCHACEAE

Root parasitic herbs without chlorophyll; stems usually fleshy and unbranched. **Leaves** scale-like, spirally arranged around stems or absent; stipules absent. **Inflorescence** terminal, raceme or spike or flower solitary. **Flowers** bisexual, zygomorphic. **Sepals** (1-)4-5, spathaceous or lobed. **Petals** 5, sympetalous, more or less 2-lipped, the upper 2-lobed, the lower 3-lobed; lobes imbricate. **Stamens** 4, didynamous; staminode 1, adaxial or absent; anthers 2-locular, dehiscing by longitudinal slits or pores, often connivent in pairs. **Ovary** superior, 1-locular, (2-)4(-6) intruded parietal placentation; ovules numerous; style 1, long; stigma 2-lobed or peltate. **Fruit** a loculicidal capsule, often enveloped by the sepals. **Seeds** numerous, minute.

An almost cosmopolitan family with 15-16 genera and about 150-200 species but absent from eastern part of S America, E Australia and New Zealand. Two genera and 3 species in Thailand (Parnell, 2001). Only 1 species recorded from Doi Phu Kha National Park. Recently, Orobanchaceae has been treated as part of Scrophulariaceae (Fischer, 2004).

AEGINETIA L.

Sp. Pl. 2: 632. 1753; Parnell, Thai For. Bull. (Bot.) 29: 73. 2001; Fischer in Fam. Gen. Vasc. Pl. 7: 408. 2004.

Leafless, perennial, rhizomatous herbs. **Flower** solitary at the end of the stem. **Calyx** spathaceous, split at the front to the base. **Corolla** tube distinct, constricted above the ovary. **Stamens** included; upper stamens spurred and gibbous; lower stamens gibbous but not spurred; spurs with a terminal conical projection at the tip; anthers dehiscing by apical pores and prolong like slits. **Style** included; stigma large, peltate.

About 4 species distributed in India through China to most of Malesia, parasitic on the roots of monocots especially grasses. Two species in Thailand (Parnell, 2001).

Aeginetia indica L.

Sp. Pl. 2: 632. 1753; Craib in Fl. Siam. Enum. 3(3): 194. 1962; Parnell, Thai For. Bull. (Bot.) 29: 73. 2001. – *A. japonica* Sieb. & Zucc., Abh. Math. Acad. Moench 4 (3): 341. 1845.

Stem erect, 1-several arising from rhizome, glabrous, all flowering, 10-35 cm high, reddish to dark purplish, rarely white. **Calyx** reddish to dark purplish, rarely white, 2-4 cm long, glabrous, often glossy, acute at apex. **Corolla** reddish to dark purplish, rarely white, 3-5 cm long, tubular, glossy outside; tube slightly curved, exerted 1.5-2 cm beyond calyx; lobes rounded. **Filaments** 4-6 mm long; anthers 4-5 mm long. **Ovary** narrowly ellipsoid 1-1.5 cm long, glabrous; style yellow or whitish pink, curved, 1.5-2 cm long, glabrous. **Capsule** ovoid, 2-2.5 cm long, enclosed in persistent calyx.

Thailand.— Throughout the country.

Distribution.— India (type), Sri Lanka, China, Japan, SE Asia to New Guinea.

Ecology.— Dry evergreen and lower montane forest, alt. 700-1,650 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: August-December.

Vernacular.— ดอกดิน Dok din (General).

Voucher specimens.— *P. Srisanga & C. Maknoi* 2060.

OXALIDACEAE

Trees, shrubs or herbs with tubers or bulbs. **Leaves** compound, pinnate or palmate, often 3-foliolate, exstipulate. **Inflorescence** in axillary cymes or panicles or flower solitary. **Flowers** bisexual, regular. **Calyx** 5, imbricate. **Corolla** 5, free or weakly connate at base, convolute, rarely imbricate. **Stamens** mostly 10, in 2 whorls, basally connate, rarely 5 fertile and 5 sterile; anthers opening by longitudinal slits. **Ovary** superior, (3-)5-locular, axile placentation, (1-)2-several pendulous ovules in each loculus; styles (3-)5, distinct. **Fruit** a loculicidal capsule or berry. **Seeds** often with basal aril.

Six genera and about 775 species mostly in tropical region especially S America (Mabberley, 1997). Three genera and 8 indigenous species in Thailand (Veldkamp, 1970). Only 1 species recorded from Doi Phu Kha National Park.

AVERRHOLA

Sp. Pl.: 428. 1753; Veldkamp in Fl. Thailand 2(1): 21. 1970; Cocucci in Fam. Gen. Vasc. Pl. 6: 288. 2004.

Evergreen trees or shrubs. **Leaves** imparipinnate, 3- or more-jugate. **Inflorescence** in axillary panicles or cauliflorous. **Flowers** 5-merous. **Sepals** shortly connate at base. **Petals** free or coherent above the claw. **Stamens** 10, in 2 whorls, basally connate or 5 fertile and 5 sterile. **Ovary** 5-locular; ovules (2-)3-7 in each loculus. **Fruit** a berry, large, yellowish green to yellowish orange, transparent. **Seeds** arillate or not.

Two species, widely cultivated throughout tropical region but original country unknown, possibly native to Malaysia and Indonesia and also occurred wild in Thailand, but type of both species from Sri Lanka (Veldkamp, 1970).

Averrhoa carambola L.

Sp. Pl.: 428. 1753; Craib in Fl. Siam. Enum. 1: 207. 1926; Veldkamp in Fl. Thailand 2 (1): 21. 1970.

Tree up to 20 m high; branches often drooping. **Leaves** 3-6-jugate; rachis up to 20 cm long, puberulous; leaflets lanceolate, elliptic to ovate, variable in shape and size, up to 10 cm long and 4 cm wide; base cuneate to rounded, oblique; apex acute to acuminate, entire, puberulous to glabrescent, glaucous beneath; petiolules 1-2 mm long, puberulous. **Inflorescence** in axillary panicles, rarely ramiflorous, up to 7 cm long, puberulous; pedicels 3-6 mm long, articulated below the flower. **Sepals** red purplish, oblong to ovate, 2-4 mm long, 1-2 mm wide, sparsely puberulous. **Petals** red purplish, oblanceolate to obovate, 6-8 mm long, 2-3 mm wide, coherent above the claw, minute septate-glandular hairy inside. **Stamens** 10, in 2 whorls, 5 fertile and 5 sterile; shorter whorl sterile, often swollen at base, 1.5-2 mm long; fertile ones 3-4 mm long. **Ovary** ellipsoid, 2-3 mm long, sparsely puberulous on ridges; ovules 3-5 in each loculus. **Berry** yellowish orange, ellipsoid, up to 15 cm long and 8 cm wide, 5 deeply lobed, star shaped in cross section. **Seeds** black, up to 10, 10-12 mm long, 3-5 mm wide, enclosing by bilabiate aril.

Thailand.— Northern: Chiang Mai, Nan; South-eastern: Trat; Central: Bangkok.

Distribution.— Native country unknown, possibly native to Malaysia and Indonesia and also occurred wild in Thailand (Veldkamp, 1970).

Ecology.— Dry evergreen forest, near streams, occurred wild, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: April-June; fruiting: June-August.

Uses.— Fruits edible, sour taste.

Vernacular.— มะเฟือง Ma fuang (General).

Voucher specimens.— *P. Srisanga* 1458.

PASSIFLORACEAE

Climbers with tendrils, rarely trees or shrubs. **Leaves** simple, alternate, entire or lobed, or rarely compound, often with glands on the petiole; stipules usually small and deciduous or absent. **Inflorescence** axillary, cymose, or flower solitary. **Flowers** bisexual or unisexual (either staminodes or a vestigial ovary present, and then plants mostly dioecious), actinomorphic. **Sepals** (4-)5(-8), imbricate, free or partly united, persistent. **Petals** as many as and alternate with the sepals, rarely absent, imbricate, free or shortly united. Corona of one or more rows of thread-like filaments or scales

or annular, inserted on the hypanthium, rarely absent. Androgynophore present or absent. **Stamens** (4-)5(-numerous), usually alternate with the petals, free or shortly united or in bundles, sometimes arising from the gynophore; anthers 2-locular, opening by longitudinal slits. **Ovary** superior, sometimes on a gynophore, 1-locular, 3(-5) parietal or rarely apical placentas; styles (1)3(-5), free or basally connate; stigmas often capitate; ovules usually numerous. **Fruit** a berry-like or 3(-5)-valved longitudinal capsule. **Seeds** usually numerous, surrounded by a fleshy aril.

Seventeen genera and about 575 species throughout tropical and subtropical regions especially in America (Mabberley, 1997). Two genera and about 20 species, native or introduced in Thailand. Two genera and 2 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Flowers unisexual. Androgynophore absent. Fruit 3(-5)-valved longitudinal capsule 1. *Adenia*
1. Flowers bisexual. Androgynophore present. Fruit a berry-like, indehiscent 2. *Passiflora*

1. *ADENIA* Forssk.

Fl. Aegypt.-Arab.: 77. 1775; Cusset in Fl. C.L.V. 5: 132. 1967; de Wilde, Med. Landb. Hogeschool Wagen. 71-18: 50. 1971 (monograph); in Fl. Mal. I(7): 417. 1972.

Climbers with tendrils, often with a rootstock or tuber. **Leaves** simple, entire or lobed, or rarely compound, often with 1-2 glands on the petiole apex or leaf base; stipules minute. **Inflorescence** axillary, cymose; bracts and bracteoles minute. **Flowers** unisexual (either staminodes or a vestigial ovary present, and then plants mostly dioecious), greenish or yellowish. **Sepals** (4-)5(-6), free or partly united. **Petals** (4-)5(-6), free or shortly united, mostly smaller than and included within the calyx. Corona mostly a simple lacinate membrane or composed of hairs, sometimes fleshy, or absent. Androgynophore absent. **Stamens** (4-)5(-6), free or shortly united; anthers basifixed. **Ovary** shortly stipitate or sessile, globose to fusiform, 3(-5) parietal placentas; styles 3(-5), free or basally connate; stigmas capitate; ovules usually numerous. **Fruit** a 3(-5)-valved longitudinal capsule, stipitate; pericarp coriaceous to fleshy, green, yellow or red. **Seeds** compressed.

About 92 species in Africa, Madagascar, S & SE Asia (de Wilde, 1971). About 6 species in Thailand.

Adenia heterophylla (Bl.) Koord.

Exk. Fl. Java 2: 637. 1912; Cusset, Adansonia 7(3): 373. 1967; de Wilde, Med. Landb. Hogeschool Wagen. 71-18: 216, fig. 35. 1971 (see also for complete synonymy); in Fl. Mal. I(7): 426, fig. 8. 1972. – *Modecca heterophylla* Bl., Bijdr. 940. 1826. – *Adenia chevalieri* Gagnep., Bull. Mus. Hist. Nat. Paris 25: 126. 1919; Craib in Fl.

Siam. Enum. 1: 746. 1931; Cusset in Fl. C.L.V. 5: 140, Pl. II: 2, V: 20-23, VII: 2-3. 1967; Adansonia 7(3): 372. 1967.

Climber with tendrils; stem glabrous. **Leaves** lanceolate, oblong to elliptic, herbaceous to subcoriaceous, 8-14 cm long, 3-6 cm wide, glabrous on both surfaces; base rounded; apex acute to shortly acuminate; margin entire with 3-15 dark minute glands; primary veins 3-plinerved at base, 2-3 pairs above; petioles 1-2.5 mm long, glabrous. Glands 2, 1-2 mm in diam., on auricles at leaf base. **Inflorescence** up to 20 cm long, up to 40-flowered in male, (1-)2-4(-8)-flowered in female. **Flowers** creamy yellow. **Male flowers** tubular to urceolate, 15-30 mm long, including 7-15 mm long stipe; pedicels 5-10 mm long. Calyx tube 5-12 mm long; lobes (4-)5, narrowly triangular, 1-3 mm long. Petals (4-)5, narrowly triangular to lanceolate, 2-4 mm long. Corona absent. Stamens (4-)5; filaments 1-4 mm long, connate; anthers 3-4 mm long. **Female flowers** tubular, 12-18 mm long, including 2-6 mm long stipe; pedicels 1-10 mm long. Calyx tube 6-13 mm long; lobes (4-)5, narrowly triangular, 1-2 mm long. Petals (4-)5, oblong to lanceolate, 2-4 mm long. Corona absent. Staminodes 1-3 mm long. Gynophore 2-3 mm long. Ovary oblong to subglobose, 3-5 mm long; styles 3(-5), free or slightly connate at base. **Fruit** fusiform, narrowly ellipsoid to oblong-lanceolate, 6-9 cm long, 3-4 cm wide, red, glabrous, 3-valved, 3-ridged; pericarp coriaceous, 1-2 mm thick; gynophore 15-22 mm long; stipe below the withered perianth 3-6 mm long. **Seeds** numerous, obliquely orbicular, compressed, 8-13 mm long and wide, black, surrounded by a fleshy white aril.

Thailand.— Northern: Nan; Central: Phra Nakhon Si Ayutthaya; South-eastern: Chanthaburi.

Distribution.— S China, Laos, Cambodia, Vietnam, Indonesia (Java-type), New Guinea, Philippines, N Australia (Queensland).

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: March-June.

Uses.— Aril edible, sweet taste.

Vernacular.— กอนกุง Kon Kung (Lua-Nan).

Voucher specimens.— *P. Srisanga* 1312, 1466.

Notes.— According to de Wilde (1971), *Adenia heterophylla* (Bl.) Koord. is a variable species which comprises of 4 subspecies and one with 2 varieties, distributed in S China, SE Asia, through Malesia to N Australia. Specimens from Doi Phu Kha National Park belong to subsp. *heterophylla* var. *heterophylla*.

2. PASSIFLORA L.

Sp. Pl.: 955. 1753; Cusset in Fl. C.L.V. 5: 106. 1967; de Wilde in Fl. Mal. I(7): 407. 1972.

Climbers with tendrils, sometimes prostrate. **Leaves** simple, entire or lobed, or rarely compound; petioles with or without glands; stipules minute. **Inflorescence** axillary, cymose; bracts and bracteoles minute. **Flowers** bisexual. **Sepals** 5, free. **Petals** 5, free, usually showy. Corona composed of a mostly complicated outer corona and mostly a flat or plicate inner corona. Androgynophore present. **Stamens**

5(-8); anthers dorsifixed, versatile. **Ovary** sessile or stipitate, globose to fusiform, 3(-5) parietal placentas; styles 3(-5), free; stigmas capitate; ovules usually numerous. **Fruit** a berry-like, indehiscent, stipitate. **Seeds** compressed.

About 430 species in tropical region mainly in America (Mabberley, 1997). About 14 species, native or introduced as ornamentals and for edible fruits in Thailand.

Passiflora wilsonii Hemsl.

Kew Bull. 1908: 17. 1908; Cusset, Adansonia 7(3): 377. 1967; de Wilde, Blumea 20 (1): 235, figs. 1c, 4. 1972. – *P. celata* Cusset in Fl. C.L.V. 5: 122, Pl. II: 13, IV. 1967; Adansonia 7(3): 374. 1967. – *P. spirei* Cusset in Fl. C.L.V. 5: 122, Pl. II: 8, III: 4. 1967; Adansonia 7(3): 376. 1967.

Climber with tendrils; stem pubescent. **Leaves** broadly ovate, bilobed, herbaceous, 5-9 cm long and wide, puberulous on both surfaces, glabrescent above; base broadly rounded; apex acute to acuminate; margin entire; primary veins 5(-7)-plinerved at base, 1-(2) pairs above; petioles 3-5.5 mm long, puberulous, with 2 glands below the middle. **Inflorescence** subsessile, 2-20-flowered. **Flowers** creamy white; pedicels 5-15 mm long. **Sepals** oblong to ovate, 7-11 mm long, glabrous. **Petals** oblong, 7-10 mm long, glabrous. Outer corona consisting of threads in 1 row, 3-6 mm long; inner corona plicate, 2-3 mm long. Androgynophore 6-10 mm long. **Stamens** 5; filaments 4-6 mm long, anthers 2-3 mm long. **Ovary** ellipsoid, 2-3 mm long, glabrous, sessile; styles 3, 3-5 mm long, curved. **Fruit** subglobose, 2-2.5 cm in diam., glabrous; pericarp coriaceous, ca. 0.5 mm thick; androgynophore 10-12 mm long; stipe below the withered perianth 10-12 mm long. **Seeds** numerous, obliquely ovoid-orbicular, compressed, 3-4 mm long and wide, with honeycombed surface, surrounded by a fleshy aril.

Thailand.— Northern: Nan; Central: Phra Nakhon Si Ayutthaya.

Distribution.— Myanmar, S China (Yunnan-type), Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,700 m (Doi Phu Kha).

Phenology.— Flowering: January-February; fruiting: May-June.

Voucher specimens.— *P. Srisanga* 1436.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

PIPERACEAE

Trees, shrubs, herbs or climbers, sometimes epiphytic, often aromatic. Vascular bundles of the stem closed and scattered in transverse section as in monocotyledon-like. **Leaves** simple, alternate or opposite, entire, succulent, membranous or coriaceous, petiolate. **Inflorescence** axillary, terminal or leaf-opposed, spikes or rarely racemes, simple or compound. **Flowers** bisexual or unisexual, minute; perianth absent, each flower subtended by a bract. **Stamens** 2-6, free. **Ovary** superior, 1-locular; ovule solitary, basal. **Fruit** a baccate or drupaceous.

A pantropical family with 5 genera and about 3,000 species (Tebbs, 1993). Two genera and about 40 species in Thailand. Two genera and 8 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Succulent herbs. Stipules absent. Stamens 2. Stigma 1 **1. *Peperomia***
 1. Trees, shrubs, herbs or climbers. Stipules present. Stamens 2-6. Stigmas 2-4 **2. *Piper***

1. *PEPEROMIA* Ruiz Lopez & Pavon

Fl. Peruv. Prodr. 8: 8. 1794; Tebbs in Fam. Gen. Vasc. Pl. 2: 519. 1993; Cheng, Xia & Gilbert in Fl. China 4: 129. 1999.

Succulent herbs, terrestrial or epiphytic, erect, repent or scandent, rarely more than 1 m, exstipulate. **Leaves** alternate, opposite or whorled, glabrous or pubescent, sometimes with pellucid glands; venation palmate or pinnate; petioles sometimes sheathing. **Inflorescence** axillary or terminal, simple or compound spikes, usually erect. **Flowers** bisexual, sessile or shortly pedicellate; floral bracts usually orbicular. **Stamens** 2; filaments short. **Stigma** 1, penicillate. **Fruit** a drupe, sessile or pedicellate.

About 1,000 species, pantropical (Tebbs, 1993). Several species are grown as ornamentals. About 5 native species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves thin and flattened when dry. Rachis of inflorescence glabrous **1. *P. heyneana***
 1. Leaves thick and wrinkled when dry. Rachis of inflorescence pubescent **2. *P. tetraphylla***

1. *Peperomia heyneana* Miq.

Syst. Piper.: 123. 1843; Long in Fl. Bhutan 1(2): 344. 1984; Cheng, Xia & Gilbert in Fl. China 4: 130. 1999.

Perennial herb, 10-30 cm high, stoloniferous; stem glabrous to pubescent. **Leaves** in whorls of 2-4, elliptic, oblanceolate to obovate, rarely suborbicular, 5-15(-37) mm long, 3-8(-18) mm wide, thin and flattened when dry, pubescent when young and then becoming glabrous or sparsely hairy towards the base; base cuneate; apex obtuse to rounded, sometimes emarginate; petioles 1-8(-12) mm long, pubescent.

Spike terminal or rarely axillary, usually solitary or rarely few-fascicled, 1-4.5 cm long; rachis glabrous. **Fruit** ovoid, ca. 0.5-1 mm long.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, Sikkim, Myanmar, China.

Ecology.— Dry evergreen and lower montane forest, on moist rocks, on tree trunks, sometimes by stream banks, and on limestone rocks in lower montane scrub, alt. 800-1,700 m (Doi Phu Kha, Doi Phu Wae, Sapan Waterfall).

Phenology.— Flowering and fruiting: July-December.

Voucher specimens.— *P. Srisanga* 424, 1583, 1690, 2158, 2295; *P. Srisanga et al.* 785.

2. *Peperomia tetraphylla* (G. Forst.) Hook. & Arn.

Bot. Beechey Voy.: 97. 1832; Long in Fl. Bhutan 1(2): 344, fig. 28: n-q. 1984; Cheng, Xia & Gilbert in Fl. China 4: 129. 1999. – *Piper teraphyllum* G. Forst., Prodr. Fl. Ins. Austr. 5: 5. 1786.

Perennial herb, 10-30 cm high, stoloniferous; stem glabrous to pubescent. **Leaves** in whorls of 4, elliptic, ovate to suborbicular, 8-13 mm long, 5-9 mm wide, thick and wrinkled when dry, glabrous or pubescent; base cuneate to obtuse; apex obtuse to rounded; petioles 1-2 mm long, pubescent. **Spike** terminal or axillary, solitary, 2-4.5 cm long; rachis pubescent. **Fruit** ovoid, ca. 1 mm long.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Sri Lanka, Nepal, Bhutan, Sikkim, China, SE Asia, Africa, Central and S America, Oceania.

Ecology.— Lower montane forest, on tree trunks, alt. 1,300-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: September-December.

Voucher specimens.— *P. Srisanga* 362, 1203, 1688, 2293.

2. *PIPER* L.

Sp. Pl.: 28. 1753; Tebbs in Fam. Gen. Vasc. Pl. 2: 518. 1993; Cheng, Xia & Gilbert in Fl. China 4: 111. 1999.

Shrubs or climbers, rarely herbs or trees, terrestrial or rarely epiphytic, stipulate. Stems often thickened at nodes and occasionally producing adventitious roots. **Leaves** alternate, symmetrical or asymmetrical, occasionally peltate, sometimes lobed at base, membranous or coriaceous, often with pellucid glands; venation palmate or pinnate; petioles sometimes sheathing. **Inflorescence** leaf-opposed, spikes or rarely racemes, simple or compound, pedunculate. **Flowers** usually unisexual, rarely bisexual, sessile or pedicellate; floral bracts orbicular, triangular or calciform. **Stamens** 2-6. **Stigmas** 2-4. **Fruit** a drupe, sessile or pedicellate.

About 1,000 species, pantropical (Tebbs, 1993). Several species are spices, *Piper nigrum* L. is the most important cultivated for the production of Pepper. Many species are used as local medicine. About 35 species in Thailand. Six species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|--------------------------------------|
| 1. Erect subshrubs | 1. <i>P. boehmeriifolium</i> |
| 1. Woody climbers | |
| 2. Infructescence subglobose or shortly cylindric, less than 2 cm long | 3. <i>P. mullesua</i> |
| 3. Leaves subcoriaceous, colourless glandular beneath | 6. <i>P. sylvaticum</i> |
| 3. Leaves membranous, distinctly dark glands beneath | |
| 2. Infructescence oblong, longer than 2 cm | 2. <i>P. aff. laetispicum</i> |
| 4. Fruits with distinctly stalk | |
| 4. Fruits sessile | |
| 5. Leaves elliptic to ovate, membranous, 9-15 cm long, 6-9 cm wide | 4. <i>P. pedicellatum</i> |
| 5. Leaves oblong-lanceolate to elliptic, subcoriaceous, 6-12 cm long, 2-4.5 cm wide | 5. <i>P. suipigua</i> |

1. *Piper boehmeriifolium* (Miq.) C. DC.

In A. DC., Prodr. 16(1): 348. 1868; Cheng, Xia & Gilbert in Fl. China 4: 123. 1999. – *Chavica boehmerifolia* Miq., Syst. Piper.: 123. 1843.

Erect subshrub, 1-2 m high; stem terete, ridged when dry, glabrous or nearly so. **Leaves** lanceolate, elliptic to narrowly ovate, membranous, (8-)13-24 cm long, (2.5-)4-10 cm wide, glabrous on both surfaces or sparsely pubescent on veins, glandular beneath; base oblique; apex acuminate; petioles 3-10 mm long, glabrous or sparsely pubescent. **Flowers** unisexual, white or greenish white. **Male spikes** 10-16(-20) cm long, 0.2-0.4 cm wide; peduncles 1-3.5 cm long; bracts suborbicular, 1-2 mm long and wide, peltate, stalked, glabrous; stamens 2. **Female spikes** 9-12 cm long; peduncles and bracts as in male spikes. **Fruit** densely clustered, subglobose, 2-3 mm in diam.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Bhutan, Sikkim, Myanmar, China, Vietnam, Malaysia.

Ecology.— Lower montane forest, alt. 1,400-1,700 m (Doi Phu Kha).

Phenology.— Flowering: November-January.

Voucher specimens.— *P. Srisanga* 1204, 1259, 2299, 2330, 2366.

2. *Piper aff. laetispicum* C. DC.

Not. Syst. Paris 3: 42. 1914; Cheng, Xia & Gilbert in Fl. China 4: 117. 1999.

Woody climber; stem terete, slightly ridged when dry, glabrous. **Leaves** oblong-lanceolate to narrowly elliptic, subcoriaceous, 12-17 cm long, 4.5-6.5 cm wide, glabrous or subglabrous on upper surface, sparsely minute puberulous and glandular on lower surface; base obliquely cordate; apex acute to acuminate; petioles 2-5 mm long, sparsely minute puberulous. **Flowers** not known. **Infrutescence** 10-13 cm long. **Fruit** subglobose, 4-5 mm in diam., orange; stalks distinct, 4-7 mm long.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Fruiting: May-June.

Voucher specimens.— *P. Srisanga* 1478.

Notes.— Due to lacking flowers materials. The affinity is uncertain.

3. *Piper mullesua* Buch.-Ham. ex D. Don

Prodr. Fl. Nepal.: 20. 1825; Long in Fl. Bhutan 1(2): 347. 1984; Cheng, Xia & Gilbert in Fl. China 4: 115. 1999.

Woody climber or scandent shrub; stem terete, sometimes warted, glabrous. **Leaves** lanceolate, elliptic to ovate, subcoriaceous, (5-)7-9(-12) cm long, (2-)3-4(-5) cm wide, glabrous on both surfaces, glandular beneath; base cuneate, symmetric or slightly oblique; apex acuminate to caudate; petioles 0.5-1.3 cm long, glabrous. **Flowers** bisexual. **Spikes** subglobose, 2.5-3 cm long; peduncles 2-3 mm long; bracts orbicular, ca. 1 mm long and wide, peltate, subsessile; stamens 2. **Infrutescence** subglobose or shortly cylindric, 6-12 mm long. **Fruit** densely clustered, subglobose, ca. 2 mm in diam., red.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, China.

Ecology.— Lower montane forest, alt. 1,300-1,700 m (Doi Phu Kha).

Phenology.— Flowering: November-January.

Uses.— Roots soak for making spirit and drink for good health. Leaves edible.

Vernacular.— ฟักเห็ด Phak Phed (Nan).

Voucher specimens.— *P. Srisanga* 2249; *P. Srisanga* & *C. Maknoi* 2006.

4. *Piper pedicellatum* C. DC.

J. Bot. 4: 164. 1866; Cheng, Xia & Gilbert in Fl. China 4: 124. 1999.

Woody climber; stem terete, ridged when dry, glabrous or nearly so. **Leaves** elliptic to ovate, membranous, 9-15 cm long, 6-9 cm wide, glabrous or subglabrous on both surfaces, glandular beneath; base oblique; apex acute to acuminate; petioles 1-2 cm long, glabrous or subglabrous. **Flowers** unisexual, greenish white. **Male spikes** 10-20 cm long, 0.2-0.3 cm wide; peduncles 1-2 cm long, glabrous; bracts suborbicular, 0.5-1 mm long and wide, peltate, stalked, glabrous; stamens 2. **Female**

spikes 10-15 cm long; bracts orbicular, ca. 1 mm long and wide, stalked. **Fruit** ovoid, 1.5-2 mm in diam; sessile.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Bangladesh, Bhutan, Sikkim, China, N Vietnam.

Ecology.— Lower montane forest, alt. 1,400-1,600 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: August-October.

Voucher specimens.— *P. Srisanga* 1689.

5. *Piper suipigua* Buch.-Ham. ex D. Don

Prodr. Fl. Nepal.: 20. 1825; Long in Fl. Bhutan 1(2): 350. 1984; Cheng, Xia & Gilbert in Fl. China 4: 128. 1999.

Woody climber or scandent shrub; stem ridged when dry, glabrous. **Leaves** oblong-lanceolate to elliptic, subcoriaceous, 6-12 cm long, 2-4.5 cm wide, glabrous on both surfaces, glandular beneath; base obliquely cuneate to rounded; apex acuminate to caudate; petioles 5-13 mm long, glabrous or sparsely puberulous. **Flowers** unisexual. **Male spikes** 8-16 cm long, 0.2-0.3 cm wide; peduncles 1-2 cm long, glabrous; bracts orbicular, 1-1.5 mm long and wide, peltate, sessile; stamens 3. **Female spikes** 6-12 cm long; peduncles and bracts as in male spikes. **Fruit** ovoid, ca. 4 mm in diam; sessile.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan China (Yunnan).

Ecology.— Dry evergreen forest, alt. 900-1,000 m (Doi Phu Kha, Thon Thong Waterfall).

Phenology.— Flowering and fruiting: July-September.

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2095.

6. *Piper sylvaticum* Roxb.

Fl. Ind. 1: 158. 1820; Long in Fl. Bhutan 1(2): 348. 1984; Cheng, Xia & Gilbert in Fl. China 4: 121. 1999.

Woody climber; stem ridged when dry, glabrescent. **Leaves** lanceolate, elliptic to ovate, membranous, 8-11 cm long, 3-5 cm wide, glabrous on both surfaces, except sometimes sparsely puberulous along veins beneath, distinctly dark glands beneath; base slightly oblique, rounded to cuneate; apex acuminate; petioles 7-11 mm long, glabrous. **Flowers** unisexual. **Male spikes** 5-8 cm long; bracts orbicular, peltate; stamens 4. **Infrutescence** shortly cylindric, 1-2 cm long. **Fruit** densely clustered, globose, 2-3 mm in diam., sessile.

Thailand.— Northern: Nan.

Distribution.— India, Bhutan, Sikkim, Bangladesh, Myanmar, China.

Ecology.— Lower montane forest, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: August-October.
 Voucher specimens.— *P. Srisanga* 1699.

PITTOSPORACEAE

Trees, shrubs or climbers, sometimes spiny. **Leaves** simple, alternate or whorled, leathery; stipules absent. **Inflorescence** umbellate, paniculate, corymbose or flower solitary. **Flowers** bisexual, rarely unisexual, actinomorphic, rarely zygomorphic. **Sepals** 5, free or connate below, imbricate. **Petals** 5, free or basally connate forming distinct tube with imbricate lobes. **Stamens** 5, alternate with the petals, free or somewhat connivent; anthers 2-locular, opening by longitudinal slits or terminal pores. **Ovary** superior, completely or incompletely 1-5-locular, axile or parietal placentation; style simple; ovules numerous. **Fruit** a berry or loculicidal capsule. **Seeds** mostly immersed in a viscid pulp, rarely winged.

Nine genera and about 200 species in tropical and subtropical regions especially Australia (Mabberley, 1997). One genus and about 5 species in Thailand. Two species recorded from Doi Phu Kha National Park.

PITTOSPORUM Banks ex Gaertn.

Fruct. 1: 286, t. 59. 1788; Baker & Steenis in Fl. Mal. I(5): 345. 1957; Zhiyun, Hongda & Turland in Fl. China 9: 1. 2003.

Evergreen trees or shrubs. **Leaves** alternate or whorled, usually clustered at branchlet apex. **Inflorescence** terminal or axillary, umbellate, paniculate, corymbose or flower solitary. **Flowers** bisexual, rarely unisexual, actinomorphic, rarely zygomorphic. **Sepals** free or slightly connate at base, usually short and small. **Petals** free or basally connate. **Anther** dorsifixed, opening by longitudinal slits. **Ovary** 1-locular or incompletely 2-3(-5)-locular; style simple, 2-5-lobed. **Fruit** a loculicidal capsule, dehiscent by 2-5-valved; pericarp woody or leathery, usually with horizontal striate inside. **Seeds** 1-numerous, mostly immersed in a viscid pulp.

About 150 species in tropical and subtropical regions of Asia, Africa, Australia to Pacific Islands (Mabberley, 1997).

KEY TO THE SPECIES

- | | |
|------------------------------|---------------------|
| 1. Petal free | 1. <i>P. kerrii</i> |
| 1. Petals distinctly connate | 2. <i>P. sp.</i> |

1. *Pittosporum kerrii* Craib

Kew Bull. 1925: 16. 1925; in Fl. Siam. Enum. 1: 98. 1925; Zhiyun, Hongda & Turland in Fl. China 9: 16. 2003.

Tree, 6-12 m high; young branchlets lenticellate. **Leaves** alternate, clustered at branchlet apex, oblanceolate to narrowly obovate, leathery, 5-13 cm long, 2-5 cm wide, glabrous on both surfaces; base cuneate, attenuate onto the petiole; apex acute; margin entire; primary veins 7-10 pairs; petioles 0.5-1.5 cm long, glabrous. **Inflorescence** in terminal panicles; peduncle 2-4 cm long, lenticellate, minutely ferruginous puberulous, glabrescent. **Flowers** slightly fragrant; pedicels 2-4 mm long, minutely ferruginous puberulous, glabrescent. **Sepals** free or slightly connate at base, ovate, 2-3 mm long, glabrous. **Petals** creamy yellow, narrowly elliptic, free, 6-7 mm long. **Filaments** 3-4 mm long; anthers ca. 1.5 mm long. **Ovary** ovoid, 2-2.5 mm long, glabrous, except pubescent at base; style 1-2 mm long. **Capsule** subglobose, 6-8 mm in diam., glabrous, dehiscent by 2-valved; pericarp thinly woody, with numerous horizontal striate inside. **Seeds** 2-4, subreniform, 4-5 mm long, black, glabrous, shiny, immersed in a viscid orange-red pulp.

Thailand.— Northern: Chiang Mai (type), Nan.

Distribution.— Myanmar, S China, Laos.

Ecology.— Lower montane forest, alt. 1,400-1,600 m (Doi Phu Kha).

Phenology.— Flowering: April-June; fruiting: September-November.

Voucher specimens.— *P. Srisanga* 296.

2. *Pittosporum* sp.

Shrub, about 2 m high; young branchlets glabrous. **Leaves** alternate, clustered at branchlet apex, lanceolate, oblanceolate to narrowly obovate, thinly leathery, 5-13(-20) cm long, 2-5.5 cm wide, glabrous on both surfaces; base cuneate, attenuate onto the petiole; apex acute to acuminate; margin entire; primary veins 6-8 pairs, inconspicuous; petioles 0.5-1 cm long, glabrous. **Inflorescence** in terminal laxly panicles; peduncle 1-3 cm long, puberulous; pedicels 8-11 mm long, puberulous, glabrescent. **Sepals** free or slightly connate at base, oblong, 2-3 mm long, rounded at apex, ciliate along margin. **Petals** yellow, connate, 11-13 mm long, glabrous; tube 8-10 mm long; lobes ca. 3 mm long, obtuse at apex. **Filaments** 7-8 mm long, glabrous; anthers ca. 2 mm long. **Ovary** oblong, 4-5 mm long, pilose; style 4-5 mm long, glabrous; ovules 4. **Capsule** not known (Fig. 65).

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,800 m (Doi Phu Kha).

Phenology.— Flowering: February.

Voucher specimens.— *P. Srisanga* 471.

Notes.— Possibly new species or new recorded for Thailand.

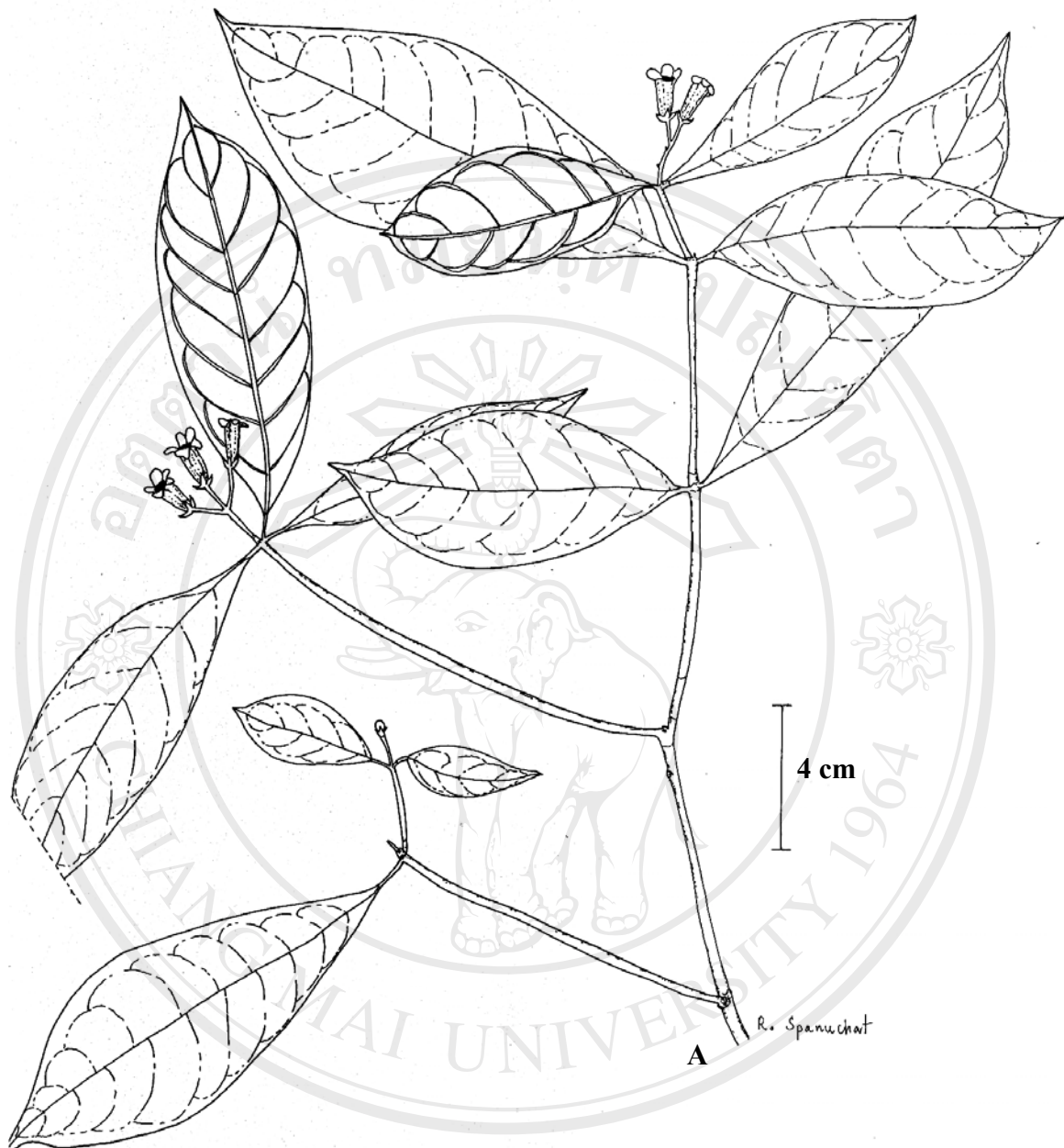


Figure 65. *Pittosporum* sp.

A. flowering branch; B. flower; C. opened corolla; D. pistil. All from *P. Srisanga* 471.

PLANTAGINACEAE

Annual or perennial herbs with short stems. **Leaves** simple, spirally arranged, entire or lobed to toothed; veins parallel; petioles forming a sheath at the base; stipules absent. **Inflorescence** in an axillary spike or capitate. **Flowers** usually bisexual, (3-) 4-merous, actinomorphic, small; bracts persistent. **Sepals** connate. **Petals** connate, scarious; lobes triangular, spreading and usually reflexed when mature. **Stamens** mostly 4, alternate with the corolla lobes, rarely 1; anthers 2-locular, versatile, dehiscing by longitudinal slits. **Ovary** superior, 2-locular, axile placentation; ovules 1-many; style 1, long; stigma 2-lobed. **Fruit** a capsule.

An almost cosmopolitan family only absent from the Arctic and Antarctic with 3 genera and about 250-260 species: *Bougueria nubicola* Decne. in Andes, S America; *Littorella* P. Bergius with 3 species in N & S America and Europe and the rest are all in *Plantago* L. (Parnell, 2003) or only one genus: *Plantago* L. (Schwarzbach, 2004).

PLANTAGO L.

Sp. Pl.: 112. 1753; Parnell, Thai For. Bull. (Bot.) 31: 54. 2003; Schwarzbach in Fam. Gen. Vasc. Pl. 7: 328. 2004.

Annual or perennial herbs. **Leaves** usually in rosette. **Inflorescence** in an axillary spike or capitate. **Flowers** bisexual. **Calyx** imbricate, persistent. **Corolla** membranous, imbricate. **Stamens** 4, exerted. **Fruit** usually a circumscissile capsule, the top segment falling off as a lid. **Seeds** 2-many, small, angular to subglobose.

Only a single native and 3 cultivated species in Thailand (Parnell, 2003).

Plantago major L.

Sp. Pl.: 112. 1753; Craib in Fl. Siam. Enum. 3(3): 194. 1962; Parnell, Thai For. Bull. (Bot.) 31: 55. 2003. – *P. asiatica* L., Sp. Pl.: 113. 1753. – *P. major* var. *asiatica* (L.) Decne. in A. DC., Prodr. 13: 694. 1852. – *P. major* var. *asiatica* (L.) Trimen, Hand. Fl. Ceylon 3: 389. 1895. – *P. erosa* Wall. in Fl. Ind. ed. Carey 1: 423. 1820.

Perennial herbs, 5-20 cm high. **Leaves** 5-15(-20), in rosette, variable in shape and size, lanceolate, elliptic to ovate, 4-10 cm long, 1.5-4.5 cm wide, nearly glabrous to sparsely hairy especially when young; base cuneate; apex obtuse to broadly acute; margin lobed; main veins 3 and marginal veins 2 from base; petioles 2-6 cm long, nearly glabrous to sparsely hairy. **Inflorescence** in an axillary spike, (7-)10-20(-25) cm long, furrowed, nearly glabrous. Bracts elliptic, 1-2 mm long, pale and membranous at margin. **Calyx** ovate, 2-2.5 mm long, obtuse or acute at apex, scarious, pale and membranous at margin, keeled. **Corolla** white to lilac, 3-3.5 mm long; lobes lanceolate, spreading, ca. 1 mm long. **Stamens** 4-6 mm long; anthers white or creamy white. **Ovary** ellipsoid to ovoid, 1-1.5 mm long; style yellow or whitish pink, curved; stigma ca. 2 mm long. **Capsule** ovoid, 3-4 mm long. **Seeds** many, black, angular, 0.5-1 mm long.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Phrae, Nan, Phitsanulok; South-western: Kanchanaburi; Peninsular: Yala.

Distribution.— Cosmopolitan.

Ecology.— Lower montane forest by roadsides or in open and damp places and lower montane scrub among limestone rocks, alt. 1,500-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: September-December.

Vernacular.— หย้าเอ็นยัด Ya en yuet (General).

Voucher specimens.— *P. Srisanga* 1215, 2661.

POLYGALACEAE

Trees, shrubs, herbs or woody climbers. **Leaves** simple, alternate, exstipulate. **Inflorescence** axillary or terminal. **Flowers** bisexual, more or less zygomorphic. **Sepals** 5, sometimes markedly unequal, then with the inner sepals (alae) large and petaloid. **Petals** 3 or 5, free or partially connate, the lower petal (keel) more or less boat-shaped and enclosing the stamens and style; sometimes with a distal appendage. **Stamens** 4-8, free, monadelphous or triadelphous; anthers basifixed, 2-locular, dehiscing by a single apical pore or longitudinal slit. **Ovary** superior, 1-2-locular; ovules 1 per cell and apical, or in *Xanthophyllum* Roxb. 4 or more in a 1-locular bicarpellate ovary with 2 parietal placentas. **Fruit** a capsule, samara or berry. **Seeds** 1-20, with or without an aril.

A cosmopolitan family of about 17 genera and 1,000 species. Five genera and 36 species in Thailand (Pendry, 2001). Two genera and 4 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Sepals unequal, the two inner sepals more or less petaloid,
about as long as the petals
1. Sepals equal, none petaloid

1. *Polygala*
2. *Salomonina*

1. *POLYGALA* L.

Sp.Pl.: 701. 1753; Pendry in Fl. Thailand 7(3): 499. 2001. – *Chamaebuxus* (DC.) Spach, Hist. Nat. Veg. 7: 125. 1838 (1839).

Annual or perennial herbs, shrubs or small woody climbers; roots often aromatic (methyl salicylate). **Leaves** alternate or rarely subopposite. **Inflorescence** axillary or terminal. Bracts 3. **Sepals** 5, unequal; the three outer sepals small, green, the two inner sepals (alae) larger, more or less petaloid. **Petals** 3, unequal, the upper petals more or less connate with the keel which is boat-shaped in the apical part, enclosing the anthers and stigma; the distal point of the keel with a two lobed, finely

divided or brush-like appendage. **Stamens** 8, connate in a staminal sheath open on the upper side and adnate to the corolla. **Ovary** 2-locular; ovules pendulous; style elongate, with two stigma lobes. **Fruit** a 2-seeded dehiscent capsule, often winged. **Seeds** arillate, rarely with a hollow appendage at the opposite end to the aril (strophiole).

A cosmopolitan genus of about 500 species found in tropical and temperate regions with its greatest diversity in S America and secondary centres in N America and S Africa. Sixteen species in Thailand (Pendry, 2001). Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|---------------------------------|
| 1. Shrubs | 1. <i>P. arillata</i> |
| 1. Herbs up to 30 cm tall | |
| 2. Capsule without persistent calyx; flower yellow | 2. <i>P. cardiocarpa</i> |
| 2. Capsule with persistent calyx; flower green, white or pink | 3. <i>P. chinensis</i> |

1. ***Polygala arillata*** Buch.-Ham. ex D. Don

Prodr. Fl. Nepal.: 199. 1825; Pendry in Fl. Thailand 7(3): 501, pl. XIX: B. 2001. – *P. kerrii* Craib, Kew Bull. 1922: 235. 1922; in Fl. Siam. Enum. 1: 103. 1925 – *Chamaebuxus arillata* Kurz, Fl. Burm. 1: 79. 1877. – *Polygala tonkinensis* auct. non Chodat: Gagnep. in Fl. Gén. I.-C. Suppl. 1: 229. 1939.

Erect shrub 1-5 m high; twigs shortly hairy, glabrescent. **Leaves** ovate to elliptic to slightly obovate, 5-13(-18) cm long, 1.5-8.5 cm wide, glabrous to sparsely hairy, especially on veins and towards margin; base cuneate to rounded; apex acuminate; midrib slightly sunken on upper surface, hairy; petioles 5-10 mm long. **Inflorescence** terminal or axillary, raceme, 10-60-flowered, rather slender and lax, erect to pendulous, shortly hairy, up to 20 cm long; bracts ovate-caudate, caducous, up to 3 mm long. **Flowers** yellow; pedicels 4-5 mm long. **Outer sepals** sparsely hairy, ciliate, unequal, the two lower oblong to ovate 3-5 mm long, the upper markedly saccate at the base, 6-8 mm long. **Alae** obovate, cucullate, minutely ciliate, 11-14 mm long. **Upper petals** glabrous or slightly hairy at base, 11-14 mm long, free parts oblong 5-6 mm long. **Keel** 12-16 mm long, appendage finely divided with more or less connate lobes, 1-3 mm long. **Stamens** 11-14 mm long. **Ovary** oblong to orbicular, winged, glabrous or ciliate, ca. 2 mm long; style 9-11 mm long. **Capsule** green, more or less purple-tinged, oblong, 2-lobed, glabrous, with prominent concentric ridges, 9-11 mm long, 11-15 mm wide; wing ribbed, up to 4 mm broad. **Seeds** spheroid, black, glabrous, 4-5 mm in diam.; aril bright orange.

Thailand.— Northern: Mae Hong Son, Chiang Mai (type of *P. kerrii*), Nan, Tak, Phitsanulok, Kamphaeng Phet; North-eastern: Loei; Eastern: Nakhon Ratchasima; South-eastern: Trat.

Distribution.— India, Nepal (type), Sri Lanka, Myanmar, S China, Cambodia, Laos, Vietnam.

Ecology.— Lower montane forest, in open and shaded places, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: June-August.

Vernacular. — ตังไค่ป้า Tang kai pa (Loei).

Voucher specimens.— *P. Srisanga* 912, 975; *P. Srisanga et al.* 766.

2. *Polygala cardiocarpa* Kurz

J. As. Soc. Beng. 41: 293. 1872; Craib in Fl. Siam. Enum. 1: 100. 1925; Pendry in Fl. Thailand 7(3): 502, fig. 48: A-C. 2001. – *P. lacei* Craib, Kew Bull. 1916: 260. 1916; in Fl. Siam. Enum. 1: 103. 1925.

Erect herb, 10-30 cm high; stem ridged, glabrous. **Leaves** ovate, 1-4 cm long, 0.8-1.6 cm wide; base attenuate; apex acute, mucronate; margin and sometimes upper surface with flattened scale-like hairs, glaucous below; petioles 5-10 mm long. **Inflorescence** axillary or terminal, unbranched, glabrous, 20-100-flowered, up to 15 cm long; bracts linear, caducous, ca. 0.7 mm long. **Flowers** yellow; pedicels ca. 0.5 mm long. **Outer sepals** broadly ovate, glabrous or sparsely ciliate at apex, ca. 1 mm long. Alae obovate, to oblong or elliptic and shortly stalked, ca. 3 mm long. **Upper petals** spathulate, 3-4 mm long, free parts 1-2 mm long. Keel 3-4 mm long, appendage 2-lobed, ca. 1 mm long. **Stamens** equally connate, ca. 2.5 mm long. **Ovary** obcordate, ca. 1 mm long; style curved, inflated at apex, 1-2 mm long. **Capsule** obcordate, with prominent concentric ridges, 2-4 mm long; wing up to 1 mm broad, markedly ribbed. **Seeds** ellipsoid, 1-1.5 mm long, dark grey or black, tuberculate, glabrous; aril apically projecting, shortly lobed.

Thailand.— Northern: Chiang Mai (type of *P. lacei*), Chiang Rai, Nan.

Distribution.— Myanmar (type), Malaysia (Langkawi).

Ecology.— Lower montane forest, in rather open places on limestone; alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: August-December.

Vernacular.— ลูกมณี Luk mani (Northern).

Voucher specimens.— *P. Srisanga* 436, 2155.

Notes.— New locality recorded from Nan, in Thailand.

3. *Polygala chinensis* L.

Sp. Pl.: 704. 1753; Pendry in Fl. Thailand 7(3): 503, fig. 48: D-K. 2001. – *P. glomerata* Lour., Fl. Cochinch. 1: 426. 1790; Craib in Fl. Siam. Enum. 1: 101. 1925. – *P. glomerata* var. *pygmaea* C.Y. Wu & S.K. Chen, Acta Bot. Yunnan. 2(1): 89. 1980. – *P. glomerata* var. *villosa* C.Y. Wu & S.K. Chen, Acta Bot. Yunnan. 2(1): 90. 1980. – *P. densiflora* Bl., Bijdr.: 59. 1825. – *P. subopposita* S.K. Chen, Acta Bot. Yunnan. 2(1): 85. 1980.

Erect herb, woody at base, 15-60 cm high; stem terete, indumentum of short curved and long patent hairs, especially on young parts. **Leaves** alternate to subopposite, elliptic to narrowly ovate or obovate, 1-7 cm long, 0.6-2.5 cm wide, sparsely to rather densely appressed hairy, glaucous below; base cuneate to rounded or scarcely cordate; apex mucronate, acute to rounded or retuse; midrib flat or prominent above; petioles 1-2 mm long, short curved hairs. **Inflorescence** axillary, 3-20-flowered, glabrescent or with short curved or long patent hairs, 0.5-3 cm long; bracts broadly ovate or triangular, ciliate, caducous, ca. 0.7 mm long. **Flowers** greenish, white or pink; pedicels ca. 1 mm long. **Outer sepals** unequal, ovate, acuminate, ciliate, the two lower 1-2 mm long, the upper 2-3 mm long. **Alae** ovate or oblong, oblique, apex acuminate, ciliate, 4-7 mm long, 1-3 mm wide. **Upper petals** spatulate or obtriangular, hairy in lower half, 3-5 mm long, free parts 2-4 mm long. **Keel** auriculate, 4-6 mm long, appendage of two connate brush-like bundles, ca. 2 mm long. **Stamens** irregularly connate to about half-way, 4-6 mm long. **Ovary** orbicular, densely long ciliate along margin towards apex, ca. 1 mm in diam.; style curved, strongly reflexed apically, 3-6 mm long. **Capsule** with persistent calyx, orbicular or rectangular, emarginate, ciliate, sparsely short hairy, 3-5 mm in diam. **Seeds** ovoid to almost globose, black with short, white hairs, 2-3 mm in diam.; aril irregular 3-lobed.

Thailand.— Throughout the country.

Distribution.— NE India (type) to S China and SE Asia.

Ecology.— Grassland and dry evergreen forest, alt. 900-1,100 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: November-March.

Vernacular.— ปีกไก่ดำ Pik kai dam (General).

Voucher specimens.— *P. Srisanga et al.* 2464.

2. *SALOMONIA* Lour.

Fl. Cochinch. 1: 14. 1790, nom. cons., non Heister ex Fabricus, En.: 20. 1759; Koyama, Bull. Nat. Sci. Mus., Tokyo, B. 21: 1. 1995; Pendry in Fl. Thailand 7(3): 520. 2001.

Small, erect annual herbs, sometimes parasitic, with aromatic roots (methyl salicylate). Stems angular or winged. **Leaves** palmately veined. **Inflorescence** terminal or axillary spike. Bracts lanceolate with a scarious margin. **Sepals** 5, almost equal or rather unequal, connate at the base. **Petals** 3, unequal, the upper petals half-way connate with the keel which is boat-shaped in the apical part, enclosing the anthers and stigma. **Stamens** 4-6, connate in a staminal sheath open on the upper side and adnate to the corolla, enclosing stigma. **Ovary** 2-locular. **Fruit** laterally compressed capsule, with a double row of spines along margin; the face glabrous or hairy and with or without protruding reticulations or appressed appendages. **Seed** solitary in each loculus, ellipsoid, black, exarillate, slightly winged.

Five species found from India to Japan, SE Asia and N Australia. All of them also found in Thailand (Pendry, 2001). Only 1 species recorded from Doi Phu Kha National Park.

Salomonina cantoniensis Lour.

Fl. Cochinch. 1: 14. 1790; Craib, Contrib. Fl. Siam: 14. 1912; in Fl. Siam. Enum. 1: 99. 1925; Koyama, Bull. Nat. Sci. Mus., Tokyo, B. 21: 3, fig. 2b. 1995; Pendry in Fl. Thailand 7(3): 521, pl. XIX: A. 2001. – *S. edentula* DC., Prodr. 1: 334. 1824. – *S. cantoniensis* var. *edentula* (DC.) C.Y. Wu in Fl. Yunnan. 3: 291. 1983.

Herb up to 30 cm, often much branched and spreading, glabrous throughout. Stem 3-winged. **Leaves** broadly triangular to cordate, 9-24 mm long, 8-16 mm wide; base truncate to cordate; apex acute and mucronate; margin entire or slightly sinuate, 3-5(-7)-veined; petioles 1-3 mm long. **Flowers** blue or pink-purple. **Sepals** ca. 0.5 mm long, almost equal. **Petals** 1.5-2.5 mm long. **Capsule** 1.5-2 mm long, ca. 1 mm wide, with prominent reticulate venation and sometimes with erect minute hairs, 4-14 straight or slightly hooked spines on each locule margin, up to 1 mm long.

Thailand.— Almost throughout the country.

Distribution.— E India, Nepal, Bangladesh, Myanmar, S China, SE Asia.

Ecology.— Deciduous, dry evergreen and lower montane forest, also in open areas, by streams and along roadsides, alt. 700-1,300 m (Sapan Waterfall, Doi Phu Kha).

Phenology.— Flowering and fruiting: July-November.

Vernacular.— เข็มหมากเขม Niam nok khao (Loei).

Voucher specimens.— *P. Srisanga* 347, 1614, 1965, 2178.

POLYGONACEAE

Annual or perennial herbs, shrubs, trees, or climbers. **Leaves** simple, mostly alternate and penninerved, rarely opposite or whorled; margin usually entire, petiolate or sessile; stipules commonly well developed and connate into a tubular, persistent or deciduous, scarious, membranous to hyaline, sheathing the stem (ocrea), or sometimes much reduced or wanting. **Inflorescence** axillary or terminal, basically cymose, arranged in head-like, spikes, racemes or panicles. **Flowers** bisexual or unisexual, actinomorphic, pedicellate, articulate, often with a distinctly stipitate base above the articulation. **Perianth** 2-6, basally connate into a minute to conspicuous floral tube, usually in 2 whorls of 3 segments or in 1 whorl of 5, mostly persistent in fruit. **Stamens** (2-)5-9; filaments free or basally connate, often basally adnate to the perianth tube forming a distinct ring; anthers usually versatile, dehiscing by longitudinal slits. Annular nectary disk often present around the base of the ovary, or the nectaries several and placed between the bases of the stamens. **Ovary** superior, 1-locular; styles 1-3; ovule 1, on a basal or very shortly columnar free central placenta. **Fruit** an achene or nut, trigonous or sometimes lenticular, mostly subtended by the accrescent perianth.

An almost cosmopolitan family with 43 genera and about 1,100 species (Brandbyge, 1993). About 7 genera and 40 species, native or introduced in Thailand. One genus and 3 species recorded from Doi Phu Kha National Park.

PERSICARIA (L.) Miller

Gard. Dict. Abr. Ed. 4. 1754; Brandbyge in Fam. Gen. Vasc. Pl. 2: 542. 1993.

Annual or perennial herbs; stem erect, prostrate or twining. **Leaves** simple, alternate, penninerved; margin entire, petiolate or sessile; stipules well developed and connate into a tubular, persistent or deciduous, scarious, membranous to hyaline, sheathing the stem (ocrea); ocrea entire and tubular, pale brown or hyaline, glabrous or pubescent, or with cilia on upper margin. **Inflorescence** axillary or terminal, basically cymose, arranged in head-like, capitate, spikes, racemes or panicles. **Flowers** bisexual. **Perianth** 4-5 in 1 whorl, persistent in fruit. **Stamens** 4-8; filaments subulate or filiform. **Styles** 2-3. **Fruit** an achene, trigonous or lenticular, enclosed by the accrescent perianth.

About 150 species, subcosmopolitan (Brandbyge, 1993). About 20-25 species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---------------------------------------|--------------------------------|
| 1. Inflorescence head-like | |
| 2. Petioles not winged. Flowers white | 1. <i>P. chinensis</i> |
| 2. Petioles winged. Flowers purple | 3. <i>P. nepalensis</i> |
| 1. Inflorescence raceme, filiform | 2. <i>P. faccida</i> |

1. ***Persicaria chinensis*** (L.) H. Gross

Bot. Jahrb. Syst. 49: 269. 1913. – *Polygonum chinense* L., Sp. Pl.: 520. 1753; Hook.f. in Fl. Br. Ind. 5: 44. 1886; Courchet in Fl. Gén. I.-C. 5: 37. 1910; Larsen, Dansk Bot. Ark. 20(1): 52. 1961.

Perennial herb, up to 1 m high, woody at base; stem glabrous. Ocrea obliquely divided to the base, glabrous or hairy. **Leaves** variable, oblong-lanceolate to ovate, 5-20 cm long, 1.5-10 cm wide, glabrous or pubescent; base cuneate or rounded to subtruncate; apex acuminate; petioles 0.5-1.5 cm long, with rounded, amplexicaul basal auricles. **Inflorescence** in terminal head-like panicles; peduncle glandular hairy. **Perianth** 5, white, 3-4 mm long, rounded at apex. **Stamens** 8. **Styles** 3. **Fruit** trigonous, oblong, 4-5 mm long, black, glabrous.

Thailand.— Northern: Almost throughout.

Distribution.— India, Nepal, Bhutan, Sikkim, Sri Lanka, China, Japan, SE Asia.

Ecology.— Lower montane forest, old clearing, along walksides, alt. 1,100-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: Almost throughout the year.

Vernacular.— ผักไฟน้ำ Phak phai nam (Northern).

Voucher specimens.— *P. Srisanga* 370, 416, 925, 1767, 2200, 2648.

Notes.— Variable species in leaf shape, size and indumentum. Several varieties are recognized. In Doi Phu Kha, 3 varieties are found:

var. *chinense*: leaves oblong-lanceolate, subglabrous, only hairy along midrib beneath;

var. *hispidum*: leaves oblong-lanceolate to lanceolate, hispid-hirsute on both surfaces

var. *ovatifolium*: leaves ovate, glabrous on both surfaces.

2. *Persicaria flaccida* (Meisn.) H. Gross

Beih. Bot. Centralbl. 37(2): 112. 1919. — *Polygonum flaccidum* Meisn. in A. DC., Prodr. 14(1): 107. 1856; Hook.f. in Fl. Br. Ind. 5: 39. 1886; Courchet in Fl. Gén. I-C. 5: 30. 1910; Larsen, Dansk Bot. Ark. 20(1): 52. 1961.

Annual herb, up to 40 cm high; stem glabrous or sparsely pubescent, erect, sometimes decumbent or creeping at the base, rooting at lower nodes. Ocrea tubular, truncate, sparsely pubescent, with long cilia at mouth. **Leaves** lanceolate to narrowly elliptic, 1.5-6.5 cm long, 1-2.5 cm wide, sparsely pubescent on both surfaces; base cuneate, slightly oblique; apex acuminate with blunt tip; petioles 5-12 mm long, pubescent. **Inflorescence** in terminal raceme, filiform; 10-15 cm long; bract tubular, obliquely truncate, with long cilia at mouth. **Perianth** 4, pinkish white, ca. 2 mm long, acute at apex. **Stamens** 8. **Styles** 3. **Fruit** trigonous, 2-2.5 mm long, brown-black, glabrous.

Thailand.— Northern: Almost throughout.

Distribution.— India, Nepal, Bhutan, Sikkim, Sri Lanka, Myanmar, Vietnam, Malaysia, Australia.

Ecology.— Dry evergreen and lower montane forest, in shaded and moist places, by streams, alt. 1,000-1,500 m (Doi Phu Kha, Nan Watershed).

Phenology.— Flowering and fruiting: Almost throughout the year.

Vernacular.— ตักไฟน้ำ Phak phai nam (Northern).

Voucher specimens.— *P. Srisanga* 317, 2224: *P. Srisanga et al.* 629, 784.

3. *Persicaria nepalensis* (Meisn.) H. Gross

Bot. Jahrb. Syst. 49: 277. 1913. — *Polygonum nepalense* Meisn., Monogr. 84, t. 7, fig. 2. 1826.

Annual herb, up to 40 cm high; stem glabrous, erect, sometimes decumbent or creeping at the base, rooting at lower nodes. Ocrea tubular, obliquely truncate, glabrous. **Leaves** ovate to rhomboid, 1.5-5 cm long, 1-3.5 cm wide, glabrous on both surfaces, glandular on lower surface; base obliquely cordate or rounded to obliquely cuneate; apex acute to acuminate; petioles 0.3-2 cm long, winged and with 2 rounded, amplexicaul basal auricles. **Inflorescence** in terminal head-like; peduncle 0.5-3 cm

long, glandular hairy. **Perianth** 4, purple, 1-2 mm long, rounded at apex. **Stamens** 4-5. **Styles** 2-3. **Fruit** trigonous or lenticular, ca. 2 mm long, brown, glabrous.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, Sikkim, China.

Ecology.— Lower montane forest, open and wet places, alt. 1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: August-November.

Voucher specimens.— *P. Srisanga* 1496.

PRIMULACEAE

Annual or perennial herbs, rarely suffruticose. **Leaves** alternate, opposite or whorled, often all basal, simple, entire to lobed. **Inflorescence** in racemes, panicles, umbels or flower solitary, usually with bracts. **Flowers** bisexual, (4-)5-merous, often dimorphic by heterostyly. **Calyx** persistent. **Corolla** gamopetalous, actinomorphic. **Stamens** as many as and opposite corolla lobes; filaments free or connate into a tube at the base. **Ovary** superior, rarely half-inferior, 1-locular, free-central placentation; style simple; stigma capitate, inconspicuous. **Fruit** a capsule, dehiscent by valves, rarely circumscissile or indehiscent. **Seeds** few to many.

Twenty-two genera with about 1,000 species mainly in temperate and mountainous regions of the northern hemisphere. Many species are cultivated as ornamentals. Four genera and 19 species native in Thailand (Maxwell, 1998b; Hu, 1999). Only 1 genus and 3 species recorded from Doi Phu Kha National Park.

LYSIMACHIA L.

Sp. Pl.: 146. 1753; Hu in Fl. Thailand 7(1): 155. 1999; Ståhl & Anderberg in Fam. Gen. Vasc. Pl. 6: 272. 2004.

Erect or procumbent herbs, rarely suffruticose, glabrous or pubescent, often with pellucid or coloured glands. **Leaves** cauline, alternate, opposite or whorled, usually entire. **Inflorescence** in racemes, panicles, umbels or flower solitary. **Flowers** usually 5-merous. **Calyx** deeply split. **Corolla** white, yellow or rarely pink, subrotate or campanulate; tube usually very short; lobes contorted in bud. **Anthers** basifixed or versatile, opening by apical pores or longitudinal slits. **Capsule** more or less globose, usually dehiscent by valves.

About 180 species occurring mainly in temperate and subtropical parts of the northern hemisphere. Fourteen species in Thailand (Hu, 1999). Recently, *Lysimachia* L. has been excluded from Primulaceae and included within Myrsinaceae (Anderberg, 2004; Ståhl & Anderberg, 2004b).

KEY TO THE SPECIES

1. Leaves glabrous. Flower solitary, axillary

2. Stem terete, glandular. Anthers 5-7 mm long, opening by apical pores
 1. *L. garrettii*
2. Stem distinctly 4-angled, winged, glabrous. Anthers 2.5-3.5 mm long,
 opening by longitudinal slits
 2. *L. laxa*
1. Leaves pubescent. Flowers in subumbellate, terminal or axillary
 3. *L. pilosa*

1. *Lysimachia garrettii* Fletcher

Kew Bull. 1936: 41. 1936; in Fl. Siam. Enum. 2: 324. 1938; Hu, Acta Phytotax. Sin. 23: 359. 1985; in Fl. Thailand 7(1): 158. 1999.

Perennial herb up to 1 m high. Stem erect, terete, glandular. **Leaves** alternate, lanceolate, elliptic to ovate, 3-7 cm long, 1.5-3.5 cm wide, glabrous; base attenuate onto the petiole, decurrent; apex acuminate; primary veins 4-6 pairs; petioles ca. 1 cm long, usually glandular. **Flower** solitary, axillary; pedicels 2-3.5 cm long, sparsely glandular. **Calyx** split nearly to the base; lobes ovate-lanceolate, 2-5 mm long, 0.5-1.5 mm wide, sparsely glandular outside, acuminate at apex. **Corolla** yellow, deeply lobed; lobes elliptic to oblong, 10-12 mm long, 4-6 mm wide, rounded at apex. **Filaments** connate into a ca. 0.5 mm ring at base, free parts ca. 1 mm long; anthers basifixed, 5-7 mm long, opening by apical pores. **Ovary** ovoid; style ca. 7 mm long. **Capsule** globose, whitish with dark glandular short lines, 5-7 mm in diam., 5-valved. **Seeds** many, small, angulate, black.

Thailand.— Northern: Chiang Mai (type: *Garrett* 403: K-holo; E-iso), Nan.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: April-July.

Vernacular.— ประจําตอย Pra cham doi (Chiang Mai).

Voucher specimens.— *K. Larsen et al.* 43680 (AAU); *P. Srisanga* 1435; *P. Srisanga & S. Watthana* 696; *P. Srisanga et al.* 831.

Notes.— Rare species. Only known from the type collection, new locality recorded from Nan, in Thailand.

2. *Lysimachia laxa* Baudo

Ann. Sc. Nat. ser. 2, 20: 347. 1843; Hu, Acta Phytotax. Sin. 23: 359. 1985; in Fl. Thailand 7(1): 158. 1999. – *L. ramosa* Wall. ex Duby in DC., Prodr. 8: 65. 1844; Fletcher in Fl. Siam. Enum. 2: 325. 1938.

Annual herb up to 60 cm high, with numerous fibrous roots. Stem erect, distinctly 4-angled, winged, usually much branched, glabrous. **Leaves** alternate, lanceolate to elliptic, 3-13 cm long, 1-4.5 cm wide, glabrous; base attenuate onto the petiole; apex acuminate; primary veins 4-6 pairs, prominent on lower surface, subsessile or with petioles up to 1 cm long. **Flower** solitary, axillary; pedicels 2-4 cm long, glabrous. **Calyx** split nearly to the base; lobes ovate-elliptic, 3-4 mm long, acuminate at

apex; margin membranous, glabrous. **Corolla** yellow; tube ca. 2 mm long; lobes elliptic-obovate, 4-6 mm long, obtuse at apex. **Filaments** connate into a ca. 0.5 mm ring at base, free parts ca. 1.5 mm long; anthers basifixed, 2.5-3.5 mm long, opening by longitudinal slits. **Ovary** globose, glabrous; style 2-3 mm long. **Capsule** globose, light brown with darker longitudinal lines, 5-7 mm in diam., 5-valved.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— India, Sikkim (type), Nepal, Sri Lanka, Myanmar, China, Vietnam, Indonesia.

Ecology.— Dry evergreen and lower montane forest, often by streams and moist shady places, alt. 900-1,600 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: May-October.

Vernacular.— บางดอย Bang doi (Chiang Mai, Loei).

Voucher specimens.— *P. Srisanga* 1425, 1554, s.n. (20 Oct. 2000); *P. Srisanga* & *C. Maknoi* 2052.

Notes.— New locality recorded from Nan, in Thailand.

3. *Lysimachia pilosa* Fletcher

Kew Bull. 1936: 42. 1936; in Fl. Siam. Enum. 2: 325. 1938; Hu, Acta Phytotax. Sin. 23: 357. 1985; in Fl. Thailand 7(1): 157. 1999.

Perennial herb, 15-30 cm high. Stem erect, terete, pubescent. **Leaves** alternate, confined to the upper stem, elliptic to ovate, (1.3-)3-7 cm long, (0.8-)2-4.5 cm wide, pubescent on both surfaces, especially on the midrib below; base cuneate or rounded; apex acute; primary veins 4-6 pairs, prominent on lower surface; petioles 3-15(-30) mm long, densely villous. **Inflorescence** terminal and axillary, subumbellate, 2-5-flowered; peduncle 8-25 mm long, densely villous. **Flowers** subtended by leafly linear or lanceolate bract; bracts 3-5 mm long, 0.5-1.5 mm wide, villous; pedicels 8-20 mm long, villous. **Calyx** split nearly to the base; lobes lanceolate, 5-7 mm long, 1-1.5 mm wide, sparsely pubescent, black glandular, acuminate at apex. **Corolla** yellow; lobes ovate, 8-9 mm long, 4-5 mm wide, rounded at apex. **Filaments** connate at base, free parts ca. 1 mm long; anthers basifixed, 2-3 mm long, opening by apical pores. **Ovary** globose or broadly ellipsoid, ca. 1 mm in diam., sparsely glandular at apex, 5 ridges; style 4-5 mm long, glabrous or very sparsely glandular at base. **Capsule** not known (Fig. 66).

Thailand.— Northern: Chiang Mai (type: *Kerr* 6341: K-holo; BK, E-iso), Nan.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: May-July.

Voucher specimens.— *P. Srisanga* 1387, 1976.

Notes.— Rare species. Only known from the type collection and *Garrett* 547 from Doi Inthanon, the same area as type locality, new locality recorded from Nan, in Thailand.



Figure 66. *Lysimachia pilosa* Fletcher

A. habit; B-D. flower; E. calyx and pistil; F. stamen; G. pistil. Scale bars 1 cm in A; 1 mm in B-G.

PROTEACEAE

Evergreen trees or shrubs. **Leaves** simple, pinnately or bipinnately compound, mostly spirally arranged, rarely opposite or verticillate; stipules absent. **Inflorescence** racemose, umbellate or capitate. **Flowers** bisexual, sometimes unisexual, 4-merous. **Sepals** valvate, its members at first coherent below, forming a tube, each expanding apically into a small concave blade at the base of which the stamen arises, sometimes cleft on one side or 3 connate and 1 free. **Petals** absent. **Stamens** opposite to the calyx lobes; filaments adnate to the lobes, rarely free; anthers free, 2-locular, opening by longitudinal slits. Disc annular, or open on one side or of 4 separate glands. **Ovary** superior, sessile or stipitate, 1-locular; ovules 1-2, pendulous or lateral attached; style simple, long. **Fruit** a capsule, drupe, follicle or nut.

About 77 genera with at least 1,600 species throughout tropical and subtropical regions especially the S hemisphere in S Africa and Australia (Mabberley, 1997). Only 2 genera: *Heliciopsis terminalis* (Kurz) Sleum. and *Helicia* Lour. with about 8 indigenous species in Thailand (Na Songkhla, 1987). One genus with 3 species recorded from Doi Phu Kha National Park.

HELICIA Lour.

Fl. Cochinch.: 83. 1790; Sleum., Blumea 8(1): 7. 1955; Na Songkhla in Fl. Thailand 5 (1): 106. 1987. – *Helittophyllum* Bl., Bijdr.: 652. 1825.

Trees or shrubs. **Leaves** simple, mostly spirally arranged, rarely subopposite or 3-4-verticillate, entire, serrate or pinnatifid, sessile or petiolate. **Inflorescence** in simple raceme, many-flowered, axillary or ramiflorous. **Flowers** bisexual; bracts small, ovate-acuminate to subulate; bracteoles minute; pedicels mostly in pairs or solitary, free or connate at the lower part. **Perianth** 4; tube straight, somewhat swollen at base. **Stamens** 4, nearly sessile, inserted at the base of perianth segment; anthers oblong; connective apiculate. Disc glands 4, free or connate into a cup. **Ovary** ovoid or globose, sessile; style slender, clavate towards the apex, stigma punctiform; ovules 2, anatropous. **Fruit** a nut or drupe-like. **Seeds** 1-2, subglobose.

About 87 species in S India, Sri Lanka, SE China, Taiwan, S Japan throughout SE Asia extending to Melanesia and Australia (Sleumer, 1955; Na Songkhla, 1987).

KEY TO THE SPECIES

1. Leaves lanceolate, elliptic to ovate, glabrous, 8-14(-19) cm long **2. *H. nilagirica***
1. Leaves oblanceolate, rufous tomentose, glabrescent, 15-40(-45) cm long
 2. Petioles 0.5-1(-1.5) cm long. Inflorescence axis 1(-2) mm wide. Perianth 1.5-2.7 cm long, sparsely rufous tomentose outside. Anthers 1.5-2 mm long. Ovary ca. 1 mm long; disc ca. 0.5 mm high, subrotund-ovate, free
 - 1. *H. formosana* var. *oblanceolata***
 2. Petioles (1-)2-3 cm long. Inflorescence axis 3-5 mm wide. Perianth (2-)2.5-3.3 cm long, densely rufous tomentose outside. Anthers 4-5 mm long. Ovary 2-3 mm long; disc ca. 1 mm high, connate, truncate
 - 3. *H. pyrrhobotrya***

1. *Helicia formosana* Hemsl. var. *oblanceolata* Sleum.

Blumea 8(1): 53. 1955; Na Songkhla in Fl. Thailand 5(1): 117, fig. 36. 1987.

Tree up to 10 m high. Branchlets sparsely rufous tomentose, glabrescent later. Terminal buds rufous tomentose. **Leaves** alternate, chartaceous to subcoriaceous, oblanceolate to narrowly obovate, 15-35 cm long, 3-8 cm wide, sparsely rufous tomentose on both surfaces, glabrescent later; base cuneate, attenuate onto the petiole; apex acute to acuminate; margin serrate; midrib crested on both surfaces; primary veins 8-10 pairs, more prominent below; petioles 0.5-1(-1.5) cm long, sparsely rufous tomentose, glabrescent later. **Inflorescence** axillary or cauliflorous racemes, 15-30 cm long; axis 1(-2) mm wide, rufous tomentose. **Flowers** in pairs; pedicels 3-5 mm long, rufous tomentose, connate at base; bracteoles linear, lanceolate, subulate, 1-2 mm long, rufous tomentose. **Perianth** white, free, 1.5-2.7 cm long, glabrous inside, sparsely rufous tomentose outside. **Stamens** sessile; anthers arising at the base of flower bud head, 1.5-2 mm long, glabrous. **Ovary** ellipsoid, ca. 1 mm long, glabrous; disc ca. 0.5 mm high, subrotund-ovate, free; style 13-22 mm long, glabrous; stigma 1-2 mm long. **Fruit** subglobose, brown, 1.5-2.5 cm long and wide.

Thailand.— Northern: Chiang Mai, Nan, Nakhon Sawan (type: *Kerr* 6060: BM); North-eastern: Loei; Eastern: Chaiyaphum, Nakhon Ratchasima; South-western: Kanchanaburi.

Distribution.— China (Hainan), Laos, Vietnam.

Ecology.— Dry evergreen forest, often by streams, alt. 700-900 m (Sapan Waterfall, Doi Phu Kha).

Phenology.— Flowering: May-July; fruiting: December-May.

Vernacular.— เข็มยอดคนดง Mueat kon dong (Northern).

Voucher specimens.— *P. Srisanga* 1476, 1963, 2566, 2585.

2. *Helicia nilagirica* Bedd.

Madr. J. Lit. Sci. ser. 23, 3(1): 56, pl. 11. 1864; Sleum., Blumea 8(1): 69. 1955; Na Songkhla in Fl. Thailand 5(1): 112, fig. 33. 1987. – *H. cochinchinensis* auct. non Lour.: Meisn. in DC., Prodr. 14: 442. 1856, quoad pl. Assam. – *H. erratica* Hook.f. in Fl. Br. Ind. 5: 189. 1886. – *H. robusta* auct. non (Roxb.) R. Br. ex Wall.: Hosseus, Beibl. Bot. Centralbl. 28, 2. Abt.: 385. 1911.

Tree up to 10 m high. Branchlets sparsely rufous tomentose, glabrescent later. Terminal buds blackish rufous tomentose. **Leaves** alternate, chartaceous to subcoriaceous, lanceolate, elliptic to ovate, 8-14(-19) cm long, 4-7(-9) cm wide, glabrous on both surfaces, paler and slightly glaucous below; base cuneate, slightly attenuate onto the petiole; apex acute to acuminate; margin coarsely serrate; midrib crested on both surfaces; primary veins 6-8 pairs, more prominent below; petioles 0.5-1.5 cm long, sparsely minutely rufous tomentose, glabrescent later. **Inflorescence** axillary or cauliflorous racemes, 10-20 cm long; axis 1-2 mm wide, glabrous to sparsely rufous tomentose, glabrescent later. **Flowers** in pairs; pedicels 2-4 mm long,

glabrous, connate at base; bracteoles linear, subulate, ca. 1 mm long, rufous tomentose. **Perianth** white or yellowish, free, 1.2-1.5 cm long, glabrous. **Stamens** sessile; anthers arising at the base of flower bud head, 2-2.5 mm long, glabrous. **Ovary** ellipsoid, ca. 1 mm long, glabrous; disc ca. 0.5 mm high, subrotund-ovate, free; style 10-13 mm long, glabrous; stigma 1-1.5 mm long. **Fruit** subglobose, brown to purplish brown, 2-3 cm long and wide. **Seed** 1, white.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; North-eastern: Loei.

Distribution.— India (type), Myanmar, S China (Yunnan), Laos, Cambodia, Vietnam.

Ecology.— Dry evergreen and lower montane forest, alt. 1,100-1,500 m (Nan Watershed, Doi Phu Huat, Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: April-June; fruiting: February-November and persistent almost throughout the year.

Vernacular.— หม้อดคนตัวผู้ Mueat kon tua phu (Northern).

Voucher specimens.— *P. Srisanga* 521, 1816; *P. Srisanga* & *C. Maknoi* 2074.

3. *Helicia pyrrobotrya* Kurz

J. As. Soc. Beng. 42(2): 103. 1873; Sleum., Blumea 8(1): 65. 1955.

Tree up to 15 m high. Branchlets densely rufous tomentose, glabrescent later. Terminal buds densely blackish rufous tomentose. **Leaves** alternate, chartaceous to subcoriaceous, oblanceolate to narrowly obovate, (20-)30-40(-45) cm long, (5.5-)7-12 cm wide, rufous tomentose on both surfaces, glabrescent later; base cuneate; apex acute; margin serrate; midrib crested above, raised or strong crested and prominent below; primary veins 10-14 pairs, raised and prominent below; petioles (1-)2-3 cm long, rufous tomentose, glabrescent later. **Inflorescence** axillary or cauliflorous racemes, 20-35 cm long; axis 3-5 mm wide, densely rufous tomentose. **Flowers** in pairs; pedicels 3-6(-8) mm long, densely rufous tomentose, connate at base; bracteoles linear, lanceolate, subulate, ca. 2 mm long, densely rufous tomentose. **Perianth** white or yellowish, free, (2-)2.5-3.3 cm long, glabrous inside, densely rufous tomentose outside. **Stamens** sessile; anthers arising at the base of flower bud head, 4-5 mm long, glabrous. **Ovary** ellipsoid, 2-3 mm long, glabrous; disc ca. 1 mm high, connate, truncate; style excentric, 18-22 mm long, glabrous; stigma 2-3 mm long. **Fruit** subglobose or broadly ellipsoid, brown, 2-3 cm long and wide. **Seed** 1, violet, 2.2-2.5 cm long and wide (Fig. 67).

Thailand.— Northern: Nan.

Distribution.— Myanmar (type), S China (Yunnan).

Ecology.— Lower montane forest, alt. 1,400-1,700 m (Doi Phu Kha).

Phenology.— Flowering: March-July; fruiting: December-February.

Voucher specimens.— *P. Srisanga* 939, 1294, 1300, 1448; *P. Srisanga* & *S. Watthana* 637.

Notes.— New recorded for Thailand.

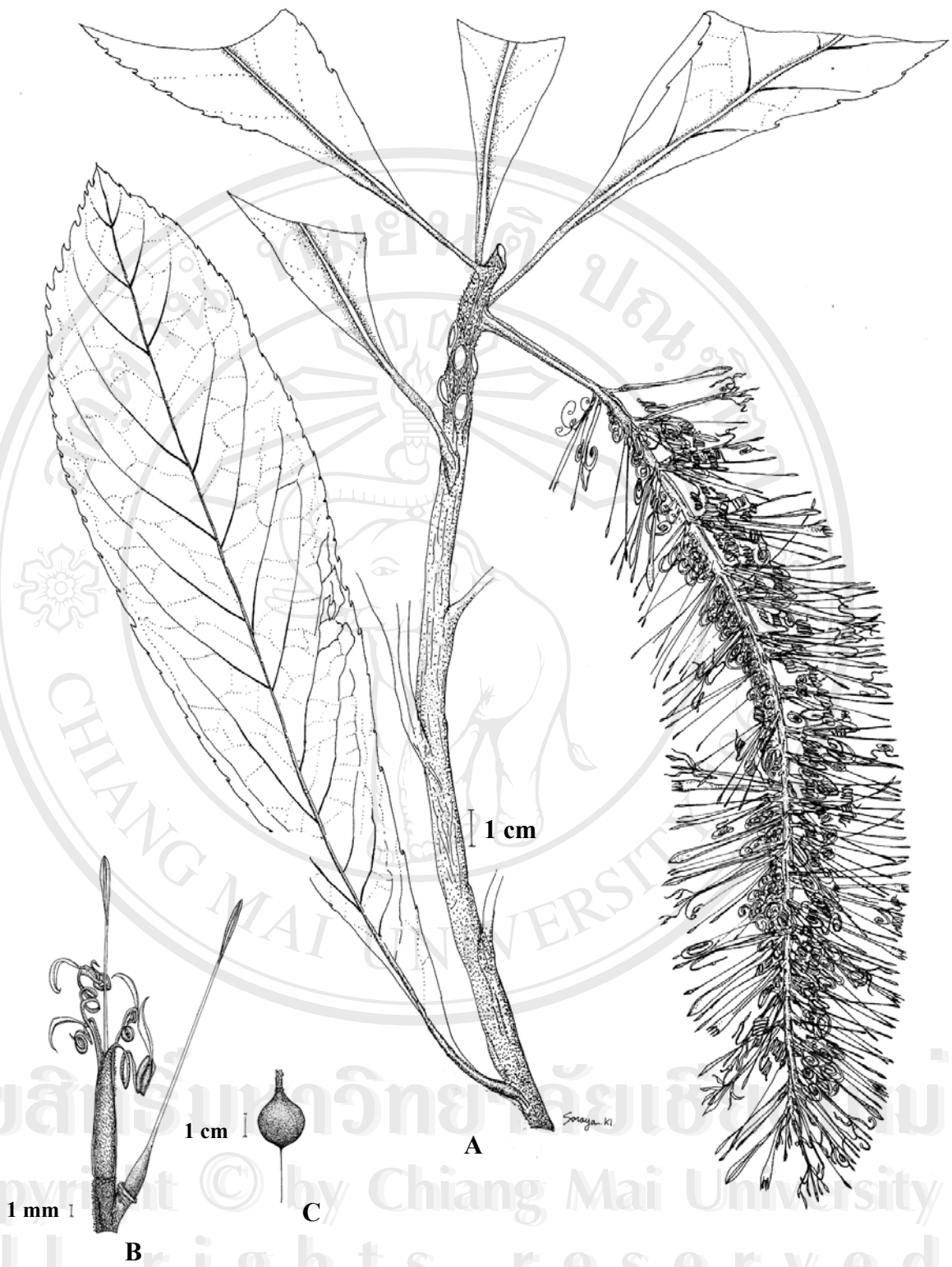


Figure 67. *Helicia pyrrhobotrya* Kurz

A. flowering branch; B. flowers; C. fruit.

RAFFLESIACEAE

Parasitic plants, without chlorophyll and roots; endophytic body in the form of strings or plates of cell inside the host plants; flowering bud or branches bursting through the cortex of host tissues. **Flowers** in short racemes or spikes or solitary, bearing stem appearing from a tuber, unisexual (monoecious or dioecious) or rarely bisexual. **Tepals** often forming a tube at the base. **Stamens** 8-many, united into a synandrium or inserted around the central column; filaments absent; anthers opening with slits or pores. **Ovary** usually inferior, rarely half-inferior or superior (*Mitrastemma* Makino), 1-locular, 4 to many parietal placentation; stigma at or near the apex of the column. **Fruit** a berry. **Seeds** numerous.

Nine genera and about 55 species mostly in tropical regions (Meijer, 1993). Four genera and 6 species in Thailand (Hansen, 1972c; Meijer, 1984; Bänziger & Hansen, 1997; 2000; Picheansoonthon, 2002). Only 1 species recorded from Doi Phu Kha National Park.

SAPRIA Griff.

Proc. Linn. Soc. London 1: 216. 1844; Trans. Linn. Soc. London 19: 314. 1845; Hansen in Fl. Thailand 2(2): 182. 1972; Meijer in Fam. Gen. Vasc. Pl. 2: 561. 1993. – *Richthofenia* Hosseus, Bot. Jahrb. 41: 55. 1907.

Herbaceous, dioecious, fleshy, root parasitic plants, with strongly reduced stem. **Flowers** unisexual, solitary, large, more than 10 cm in diam., red or pink with coloured warts. **Perianth** tubular, 10-lobed; lobes imbricate, around a central diaphragm, which is covered with ramenta above. **Anthers** 20, below the rim of the expanded apex of the central column. **Ovary** inferior.

Three species in India (Assam), Bhutan, S China and continental SE Asia. All species occurred in Thailand (Bänziger & Hansen, 1997; Picheansoonthon, 2002).

Sapria himalayana Griff.

Proc. Linn. Soc. London 1: 217. 1844; Trans. Linn. Soc. London 19: 314, t. 34-39. 1845; Hansen, Bot. Tidsskr. 67: 113. 1972; in Fl. Thailand 2(2): 182. 1972. – *Richthofenia siamensis* Hosseus, Bot. Jahrb. 41: 55, t. 1-2. 1907; Craib, Kew Bull. 1911: 449. 1911.

Tuber broadly cupular. Stem short, much depressed, up to 1 cm long. **Leaves** about 10, broadly triangular or semicircular, obtuse, covering lower part of perianth tube. **Flowers** 10-20 cm in diam. **Perianth** tube 6-8 cm long; lobes 10, in two series, broadly triangular, 6-8 cm long, 4-6 cm wide, obtuse at apex, red with yellow warts; at their insertion, the tube is partly closed by 7-14 mm wide corona (diaphragm); upper surface of corona covered with ca. 10 mm long, numerous filiform processes (ramenta); in the central part, an aperture, 1.8-3.7 cm in diam., which is smaller than the disk inside, 3.3-5.1 cm in diam.; below the aperture ca. 20 longitudinal ridges are found in the blood-coloured throat; from the base of the tube appears a columnar

structure much flattened and widened in its top part (disk). **Male flowers:** anthers 20, sessile on the column immediately below the widened part, 2-celled, opening with a pore. **Female flowers:** the column thicker, ca. 20 small outgrowths at the same position as the anthers. **Ovary** inferior with numerous irregular cavities which on their internal walls carry innumerable ovules (Fig. 139).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India (type), Myanmar, China, Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Parasitizing *Tetrastigma cruciatum* Craib & Gagnep. and *Illigera trifoliata* Dunn. The smell of rotten meat attracts various Diptera; when the insects are trapped by the corona and the widened part of the column, they probably effect pollination (Hansen, 1972c).

Phenology.— Flowering: October-January.

Vernacular.— กระโดนฤๅษี Kathon rusi (General).

Voucher specimens.— *P. Srisanga* 2252.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

RANUNCULACEAE

Annual or perennial herbs, climbers, rarely small shrubs. **Leaves** simple or compound, alternate or opposite; stipules absent or represented by stipule-like petiolar basal sheaths. **Inflorescence** axillary or terminal, basically cymose or flower solitary. **Flowers** bisexual, rarely unisexual, actinomorphic. **Sepals** (3-)4-8(-10), free, imbricate, semi-valvate or valvate, mostly caducous, sometimes petaloid, rarely spurred at the base. **Petals** 1-13 or absent, free. **Stamens** usually numerous; filaments free, usually in several series; anthers 2-locular, opening by longitudinal slits. **Ovary** superior; carpels usually many, rarely 1 or few, free, inserted on a short globular or elongate axis; ovule 1, nearly basal and pendulous or several to numerous and marginal placentation. **Fruit** an achene, berry, capsule or follicle.

Fifty-nine genera and about 2,500 species mainly in N temperate region, fewer in tropical and S Hemisphere (Tamura, 1993). Many species are cultivated as ornamentals. Five genera and about 22 species in Thailand (Tamura, 1997). Two genera and 6 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Stems twisted. Leaves opposite

1. *Clematis*

1. Stems erect. Leaves alternate

2. *Thalictrum*

1. CLEMATIS L.

Sp. Pl.: 543. 1753; Tamura, Acta Phytotax. Geobot. 38: 38. 1987; in Fam. Gen. Vasc. Pl. 2: 577. 1993.

Perennial herbs with woody base, climbers or small shrubs; stem twisted, scandent; internodes elongated. **Leaves** opposite, simple or compound; petioles mostly twining. **Inflorescence** axillary or terminal, trichotomously compound, rarely flower solitary. **Flowers** bisexual or rarely unisexual. **Sepals** 4, sometimes 6 or 8, petaloid. **Petals** absent. **Carpels** many; ovule 1 in each carpel. **Fruit** an achene, sessile or subsessile, beaked with a long elongated plumose tail.

About 240 species, cosmopolitan. Ten species in Thailand (Tamura, 1997). Five species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|---------------------------|
| 1. Leaves simple | 3. <i>C. fulvicoma</i> |
| 1. Leaves compound | |
| 2. Leaves pinnately compound. Stamens hairy | |
| 3. Leaves 5-foliolate, pubescent | 1. <i>C. buchananiana</i> |
| 3. Leaves 3-foliolate, glabrous or glabrescent | 4. <i>C. sikkimensis</i> |
| 2. Leaves bipinnately compound. Stamens glabrous | |
| 4. Stems and leaves glabrous. Leaves membranous | 2. <i>C. eichleri</i> |
| 4. Stems and leaves ferruginous pubescent. Leaves subcoriaceous | 5. <i>C. subumbellata</i> |

1. *Clematis buchananiana* DC.

Syst. Nat. 1: 140. 1817; Tamura, J. Phytogeogr. Tax. 28: 14. 1980; Thai For. Bull. (Bot.) 25: 65, fig. 1. 1997. – *C. wattii* Drum. & Craib, Kew Bull. 1915: 421. 1915; Craib in Fl. Siam. Enum. 1: 16. 1925.

Climber; stems striate, brownish to ferruginous pubescent. **Leaves** pinnately compound, 5-foliolate; leaflets broadly elliptic to broadly ovate, chartaceous, (5-)8-13 cm long, (3-)6-11.5 cm wide, pubescent on both surfaces, especially on nerves; base broadly cuneate, rounded to subcordate; apex acute to shortly acuminate; margin crenate-dentate, (3-)5(-7)-nerved from the base; petiolules 1.5-3 cm long, brownish to ferruginous pubescent. **Inflorescence** axillary or terminal, paniculate, up to 20 cm long, brownish to ferruginous pubescent. **Flowers** bisexual. **Sepals** 4(-5), creamy yellow, oblong-lanceolate, 2.3-3 cm long, 0.4-0.6(-0.8) cm wide, densely tomentose outside, glabrous to pubescent inside. **Stamens** 1.2-2 cm long, hairy. **Achene** ovoid, 3-4 mm long, tomentose; tail (3-)3.5-4 cm long, plumose, silky creamy white.

Thailand.— Northern: Chiang Mai (type of *C. wattii*), Chiang Rai, Nan.

Distribution.— E Himalayas (Nepal-type), Myanmar, S China (Yunnan), Vietnam.

Ecology.— Lower montane scrub, among grasses on limestone rocks, alt. 1,400-1,750 m (Doi Phu Wae).

Phenology.— Flowering: November-January; fruiting: January-March.

Vernacular.— กำปองหลวง Kam pong luang (Northern).

Voucher specimens.— *P. Srisanga* 421, 1226, 1296, 1896; *P. Srisanga et al.* 2419.

Notes.— New locality recorded from Nan, in Thailand.

2. *Clematis eichleri* (Tamura) Tamura

Thai For. Bull. (Bot.) 25: 70, fig. 3. 1997. — *Naravelia eichleri* Tamura, Acta Phytotax. Geobot. 37: 109. 1986.

Climber; stems striate. **Leaves** ternately compound; leaflets lanceolate to elliptic, membranous, (2.5-)4-9 cm long, (1.5-)2-4 cm wide, glabrous on both surfaces; base broadly cuneate, subtruncate to subcordate; apex acute to acuminate; margin entire, 5-7-nerved from the base; petiolules 0.4-6 cm long, glabrous. **Inflorescence** axillary or terminal, paniculate, up to 15 cm long, puberulous. **Flowers** bisexual. **Sepals** 4, greenish white, elliptic-oblong, 8-11 mm long, 3-4 mm wide, glabrous except densely white tomentose along margin. **Stamens** 8-11(-13) mm long, glabrous. **Achene** obliquely fusiform, 8-11 mm long, glabrous, with thick margin; tail 5-7.5 cm long, plumose, white.

Thailand.— Northern: Chiang Mai (type: *Kerr* 2903: BM, E, K), Chiang Rai, Lamphun, Nan.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: November; fruiting: January-February.

Voucher specimens.— *P. Srisanga* 1860, 2322.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

3. *Clematis fulvicoma* Rehd. & Wils.

In Sargent Pl. Wils. 1: 327. 1913; Tamura, J. Phytogeogr. Tax. 28: 14. 1980; Thai For. Bull. (Bot.) 25: 73. 1997.

Climber; stems striate, glabrous to puberulous around nodes. **Leaves** simple, elliptic to ovate, subcoriaceous, 13-19 cm long, 7-12 cm wide, glabrous on both surfaces; base truncate to subcordate; apex acute to shortly acuminate; margin entire, 5(-7)-nerved from the base; petioles 5.5-8 cm long, glabrous, striate. **Inflorescence** axillary or terminal, paniculate, up to 30 cm long, dark brownish puberulous. **Flowers** bisexual. **Sepals** 4, brown, oblong-lanceolate, 1.3-1.6 cm long, 0.25-0.3 cm wide, densely short tomentose on both sides. **Stamens** 8-11 mm long, glabrous. **Achene** fusiform-ovoid, 2-3 mm long, tomentose; tail 3-3.5 cm long, plumose, brownish (Fig. 140).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Myanmar, S China (Yunnan-type).

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: October-November; fruiting: December-January.

Vernacular.— เครื่องเหล็กจาง Khruua lueang jang (Northern).

Voucher specimens.— *P. Srisanga* 1733, 2380; *P. Srisanga* & *C. Puff* 1098.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

4. *Clematis sikkimensis* (Hook.f. & Thomson) Drumm. ex Burkill

Rec. Bot. Surv. India. 10: 229. 1925; Tamura, Thai For. Bull. (Bot.) 25: 65. 1997. – *C. acuminata* DC. var. *sikkimensis* Hook.f. & Thomson in Fl. Br. Ind. 1: 6. 1872; Tamura, J. Phytogeogr. Tax. 28: 14. 1980. – *C. siamensis* Drumm. & Craib, Kew Bull. 1915: 420. 1915; Craib in Fl. Siam. Enum. 1: 15. 1925.

Climber; stems striate, sparsely hairy. **Leaves** pinnately compound, 3-foliolate; leaflets lanceolate, elliptic to ovate, chartaceous, 4-10 cm long, (1.7-)3-7 cm wide, glabrous or at most sparsely hairy on nerves on both surfaces; base broadly cuneate, rounded to subcordate; apex acute to acuminate; margin entire, 3(-5)-nerved from the base; petiolules 0.4-2.2 cm long, glabrous to sparsely pubescent. **Inflorescence** axillary or terminal, paniculate, up to 7 cm long, glabrous to sparsely pubescent. **Flowers** bisexual. **Sepals** 4, pale yellow, oblong-lanceolate, 1.2-1.4 cm long, 0.25-0.4 cm wide, glabrous except tomentose along margin and apex inside. **Stamens** 1.2-1.4 cm long, hairy. **Achene** (immature) ovoid, tomentose; tail plumose, white.

Thailand.— Northern: Chiang Mai (type of *C. siamensis*), Nan.

Distribution.— India, Nepal, Sikkim (type), Myanmar.

Ecology.— Lower montane forest, alt. 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering: November-February.

Vernacular.— พวงแก้วสิกขิม Puang kaew sikkim (Northern).

Voucher specimens.— *P. Srisanga* 499.

Notes.— New locality recorded from Nan, in Thailand.

5. *Clematis subumbellata* Kurz

J. As. Soc. Beng. 39(2): 61. 1870; Tamura, J. Phytogeogr. Tax. 28: 14. 1980; Thai For. Bull. (Bot.) 25: 67, fig. 2. 1997. – *C. floribunda* Kurz, J. Bot. 5: 240. 1867, non Planch. & Triana 1862. – *C. umbellifera* Gagnep., Bull. Soc. Bot. France 82: 477. 1935. – *C. kerriana* Drumm. & Craib, Kew Bull. 1914: 122. 1914; Craib in Fl. Siam. Enum. 1: 15. 1925. – *C. laxipaniculata* Péri, Sinensia 7: 437, fig. 1. 1936.

Climber; stems striate, ferruginous pubescent. **Leaves** ternately compound; leaflets lanceolate to elliptic, subcoriaceous, (1.5-)2-5.5 cm long, 1.5-2.8 cm wide, sparsely ferruginous pubescent on upper surface, densely and softly on lower surface; base rounded to subcordate; apex obtuse to acute; margin entire, 3(-5)-nerved from the base; petiolules 0.4-2.5 cm long, ferruginous pubescent. **Inflorescence** axillary or terminal, paniculate, up to 20 cm long, ferruginous pubescent. **Flowers** bisexual. **Sepals** 4, creamy yellow, elliptic-oblong to narrowly spatulate, 6-7 mm long, 2-3 mm wide, densely tomentose on both sides. **Stamens** 3-4 mm long, glabrous. **Achene** obliquely fusiform, 5-6 mm long, tomentose; tail 2.5-3.5 cm long, plumose, silky white.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan; North-eastern: Loei; Eastern: Chaiyaphum; South-western: Kanchanaburi (type of *C. kerriana*).

Distribution.— Myanmar (type), S China (Yunnan).

Ecology.— Lower montane scrub, among grasses on limestone rocks, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering: December-February; fruiting: February-April.

Vernacular.— เครื่องฟานไห้ Khruea fan hai (Chiang Mai).

Voucher specimens.— *P. Suksathan* 1788.

Notes.— New locality recorded from Nan, in Thailand.

2. *THALICTRUM* L.

Sp. Pl.: 545. 1753; Tamura in Fam. Gen. Vasc. Pl. 2: 581. 1993

Perennial herbs, usually with rhizomes; stem erect. **Leaves** alternate, ternately to pinnately compound; leaflets lobed. **Inflorescence** terminal or axillary, corymbose, paniculate, racemes or umbelliform. **Flowers** bisexual or rarely unisexual. **Sepals** (3-) 4-8 (-10), sometimes petaloid. **Petals** absent. **Stamens** 5-many. **Carpels** many; ovule 1 in each carpel. **Fruit** an achene, sessile or stipitate, with longitudinal ribbed.

About 200 species, cosmopolitan especially in N temperate region. Four species, one with 2 varieties in Thailand (Tamura, 1997). One species recorded from Doi Phu Kha National Park.

Thalictrum foliolosum DC.

Syst. Nat. 1: 175. 1817; Craib in Fl. Siam. Enum. 1: 18. 1925; Tamura, J. Phytogeogr. Tax. 28: 16. 1980; Grierson in Fl. Bhutan 1(2): 298. 1984; Tamura, Thai For. Bull. (Bot.) 25: 79. 1997.

Erect perennial herb, up to 2 m high. **Leaves** ternately compound; leaflets ovate to broadly ovate or suborbicular, membranous, 1-3.5 long and wide, glabrous, lobed; base truncate to subcordate; apex acute; lateral petiolules 2-5 mm long. **Inflorescence** terminal and axillary, panicles. **Sepals** 4, white-violet, obovate, 2-3 mm long, 1-1.5 mm wide, glabrous. **Stamens** 13-18, 2-3 mm long, glabrous. **Carpels** 4, fusiform, glabrous. **Achene** ellipsoid, ca. 3 mm long, sessile, ribbed, glabrous.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— E Himalayas (Nepal-type), Myanmar.

Ecology.— Lower montane forest, alt. 1,350-1,700 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: July-September.

Vernacular.— ถ้ำมรงค์ Thamma rong (Northern).

Voucher specimens.— *P. Srisanga* 2150; *P. Srisanga et al.* 836.

Notes.— New locality recorded from Nan, in Thailand.

RHAMNACEAE

Trees, shrubs or woody climbers, rarely herbs, usually with thorns. **Leaves** simple, alternate or opposite, penninerved or 3-5-nerved from the base; stipules mostly present, sometimes small. **Inflorescence** axillary or terminal, cymes, thyrses or fascicles. **Flowers** bisexual or unisexual, actinomorphic, small, 4-5-merous. **Calyx** campanulate to tubular; lobes valvate. **Petals** free, often hooded and concave, usually smaller than sepals, rarely absent. **Stamens** opposite to and often embrace by the petals; anthers 2-locular, opening by longitudinal slits. Disk mostly present, often adnate to the hypanthium. **Ovary** superior, half-inferior or inferior, 2-4-locular; ovules solitary, rarely paired in each loculus, erect from the base; stigmas lobed. **Fruit** a capsule, drupaceous or samara.

An almost cosmopolitan family with 52 genera and about 925 species (Medan & Schirarend, 2004). About 9 genera and 30 species in Thailand. Six genera and 7 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|--|----------------------------|
| 1. Leaves penninerved | |
| 2. Branches with tendrils | 2. <i>Gouania</i> |
| 2. Branches without tendrils | |
| 3. Primary veins distinctly close parallel | 1. <i>Berchemia</i> |
| 3. Primary veins not close parallel | |
| 4. Disk thin, inconspicuous. Ovary 3-4-locular, free from the disk; styles 3-4-lobed. Fruit drupaceous, 2-4-seeded | 4. <i>Rhamnus</i> |
| 4. Disk thick, 5-lobed. Ovary 2-locular, partly immersed in the disk; styles deeply 2-lobed. Fruit a 1-seeded samara, with an elongate terminal wing | 5. <i>Ventilago</i> |
| 1. Leaves with more or less distinctly 3(-5)-nerved at base | |
| 5. Plants unarmed. Nerves at leaves base reaching about the middle. Ovary half-inferior. Fruit with swollen and fleshy peduncles when fruit maturity | 3. <i>Hovenia</i> |
| 5. Plants armed or not. Nerves at leaves base reaching almost to the apex. Ovary superior. Fruit not as above | 6. <i>Ziziphus</i> |

1. *BERCHEMIA* Necker ex DC.

Prodr. 2: 22. 1825; Lawson in Fl. Br. Ind. 1: 637. 1875; Medan & Schirarend in Fam. Gen. Vasc. Pl. 6: 333. 2004.

Shrubs or woody climbers, unarmed. **Leaves** alternate, entire, with close parallel penninerved. **Inflorescence** axillary or terminal, panicles or fascicles. **Flowers** bisexual, 5-merous. **Petals** hooded and concave. Disk present. **Ovary** superior, 2-locular, surrounded by disk; ovules solitary in each loculus; stigmas 2-lobed. **Fruit** drupaceous, 2-seeded.

About 20 species mostly in SE Asia, one in New Caledonia and one in N America (Medan & Schirarend, 2004). Only 1 species in Thailand.

***Berchemia floribunda* (Wall.) Brongn.**

Ann. Sc. Nat. Sér. 1, 10: 357. 1827; Lawson in Fl. Br. Ind. 1: 637. 1875; Craib in Fl. Siam. Enum. 1: 299. 1926; Tardieu-Blot in Fl. Gén. I.-C. Suppl. 1: 834. 1948; Long & Rae in Fl. Bhutan 2(1): 142. 1991. – *Zizyphus floribunda* Wall. in Fl. Ind. ed. Carey 2: 368. 1824.

Woody climber; branchlets glabrous, sometimes blackish when dry. **Leaves** elliptic to ovate, (3-)7-11 cm long, (1.5-)2.5-6 cm wide, glabrous or slightly puberulous when young; base obtuse to subcordate; apex acute to shortly acuminate; midrib raised and prominent beneath; primary veins 9-15 pairs, distinctly parallel; secondary veins numerous, distinctly parallel; petioles (0.6-)1.5-2.5(-3) cm long, glabrous or slightly puberulous when young. **Inflorescence** in axillary or terminal broadly panicles, up to 20 cm long, puberulous. **Flowers** greenish yellow; pedicels ca. 2 mm long, glabrous. **Calyx** lobes lanceolate to narrowly triangular, 2-3 mm long, acute at apex, glabrous. **Petals** obovate, hooded and concave, 1.5-2 mm long, glabrous. **Filaments** 1.5-2 mm long, glabrous, embrace by the petals. Disk thick, glabrous. **Ovary** glabrous. **Fruit** oblong-cylindric, 10-13 mm long, 4-5 mm wide, glabrous.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal (type), Bhutan, Myanmar, S China (Yunnan), Vietnam (Tonkin).

Ecology.— Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: January-February.

Vernacular.— ฮ้อสะพายควาย Ho sa phai khwai (Northern).

Voucher specimens.— *P. Srisanga* 1352, 2716; *P. Srisanga* & *S. Watthana* 691.

2. *GOUANIA* Jacq.

Select. Stirp. Am. Hist.: 263. 1763; Lawson in Fl. Br. Ind. 1: 643. 1875; Medan & Schirarend in Fam. Gen. Vasc. Pl. 6: 330. 2004.

Woody climbers, unarmed, with circinnate tendrils. **Leaves** alternate, crenate or serrate, penninerved. **Inflorescence** axillary, basically cymes and aggregated into panicles. **Flowers** bisexual or polygamous, 5-merous. **Petals** hooded and concave, sometimes absent. Disk present, annular, with 5 antisepalous staminode-like appendages. **Ovary** inferior, 3-locular, immersed in disk; ovules solitary in each loculus; stigmas 3-lobed. **Fruit** a capsule, 3-winged or 3-ridged, dehiscing into 1-seeded mericarps, crowned by the floral parts on top. **Seeds** 3.

A pantropical genus with about 50 species (Medan & Schirarend, 2004). About 3 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Gouania leptostachya* DC.**

Prodr. 2: 40. 1825; Lawson in Fl. Br. Ind. 1: 643. 1875; Craib in Fl. Siam. Enum. 1: 301. 1926; Long & Rae in Fl. Bhutan 2(1): 146, fig. 18: n-r. 1991.

Woody climber; branchlets puberulous when young, glabrescent; tendrils pubescent; stipules in pairs, broadly falcate, serrate, 7-18 mm long, 5-10 mm wide, caducous. **Leaves** broadly lanceolate, elliptic to ovate, (2.5-)6-10 cm long, (1-)2.5-4.5 cm wide, glabrous except pubescent on nerves beneath; base obtuse, rounded to subcordate; apex acute to acuminate; margin crenate-serrate; midrib raised and prominent beneath; primary veins 5-7 pairs, curved, slightly parallel; secondary veins numerous, more or less distinctly parallel; petioles 8-11 mm long, pubescent. **Inflorescence** narrowly thyrses, up to 25 cm long, puberulous. **Flowers** creamy yellow or white; pedicels 1-1.5 mm long, puberulous. **Calyx** lobes ovate, ca. 1.5 mm long, sparsely puberulous outside. **Petals** oblanceolate, hooded and concave, ca. 1 mm long, glabrous. **Filaments** ca. 1 mm long, glabrous, embrace by the petals. Disk glabrous; lobes triangular. **Ovary** glabrous. **Capsule** broadly ovoid, 3-ridges, 10-15 mm long and wide, glabrous.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; Central: Saraburi; Peninsular: Trang.

Distribution.— India (type), Nepal, Bhutan, Myanmar, Vietnam, Cambodia, Malaysia, Indonesia, Philippines.

Ecology.— Lower montane forest, open and disturbed areas, alt. 1,400-1,600 m (Doi Phu Kha).

Phenology.— Flowering: August-September; fruiting: November-December.

Voucher specimens.— *P. Srisanga* 1124, 1504; *P. Srisanga* & *C. Puff* 1086.

3. *HOVENIA* Thunb.

Nov. Gen.: 7. 1781; Lawson in Fl. Br. Ind. 1: 640. 1875; Medan & Schirarend in Fam. Gen. Vasc. Pl. 6: 327. 2004.

Trees or shrubs, unarmed. **Leaves** alternate, with more or less distinctly 3-nerved at base and reaching about the mid-leaf. **Inflorescence** axillary or terminal, dichotomously cymes. **Flowers** bisexual, 5-merous. **Calyx** tube obconical. **Petals** hooded and concave. Disk flat, hairy. **Ovary** half-inferior, 3-locular, immersed in disk; ovules solitary in each loculus; style deeply 3-lobed. **Fruit** drupaceous, 3-seeded, with swollen and fleshy peduncles when fruit maturity.

About 7 species in E & SE Asia (Medan & Schirarend, 2004). One species in Thailand (Maxwell, 1994).

Hovenia dulcis Thunb.

Nov. Gen.: 7. 1781; Lawson in Fl. Br. Ind. 1: 640. 1875. – *H. acerba* Lindl., Bot. Reg. t. 501; Long & Rae in Fl. Bhutan 2(1): 145, fig. 18: k-m. 1991.

Deciduous tree, 5-10 m high; branchlets glabrous, sometimes sparsely puberulous when young, with white lenticels. **Leaves** elliptic to ovate, 9-15(-17) cm long, 4.5-8 cm wide, glabrous or sparsely puberulous on nerves beneath; base rounded, broadly cuneate to subcordate, more or less oblique; apex acuminate; margin

crenate-serrate; midrib raised and prominent beneath; primary veins 3-nerved at base, 2-4 pairs above; petioles 1-1.5 cm long, puberulous. **Inflorescence** axillary or terminal, 3-6 cm long, puberulous. **Flowers** white; pedicels 1-1.5 mm long, sparsely puberulous. **Calyx** lobes lanceolate to narrowly triangular, 1-1.5 mm long, reflexed, acute at apex, glabrous. **Petals** oblanceolate, concave, ca. 1.5 mm long, glabrous. **Filaments** ca. 1.5 mm long, glabrous, embrace by the petals. Disk flat, tomentose. **Ovary** glabrous; style ca. 1.5 mm long, glabrous, 3-lobed, divided to about the middle. **Fruit** globose, 5-6 mm in diam., obscurely 3-lobed, glabrous. **Seeds** flatten, lens-shape, 4-5 mm long and wide, glabrous, shiny.

Thailand.— Northern: Chiang Mai, Lampang, Nan.

Distribution.— E Himalayas, China, Korea, Japan (type).

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: June-August; leaves: March-December.

Vernacular.— หมอนหิน Mon hin (Northern).

Voucher specimens.— *P. Srisanga* 732; *P. Srisanga & S. Watthana* 662.

4. *RHAMNUS* L.

Sp. Pl.: 193. 1753; Lawson in Fl. Br. Ind. 1: 638. 1875; Medan & Schirarend in Fam. Gen. Vasc. Pl. 6: 332. 2004.

Trees, shrubs or woody climbers, usually unarmed. **Leaves** alternate, rarely opposite, penninerved. **Inflorescence** axillary or terminal, panicles or fascicles. **Flowers** bisexual or unisexual, 4-5-merous. **Petals** hooded and concave. Disk thin, inconspicuous. **Ovary** superior, 3-4-locular, free from the disk; ovules solitary in each loculus; styles 3-4-lobed. **Fruit** drupaceous, 2-4-seeded.

About 100 species, subcosmopolitan, but absent from Madagascar, Australia and Polynesia (Medan & Schirarend, 2004). About 3 species in Thailand. One species recorded from Doi Phu Kha National Park

Rhamnus napalensis (Wall.) Lawson

In Fl. Br. Ind. 1: 640. 1875; Craib in Fl. Siam. Enum. 1: 300. 1926; Long & Rae in Fl. Bhutan 2(1): 143. 1991. – *Ceanothus napalensis* Wall. in Fl. Ind. ed. Carey 2: 375. 1824.

Woody climber; branchlets puberulous, glabrescent; stipules minute, early caducous. **Leaves** alternate, elliptic to ovate, (3-)7-15 cm long, (2-)4-7(-8) cm wide, glabrous except with tuft of hairs in leaf axils beneath; base rounded to broadly cuneate, sometimes slightly oblique; apex acute to shortly caudate; margin serrate; midrib raised and prominent beneath; primary veins 5-7 pairs; petioles (5-)10-15(-20) mm long, sparsely puberulous, glabrescent, canaliculate. **Inflorescence** in axillary or terminal, basically fascicles and aggregated into panicles, 3-7 cm long, puberulous.

Flowers greenish, 5-merous; pedicels ca. 1 mm long, sparsely puberulous, glabrescent. **Calyx** lobes triangular, ca. 1.5 mm long, sparsely puberulous or glabrous outside. **Petals** spatulate, concave, 0.5-1 mm long, glabrous. **Filaments** embrace by the petals. **Ovary** rounded, glabrous; styles deeply 3-lobed. **Fruit** subglobose to broadly obovoid, 4-5 mm long and wide, red, glabrous, 6-lobed, subtended by persistent calyx cup, sometimes with sublateral style remains. **Seeds** 3, subtriangulate, 4-5 mm long, glabrous, furrowed on the back.

Thailand.—Northern: Chiang Mai, Nan.

Distribution.—India, Nepal (type), Bhutan, Vietnam (Tonkin).

Ecology.—Lower montane forest, by streams, alt. 1,100-1,700 m (Doi Phu Kha).

Phenology.—Flowering: May-June; fruiting: August-September.

Voucher specimens.—*P. Srisanga* 1431; *P. Srisanga* & *C. Makoni* 2051.

5. *VENTILAGO* Gaertn.

Fruct. 1: 223, t. 49, fig. 2. 1788; Lawson in Fl. Br. Ind. 1: 630. 1875; Medan & Schirarend in Fam. Gen. Vasc. Pl. 6: 332. 2004.

Woody climbers or scandent shrubs, unarmed. **Leaves** alternate, penninerved. **Inflorescence** axillary or terminal, panicles, glomerules or subumbellate cymes. **Flowers** bisexual, 5-merous. **Sepals** keeled within. **Petals** hooded and concave. **Stamens** attached to the base of petals. Disk thick, adnate to the lower half of the ovary, 5-lobed. **Ovary** superior, 2-locular, partly immersed in the disk; styles deeply 2-lobed. **Fruit** a 1-seeded samara, with an elongate terminal wing. **Seed** globose to subglobose.

About 40 species in tropical Old World (Medan & Schirarend, 2004). About 7 species in Thailand. One species recorded from Doi Phu Kha National Park

Ventilago cristata Pierre

Fl. For. Cochinch.: t. 314, fig. A. 1894; Craib in Fl. Siam. Enum. 1: 294. 1926; Tardieu-Blot in Fl. Gén. I.-C. Suppl. 1: 827. 1948.

Woody climber; branchlets puberulous, glabrescent; stipules minute, early caducous. **Leaves** alternate, elliptic, (5-)7-10 cm long, (2-)3-4 cm wide, glabrous except puberulous on nerves beneath; base rounded obliquely cuneate; apex bluntly acute; margin entire; midrib raised and prominent beneath; primary veins 5-6 pairs; secondary veins numerous, closely parallel; petioles 4-5 mm long, puberulous, glabrescent. **Inflorescence** in axillary or terminal panicles, dense-flowered, 6-10(-17) cm long, puberulous; pedicels short, up to 1 mm long, puberulous. **Calyx** green; tube campanulate; lobes triangular, ca. 1 mm long, puberulous outside. **Petals** white, obovate, concave, ca. 0.5 mm long, glabrous. **Filaments** embrace by the petals. Disk tomentose. **Fruit** ca. 4.5 cm long, 1 cm wide including terminal wing; nut globose, covered with the persistent calyx about 1/3 from the base.

Thailand.— Northern: Nan; Eastern: Roi Et, Ubon Ratchathani; South-eastern: Prachin Buri; Central: Saraburi.

Distribution.— Laos, Vietnam, Cambodia (type).

Ecology.— Dry evergreen forest, alt. 700 m (Doi Phu Kha, Tham Pha Khong).

Phenology.— Flowering: January-February.

Voucher specimens.— *P. Srisanga* 2385.

6. ZIZIPHUS Mill.

Gard. Dict. ed. 4. 1754; Lawson in Fl. Br. Ind. 1: 632. 1875; Medan & Schirarend in Fam. Gen. Vasc. Pl. 6: 327. 2004.

Trees or shrubs, erect or straggling, or woody climbers, armed or not. **Leaves** alternate, with more or less distinctly 3(-5)-nerved at base, reaching almost to the apex. **Inflorescence** axillary, rarely terminal, cymes, sometimes forming leafless panicles. **Flowers** bisexual, 5-merous. **Calyx** tube obconical. **Petals** hooded and concave, sometimes absent. Disk, flat, 5- or 10-lobed. **Ovary** superior, 2(-4)-locular, immersed in disk; ovules solitary in each loculus; style 2(-4)-lobed. **Fruit** drupaceous, 1-4-seeded.

An almost pantropical genus with about 100 species, centred in tropical America and SE Asia (Medan & Schirarend, 2004). About 10 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Tree; trunk with spine; branchlets glabrous, sometimes sparsely puberulous when young. Petals 5. Fruit black, glabrous **1. *Z. incurva***
1. Straggling shrub; branchlets pubescent with recurved spines. Petals absent. Fruit orange, hairy **2. *Z. rugosa***

1. *Ziziphus incurva* Roxb.

In Fl. Ind. ed. Carey 2: 364. 1824; Lawson in Fl. Br. Ind. 1: 635. 1875; Craib in Fl. Siam. Enum. 1: 297. 1926; Tardieu-Blot in Fl. Gén. I.-C. Suppl. 1: 831. 1948; Long & Rae in Fl. Bhutan 2(1): 140, fig. 18: a-d. 1991.

Tree, 5-12 m high; trunk with spine; branchlets glabrous, sometimes sparsely puberulous when young, with lenticels. **Leaves** elliptic to ovate, 5-13 cm long, (2-)3-6 cm wide, glabrous except sparsely puberulous on nerves beneath; base obliquely rounded; apex bluntly acuminate; margin crenate; midrib and veined raised and prominent beneath; primary veins 3(-5)-nerved at base; petioles 5-7 mm long, sparsely puberulous. **Inflorescence** in short axillary cymes, 2-3 cm long, puberulous. **Flowers** yellow; pedicels 1-2 mm long, puberulous. **Calyx** lobes ovate, 1.5-2 mm long, spreading, pubescent outside. **Petals** spatulate, concave, 1.5-2 mm long, glabrous. **Filaments** ca. 1 mm long, glabrous, embrace by the petals. Disk shortly 10-lobed,

glabrous. **Ovary** 2-locular, glabrous; style 2-lobed, divided to the middle. **Fruit** ovoid to subglobose, 9-12 mm long and wide, black, glabrous. **Seeds** 2.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal (type), Bhutan, Myanmar, Laos.

Ecology.— Lower montane forest, alt. 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering: April-May; fruiting: July-December.

Voucher specimens.— *P. Srisanga* 914, 1220, 1510.

2. *Ziziphus rugosa* Lam.

Enc. 3: 319. 1789; Lawson in Fl. Br. Ind. 1: 636. 1875; Craib in Fl. Siam. Enum. 1: 299. 1926; Long & Rae in Fl. Bhutan 2(1): 140. 1991.

Straggling shrub; branchlets pubescent with solitary recurved spines, with white lenticels. **Leaves** elliptic, 5-10 cm long, 3.5-5 cm wide, glabrous except sparsely puberulous on nerves above, softly tomentose beneath; base obliquely rounded to obliquely broadly cuneate; apex acute to bluntly acuminate; margin shallowly crenate; midrib and veined raised and prominent beneath; primary veins 3-nerved at base; petioles 4-8 mm long, tomentose. **Inflorescence** in axillary cymes, aggregated forming leafless panicles, 7-10 cm long, densely tomentose. **Flowers** yellowish green; pedicels 1-3 mm long, densely tomentose. **Calyx** lobes triangular, 1.5-2 mm long, densely tomentose outside. **Petals** absent. **Filaments** ca. 1 mm long, glabrous. Disk 5-lobed, glabrous. **Ovary** 2-locular, tomentose; style 2-lobed, divided to the middle. **Fruit** subglobose, 12-15 mm long and wide, orange, hairy. **Seeds** 2.

Thailand.— Northern: Chiang Mai, Phrae, Nan.

Distribution.— India (type), Sri Lanka, Sikkim, Myanmar, Vietnam (Tonkin).

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: February-April; fruiting: April-May.

Vernacular.— มะคั่วด Ma khwat (Northern).

Voucher specimens.— *P. Srisanga* & *S. Watthana* 674.

RHIZOPHORACEAE

Trees or shrubs; branches swollen at the nodes. **Leaves** simple, opposite, coriaceous; stipules interpetiolar, caducous. **Inflorescence** in axillary, cymose or racemose, rarely flower solitary. **Flowers** bisexual, rarely unisexual. **Calyx** (3-)4-5(-16), valvate, thick. **Corolla** as many as and alternate with the sepals, free. **Stamens** 8, 10 or numerous, often in pairs and opposite the petals; filaments usually connate at base; anthers 2- or many-locular, dehiscent by longitudinal slits or valves. **Ovary** inferior or superior, 2-12-locular or 1-locular by the suppression of the septa, each with 2 anatropous, pendulous ovules; disk present or absent; style usually simple. **Fruit** a drupe, berry or rarely capsule.

A tropical family with 15 genera and about 120 species, frequently in mangroves (4 genera) and with pneumatophores (Mabberley, 1997). Seven genera and 14 species in Thailand (Hou, 1970). Only 1 species recorded from Doi Phu Kha National Park.

CARALLIA Roxb.

Pl. Corom. 3: 8, t. 211. 1811, nom. cons.; Hou in Fl. Thailand 2(1): 13. 1970.

Trees. **Leaves** entire or serrate. **Inflorescence** dichasial. Bracteoles 2. **Calyx** 5-8. **Petals** 5-8, clawed. **Stamens** twice the number of the petals, persistent, unequal in length, the short ones antisepalous, the long ones antipetalous. Disk annular, fleshy. **Ovary** inferior, 5-8-locular; ovules 2 in each loculus. **Fruit** a berry, 1(-5)-seeded.

Ten species distributed in Madagascar, India to SE Asia and N Australia. Only 1 species in Thailand (Hou, 1970).

***Carallia brachiata* (Lour.) Merr.**

Philipp. J. Sci. 15: 249. 1919; Craib in Fl. Siam. Enum. 1: 597. 1931; Hou in Fl. Thailand 2(1): 13. 1970. – *Diatoma brachiata* Lour., Fl. Cochinch.: 296. 1790. – *C. lucida* Roxb., Pl. Corom. 3: 8, t. 211. 1811; Craib in Fl. Siam. Enum. 1: 599. 1931. – *C. integerrima* DC., Prodr. 3: 33. 1828.

Tree up to 30 m high; stipules coriaceous, 1-2.5 cm long. **Leaves** elliptic, ovate to obovate, coriaceous, 5-15 cm long, 2-10 cm wide, glabrous, entire to dentate; base cuneate or subrounded; apex acute to shortly acuminate; petioles 6-10 mm long. **Inflorescence** 1-6 cm long, usually shining by secreted resin; peduncle up to 2.5 cm long. **Flowers** shortly pedicellate or sessile. **Calyx** 6-7(-8); lobes deltoid. **Petals** white, suborbicular, crenate, ca. 1.5 mm long. **Stamens** up to 2 mm long. **Fruit** globose, 5-8 mm in diam.

Thailand.— Northern: Nan; North-eastern: Loei; South-eastern: Chanthaburi, Trat; Peninsular: Surat Thani, Nakhon Si Thammarat.

Distribution.— Widely distributed from Madagascar to tropical Asia (Indochina-type) and N Australia.

Ecology.— Lower montane forest, alt. 1,400-1,700 m (Doi Phu Kha).

Phenology.— Flowering: November-March; fruiting: March-June.

Uses.— Wood for construction.

Vernacular.— เชียงพำนางแอ Chiang pra nang ae (Central), สี่พันนางแอ Sifan nang ae (Chiang Mai).

Voucher specimens.— *P. Srisanga* 493, 553, 1879.

ROSACEAE

Trees, shrubs or herbs. **Leaves** simple or compound, alternate or rarely opposite, sometimes with glandular teeth; stipules mostly present and paired, sometimes adnate to the petiole. **Inflorescence** terminal or axillary, fascicles, racemes, corymbs, or panicles or flower solitary. **Flowers** mostly bisexual, actinomorphic, 5-merous. **Calyx** tube free or adnate to ovary; lobes imbricate, persistent or deciduous. **Petals** imbricate, free, borne on the calyx tube. **Stamens** 5-numerous, usually in sets of 5, free, rarely connate; anthers 2-locular, dehiscing by longitudinal slits. **Ovary** inferior, half-inferior or superior; carpels 1-many, free or variously connate and adnate to the calyx tube; styles free or connate, terminal, lateral or basal; ovules (1-)2 or more in each carpel. **Fruit** a follicle (Spiraeoideae), achene or drupelets (Rosoideae), drupe (Prunoideae) or pome (Maloideae).

An almost cosmopolitan family with about 95 genera and 2,825 species but mainly in N temperate region (Mabberley, 1997). A family contains many important fruits and ornamentals. Twenty-one genera and about 64 species in Thailand (Vidal, 1970; Maxwell, 1991). Four genera and 12 species, including 2 cultivated, recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|---|-----------------------------|
| 1. Branches with prickles. Carpels many, free. Fruits drupelets | 3. <i>Rubus</i> |
| 1. Branches without prickles. Carpels 1-5, connate. Fruits a drupe or pome | |
| 2. Ovary superior. Carpel 1. Fruit a drupe | 2. <i>Prunus</i> |
| 2. Ovary inferior or half-inferior. Carpels 2-5, connate. Fruit a pome | |
| 3. Evergreen tree. Inflorescence panicle. Calyx lobes persistent. Seed large, nearly as large as the fruit | 1. <i>Eriobotrya</i> |
| 3. Deciduous tree. Inflorescence corymb. Calyx lobes persistent or deciduous. Seed small, much smaller than the fruit | 4. <i>Sorbus</i> |

1. *ERIOBOTRYA* Lindl.

Trans. Linn. Soc. London 13: 102. 1821; Vidal in Fl. Thailand 2(1): 42. 1970; Kalkman in Fam. Gen. Vasc. Pl. 6: 376. 2004.

Evergreen trees. **Leaves** simple, alternate, serrate or dentate, with straight nerves ending in the teeth. **Inflorescence** in terminal panicles, broad, usually woolly. **Calyx** lobes 5, persistent; tube adnate to ovary. **Petals** 5. **Stamens** about 20. **Ovary** inferior or half-inferior; carpels 2-5, connate and adnate to the calyx tube; styles 2-5, terminal, connate at base; ovules 2 in each carpel. **Fruit** a pome; pericarp more or less fleshy; endocarp thin. **Seeds** 1-3, nearly as large as the fruit.

About 26 species distributed from E Himalayas to E and SE Asia and southwards to W Malesia (Mabberley, 1997). Two indigenous and 1 cultivated: Loquat (*E. japonica* (Thunb.) Lindl.), species in Thailand (Vidal, 1970). One species recorded from Doi Phu Kha National Park.

***Eriobotrya bengalensis* (Roxb.) Hook.f.**

In Fl. Br. Ind. 2: 371. 1878; Craib in Fl. Siam. Enum. 1: 579. 1931; Vidal in Fl. Thailand 2(1): 43. 1970. – *Mespilus bengalensis* Roxb., Fl. Ind. 2: 510. 1832.

Tree up to 15 m high. **Leaves** ovate, elliptic to lanceolate, slightly coriaceous, 10-20 cm long, 4-8 cm wide, glabrous; base cuneate; apex acute to acuminate or obtuse; margin coarsely serrate; primary veins 9-15 pairs, prominent on both surfaces; petioles 2-4 cm long. **Inflorescence** 8-12 cm long, tomentose; pedicels 3-5 mm long. **Calyx** green, 2-3 mm long, glabrous inside, pubescent outside; lobes triangular-ovate, obtuse or acute at apex. **Petals** white, obovate to suborbicular spatulate, glabrous, 4-5 mm long, 3-4 mm wide. **Ovary** half-inferior, woolly at the top; style 2-3, woolly at the base. **Pome** ovoid, ca. 15 mm long, 10 mm wide. **Seeds** 1(-2).

Thailand.— Northern: Chiang Mai, Lampang, Phrae, Nan; North-eastern: Nong Khai, Nakhon Phanom; Eastern: Buri Ram; South-eastern: Prachin Buri, Chon buri, Chanthaburi, Trat; South-western: Ratchaburi; Peninsular: Surat Thani, Phangnga, Satun.

Distribution.— E Himalayas (Chittagong-type), Myanmar, Vietnam, Laos, Cambodia, Malaysia, Indonesia.

Ecology.— Lower montane forest, alt. 1,400-1,800 m (Doi Phu Kha).

Phenology.— Flowering: August-February; fruiting: February-April.

Vernacular.— จำปีดง Cham pee dong (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1525, 2323.

2. PRUNUS L.

Sp. Pl.: 473. 1753; Vidal in Fl. Thailand 2(1): 66. 1970; Kalkman in Fam. Gen. Vasc. Pl. 6: 373. 2004.

Evergreen or deciduous trees or shrubs. **Leaves** simple, alternate, entire, serrate or dentate. Stipules early caducous. **Inflorescence** in fascicles or racemes or flower solitary. **Calyx** lobes 5-10, deciduous. **Petals** 5 or absent. **Stamens** 10-numerous. **Ovary** superior; carpel 1, enclosed in the calyx tube; style 1, terminal; ovules 2, pendulous. **Fruit** a drupe. **Seed** 1.

More than 200 species, mainly in N temperate region. The genus includes many important fruits of temperate region such as almond, apricot, cherry, nectarine, peach, plum etc., ornamentals such as flowering cherry, Zakura etc. and timbers (Mabberley, 1997). Seven indigenous and about 4 cultivated species in Thailand (Vidal, 1970). Four species including 2 cultivated, recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Deciduous tree. Leaves serrate, glandular at teeth

2. Stipules laciniate. Flowers in fascicles, often 3-flowered, pedicellate.
Ovary and fruit glabrous **1. *P. cerasoides***
2. Stipules linear. Flowers mostly solitary, subsessile. Ovary and fruit tomentose
3. Leaves about twice as long as wide **2. *P. mume***
3. Leaves 4-5 times as long as wide **3. *P. persica***
1. Evergreen tree. Leaves mostly entire, if remotely serrate, teeth not glandular
4. *P. wallichii*

1. *Prunus cerasoides* D. Don

Prodr. Fl. Nepal.: 239. 1825; Vidal in Fl. Thailand 2(1): 68. 1970. – *P. puddum* Roxb. ex Brand., For. Fl. Br. Ind.: 194. 1874. – *P. campanulata* Maxim., Bull. Acad. Sci. St. Pétersb. 29: 103. 1883. – *P. hosseusii* Diels in Fedde, Rep. Nov. Spec. 4: 289. 1907; Craib in Fl. Siam. Enum. 1: 565. 1931.

Deciduous tree up to 10 m high. **Leaves** ovate to lanceolate, 5-12 cm long, 3-5 cm wide, glabrous; base broadly cuneate; apex acuminate; margin serrate; primary veins 8-12 pairs; petioles 8-15 mm long, usually with (1-)2(-4) glands, rarely absent. Stipules laciniate, subulate, glandular, deciduous. **Inflorescence** from axillary buds, fascicled or umbelled, often 3-flowered, glabrous; pedicels 7-22 mm long. **Flowers** 10-20 mm across. **Calyx** red or pink, 7-12 mm long, glabrous; tube obconical to funnel-shaped; lobes triangular, obtuse or acute at apex. **Petals** red, pink or white, obovate, elliptic to suborbicular, glabrous, 7-11 mm long, 4-8 mm wide. **Stamens** 30-35, 6-10 mm long; filaments glabrous. **Ovary** glabrous; style 10-14 mm long; stigma subpeltate, lobulate. **Drupe** ellipsoid to ovoid, 10-13 mm long, 5-7 mm wide, red. **Seed** rugose.

Thailand.— Northern: Chiang Mai (type of *P. hosseusii*), Chiang Rai, Nan.

Distribution.— Himalayas (Nepal-type), Myanmar, S China, Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,300-1,700 m (Doi Phu Kha).

Phenology.— Flowering: December-January; fruiting: March-May; leaves: January-November.

Uses.— Cultivated for ornamentals in high altitude in northern Thailand.

Vernacula.— นางพญาเสือโคร่ง Nang phaya suea khong (Northern).

Voucher specimens.— *P. Srisanga* 371, 2340, 2703.

2. *Prunus mume* Sieb. & Zucc.

Fl. Jap. 1: 29, t. 11. 1826; Vidal in Fl. C.L.V. 6: 162, pl. XXII: 5-7. 1968.

Deciduous tree up to 6 m high. **Leaves** elliptic to obovate, 5-8 cm long, 3-5 cm wide, sparsely pubescent; base cuneate to broadly cuneate; apex acuminate; margin serrate; primary veins 5-8 pairs; petioles 10-15 mm long, pubescent. Stipules subulate, glandular, deciduous. **Flowers** mostly solitary, 2-3 cm across, subsessile. **Calyx** tube campanulate; lobes elliptic-ovate, obtuse at apex, pubescent outside.

Petals white or pink, suborbicular. **Stamens** 35-40; filaments glabrous. **Ovary** tomentose; style villous below, glabrous above. **Drupe** subglobose, 2-3 cm long and wide, tomentose, yellow-red. **Seed** rugose.

Thailand.— Cultivated. Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— Native of China and Japan (type). Cultivated in temperate region and on tropical mountains.

Ecology.— Cultivated in lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: January-February; fruiting: May-July; leaves: February-November.

Uses.— Fruit edible.

Vernacular.— บัวย Buai (General), Japanese Apricot (English).

Voucher specimens.— *P. Srisanga* s.n.

3. *Prunus persica* (L.) Batsch

Beytr. Entw. Pragm. Gesch. 1: 30. 1801; Vidal in Fl. Thailand 2(1): 67. 1970. – *Amygdalus persica* L., Sp. Pl. 472. 1753. – *Prunus persica* Stokes, Bot. Mat. Med. 3: 100. 1812; Craib in Fl. Siam. Enum. 1: 565. 1931.

Deciduous tree up to 6 m high. **Leaves** lanceolate, (5-)8-15 cm long, 1.5-3 cm wide, glabrous; base cuneate with 2 sessile glands; apex acuminate; margin serrate; primary veins 8-10 pairs; petioles 5-15 mm long, glabrous. Stipules subulate, glandular, deciduous. **Flowers** mostly solitary, 2.5-3.5 cm across, subsessile. **Calyx** tube campanulate; lobes elliptic-ovate, obtuse at apex, pubescent outside. **Petals** pink, obovate. **Stamens** 35-40; filaments glabrous. **Ovary** tomentose; style villous below, glabrous above. **Drupe** subglobose, 5-7 cm long and wide, tomentose, yellow-red. **Seed** rugose.

Thailand.— Cultivated. Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— Native of China. Cultivated in temperate region and on tropical mountains.

Ecology.— Cultivated in lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: January-February; fruiting: May-June; leaves: February-November.

Uses.— Fruit edible.

Vernacular.— ท้อ Tho (General), Peach (English).

Voucher specimens.— *P. Srisanga* s.n.

4. *Prunus wallichii* Steud.

Nomencl. ed. 2, 2: 404. 1841; Vidal in Fl. Thailand 2(1): 68. 1970. – *Cerasus acuminata* Wall., Pl. As. Rar. 2: 78, t. 181. 1831. – *Prunus acuminata* (Wall.) Dietr., Syn. Pl. 3: 42. 1843; Craib in Fl. Siam. Enum. 1: 564. 1931.

Evergreen tree, up to 20 m high. **Leaves** lanceolate to ovate, 5-13 cm long, 2.5-5 cm wide, glabrous; base broadly cuneate to rounded, slightly oblique; apex acuminate; margin entire, rarely remotely serrate; primary veins 6-10 pairs; petioles 5-10 mm long, eglandular. **Stipules** linear, early caducous. **Inflorescence** axillary, solitary or 2-3-fascicled racemes, 2-10 cm long, glabrous or sparsely pubescent; pedicels 2-5 mm long, glabrous or sparsely pubescent. **Flowers** 4-6 mm across. **Calyx** green outside, yellow inside, 2-3 mm long, glabrous outside, hairy inside in the basal part; tube campanulate; lobes triangular, minute, obtuse at apex. **Petals** white, elliptic, 2-4 mm long, glabrous. **Stamens** 10-20, 2-3 mm long. **Ovary** hairy; style 2-3 mm long, glabrous; stigma globose. **Drupe** ellipsoid to ovoid, 13-18 mm long, 5-8 mm wide, glabrous, black. **Seed** smooth (Fig. 68).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— E Himalayas (Nepal-type), Myanmar, S China, Laos, Vietnam, Malaysia, Indonesia.

Ecology.— Dry evergreen and lower montane forest, often near streams, alt. 800-1,800 m (Sapan Waterfall, Doi Phu Kha).

Phenology.— Flowering: October-December; fruiting: July-October.

Voucher specimens.— *P. Srisanga* 1165, 1715, 1716, 1777, 1950, 2215, 2240; *P. Srisanga* & *C. Maknoi* 2102.

Notes.— New locality recorded from Nan, in Thailand.

3. *RUBUS* L.

Sp. Pl.: 492. 1753; Thuan in Fl. Thailand 2(1): 46. 1970; Kalkman in Fam. Gen. Vasc. Pl. 6: 369. 2004.

Shrubs or shrublets, often lianas. Branches sarmentose, mostly armed with straight or hooked prickles. **Leaves** simple or compound, stipulate. **Inflorescence** terminal or axillary, panicles or glomerules or flower solitary. **Calyx** campanulate or urceolate; lobes 5, imbricate, persistent. **Petals** 5, obovate to orbicular, clawed, usually caducous. **Stamens** numerous, mostly 2-seriate. **Ovary** superior, carpels numerous, free, inserted on a receptacle; style terminal; ovules 2 in each carpel. **Fruit** consisting of numerous drupelets.

More than 250 species, cosmopolitan. The genus includes many important fruits of temperate region such as raspberry, blackberry etc. and ornamentals (Mabberley, 1997). Twenty-three indigenous species in Thailand (Thuan, 1970). Six species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves simple
 2. Stipule and bract segments filiform. Terminal leaf lobe acute. Inflorescence indumentum golden yellow **1. *R. alceifolius***
 2. Stipules and bract lobed. Terminal leaf lobe 3-lobed. Inflorescence indumentum brownish **4. *R. multibracteatus***

1. Leaves compound
 3. Leaves 3-foliolate
 4. Branches covered with dense, long, reddish bristles. Leaflets truncate or emarginate at apex **2. *R. ellipticus* forma *obcordatus***
 4. Branches not covered with dense, long, reddish bristles. Leaflets acuminate at apex **3. *R. leucanthus***
 3. Leaves pinnate, leaflets more than 3
 5. Branches covered with dense, long, reddish bristles. Leaflets not white silky underneath. Petals white **6. *R. sorbifolius***
 5. Branches not covered with dense, long, reddish bristles. Leaflets white silky underneath. Petals pink **5. *R. niveus***

1. ***Rubus alceifolius*** Poir.

In Lam, Enc. 6: 247. 1804; Craib in Fl. Siam. Enum. 1: 568. 1931; Thuan in Fl. Thailand 2(1): 55. 1970. – *R. moluccanus* auct. non L.: Lour, Fl. Cochinch.: 324. 1790.

Erect or clambering shrub. Branches yellow tomentose, covered with curved prickles and sometimes glandular hairs. **Leaves** simple, broadly ovate to orbicular, 3-7-lobed, 5-20 cm long, 3-15 cm wide, tomentose on both surfaces, especially on nerves and below, rugose above; base broadly cordate; apex acute; margin serrate; petioles 2-5 cm long, tomentose. Stipules joined to the branches, caducous; stipule segments filiform. **Inflorescence** in axillary and terminal panicles, up to 15 cm long, golden yellow tomentose; pedicels 1-2 cm long; bract segments filiform. **Flowers** 1.5-2 cm across. **Calyx** golden yellow tomentose, urceolate, 9-12 mm long; lobes triangular, acute at apex. **Petals** white, obovate, glabrous. **Stamens** 4-5 mm long. **Styles** 5-6 mm long; stigma flattened. **Fruit** globose; drupelets red.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Nan, Tak; North-eastern: Nong Khai; South-eastern: Chanthaburi; South-western: Phetchaburi; Peninsular: Nakhon Si Thammarat, Surat Thani.

Distribution.— Japan, China, Myanmar, Laos, Cambodia, Vietnam, Indonesia (Java-type), Philippines.

Ecology.— Lower montane forest, open places, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: May-September; fruiting: August-November.

Uses.— Fruit edible.

Vernacular.— นามขี้หนู Nam khai pu (General).

Voucher specimens.— *P. Srisanga* 1403.

2. ***Rubus ellipticus*** J. E. Smith forma ***obcordatus*** Franch.

Pl. Delav.: 206. 1890; Thuan in Fl. Thailand 2(1): 52. 1970. – *R. ellipticus* var. *obcordatus* Focke, Biblioth. Bot. 17: 199. 1911. - *R. obcordatus* (Franch.) Thuan in Fl. C.L.V. 7: 34, pl. II: 3. 1968.

Erect or clambering shrub. Branches covered with dense, long, reddish bristles, hooked prickles. **Leaves** compound, 3-foliolate; leaflets obovate, 3-7 cm long, 2-6 cm wide, terminal one bigger and petiolulate, lateral ones sessile, sparsely hairy or glabrescent above, grey tomentose below; base broadly cuneate, obtuse, rounded to subcordate; apex truncate to emarginate; margin serrate; petioles 2-4 cm long. Stipules joined to the petiole, filiform, hairy. **Inflorescence** in axillary and terminal panicles, up to 8 cm long, grey tomentose; pedicels 5-10 mm long; bract incised. **Flowers** 8-12 mm across. **Calyx** grey tomentose, urceolate to campanulate, 3-5 mm long; lobes broadly ovate, acute to mucronate at apex. **Petals** white, obovate, 4-5 mm long, sparsely hairy at the lower half. **Stamens** 2.5-3 mm long. **Styles** 3-4 mm long. **Fruit** globose; drupelets yellow (Fig. 69).

Thailand.— Northern: Chiang Mai, Lamphun, Phrae, Nan, Phitsanulok.

Distribution.— India, China (type), Laos, Vietnam.

Ecology.— Lower montane forest and lower montane scrub, open places, alt. 1,500-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: November-January; fruiting: February-April.

Uses.— Fruit edible.

Vernacular.— หมากไข่กุง Nam khai kung (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1811, 2333, 2673; *W. Nanakorn* 8286.

3. *Rubus leucanthus* Hance

In Walpers, Ann. Bot. Syst. 2: 468. 1852; Craib in Fl. Siam. Enum. 1: 571. 1931; Thuan in Fl. Thailand 2(1): 49, fig. 2. 1970. — *R. leucanthus* var. *villosulus* Card., Not. Syst. 3: 306. 1917.

Erect or clambering shrub. Branches glabrous, covered with strong hooked prickles. **Leaves** compound, 3-foliolate; leaflets elliptic to ovate, subcoriaceous, 5-10 cm long, 2.5-5 cm wide, terminal one bigger and with longer petiolulate than lateral ones, glabrous on both surfaces or sparsely hairy on the midrib and nerves; base broadly cuneate, obtuse to rounded, sometimes slightly oblique; apex acuminate; margin serrate; petioles 2-6 cm long, prickly. Stipules joined to the petiole, linear. **Inflorescence** in axillary few-flowered racemes or terminal panicles, up to 10 cm long, glabrous; pedicels 5-12 mm long, glabrous; bract tri-fid, caducous. **Flowers** 10-15 mm across. **Calyx** campanulate, 9-12 mm long, glabrous outside, tomentose inside and along the margin; lobes ovate to broadly ovate, acuminate to mucronate at apex. **Petals** white, obovate, 10-12 mm long. **Fruit** globose; drupelets red (Fig. 69).

Thailand.— Northern: Nan.

Distribution.— China (type), Laos, Cambodia, Vietnam.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: July-August.

Uses.— Fruit edible.

Voucher specimens.— *P. Srisanga* 969; *P. Srisanga* & *S. Watthana* 695.

4 *Rubus multibracteatus* Lév. & Van.

Le monde des plantes 11: 99, t. 5. 1902; Thuan in Fl. Thailand 2(1): 56. 1970. – *R. mallodes* Focke, Biblioth. Bot. 17: 104, fig. 45. 1911; Craib in Fl. Siam. Enum. 1: 572. 1931.

Erect or clambering shrub. Branches brown tomentose, covered with hooked prickles. **Leaves** simple, broadly ovate to orbicular, 5-lobed, 5-15 cm long and wide, tomentose on both surfaces, especially on nerves and below, rugose above; base deeply cordate; apex 3-lobed, acute; margin serrate; petioles 3.5-9 cm long, tomentose. Stipules joined to the branches, caducous, lobed. **Inflorescence** in axillary and terminal panicles, 3-10 cm long, brown tomentose; pedicels 6-15 mm long; bract incised. **Flowers** ca. 1.5 cm across. **Calyx** brown tomentose, urceolate, 9-11 mm long; lobes triangular, acute to acuminate at apex. **Petals** white, broadly obovate, glabrous. **Stamens** 4-5 mm long. **Styles** 6-8 mm long; stigma lobed. **Fruit** globose; drupelets red.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— China (type), Laos, Vietnam.

Ecology.— Lower montane forest and lower montane scrub, open places, alt. 1,300-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: December-May; fruiting: May-July.

Uses.— Fruit edible.

Vernacular.— มะตาวู Mata pu (Nan).

Voucher specimens.— *P. Srisanga* 535, 1401, 2647; *P. Srisanga et al.* 754, 788.

5. *Rubus niveus* Thunb.

Diss. Rub.: 9, fig. 3. 1813; Craib in Fl. Siam. Enum. 1: 573. 1931; Thuan in Fl. Thailand 2(1): 51. 1970. – *R. lasiocarpus* J. E. Smith in Rees, Cyclop. 32: Rubus n. 6. 1819. – *R. micranthus* D. Don, Prodr. Fl. Nepal.: 235. 1825. – *R. lasiocarpus* var. *micranthus* (D. Don) Hook.f. in Fl. Br. Ind. 2: 339. 1878.

Erect or semi-scandent shrub. Branches glabrous, glaucous, covered with scattered hooked prickles. **Leaves** pinnately compound, 7-11-foliolate; leaflets lanceolate, elliptic to ovate, 2-5 cm long, 1-2 cm wide, terminal one petiolulate, lateral ones sessile to subsessile, glabrous or sparsely hairy on the nerves and margins above, white silky below; base cuneate, slightly oblique; apex acuminate; margin serrate; primary veins 6-10 pairs, impressed above, raised and prominent below; rachis 2-9 cm long, sparsely hairy, covered with scattered hooked prickles. Stipules joined to the petiole, lanceolate, glabrous. **Inflorescence** in axillary and terminal panicles, up to 3.5 cm long, tomentose; pedicels up to 10 mm long, tomentose; bract lanceolate, small, tomentose. **Flowers** 5-10 mm across. **Calyx** tomentose, campanulate, 5-8 mm long; lobes broadly lanceolate, acuminate to mucronate at apex. **Petals** pink, obovate, 5-8 mm long. **Stamens** 1-2 mm long. **Styles** 3-3.5 mm long. **Fruit** globose; drupelets dark red.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Sri Lanka, Myanmar, China, Laos, Vietnam, Indonesia (Java-type), Philippines.

Ecology.— Lower montane scrub, open ground among limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering: November-January; fruiting: March-May.

Uses.— Fruit edible.

Vernacular.— ไผ่ขี้หมู Khai pu (Northern).

Voucher specimens.— *P. Srisanga* 2671.

Notes.— New locality recorded from Nan, in Thailand.

6. *Rubus sorbifolius* Maxim.

Bull. Acad. Sci. St. Pétersb. 17: 158. 1871; Craib in Fl. Siam. Enum. 1: 573. 1931; Thuan in Fl. Thailand 2(1): 49. 1970. – *R. asper* Wall. ex D. Don, Prodr. Fl. Nepal.: 234. 1825, non Presl.

Shrub or liana. Branches villous, covered with dense, long, reddish bristles, scattered hooked prickles. **Leaves** pinnately compound, 5-7-foliolate; leaflets lanceolate, 2-7 cm long, 1-2 cm wide, sparsely hairy on both surfaces; base cuneate, rounded to subcordate, slightly oblique; apex acuminate; margin serrate; midrib prickly; primary veins 6-10 pairs, impressed above, raised and prominent below; rachis 3-9 cm long, covered with long reddish bristles, scattered hooked prickles. Stipules joined to the petiole, lanceolate. **Inflorescence** in axillary and terminal, (1-) 3-flowered; pedicels 1.5-3 cm long, reddish bristles. **Flowers** ca. 10 mm across. **Calyx** tomentose, campanulate, 8-11 mm long; lobes lanceolate, long acuminate at apex. **Petals** white, obovate, 6-9 mm long. **Stamens** 2-3 mm long. **Styles** 3-3.5 mm long. **Fruit** globose to oblong; drupelets reddish orange (Fig. 69).

Thailand.— Northern: Chiang Mai, Phrae, Nan, Phitsanulok; North-eastern: Loei.

Distribution.— India (type), China, Taiwan, Korea, Japan, Laos, Vietnam, Indonesia.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: October-November; fruiting: November-December.

Uses.— Fruit edible.

Vernacular.— ไผ่ขี้หมู Nam khai pu (General).

Voucher specimens.— *P. Srisanga* 1751.

4. *SORBUS* L.

Sp. Pl.: 477. 1753; Vidal in Fl. Thailand 2(1): 36. 1970; Kalkman in Fam. Gen. Vasc. Pl. 6: 375. 2004.

Deciduous trees or shrubs, sometimes epiphytes. **Leaves** simple or compound, often toothed or lobes. **Inflorescence** in terminal corymbs. **Calyx** lobes 5, persistent or deciduous. **Petals** 5. **Stamens** 15-25. **Ovary** inferior or half-inferior; carpels 2-5, connate; styles free or connate at base; ovules 2 in each carpel. **Fruit** a pome; mesocarp fleshy or hard. **Seeds** 1-2, much smaller than the fruit.

About 193 species distributed in N hemisphere (Mabberley, 1997). Two species in Thailand (Vidal, 1970). One species recorded from Doi Phu Kha National Park.

Sorbus granulosa (Bertol.) Rehd.

In Sargent Pl. Wils. 2: 274. 1915; Vidal in Fl. Thailand 2(1): 36. 1970. – *Pyrus granulosa* Bertol., Mem. Res. Acad. Sci. Ist. Bologna ser. 2. 4: 312, t. 3. 1864. – *Pyrus cuspidata* Bertol. var. *lenticellata* Craib in Fl. Siam. Enum. 1: 576. 1931.

Tree up to 13 m high or epiphytic shrub up to 6 m high. Branchlets white lenticellate. **Leaves** simple, elliptic to ovate, 6-13 cm long, 3-7 cm wide, tomentose floccose when young, glabrous later; base rounded to broadly cuneate; apex acuminate to mucronulate; margin serrate or crenate; primary veins 6-10 pairs, raised and prominent below; petioles 2-4 cm long. **Inflorescence** white tomentose when young, glabrous later; pedicels 2-5 mm long. **Calyx** campanulate, tomentose; tube 3-3.5 mm long; lobes deltoid, 1-2 mm long, deciduous. **Petals** white, ovate, 4-5 mm long. **Stamens** 20-25, 5-9 mm long. **Carpels** 2-4; styles 2-4, more or less connate at base, glabrous. **Pome** globose, glaucous when young, 1-2 cm long and wide, white spotted.

Thailand.— Northern: Nan, Phitsanulok; South-eastern: Prachin Buri, Chanthaburi.

Distribution.— India (Assam-type), S China (Yunnan), Laos, Cambodia, Vietnam.

Ecology.— Lower montane forest, alt. 1,600-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: November-January; fruiting: almost throughout the year; leaves: January-November.

Voucher specimens.— *P. Srisanga* 936, 1186, 1255, 1256, 1432; *P. Srisanga* & *C. Puff* 1093.

Notes.— New locality recorded from Nan, in Thailand.

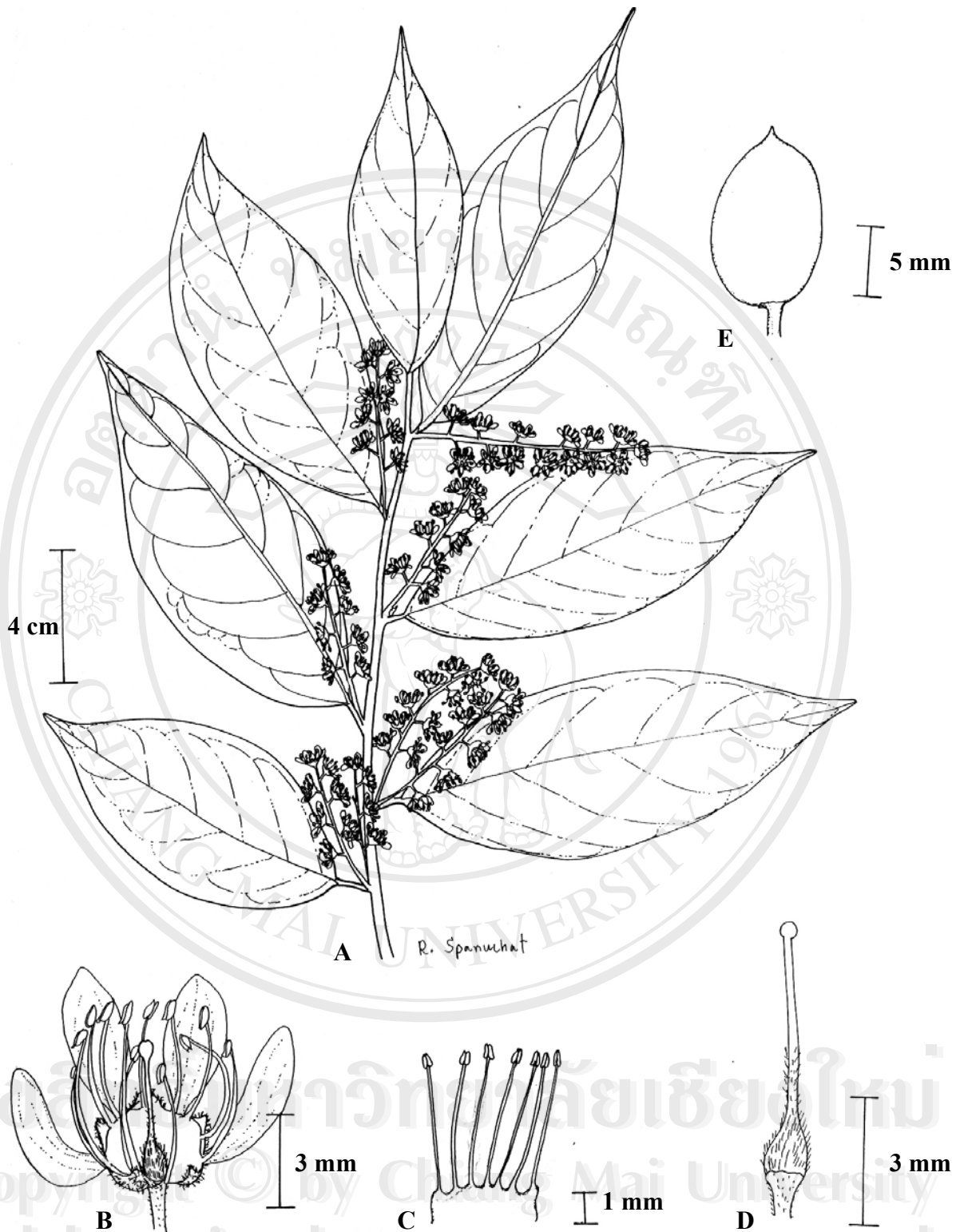


Figure 68. *Prunus wallichii* Steud.

A. flowering branch; B. flower; C. stamens; D. pistil; E. fruit.

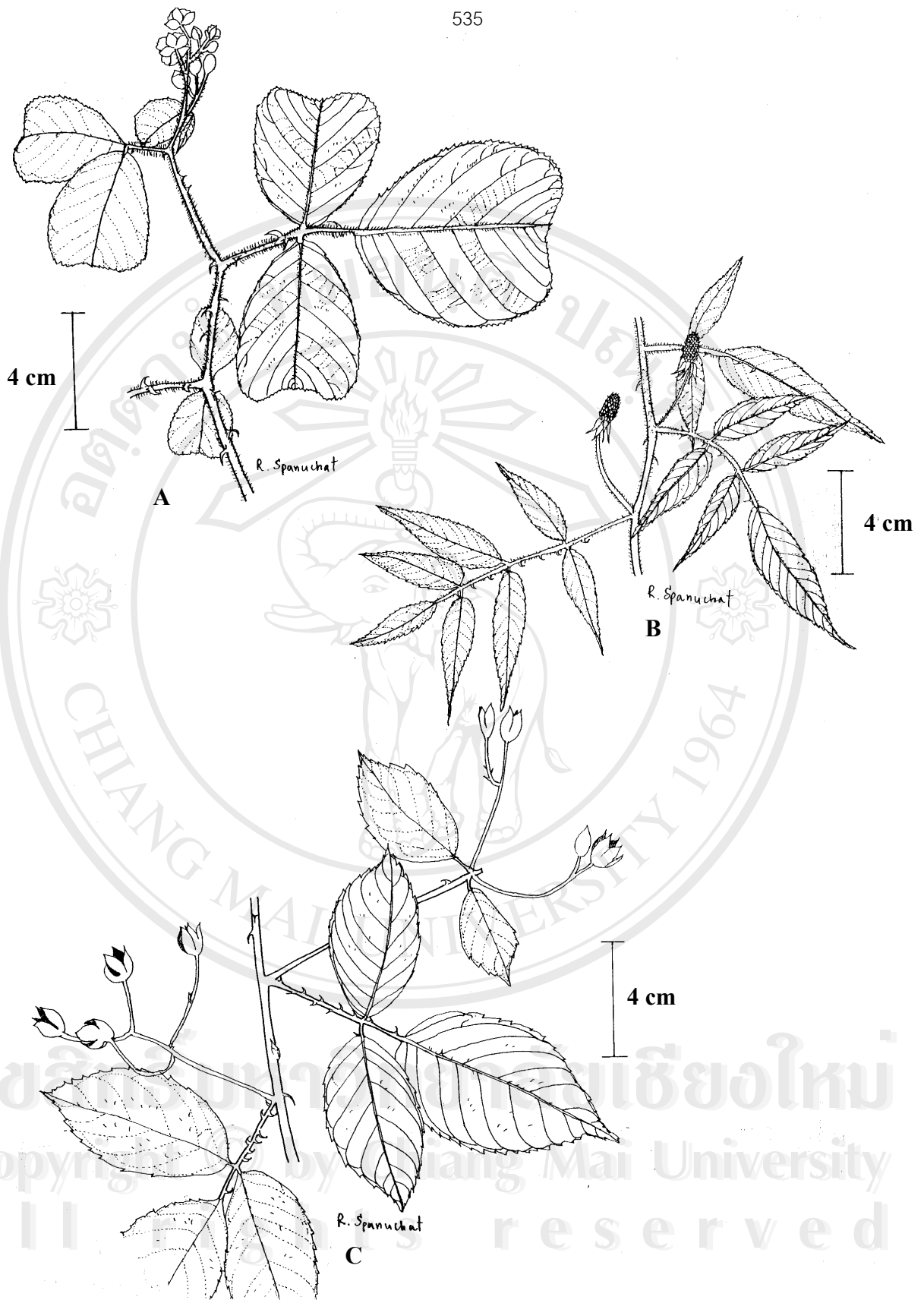


Figure 69. *Rubus* spp.

A. *R. ellipticus* J.E. Smith forma *obcordatus* Franch.; B. *R. sorbifolius* Maxim.;
C. *R. leucanthus* Hance.

RUBIACEAE

Trees, shrubs, climbers or herbs, epiphytes or rarely aquatic plants. **Leaves** simple, opposite and decussate, rarely verticillate, entire or very rarely tooth; stipules inter- or intra-petiolar, free or connate, sometimes leafy and indistinguishable from the leaves. **Inflorescence** axillary or terminal, cymes, capitate, rarely flower solitary. **Flowers** mostly bisexual, actinomorphic, rarely slightly zygomorphic, often heterostylous. **Sepals** 4-5, sometimes enlarged and brightly coloured. **Petals** (3-)4-5 (-10); lobes valvate, imbricate or convolute. **Stamens** as many as corolla lobes and alternate with them, inserted in the tube or at its mouth; anthers mostly free, 2-locular, opening by longitudinal slits. **Ovary** inferior, 2-many-locular, axile placentation, rarely 1-locular with parietal placentation; ovules 1-numerous in each loculus; style often slender, variously lobed. **Fruit** berry, capsule, drupe or schizocarp. **Seeds** 2-numerous, rarely winged.

About 630 genera and 10,200 species, cosmopolitan especially in tropical region (Mabberley, 1997). About 105 genera and 600 species in Thailand. Thirty-six genera and 80 species recorded from Doi Phu Kha National Park (Table 11).

Annotated Checklist of Rubiaceae

The following checklist includes Rubiaceae collected from this study between 1998 and 2003. The genera are arranged alphabetically as well as for the species within the genera. Voucher specimens were also compared with the materials deposited at BKF, CMU and QBG.

Table 11. Checklist of Rubiaceae of Doi Phu Kha National Park.

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	References & Notes
<i>Aidia yunnanensis</i> (Hutch.) Yamazaki		DEF, LMF	700-1,200	May-Nov	May-Nov	PS 336, 1462, 2234	Ridsdale (1996)
<i>Argostemma ebracteolatum</i> Geddes		LMF, by streams	1,500-1,600	Jun-Jul		PS 731, 1975; PS et al. 773	Sridith (1999); E
<i>Argostemma khasianum</i> C.B. Clarke		DEF, by streams	800-850	Jun-Sep		PS 1590, 1947, 2569	Sridith (1999)
<i>Argostemma laxum</i> Geddes		DEF, by streams	800-1,000	Jun-Sep		PS 1589, 1917	Sridith (1999); E
<i>Argostemma lobulatum</i> Craib var. <i>variable</i> Sridith		DEF	1,000	Jun-Jul		PS 1923	Sridith (1999); E
<i>Argostemma verticillatum</i> Wall.		DEF, by streams	800	Jun-Jul		PS 2572	Sridith (1999)
<i>Canthium</i> sp.		LMF	1,300-1,400	Sep-Oct	Nov-Jan	PS 1683, 2251, 2329	
<i>Chassalia curviflora</i> (Wall.) Thwaites	Khem khao	DEF, LMF	700-1,700	Apr-May	Aug-Sep	PS 648, 702, 1416, 1547, 1574	
<i>Clarkella nana</i> (Edgew.) Hook.f.		DEF, LMS	1,000-1,750	Jun-Jul	Aug-Sep	PS 1915, 2129; PS et al. 878	Fig. 70
<i>Duperrea pavettaefolia</i> (Kurz) Pitard	Khem doi	DEF, by streams	700-900	May-Jun	Aug-Sep	PS 1453; PS & C. Maknoi 2059	Fig. 141
<i>Fagerlindia</i> sp.		LMF	1,100-1,600	Mar-Apr	Jul-Dec	PS 252, 363, 1628, 1971; PS & C. Maknoi 2075; PS & S. Wattana 650, 663; C. Puff 990916-1/3	

(continued)

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	References & Notes
<i>Fosbergia thailandica</i> Tirveng. & Sastre	Khat khao phu kha	LMF	1,600-1,700	Nov-Apr	Apr-Sep	PS 1179; PS & S. Wathana 682, 692; PS et al. 815; C. Puff 990917-1/4	Tirvengadum & Sastre (1997); Ed; Fig. 142
<i>Galium punduanum</i> Wall. ex Craib		LMS	1,700-1,800	Aug-Nov	Nov-Jan	PS 1841, 2154; P. Suksathan 1794	
<i>Geophila repens</i> (L.) I.M. Johnston	Mali din	DEF, by streams	700-900	Jun-Sep	Sep-Nov	PS 330, 1556, 2575	
<i>Hedyotis capitellata</i> Wall. ex G. Don var. <i>pubescens</i> Kurz	Sum hin	DEF	800-900	Mar-Apr		PS 573, 1317	Fukuoka (1970)
<i>Hedyotis cherevensis</i> (Pierre ex Pit.) Fukuoka		LMF	1,800	Aug-Sep	Aug-Sep	PS 1536	Fukuoka (1970)
<i>Hedyotis coronaria</i> (Kurz) Craib	Wang ot	DEF	800-1,000	Jun-Jul		PS 1934, 2532	Fukuoka (1970)
<i>Hedyotis elegans</i> Wall. ex Kurz		DEF	800-900	Jun-Jul	Jun-Jul	PS 1951	Fukuoka (1970)
<i>Hedyotis lindleyana</i> Hook. ex Wight & Arn.		DEF	1,000-1,100	Aug		PS & C. Maknoi 2086	Fukuoka (1970)
<i>Hedyotis cf. uncinella</i> Hook. & Arn.		LMF	1,300-1,500		Sep	C. Puff 990916-1/2	Fukuoka (1970)
<i>Hedyotis</i> sp.		DEF	1,000	Jul-Aug		PS 255	
<i>Hypobathrum</i> sp.		LMF	1,500-1,600		Nov	PS 363	
<i>Ixora butterwickii</i> Hole	Khem pa	DEF, by streams	600-850	Apr-May	Nov-Jan	PS 1280, 1377, 2607	
<i>Ixora henryi</i> H. Lev.		LMF	1,500-1,700	Nov-Jan	Aug-Oct	PS 392, 498, 1206, 1269, 1745; PS & C. Maknoi 2040	Chamchumroon (2003)
<i>Knoxia sumatrensis</i> (Reiz.) DC.		DEF, LMF	900-1,200	Aug-Sep	Nov-Dec	PS 1838, 2172	

(continued)

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	References & Notes
<i>Lasianthus fordii</i> Hance		LMF	1,300-1,600	Nov	Aug-Sep	PS 1663, 1892, 2250	Zhu (2001)
<i>Lasianthus hookeri</i> C.B. Clarke ex Hook.f.		DEF, LMF	900-1,650	Mar-Apr	Aug-Sep	PS 1564, 1676; PS & S. Waththana 712	Zhu (2001)
<i>Lasianthus kurzii</i> Hook.f.		LMF	1,700		Aug-Sep	PS & C. Maknoi 2008	Zhu (2001)
<i>Lasianthus rhinocerotis</i> Bl. subsp.		LMF	1,700	Aug-Sep		PS & C. Maknoi 2015	Zhu, Wang & Li (2000); Zhu (2001)
<i>xishuangbannaensis</i> H. Zhu & H. Wang							
<i>Lasianthus saxorum</i> Craib		LMF	1,700-1,800	Sep-Nov	Sep-Nov	PS 265, 1144	Zhu (2001)
<i>Lasianthus sikkimensis</i> Hook.f.		LMF	1,600-1,700		Sep-Oct	PS 277	Zhu (2001)
<i>Lasianthus trichophlebus</i> Hemsf.		LMF	1,300-1,400		Sep-Oct	PS 1679	Zhu (2001)
<i>Lasianthus wallichii</i> (Wight & Arn.) Wight		DEF	800-900		Dec-Jan	PS 2400	Zhu (2001)
<i>Luculia gratissima</i> Sweet	Chom phu phim chai	LMF	1,700	Nov-Dec		PS 377	Fig. 143
<i>Metadina trichotoma</i> (Zoll. & Mor.) Bakh.f.	Khamin ton	DEF	1,000	Feb-Mar		PS 514	
<i>Mouretia larsenii</i> Tange		DEF	750-850	Jun-Aug	Aug-Sep	PS 1960; PS & C. Maknoi 2072	Tange (1997)
<i>Mussaenda parva</i> Wall. ex G. Don		LMF	1,000-1,500	Aug-Feb		PS 2173, 2685	
<i>Mussaenda</i> sp. 1		DEF	900		Aug-Sep	PS 1560	
<i>Mussaenda</i> sp. 2		DEF, LMF, OP	800-1,330	Jun-Sep		PS 1637, 2541	
<i>Mussaenda</i> sp. 3		DEF	800	Jun-Jul		PS 2546	
<i>Mycetia chasalioides</i> (Craib) Craib		DEF, by streams	700-1,000	Jun-Sep	Jun-Sep	PS 1928, 2522; PS & C. Maknoi 2058, 2094	Fukuoka (1989); Fig. 144

(continued)

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	References & Notes
<i>Mycetia glandulosa</i> Craib		DEF, by streams	800-900	May-Jun	Aug-Sep	PS 1468, 1551	Fukuoka (1989)
<i>Mycetia gracilis</i> Craib		LMF	1,000-1,700	Jun-Jul	Sep-Dec	PS 305, 382, 730, 923, 966, 1210; PS et al. 767; C. Puff 990916-1/7	Fukuoka (1989)
<i>Mycetia hirta</i> Hutch.		DEF, LMF	800-1,200	May-Jun	Aug-Jan	PS 1170, 1279, 1464, 1540 2730; PS & C. Maknoi 2103	New record
<i>Mycetia sinensis</i> (Hemsl.) Craib		LMF	1,500-1,700	May-Jul	Sep-Nov	PS 1386, 1641, 1727, 1768 1979; PS et al. 833; C. Puff 990917-1/3	New record
<i>Mycetia</i> sp. 1		LMF, by streams	1,100-1,200		Nov	PS 2227	
<i>Mycetia</i> sp. 2		LMF	1,300-1,400		Nov	PS 2243, 2247	
<i>Mycetia</i> sp. 3		DEF	800	Jun-Jul		PS 2534	
<i>Neanotis</i> sp. 1		LMF, OP	1,300-1,800	Aug-Jan	Aug-Jan	PS 1117, 1258, 1491, 1608	
<i>Neanotis</i> sp. 2		LMS, OP	1,700	Aug-Sep		PS 2130	
<i>Neanotis</i> sp. 3		LMS, OP	1,700	Aug-Sep		PS 2134	
<i>Neanotis</i> sp. 4		LMF, OP	1,700	Sep	Sep	C. Puff 990917-1/2	
<i>Neohymenopogon parasiticus</i> (Wall.) Bennet	Pho a sai	LMF	1,700-1,800	Aug-Sep	Sep-Nov	PS 278, 1498, 1720, 1805; PS & C. Maknoi 1993	Fig. 145
<i>Neonauclaea pallida</i> (Reinw. ex Havil.) Bakh.f.		LMF	1,500	Nov		PS 1883	
<i>Ophiorrhiza angkae</i> Craib	Soi kachap	LMF	1,650	Feb-Apr		PS & S. Wathhana 700	

(continued)

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	References & Notes
<i>Ophiorrhiza fasciculata</i> D. Don		LMF	1,300-1,500	May-Sep		PS 1402; C. Puff 990916-1/1	
<i>Ophiorrhiza cf. rugosa</i> Wall.		DEF, LMF, by streams	800-1,500	Apr-Sep	Apr-Sep	PS 1398, 1400, 1469, 1549, 1550, 2576; PS & S. Watthana 625, 649, C. Puff 990916-1/4	
<i>Ophiorrhiza subcapitata</i> Hook.f.		DEF	850	Jun-Jul		PS 1968	
<i>Ophiorrhiza</i> sp.		DEF	800	Jun-Jul		PS 2573	
<i>Pavetta indica</i> L.	Khem pa	DEF, LMF	1,000-1,300	Jun-Jul	Sep-Nov	PS 306, 2167	Fig. 146
<i>Pavetta tomentosa</i> Roxb. ex Smith	Khao san pa	DEF, LMF	700-1,600	Mar-May	Aug-Nov	PS 338, 1477, 2304; PS & C. Maknoi 2032; PS & S. Watthana 660	
<i>Prismatomeris fragrans</i> Geddes		DEF	900	Mar		PS 571	
<i>Prismatomeris tetrandra</i> (Roxb.) K. Schum.	Ta lai	DEF	850	May	Jul-Aug	PS 1941	
<i>Psychotria siamica</i> (Craib) Hutch.		DEF	750-1,000	Jun-Jul	Jul-Sep	PS 254, 1565, 2590; PS & C. Maknoi 2068	
<i>Psychotria</i> sp. 1		LMF	1,500-1,700	May-Jul	Sep-Dec	PS 368, 922, 1200, 1380; PS et al. 782; C. Puff 990916-1/5, 990916-1/6	
<i>Psychotria</i> sp. 2		DEF	800-900	Jun-Jul	Jun-Jul	PS 2533	
<i>Psychotria</i> sp. 3		DEF	800	Jun-Jul		PS 2580	

(continued)

Scientific names	Vernacular	Ecology	Elevation (m)	Flowering	Fruiting	Voucher specimens	References & Notes
<i>Rubia crassipes</i> Coll. & Hemsl.		LMF, LMS	1,400-1,800	Jul-Nov	Nov-Dec	PS 365, 1765, 1853; PS et al. 874; C. Puff 990917-1/1	
<i>Saprosma</i> sp. 1		LMF, by streams	1,400-1,500	Mar		PS 1355	
<i>Saprosma</i> sp. 2		DEF, by streams	750		Aug-Sep	PS & C. Maknoi 2066	
<i>Schizomussaenda dehiscens</i> (Craib) H.L. Li	Kamboe ton	LMF	1,300-1,400	Jun-Sep		PS 745, 1684	
<i>Sinoadina racemosa</i> (Sieb. & Zucc.) Ridsd.		LMF	1,500-1,550	Oct-Nov		PS 358, 1630, 2267	
<i>Spermacoce</i> sp. 1		LMF	1,300	Oct-Nov		PS 1121	
<i>Spermacoce</i> sp. 2		LMF, RS	1,600	Aug-Sep		PS 1515	
<i>Spermacoce</i> sp. 3		DEF	1,000	Sep-Oct		PS 2177	
<i>Tarenna</i> sp.		DEF	850		Jul	PS 1959	
<i>Tarennoidea wallichii</i> (Hook.f.) Tirveng. & Sastre		LMF	1,700-1,800		Jul-Dec	PS 1231, 1518, 1977	
<i>Uncaria homomalla</i> Miq.	Khao khwai mae wong	LMF	1,400-1,700	Feb-Mar	Jun-Jul	PS et al. 817, 2480	Ridsdale (1978)
<i>Uncaria macrophylla</i> Wall.	Khao khwai mae lup	DEF	800-900	Oct-Nov		PS 353	Ridsdale (1978)
<i>Wendlandia paniculata</i> (Roxb.) DC.	Khaeng kwang	LMF	1,300	Mar-Apr		PS 600	
<i>Wendlandia tinctoria</i> (Roxb.) DC.	Khaeng kwang	MDF, PF, SF	800-1,000	Feb-Mar		PS 512, 577	

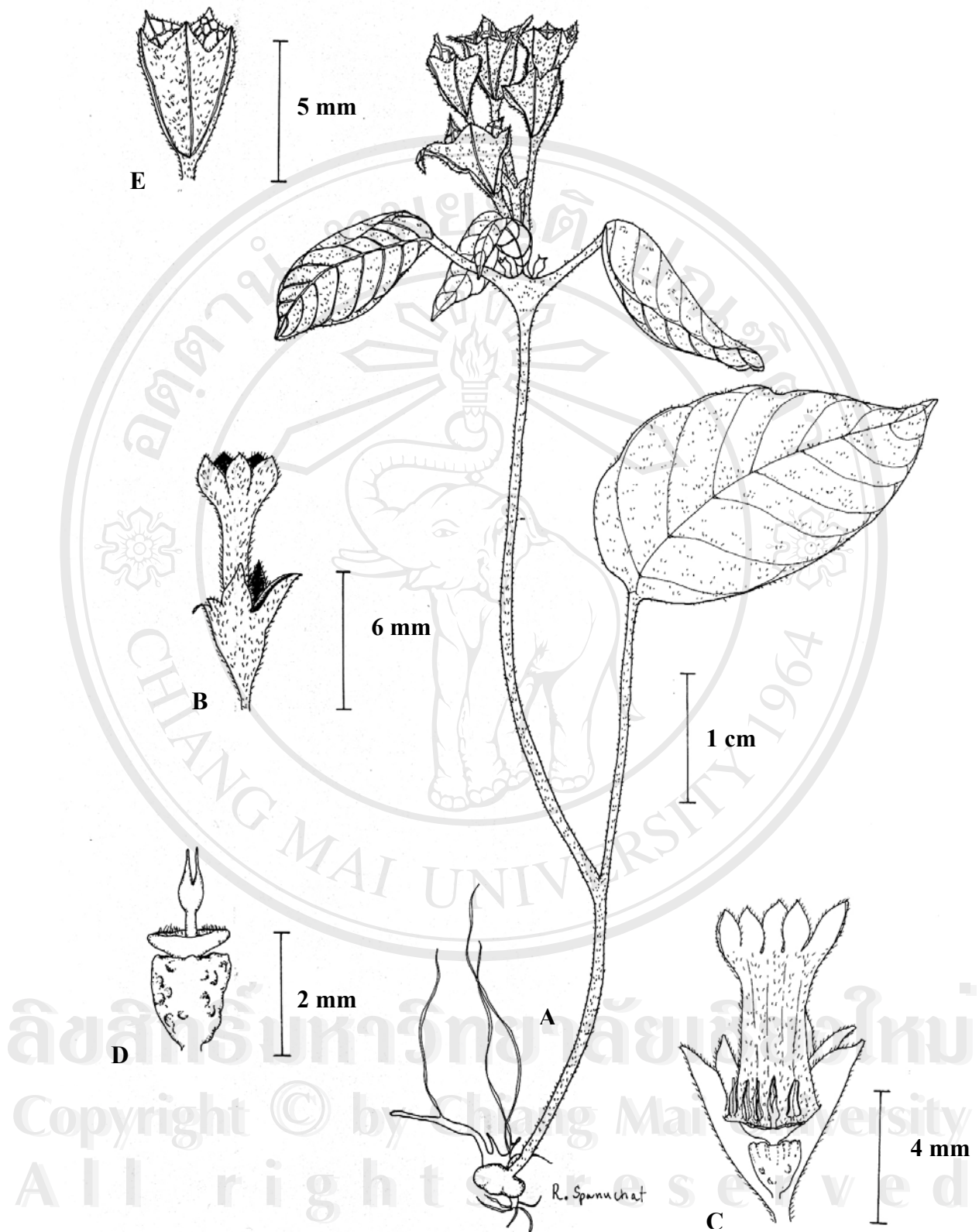


Figure 70. *Clarkella nana* (Edgew.) Hook.f.

A. habit; B. flower; C. opened flower; D. pistil; E. fruiting calyx.

RUTACEAE

Trees, shrubs or climbers, rarely herbs, sometimes spiny. **Leaves** alternate or opposite, simple or compound, pellucid punctate; stipules absent. **Inflorescence** axillary or terminal, cymose or racemose or flower solitary. **Flowers** bisexual, rarely unisexual, actinomorphic. **Sepals** (2-)5, free or connate, imbricate. **Petals** (2-)5, mostly free, imbricate or valvate. **Stamens** usually the same as or double the number of the petals, rarely many to 60; filaments free or rarely united; anthers 2-locular, opening by longitudinal slits; the connective often glandular at the apex. Disk usually present within the stamens. **Ovary** superior, syncarpous, often 4-5-locular or the carpels free towards the base; styles free or connate; ovules usually 2 in each loculus. **Fruit** a berry, drupe, hesperidium, capsule, follicle or schizocarp.

An almost cosmopolitan family with about 156 genera and 1,800 species (Mabberley, 1997). About 21 genera and 65 species in Thailand. Ten genera and 13 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|--|----------------------------|
| 1. Plants unarmed | |
| 2. Leaves simple, opposite or subopposite | 1. <i>Acronychia</i> |
| 2. Leaves compound, if unifoliolate, then alternate | |
| 3. Perennial herbs. Leaves bi- or trinate | 2. <i>Boenninghausenia</i> |
| 3. Trees or shrubs. Leaves unifoliolate, trifoliolate or odd-pinnate | |
| 4. Leaves opposite, trifoliolate | 5. <i>Melicope</i> |
| 4. Leaves alternate, unifoliolate or odd-pinnate | |
| 5. Inflorescence panicles or racemes, pyramidal in outline | 3. <i>Clausena</i> |
| 5. Inflorescence in short cymes, if corymbose panicles, then flat topped | |
| 6. Petals less than 5 mm long. Style short | 4. <i>Glycosmis</i> |
| 6. Petals at least 6 mm long. Style distinct | |
| 7. Petals puberulous. Ovary shortly stipitate | 6. <i>Micromelum</i> |
| 7. Petals glabrous. Ovary not stipitate | 7. <i>Murraya</i> |
| 1. Plants armed with spines | |
| 8. Leaves simple | 8. <i>Paramignya</i> |
| 8. Leaves compound | |
| 9. Fruit berry | 9. <i>Toddalia</i> |
| 9. Fruit follicle | 10. <i>Zanthoxylum</i> |

1. *ACRONYCHIA* J.R. & G. Forst.

Char. Gen.: 53. 1776; Grierson in Fl. Bhutan 2(1): 17. 1991.

Trees or shrubs, unarmed. **Leaves** simple, opposite or subopposite, articulated at base. **Inflorescence** in axillary or terminal corymbs. **Flowers** bisexual. **Calyx** 4-lobed. **Petals** 4, free, valvate. **Stamens** 8, alternately longer and shorter. **Ovary** 4-locular. **Fruit** a fleshy capsule. **Seeds** 2 in each loculus.

About 43 species in Indo-malaysian region and W Pacific (Mabberley, 1997). About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Acronychia pedunculata* (L.) Miq.**

Fl. Ind. Bat. Suppl.: 532. 1861-1862; Craib in Fl. Siam. Enum. 1: 221. 1926; Grierson in Fl. Bhutan 2(1): 17. 1991.

Tree, up to 15 m high. **Leaves** lanceolate, elliptic to ovate, subcoriaceous, 6-20 cm long, 2-6.5 cm wide, glabrous on both surfaces; base cuneate; apex acute to shortly acuminate; petioles (1-)1.5-3 cm long, canaliculate. **Inflorescence** 4-9 cm long, minutely puberulous; pedicels 5-7 mm long, minutely puberulous. **Sepals** ovate, ca. 1 mm long, minutely puberulous, rounded at apex. **Petals** green, oblong, 6-7 mm long, glabrous outside, puberulous inside, acute at apex. **Filaments** 4-6 mm long, puberulous; anthers ca. 0.5 mm long, ovoid to rounded. **Ovary** conical, ca. 3 mm long, densely pubescent; style ca. 2 mm long, glabrous. **Capsule** subglobose, 8-10 mm in diam.

Thailand.— Northern: Chiang Mai, Lampang, Nan; Eastern: Ubon Ratchathani; South-eastern: Chon Buri, Chanthaburi; South-western: Prachuap Khiri Khan; Peninsular: Phuket, Pattani.

Distribution.— India (type), Bhutan, SE Asia.

Ecology.— Dry evergreen forest, alt. 800-900 m (Sapan Waterfall).

Phenology.— Flowering: June-July; fruiting: October-February.

Vernacular.— กะฮาม Ka uam (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1955.

2. *BOENNINGHAUSENIA* Reich. ex C.F. Meisn.

Pl. Vasc. Gen. 1: 60. 1837; Grierson in Fl. Bhutan 2(1): 7. 1991.

Perennial herbs. **Leaves** alternate, bi- or trinate; leaflets entire. **Inflorescence** in terminal cymes. **Flowers** bisexual. **Calyx** cup-shaped, 4-5-lobed. **Petals** 4-5, free, oblanceolate. **Stamens** 6-8, inserted on a short disk. **Ovary** 3-5-lobed; lobes connate at base, borne on a slender gynophore, each bearing a short ventral style. **Fruit** a capsule, borne on an elongated gynophore. **Seeds** 6-8 in each cell.

Monotypic genus in tropical Old World (Mabberley, 1997).

***Boenninghausenia albiflora* Reich. ex C.F. Meisn.**

Conspect.: 197. 1828; Hook.f. in Fl. Br. Ind. 1: 486. 1875; Craib in Fl. Siam. Enum. 1: 215. 1926; Grierson in Fl. Bhutan 2(1): 7, fig. 1: a-d. 1991.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— E Himalayas (Nepal-type), China, Japan, SE Asia.
 Ecology.— Lower montane forest, open places, alt. 1,400-1,500 m (Doi Phu Wae).
 Phenology.— Flowering and fruiting: August-January.
 Voucher specimens.— *P. Srisanga* 413, 1806, 2160.

3. *CLAUSENA* Burm.f.

Fl. Ind.: 87, t. 29, f. 2. 1768; Grierson in Fl. Bhutan 2(1): 7. 1991; Molino, Bull. Mus. Natl. Hist. Nat. Paris, sec. B, Adansonia 1: 107. 1994.

Trees or shrubs, unarmed. **Leaves** alternate, imparipinnate, rarely unifoliolate; leaflets (1-)5-31. **Inflorescence** in terminal or axillary, panicles or racemes, pyramidal in outline. **Flowers** bisexual. **Calyx** 4-5-lobed, persistent. **Petals** 4-5, free, imbricate. **Stamens** 8 or 10, inserted on an elongated disk, alternately longer and shorter; filaments broadened; anthers dorsifixed, dehiscing by longitudinal slits. **Ovary** ovoid, 4-5-locular, axile placentation, shortly stipitate; style thick; ovules 2 in each loculus, pendulous. **Fruit** a berry, globose to ovoid. **Seed** 1 in each loculus.

Fifteen species in tropical Old World (Molino, 1994). About 4 species in Thailand. One species recorded from Doi Phu Kha National Park.

Clausena excavata Burm.f.

Fl. Ind.: 87, t. 29, f. 2. 1768; Hook.f. in Fl. Br. Ind. 1: 504. 1875; Craib in Fl. Siam. Enum. 1: 231. 1926; Grierson in Fl. Bhutan 2(1): 16. 1991; Molino, Bull. Mus. Natl. Hist. Nat. Paris, sec. B, Adansonia 1: 115, fig. 2: 1-7. 1994.

Thailand.— Northern: Almost throughout the country.

Distribution.— E Himalayas, China, SE Asia (Java-type).

Ecology.— Lower montane forest, disturb areas, open places, alt. 1,400-1,500 m (Doi Phu Wae).

Phenology.— Flowering: February-March; fruiting: May-September.

Vernacular.— เขี้ยวพาน Phia fan (Northern).

Voucher specimens.— *P. Srisanga et al.* 2438.

4. *GLYCOSMIS* Correa

Ann. Mus. Nat. Hist. Nat. Paris 6: 384. 1805; Grierson in Fl. Bhutan 2(1): 7. 1991.

Shrubs or small trees, unarmed. **Leaves** alternate, unifoliolate or imparipinnate. **Inflorescence** terminal or axillary cymes. **Flowers** bisexual. **Calyx** 4-5-lobed. **Petals** 4-5, free, glandular. **Stamens** 8 or 10; filaments broadened. **Ovary** ovoid, glandular; stigma sessile. **Fruit** a berry. **Seed** 1.

About 43 species in Indo-malaysian region (Mabberley, 1997). About 14 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Glycosmis cochinchinensis* (Lour.) Pierre ex Engl.**

In Engl. & Prantl, Nat. Pflanzenfam. 3, 4: 185, fig. 106. 1895; Craib in Fl. Siam. Enum. 1: 222. 1926; Stone, Proc. Acad. Nat. Sci. Philadelphia 137: 3. 1985.

Thailand.— Northern: Chiang Mai, Nan; Eastern: Nakhon Ratchasima; South-eastern: Chon Buri, Trat; Central: Bangkok.

Distribution.— S China, Laos, Vietnam.

Ecology.— Dry evergreen forest, alt. 800-900 m (Sapan Waterfall).

Phenology.— Flowering: August-December; fruiting: November-January.

Vernacular.— เขยโค่ Khoei kho (General).

Voucher specimens.— *P. Srisanga* 1222, 1486, 1681, 2207.

5. MELICOPE J.R. & G. Forst.

Char. Gen.: 55. 1776; Grierson in Fl. Bhutan 2(1): 7. 1991.

Shrubs or small trees, unarmed. **Leaves** opposite, trifoliolate. **Inflorescence** in axillary panicles. **Flowers** bisexual. **Calyx** 4-lobed. **Petals** 4, free. **Stamens** 4. **Ovary** 4-lobed; lobes connate at base, each bearing a short ventral style. **Fruit** a capsule. **Seeds** 2 in each cell, black, glossy.

About 150 species in Indo-malaysian region to Australia (Mabberley, 1997). About 6 species in Thailand. Three species recorded from Doi Phu Kha National Park.

1. *Melicope pteleifolia* (Champ. ex Benth.) Hartley

Ecology.— Lower montane forest, open places, alt. 1,500-1,800 m (Doi Phu Kha).

Phenology.— Flowering: January-April; fruiting: July-November.

Uses.— Leaves edible.

Vernacular.— เขี้ยกระหิง Phia kra thing (Northern), มอยฟัน Moi fun (Luo-Nan).

Voucher specimens.— *P. Srisanga* 965, 1189, 2704; *P. Srisanga* & *S. Watthana* 653; *B.G.O. Staff* 4265.

2. *Melicope* sp. 1

Ecology.— Lower montane forest, alt. 1,800-1,900 m (Doi Phu Kha).

Phenology.— Fruiting: July-November.

Voucher specimens.— *P. Srisanga* 904, 1143.

3. *Melicope* sp. 2

Ecology.— Dry evergreen forest, by streams, alt. 700-800 m (Sapan Waterfall).

Phenology.— Fruiting: August-September.
Voucher specimens.— *P. Srisanga* 1578.

6. *MICROMELUM* Bl.

Bijdr.: 137. 1825; Grierson in Fl. Bhutan 2(1): 7. 1991.

Trees or shrubs, unarmed. **Leaves** alternate, odd-pinnate; leaflets alternate. **Inflorescence** in terminal or axillary, corymbose panicles. **Flowers** bisexual. **Calyx** cup-shaped, 5-lobed. **Petals** 5, free, valvate. **Stamens** 10, alternately longer and shorter. **Ovary** ovoid, pubescent, shortly stipitate; style thick. **Fruit** a berry. **Seed** 1-2.

About 9 species in Indo-malaysian region and Pacific (Mabberley, 1997). Three species in Thailand. One species recorded from Doi Phu Kha National Park.

Micromelum sp.

Ecology.— Lower montane forest, alt. 1,500-1,600 m (Doi Phu Kha).
Phenology.— Fruiting: August-January.
Voucher specimens.— *P. Srisanga* 1218, 1482, 2692.

7. *MURRAYA* L.

Mant. 2: 554, 563. 1771; Grierson in Fl. Bhutan 2(1): 7. 1991.

Shrubs or small trees, unarmed. **Leaves** alternate, odd-pinnate; leaflets alternate. **Inflorescence** in terminal or axillary corymbs. **Flowers** bisexual. **Calyx** cup-shaped, 5-lobed. **Petals** 5, free, imbricate. **Stamens** 10, flattened, alternately longer and shorter. **Ovary** 2-5 locular, narrowed into style; stigma capitate. **Fruit** a berry, oblong. **Seeds** 1-2.

About 4 species in Indo-malaysian region to the Pacific. About 2-3 species in Thailand. One species recorded from Doi Phu Kha National Park.

Murraya paniculata (L.) Jack.

Mal. Misc. 1(5): 31. 1820; Hook.f. in Fl. Br. Ind. 1: 502. 1875; Craib in Fl. Siam. Enum. 1: 230. 1926; Grierson in Fl. Bhutan 2(1): 17. 1991.

Thailand.— Northern: Chiang Mai, Phrae, Nan, Tak, Kamphaeng Phet; South-eastern: Chon Buri; Central: Bangkok (cultivated).

Distribution.— E Himalayas (India-type), SE Asia.

Ecology.— Dry evergreen forest, by streams, alt. 700 m (Tham Pha Khong).

Phenology.— Flowering: December-January; fruiting: February-March.

Uses.— Cultivated as ornamental plants.

Vernacular.— แก้ว Kaeo (Central).

Voucher specimens.— *P. Srisanga* 2388.

8. *PARAMIGNYA* Wight

Ill. Ind. Bot. 1: 108. 1831; Grierson in Fl. Bhutan 2(1): 19. 1991.

Scrambling shrubs, armed with recurved axillary spines. **Leaves** simple, alternate, entire. **Inflorescence** axillary short racemes or flower solitary. **Flowers** bisexual. **Calyx** cup-shaped, 4-5-lobed. **Petals** 4-5, free, imbricate. **Stamens** 8-10, free, inserted around columnar disk. **Ovary** 3-5-locular, pubescent; ovules 1-2 in each loculus. **Fruit** a berry, obovoid to subglobose. **Seed** usually 1.

About 12 species in Indo-malaysian region. About 3 species in Thailand. One species recorded from Doi Phu Kha National Park.

Paramignya scandens (Griff.) Craib

In Fl. Siam. Enum. 1: 235. 1926. — *Citrus scandens* Griff., Not. 4: 495. 1854. — *Paramignya griffithii* Hook.f. in Fl. Br. Ind. 1: 510. 1875, pro parte.

Scrambling shrubs; branchlets puberulous; spines recurved downward, 4-5 mm long. **Leaves** oblong to elliptic, 9-15 cm long, 3-6 cm wide, glabrous or subglabrous on upper surface, softly pubescent on lower surface; base rounded; apex cuspidate; margin entire; petioles 4-8 mm long, puberulous. **Calyx** ca. 1 mm long; lobes 5, divided halfway or almost to the base, puberulous. **Petals** 5, white, 6-9 mm long, glabrous. **Fruit** not known.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Nan; South-eastern: Chanthaburi; South-western: Prachuap Khiri Khan.

Distribution.— Myanmar (type).

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: February-March.

Vernacular.— ทนทานแก้วไก่ Nam kiao kai (Northern).

Voucher specimens.— *P. Srisanga* 1313.

9. *TODDALIA* Juss.

Gen.: 371. 1789; Grierson in Fl. Bhutan 2(1): 11. 1991.

Scrambling shrubs, armed with recurved axillary spines. **Leaves** alternate, palmately trifoliolate. **Inflorescence** axillary or terminal cymes. **Flowers** unisexual. **Calyx** cup-shaped, 5-lobed. **Petals** 5, free, imbricate. **Stamens** 5, free, inserted around columnar disk. **Ovary** 3-5-locular, pubescent; ovules 1-2 in each loculus. **Fruit** a berry, broadly ovoid, orange-yellow.

Monotypic genus in tropical Old World (Mabberley, 1997).

***Toddalia asiatica* (L.) Lam.**

Ill. 2: 116. 1793; Hook.f. in Fl. Br. Ind. 1: 497. 1875; Craib in Fl. Siam. Enum. 1: 220. 1926; Grierson in Fl. Bhutan 2(1): 11, fig. 1: e-h. 1991.

Scrambling shrubs; spines recurved downward, ca. 2 mm long. **Leaves** alternate, palmately trifoliolate; petioles 2-5 cm long, glabrous. Leaflets lanceolate to elliptic, 4-11 cm long, 2-4 cm wide, sessile, glabrous on both surfaces; base cuneate; apex bluntly acute to bluntly acuminate; margin crenate to serrulate. **Calyx** ca. 1 mm long. **Petals** green, 3-4 mm long. **Stamens** slightly longer than the petals. **Ovary** ovoid, ca. 3 mm long. **Fruit** 7-10 mm long and wide, 3-6-grooved. **Seeds** black, 4-6.

Thailand.— Northern: Chiang Mai, Lamphun, Nan; North-eastern: Nakhon Phanom; Eastern: Ubon Ratchathani, Nakhon Ratchasima; South-eastern: Prachin Buri, Chanthaburi.

Distribution.— Tropical Africa, India (type), Bhutan, China, SE Asia.

Ecology.— Dry evergreen and lower montane forest, by streams, also in disturbed areas, alt. 800-1,200 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering: January-February; fruiting: April-September.

Vernacular.— ผักแปมป่า Phak paem pa (Northern).

Voucher specimens.— *P. Srisanga* 1332, 1597.

10. ZANTHOXYLUM L.

Sp. Pl.: 270. 1753; Hartley, J. Arn. Arb. 47(3): 173. 1966; Grierson in Fl. Bhutan 2(1): 11. 1991.

Trees or shrubs, sometimes scandent, dioecious or rarely monoecious, armed with stout spines. **Leaves** alternate, trifoliolate, imparipinnate or paripinnate; rachis sometimes winged and bearing spines; leaflets alternate or opposite. **Inflorescence** axillary or terminal, cymose, racemose or paniculate. **Flowers** unisexual, rarely bisexual, small. **Perianth** uniseriate with 4-8 undifferentiated segments or biseriate with 4-5 sepals and 4-5 petals. **Stamens** 4-6, alternate with the petals, rudimentary or absent in pistillate flowers. **Carpels** 1-5, free or connate up to the middle; ovules 2 in each carpel, pendulous; stigma capitate. **Fruit** 1-5 distinct or partially connate follicles, 2-valved, each with 1-seeded. **Seeds** red or black, usually shiny.

About 250 species in America, Africa, Asia and Australia (Mabberley, 1997). About 5 species in Thailand (Hartley, 1966). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Erect or scandent shrubs, up to 5 m high. Leaf rachis winged. Wild
1. *Z. acanthopodium*
1. Erect trees, more than 5 m high. Leaf rachis not winged. Cultivated
2. *Z. myriacanthum*

1. *Zanthoxylum acanthopodium* DC.

Prodr. 1: 727. 1824; Hook.f. in Fl. Br. Ind. 1: 493. 1875; Craib in Fl. Siam. Enum. 1: 218. 1926; Hartley, J. Arn. Arb. 47(3): 209. 1966; Grierson in Fl. Bhutan 2(1): 13, fig. 1: i-l. 1991.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Nakhon Phanom; Eastern: Ubon Ratchathani.

Distribution.— India, Nepal (type), Bhutan, Sikkim, E Pakistan, Myanmar, China, Laos, Malaysia, Indonesia (Sumatra).

Ecology.— Lower montane forest, disturb areas, alt. 1,600-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: December-February.

Voucher specimens.— *P. Srisanga* 2709.

2. *Zanthoxylum myriacanthum* Wall. ex Hook.f.

In Fl. Br. Ind. 1: 496. 1875; Hartley, J. Arn. Arb. 47(3): 185. 1966; Grierson in Fl. Bhutan 2(1): 13. 1991.

Thailand.— Northern: Nan.

Distribution.— India, China, Vietnam, Malaysia (type), Indonesia, Borneo, Philippines.

Ecology.— Cultivated in Lua villages, alt. 1,000-1,100 m (Ban Toey).

Phenology.— Flowering and fruiting: December-February.

Uses.— Seeds used as condiment.

Vernacular.— มะเขิน Ma khaen (Northern).

Voucher specimens.— *P. Srisanga* s.n.

SABIACEAE

Trees, shrubs or climbers. **Leaves** simple or pinnately compound, alternate; stipules absent. **Inflorescence** axillary or terminal, cyme, raceme, panicle or thyrse. **Flowers** bisexual or unisexual, sometimes polygamo-dioecious, small. **Sepals** (3-)5, free or sometimes basally connate, imbricate. **Petals** 4-5, mostly opposite to the sepals, imbricate, the 2 inner often smaller. **Stamens** 4-5, opposite to the petals, free or adherent to the petals, sometimes only 2 fertile; anthers 2-locular, opening by

longitudinal slits; connective thick. Disk annular, small. **Ovary** superior, 2(-3)-locular, axile placentation; ovules 1-2 in each loculus, horizontal or pendulous; styles more or less united. **Fruit** drupaceous.

Three genera and about 80 species in tropical and subtropical Asia and America (Mabberley, 1997). Two genera and about 7 species in Thailand. Two genera and 3 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Trees or shrubs. Leaves simple or pinnate. Fertile stamens 2, the other 3 abortive or reduced to scales or nectary-like **1. *Meliosma***
 1. Scandent shrubs or woody climbers. Leaves simple. Fertile stamens 5 **2. *Sabia***

1. *MELIOSMA* Bl.

Cat.: 32. 1823; Beusekom, *Blumea* 19(3): 429. 1971. – *Millingtonia* Roxb., Pl. Corom. 3: 50, t. 254. 1820, non L.f.

Trees or shrubs, evergreen, sometimes deciduous; twigs lenticellate. **Leaves** simple or imparipinnate. **Inflorescence** terminal, sometimes axillary, pyramidal panicles; bracts small, caducous. **Flowers** bisexual, zygomorphic. **Sepals** (3-)5. **Petals** 5; 3 outer ones more or less unequal, mostly suborbicular and convex; 2 inner ones equal, much smaller, reduced, opposite to the fertile stamens, more or less adherent to the base of the filaments, entire to bifid. Disk generally present, sometimes very reduced or absent. **Fertile stamens** 2; filaments short, glabrous; staminodes 3, scales or nectary-like, opposite to the outer 3 petals. **Ovary** 2(-3)-locular; ovules (1-)2 in each loculus. **Fruit** glabrous. **Seed** 1.

About 55 species in tropical Asia (15 species) and America (Beusekom, 1971; Mabberley, 1997). About 3 species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

Meliosma pinnata (Roxb.) Walp. subsp. *arnottiana* (Wight) Beus.

Blumea 19(3): 499. 1971 (see also for complete synonymy); Beusekom & Water in Fl. Mal. I.(10): 709. 1989. – *Sapindus* ? *microcarpus* Wight & Arn., Prodr. 1: 112. 1834. nom. illeg., non Ruiz & Pavon, 1804. – *Millingtonia arnottiana* Wight, Ill. Ind. Bot. 1: 144, t. 53. 1840. – *Meliosma arnottiana* Walp., Rep. 1: 423. 1842. – *M. microcarpa* Craib in Fl. Siam. Enum. 1: 340. 1926. nom. illeg.

Tree up to 20 m high. **Leaves** (2-)3-7(-8)-jugate; leaflets lanceolate to elliptic, chartaceous, (1.5-)3-9(-11) cm long, 1-2.5 cm wide, sparsely pubescent on both surfaces; base broadly cuneate to rounded; apex acuminate; margin entire; midrib impressed above, prominent beneath, sometimes with domatia in the axils of the nerves beneath. **Inflorescence** erect, spreading, up to 22 cm long, numerous-flowered; rachis pubescent. **Flowers** sessile or short pedicellate, up to 1 mm long,

pubescent. **Sepals** 4-5, ovate, unequal, up to 0.5 mm long, glabrous, ciliolate. **Petals** white; outer petals up to 1 mm long, glabrous; inner petals smaller, ciliolate, bifid. **Filaments** ca. 1 mm long. **Ovary** up to 1 mm long, pubescent; style glabrous. **Fruit** globose, 3-4 mm long and wide.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Lampang, Nan, Sukhothai; Peninsular: Phangnga.

Distribution.— India (type), Sri Lanka, China, Taiwan, Japan, SE Asia.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: April-May; fruiting: August-December.

Vernacular.— มะยมหิน Mayom hin (Chiang Mai).

Voucher specimens.— *P. Srisanga & S. Watthana* 619.

2. *SABIA* Colebr.

Trans. Linn. Soc. London 12: 355, t. 14. 1818; Water, Blumea 26(1): 4. 1980. — *Meniscosta* Bl, Bijdr.: 28. 1825. — *Enantia* Falconer, Hook. J. Bot. 4: 75. 1841. — *Androglossum* Champ. ex Benth., Hooker's J. Bot. Kew Gard. Misc. 4: 42. 1852.

Scandent shrubs or woody climbers, evergreen or deciduous; twigs terete, striate; bud scales usually present. **Leaves** simple; petioles canaliculated, smooth to wrinkled. **Inflorescence** axillary, cymose, solitary or arranged in racemose, thyrsoid or corymbose or rarely flower solitary. **Flowers** bisexual, actinomorphic. **Sepals** 5. **Petals** 5, episepalous, imbricate, glabrous. **Stamens** 5, epipetalous, equal; filaments flattened, adherent to the base of the subtending petals. Disk present. **Ovary** 2-celled, adherent to each other; ovules 2 in each cell. **Fruit** drupelets, glabrous or sparsely hairy. **Seed** 1.

Nineteen species in India, China, SE Asia to Malesian region (Water, 1980). Four species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Cymes 1-4(-6)-flowered; petals suborbicular to elliptic, 1.75-2.5 mm long, 1.25-2 mm wide **1. *S. limoniacea***
 1. Cymes 7-25-flowered; petals oblong to lanceolate, 2.25-4 mm long, 0.75-1.25 mm wide **2. *S. parviflora***

1. *Sabia limoniacea* Wall. ex Hook.f. & Thomson

Fl. Ind. 1: 210. 1855; Water, Blumea 26(1): 44, figs. 6a, 8. 1980 (see also for complete synonymy); Beusekom & Water in Fl. Mal. I.(10): 685, figs. 2-3. 1989.

Evergreen woody climber; twigs glabrous or sometimes sparsely pubescent. **Leaves** oblong to lanceolate, subcoriaceous, 4-18 cm long, 1.5-6.5 cm wide, glabrous;

base rounded to cuneate; apex acute to acuminate; primary veins 5-9 pairs; petioles 1-2 cm long, wrinkled, glabrous. **Inflorescence** in axillary cyme, solitary or arranged in racemose or thyrsoïd, up to 15 cm long; cymes 1-4(-6)-flowered; pedicels up to 5 mm long. **Sepals** ovate to elliptic, 0.75-1.25 mm long, acute to rounded at apex, glabrous to pubescent, ciliolate. **Petals** greenish white, suborbicular to elliptic, 1.75-2.5 mm long, 1.25-2 mm wide, obtuse to rounded at apex. **Stamens** 1.5-2 mm long. Disk crown-shaped. **Ovary** globular, ca. 0.5 mm long, glabrous; styles conical. **Drupelets** globular to obovoid, compressed, 10-14 mm long and wide, red, blue or black.

Thailand.— Northern: Chiang Mai, Nan; Eastern: Nakhon Ratchasima.

Distribution.— India, Sikkim, Bhutan, Bangladesh (type), Myanmar, China, Laos, Vietnam, Malaysia, Indonesia.

Ecology.— Lower montane forest, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering: October-December; fruiting: December-March.

Voucher specimens.— *P. Srisanga* 1173.

2. *Sabia parviflora* Wall.

In Fl. Ind. 2: 310. 1824; Water, Blumea 26(1): 48, fig. 3c. 1980 (see also for complete synonymy); Beusekom & Water in Fl. Mal. I.(10): 687. 1989. — *S. harmandiana* Pierre, Fl. For. Cochinch.: 5, pl. 360B. 1897; Craib in Fl. Siam. Enum. 1: 340. 1926.

Evergreen woody climber or scandent shrub; twigs glabrous or sometimes sparsely pubescent. **Leaves** oblong, lanceolate to narrowly ovate, subcoriaceous, 4-13 cm long, 1-6 cm wide, glabrous or sometimes sparsely pubescent; base rounded to broadly cuneate; apex acute to acuminate; primary veins 5-9 pairs; petioles 0.5-1.5 cm long, smooth to wrinkled, glabrous or sparsely hairy. **Inflorescence** in axillary cyme, solitary, 1.5-9 cm long, widely spreading, lax, 7-25-flowered; pedicels up to 1 cm long. **Sepals** ovate, 0.75-1.5 mm long, acute to rounded at apex, glabrous to pubescent, ciliolate. **Petals** green, oblong to lanceolate, 2.25-4 mm long, 0.75-1.25 mm wide, acute to obtuse at apex. **Stamens** 1.25-2.25 mm long. Disk crown-shaped; lobes often distinct. **Ovary** globular, ca. 0.5 mm long, glabrous; styles conical, 1-1.5 mm long. **Drupelets** globular to obovoid, compressed, 6-9 mm long and wide, red, blue or black.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal (type), Sikkim, Bhutan, Myanmar, China, Laos, Vietnam, Malaysia (Sabah).

Ecology.— Lower montane forest, alt. 1,200-1,600 m (Doi Phu Kha).

Phenology.— Flowering and fruiting almost throughout the year.

Voucher specimens.— *P. Srisanga* 920, 1232, 1339.

SANTALACEAE

Hemiparasitic herbs, shrubs or trees, on host roots or on tree-branches, sometimes thorny or xeromorphic. **Leaves** simple, alternate or opposite, entire,

sometimes reduced to scales; stipules absent. **Inflorescence** terminal or axillary. **Flowers** bisexual or unisexual, actinomorphic, small, yellow or green. **Sepals** (3-)4-6 (-8), petaloid, adnate to the ovary; lobes valvate or slightly imbricate. **Petals** absent. **Stamens** the same number as the calyx-lobes and opposite to them; anthers 2-locular, opening by longitudinal slits. Disk often present. **Ovary** inferior or half inferior, 1-locular, basal or free central placentation; ovules 1-4, pendulous. **Fruit** a drupe or nut. **Seed** solitary.

Thirty-four genera with about 540 species, cosmopolitan but mainly in southern hemisphere, with the greatest concentration in arid and semi-arid tropics. Seven genera and 13 species in Thailand (Macklin & Parnell, 2002). Only 1 species recorded from Doi Phu Kha National Park.

DUFRENOYA Chatin

Comptes Rendus Acad. Paris 51: 657. 1860; Macklin & Parnell, Thai For. Bull. (Bot.) 30: 88. 2002. – *Henslowia* A. DC., Prodr. 14: 630. 1857, pro parte. – *Hylomyza* Danser, Nova Guinea N.S. 4: 141. 1940.

Dioecious hemiparasitic shrubs on tree-branches. **Leaves** alternate; primary veins 3-11 from the base. **Male inflorescence** umbellate, 6-flowered, pedunculate, bracteate; flowers developing in the axils of the upper bracts; sepals 4-6, valvate. **Female inflorescence** 1-flowered, sessile or pedunculate; sepals 4-6; ovary 5-6-lobed; style short; stigma papillose. **Fruit** ellipsoid to obovoid with persistent calyx.

Eleven species from India and China to western Borneo. Four species in Thailand (Macklin & Parnell, 2002).

***Dufrenoya sessilis* (Craib) Stauffer**

Vierteljahrsschr. Naturf. Ges. Zurich 114: 69. 1969; Macklin & Parnell, Thai For. Bull. (Bot.) 30: 92. 2002. – *Henslowia sessilis* Craib, Kew Bull. 1911: 455. 1911. – *H. shanensis* Gamble, Kew Bull. 1913: 48. 1913.

Erect or pendulous shrubs on tree-branches. **Leaves** elliptic to broadly obovate, coriaceous, 4-9 cm long, 3-5 cm wide, glabrous; base attenuate onto the petiole; apex rounded; primary veins 5-9, raised on both surfaces; petioles 5-7 mm long, glabrous. **Male inflorescence** solitary or 2-3 together on side branches; peduncles 1-2 mm long; bracts ovate, minute, ciliate; flowers yellowish green, subsessile; sepals deltoid, ca. 1 mm long; stamens subsessile, minute. **Female inflorescence** sessile or shortly pedunculate; peduncles up to 1 mm long; flowers yellow; sepals deltoid, ca. 1 mm long; stigma 5-lobed. **Fruit** broadly ovoid, 3-5 mm long and wide, yellowish green.

Thailand.— Northern: Chiang Mai (type: *Kerr* 1768: K-holo), Chiang Rai, Lampang, Nan; North-eastern: Loei.

Distribution.— Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: October-December.

Vernacular.— กาฝากก่อดำ Kafak ko dam (Phetchabun).

Voucher specimens.— *P. Srisanga* 1815.

SAPINDACEAE

Trees or shrubs, occasionally lianas or herbaceous climbers. Indumentum of simple hairs, sometimes also bundled and apparently or glandular scales and hairs. **Leaves** alternate, simple, trifoliolate, digitate or pinnate; stipules absent, except in *Cardiospermum* L.. Leaflets: lower surface often with papillae, domatia or glands. **Inflorescence** terminal or axillary, thyrsoid. **Flowers** usually unisexual, small. **Sepals** (4-)5, uniform or dimorphic. **Petals** (3-)5 or absent, often with 1-2 scales on the inside. Disc usually an entire ring, sometimes interrupted or divided into separate glands. **Stamens** (4-)8(-10) or more, filaments free. **Ovary** 2-3-locular, smooth or tuberculate; ovules 1(-2) in each loculus; stigma lobed or not. **Fruit** of different types, but usually dehiscent leathery capsules or drupes, lobed or not, smooth, warty or with short to long spines. **Seeds** often surrounded by an ariloid.

One hundred and forty genera and about 1,350 species, widespread in all tropical and subtropical regions. Twenty-three genera and 41 species in Thailand (Welzen, 1999). Three genera and 3 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|---|-------------------------------|
| 1. Shrub or small tree. Leaves trifoliolate or digitate | 1. <i>Allophylus</i> |
| 1. Tree. Leaves paripinnate | |
| 2. Domatia absent. Petals absent. Fruit wall warty | 2. <i>Litchi</i> |
| 2. Domatia present. Petals absent or present. Fruit wall smooth | 3. <i>Mischocarpus</i> |

1. *ALLOPHYLUS* L.

Sp. Pl.: 348. 1753; Leenh., Blumea 15: 301. 1967 (revision); Welzen in Fl. Thailand 7 (1): 176. 1999. – *Gemella* Lour., Fl. Cochinch.: 648. 1760. nom. illeg., non Hill, 1961.

Shrubs or small trees, monoecious or dioecious. Indumentum of simple hairs, seldom stellately grouped hairs. **Leaves** trifoliolate or digitate. Leaflets: central one usually larger; base usually asymmetrical; margin subentire to laxly crenate to serrate with variable teeth; domatia often tuft of hairs. **Inflorescence** axillary, thyrsoid, usually solitary and unbranched, subglabrous to hirsute. **Flowers** unisexual, obliquely zygomorphic. **Sepals** 4, free, outer 2 smaller than the inner ones. **Petals** 4, with a long claw and 2 short scales. Disc abaxially interrupted, often lobes in front of petals. **Stamens** 8; filaments partly hairy; anthers glabrous. **Ovary** shortly stalked, 2-locular, hairy, smooth; stigma deeply lobed; ovule 1 in each loculus. **Fruit** drupaceous, usually one locule developed; wall thin, glabrous. **Seed** globular, without an ariloid.

A pantropical monotypic genus with about 255 synonymous names based on Leenhouts (1967) taxonomic point of view (Welzen, 1999).

***Allophylus cobbe* (L.) Raeusch.**

Nomencl. ed. 3: 108. 1779; Leenh., *Blumea* 15: 301. 1967 (see also for complete synonymy); Welzen in *Fl. Thailand* 7(1): 176, fig. 4-5. 1999. – *Rhus cobbe* L., *Sp. Pl.*: 267. 1753. – *Allophylus sootepensis* Craib, *Kew Bull.* 1911: 474. 1911. – *A. betongensis* Craib, *Kew Bull.* 1926: 359. 1926.

Shrub or small tree up to 14 m high. **Leaves** trifoliolate or digitate; petioles 3-13 cm long. Leaflets lanceolate, elliptic to ovate, membranous, 2.5-35 cm long, 1.5-22 cm wide, glabrous to sparsely hairy above, glabrous, sericeous, stiff to soft hirsute below; base cuneate to attenuate; apex acuminate; petiolules 2-5 mm long. **Inflorescence** up to 40 cm long. **Flowers** white, single or in cymes along axis. **Sepals** ovate to obovate, 1-2.5 mm long, 0.8-2 mm wide. **Petals** nail-shaped to spatulate, 1-2.2 mm long, the claw about 2/3 of the entire length; scales minute. **Anthers** ca. 0.5 mm long. **Fruit** orange to bright red, somewhat fleshy, subglobose to obovoid, 4.5-12.5 mm long, 3.5-8 mm wide.

Thailand.— Throughout the country.

Distribution.— Pantropical (Sri Lanka-type).

Ecology.— Dry evergreen and lower montane forest, alt. 800-1,700 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering: June-September; fruiting: August-September.

Vernacular.— เขี้ยวพาน Phia fan (Chiang Mai).

Voucher specimens.— *P. Srisanga* 955, 1595, 1627; *P. Srisanga* & *C. Maknoi* 2030; *P. Srisanga et al.* 787.

2. LITCHI Sonn.

Voy. Ind. Or. Chine 2: 230, t. 129. 1782; Leenh., *Blumea* 24: 398. 1978; Welzen in *Fl. Thailand* 7(1): 219. 1999.

Trees, monoecious. Indumentum of simple or 2-branched hairs. **Leaves** paripinnate. Leaflets glaucous; margin entire; domatia absent. **Inflorescence** terminal and axillary. **Flowers** unisexual, actinomorphic. **Calyx** 4-5; lobes equal. **Petals** absent. Disc annular, small. **Stamens** 6-11; filaments hairy; anthers glabrous. **Ovary** shortly stalked, 2-locular, warty; stigma lobed; ovule 1 in each loculus. **Fruit** drupaceous, lobed, usually one locule developed, acute warts, glabrous. **Seed** ellipsoid, completely covered by an ariloid.

Only 1 species, Litchi or Lychee (*Litchi chinensis* Sonn.), with 3 subspecies, which probably originated in SE China and northern part of Indo-Chinese Peninsula (Leenhouts, 1978). In Thailand, only subspecies *chinensis*, the commonly grown form, widely cultivated especially in the north (Welzen, 1999).

Litchi chinensis* Sonn. subsp. *chinensis

Voy. Ind. Or. Chine 2: 230, t. 129. 1782; Leenh., *Blumea* 24: 398. 1978; Welzen in Fl. Thailand 7(1): 220, fig. 2j, 3e, 19. 1999.

Tree up to 35 m high. **Leaves** 1-4-jugate; leaflets lanceolate to elliptic, chartaceous to subcoriaceous, (3-)8-11(-16) cm long, 1.6-4 cm wide, subglabrous on both surfaces; base cuneate; apex obtuse, acute to acuminate. **Inflorescence** up to 30 cm long. **Flowers** greenish white or yellowish, fragrant. **Calyx**: lobes triangular, ca. 1.5 mm long, 2 mm wide. **Stamens** 6(-10); filaments ca. 2.5 mm long; anthers ca. 1 mm long. **Fruit** sessile, subglobose to ovoid, fleshy, 3-4 cm long, ca. 3 cm wide, reddish to purplish; wall thin. **Seed** shiny, blackish brown, ca. 2 cm long, 1.5 cm wide; ariloid whitish.

Thailand.— Northern: Throughout; South-eastern: Chon Buri, Chanthaburi, Trat; South-western: Phetchaburi. Cultivated in many places.

Distribution.— Probably indigenous to SE China (type), Indo-China, Thailand, Malay Peninsular, Borneo and Philippines. Widely cultivated in large scale in many tropical and subtropical parts of the world.

Ecology.— Not native, cultivated in lower montane forest, alt. 1,100-1,500 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: April-May.

Uses.— Ariloid edible.

Vernacular.— ลิ้นจี่ Linchee (General), Litchi (English).

Voucher specimens.— *P. Srisanga* s.n.

3. MISCHOCARPUS Bl.

Bijdr.: 238. 1825, nom. cons.; Ham, *Blumea* 23: 251. 1977; Welzen in Fl. Thailand 7 (1): 222. 1999.

Shrubs or trees, monoecious. Indumentum of simple hairs. **Leaves** paripinnate. Leaflets: margin entire; domatia present. **Inflorescence** axillary, pseudo-terminal and ramiflorous, thyrsoid, branching, pilose. **Flowers** unisexual, actinomorphic. **Calyx** 5, usually partly connate; lobes triangular, about equal. **Petals** absent or 5, without scales. Disc annular, glabrous. **Stamens** (5-)8(-9); filaments hairy or not; anthers glabrous. **Ovary** subsessile or stipitate, (2-)3-locular, smooth, glabrescent; stigma lobed; ovule 1 in each loculus. **Fruit** a loculicidal capsule, stipitate, not winged, smooth, glabrous; wall thin. **Seed** ellipsoid to globose, covered by a thin ariloid.

Fifteen species ranging from India and SE Asia to Australia. Two species in Thailand (Welzen, 1999). Only 1 species recorded from Doi Phu Kha National Park.

***Mischocarpus pentapetalus* (Roxb.) Radlk.**

Sapind. Holl.-Ind.: 43. 1879; Ham, Blumea 23: 271, fig. 2b. 1977 (see also for complete synonymy); Welzen in Fl. Thailand 7(1): 222, fig. 20: a-b. 1999. – *Schleichera pentapetala* Roxb., Fl. Ind. ed. Carey: 275. 1832.

Tree up to 25 m high. **Leaves** (1-)2-6-jugate; leaflets ovate to elliptic, subcoriaceous, 5-40 cm long, 1-15 cm wide, glabrous on both surfaces; base rounded or cuneate; apex rounded to acuminate. **Inflorescence** up to 40 cm long. **Flowers** white to yellowish, fragrant, small. **Calyx** lobes triangular, 0.75-2 mm long and wide, puberulous outside. **Petals** 5, reduced, up to 2 mm long, 1 mm wide, not clawed. **Stamens** 6-8; filaments 3-4 mm long, partly pilose. **Fruit** red, (0.8-)1-2(-3) cm long, 0.4-1.4 cm wide, usually with 1-seeded; stipe 2-11 mm high. **Seed** shiny, dark brown; ariloid bluish.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Nan, Tak, Phitsanulok; North-eastern: Petchabun, Loei, Udon Thani, Nong Khai; Eastern: Chaiyaphum, Nakhon Ratchasima; South-eastern: Chon Buri, Rayong, Trat; Central: Saraburi, Nakhon Nayok; South-western: Kanchanaburi; Peninsular: Chumphon, Ranong, Surat Thani, Phangnga, Nakhon Si Thammarat, Trang, Satun.

Distribution.— India (type), SW China, SE Asia.

Ecology.— Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: December-May; fruiting: April-August.

Vernacular.— ชำมะล่าโย Cha ma lumyai (Northern), พะบัง Pha bang (Tin-Nan).

Voucher specimens.— *P. Srisanga* 491.

SAPOTACEAE

Trees or shrubs, mostly with white latex. **Leaves** simple, usually alternate, rarely opposite, entire, leathery; stipules present or absent. **Inflorescence** usually axillary, ramiflorous or cauliflorous, fasciculate, cymes, racemes, panicles or flower solitary. **Flowers** bisexual or unisexual (monoecious or dioecious), actinomorphic. **Sepals** (4-)5(-12), free or united, imbricate or in 2 whorls and then the outer whorl valvate or slightly imbricate. **Petals** 4-18; lobes 1-2 seriate, imbricate, sometimes with paired of appendages. **Stamens** the same number as the petals or numerous, 1-3 seriate, epipetalous; anthers 2-locular, opening by longitudinal slits. Staminodes sometimes present. **Ovary** superior, 1-15(-30)-locular, axile or axile-basal placentation; ovule usually solitary in each loculus; style simple. **Fruit** a berry, rarely drupe or capsule. **Seeds** often with large hollow hilum and shiny integument.

A pantropical family of 53 genera and about 1,100 species mostly in humid forest, but some genera extending into semi-arid and arid regions (Pennington, 1991; 2004). Ten genera and about 50 species in Thailand (Lam & Royen, 1952; Chantaranothai, 1999; Brockelman, Charoenchai & Maxwell, 2002). Only 2 genera and 3 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Leaves alternate. Sepals 6 in 2 whorls of 3. Petals (5-)6 **1. *Palaquium***
 1. Leaves opposite or subopposite. Sepals 5 in 1 whorl. Petals 5 **2. *Sarcosperma***

1. *PALAQIUM* Blanco

Fl. Filip.: 403. 1837; Royen, Blumea: 10(2): 433. 1960; Pennington, Gen. Sapot.: 148. 1991; in Fam. Gen. Vasc. Pl. 6: 407. 2004.

Trees or shrubs; stipules usually present, small and caducous. **Leaves** alternate. **Inflorescence** axillary, 1-many-flowered fascicles. **Flowers** bisexual, rarely unisexual (dioecious). **Sepals** 6, in 2 whorls of 3, free or slightly united, the outer whorl more or less valvate. **Petals** (5-)6, usually contorted; tube usually shorter than lobes and glabrous inside. **Stamens** usually 12, rarely 10 or up to 30, usually in 1 whorl; filaments free or occasionally a few partly fused; anthers glabrous or hairy. **Ovary** usually hairy, rarely glabrous, (5-)6(-10)-locular. **Fruit** a berry. **Seeds** 1-2 or several.

About 110-115 species from India, through SE Asia to the Pacific Islands (Royen, 1960; Pennington, 1991). About 10 species in Thailand (Chantaranothai, 1999). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves obtuse to rounded at apex. Inflorescence ramiflorous **1. *P. garrettii***
 1. Leaves acute, acuminate, caudate or retuse at apex. Inflorescence in leaf axils **2. *P. sp.***

1. *Palaquium garrettii* Fletcher

Kew Bull. 1937: 374. 1937; in Fl. Siam. Enum. 2: 356. 1938; Royen, Blumea 10(2): 544. 1960; Chantaranothai, Thai For. Bull. (Bot.) 27: 151. 1999. – *P. koratense* Fletcher, Kew Bull. 1937: 374. 1937; in Fl. Siam. Enum. 2: 356. 1938; Royen, Blumea 10(2): 550. 1960.

Tree up to 20 m high; branchlets irregular terete with numerous leaf-scars, ferruginous puberulous; stipules lanceolate, ca. 3 mm long, 1 mm wide, puberulous. **Leaves** conferted at apex of branches, oblong-lanceolate to oblanceolate, subcoriaceous, 12-20 cm long, 4-8 cm wide, glabrous on both surfaces; base cuneate, decurrent along upper side of petiole; apex obtuse to rounded; midrib grooved with minutely crested above, rounded and prominent below; primary veins 10-16 pairs; petioles 13-22 mm long, brown puberulous. **Inflorescence** ramiflorous, 2-5-flowered. **Flowers** fragrant; pedicels 20-30 mm long, brown puberulous. **Sepals** connate at base, brown puberulous outside, glabrous inside; outer sepals ovate, broadly acute at apex, slightly prominent medium ridge outside, 4-5 mm long, 3-4 mm wide; inner sepals broadly ovate, rounded at apex, slightly larger than the outer ones. **Petals** 6,

white, 7-8 mm long, glabrous; tube 1-1.5 mm long; lobes lanceolate to elliptic, 5-6.5 mm long, ca. 2 mm wide, truncate at apex. **Stamens** 12(-20), 4.5-6 mm long; filaments subulate, 2.5-3 mm long, glabrous; anthers sagittate, 2.5-4 mm long, sparsely brown hairs. **Ovary** conoid, ca. 1.5 mm long, puberulous, 6-locular; style exserted, 9-11 mm long, glabrous. **Fruit** ellipsoid, 3.5-4 cm long, ca. 2 cm wide, glabrescent, except sparsely hairy at apex. **Seed** 1, narrowly ellipsoid, ca. 2 cm long, 1 cm wide.

Thailand.— Northern: Chiang Mai (type), Nan; North-eastern: Loei; Eastern: Nakhon Ratchasima (type of *P. koratense*); Peninsular: Trang.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, open areas, alt. 1,400 m (Doi Phu Kha).

Phenology.— Flowering: June-July; fruiting: November-December.

Voucher specimens.— *P. Srisanga* 1989, 2268.

Notes.— New locality recorded from Nan, in Thailand.

2. *Palaquium* sp.

Shrub or small tree, ca. 3 m high; branchlets terete, brown puberulous; stipules lanceolate, ca. 4 mm long, 2 mm wide, brown puberulous. **Leaves** scattered, elliptic to oblong-elliptic, chartaceous, (8-)10-17 cm long, 4-7 cm wide, glabrous on both surfaces or only sparsely hairy along midrib on lower surface; base cuneate; apex acute, acuminate, caudate or retuse, acumen up to 18 mm long; midrib raised or crested above, rounded and prominent below; primary veins 8-12 pairs; petioles (5-)10-15 mm long, brown puberulous. **Inflorescence** in leaf axils, 1-4-flowered. **Flowers** fragrant; pedicels (10-)15-30 mm long, brown puberulous. **Sepals** connate at base, brown puberulous except for glabrous central and basal parts inside; outer sepals ovate to broadly ovate, slightly prominent medium ridge outside, 3-4 mm long, 2.5-3 mm wide; inner sepals ovate to ovate-oblong, prominent medium ridge outside, 3.5-4.5 mm long, 2-2.5 mm wide. **Petals** 6, white, 7-7.5 mm long, glabrous; tube ca. 3 mm long; lobes oblong to narrowly ovate, 4-5 mm long, ca. 2 mm wide, truncate with 2-3-lobed at apex. **Stamens** 12, 3-4.5 mm long; filaments subulate, 1.5-3 mm long, glabrous; anthers sagittate, 2-2.3 mm long, sparsely brown hairs. **Ovary** conoid, ca. 1 mm long, brown puberulous, 6-locular; style exserted, ca. 8 mm long, brown tomentose. **Fruit** not known.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: January-February.

Voucher specimens.— *P. Srisanga* 1282.

Notes.— Possibly new species. Related to *P. stellatum* King & Gamble but differs in the size of sepals, petals and stamens and to *P. calophyllum* (Teysm. & Binn.) Pierre but differs in the indumentum on lower surface of leaves and hairy petals.

2. *SARCOSPERMA* Hook.f.

In Gen. Pl. 2: 655. 1876; Lam & Varossieau, *Blumea* 3(1): 183. 1938; Lam & Royen, *Blumea* 7(1): 148. 1952; Pennington, Gen. Sapot.: 179. 1991; in Fam. Gen. Vasc. Pl. 6: 411. 2004.

Trees or shrubs. **Leaves** opposite or subopposite, often with large pits in the axils of the nerves; stipules small, mostly caducous. **Inflorescence** axillary, racemes or panicles. **Flowers** bisexual. **Sepals** 5, in 1 whorl, imbricate. **Petals** 5, imbricate; tube shorter than lobes. **Stamens** 5, opposite to the corolla lobes; filaments short, connate at base with the base of the petals; anthers basifixed. **Staminodes** 5, alternate with the corolla lobes. **Ovary** (1-)2-locular; ovule 1 in each loculus, ascending from the base of the central axis; style short and stout. **Fruit** a berry. **Seeds** (1-)2.

About 8 species from India to S China, SE Asia and Malesia (Lam & Royen, 1952; Pennington, 1991). About 3 species in Thailand. One species recorded from Doi Phu Kha National Park.

Sarcosperma arboreum Hook.f.

In Gen. Pl. 2: 655. 1876; Lam & Varossieau, *Blumea* 3(1): 192. 1938; Fletcher in Fl. Siam. Enum. 2: 363. 1938; Lam & Royen, *Blumea* 7(1): 150. 1952.

Tree up to 20 m high; branchlets terete, glabrous or slightly tomentose when young; stipules lanceolate, ca. 3 mm long, puberulous, caducous. **Leaves** oblong, lanceolate to elliptic, subcoriaceous, 10-20(-30) cm long, 3-6.5(-10) cm wide, glabrous on both surfaces; base cuneate, decurrent along upper side of petiole; apex acute to acuminate; midrib minutely crested above, raised and prominent below; primary veins 7-13 pairs; vein parallel; glandular pits distinct in the nerve axils; petioles 1-2(-2.5) cm long, minutely tomentose, glabrescent. **Inflorescence** in leaf axils, raceme or 2-3-branched panicle, minutely tomentose, 3-7 cm long. **Flowers** slightly fragrant; pedicels 1-2 mm long, puberulous. **Sepals** ovate, 2-3 mm long, puberulous outside, glabrous inside, rounded to broadly acute at apex. **Petals** creamy yellow, glabrous; tube ca. 1 mm long; lobes elliptic to narrowly ovate, 2-3 mm long, 1-1.5 mm wide, rounded to broadly acute at apex. **Anthers** ovoid, 1-1.5 mm long. **Staminodes** subulate to lanceolate, 1-1.5 mm long. **Ovary** 2-2.5 mm long, glabrous, 2-locular; style hardly exerted, 9-11 mm long, glabrous. **Fruit** ellipsoid to oblong, 2.3-3 cm long, 1.5-2 cm wide, bluish black to black. **Seeds** 1-2, narrowly ellipsoid to oblong, 2-2.5 cm long, 1-1.3 cm wide.

Thailand.— Northern: Chiang Mai, Lampang, Nan.

Distribution.— India (type), China, Myanmar.

Ecology.— Dry evergreen and lower montane forest, alt. 1,000-1,600 m (Doi Phu Kha, Tham Pha Kaow).

Phenology.— Flowering: December-February (-August); fruiting: June-July.

Uses.— Wood for indoor construction.

Vernacular.— มะฮาง Mayang (Chiang Mai), ไม้อาว Mai Tao (Lua-Nan).

Voucher specimens.— *P. Srisanga* 528, 1285, 2338, 2565; *P. Srisanga & C. Maknoi* 2044; *P. Srisanga & S. Watthana* 644; *P. Srisanga et al.* 786, 798.

SCROPHULARIACEAE

Annual or perennial herbs, undershrubs, rarely trees, shrubs or woody with straggling branches, mostly autotropic, rarely hemiparasitic, parasitic or saprophytic. **Leaves** simple, alternate or opposite, sometimes verticillate or basally opposite and apically alternate, entire to serrate or pinnatifid. **Inflorescence** axillary or terminal, racemes, spikes, panicles, subumbels, capitate or flower solitary. **Flowers** usually bisexual, usually zygomorphic, rarely actinomorphic, often bilabiate, sometimes calcarate or personate. **Calyx** (2-)4-5-lobed, variously connate, often persistent. **Corolla** sympetalous, 4-5-lobed, imbricate. **Stamens** usually 4, didynamous, rarely 2 or 5, inserted on the corolla tube and alternate with the lobes, sometimes 1-2 staminodes present. Disk present. **Ovary** superior, (1-)2-locular, axile placentation; style 1; stigma capitate or bilobed; ovules numerous. **Fruit** a capsule usually septicial and/or loculicidal, sometimes poricidal or operculate, rarely a berry. **Seeds** numerous, small, usually reticulate, rarely winged.

A cosmopolitan family with about 306 genera and 5,850 species (Fischer, 2004). A family contains many weedy species but several are widely cultivated as garden ornamentals and a few are used as medicines. Thirty-one genera and about 111 species in Thailand (Maxwell, 1989, 2002; Yamazaki, 1990; Chuakul, 1999, 2000). Nine genera and 21 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Herb or undershrub, sometimes woody at base
 2. Corolla with the upper two lobes exterior in bud
 3. Calyx arranged in two series, the outer series consisting of three larger lobes
 1. *Adenosma*
 3. Calyx arranged in one series, forming a tube
 4. Anterior filaments arising from the lower half of corolla tube
 5. Large, erect herb or undershrub, woody at base, more than 1 m high. Calyx united more than half of its length. Corolla more than 2 cm long
 3. *Cyrtandromoea*
 5. Small herb, less than 30 cm high. Calyx united about half of its length. Corolla less than 1 cm long
 6. *Mazus*
 4. Anterior filaments arising from the upper half of corolla tube
 6. Ovary glabrous
 5. *Lindernia*
 6. Ovary with short scabrid hairs at the upper part
 8. *Torenia*
 2. Corolla with the lower three lobes exterior in bud
 7. Calyx with a pair of bracteoles at base
 2. *Alectra*
 7. Calyx without a pair of bracteoles at base
 8. Corolla bilabiate
 4. *Lindenbergia*
 8. Corolla rotate, deeply lobed
 7. *Scoparia*
 9. *Wightia*
1. Tree

1. *ADENOSMA* R. Br.

Prodr.: 442. 1810; Yamazaki in Fl. Thailand 5(2): 146. 1990; Fischer in Fam. Gen. Vasc. Pl. 7: 387. 2004. – *Pterostigma* Benth., Scroph. Ind.: 20. 1835.

Annual or perennial herbs. **Leaves** opposite, serrate. **Inflorescence** in terminal racemes, spikes or capitate or flower solitary and axillary. Bracteoles 2 at the base of the calyx, filiform. **Calyx** irregularly 5-lobed; outer 3 lobes large, widely lanceolate to cordate-ovate; inner 2 lobes small, linear-lanceolate. **Corolla** cylindric, bilabiate, upper two lobes exterior in bud; upper lip elliptic to orbicular, entire or emarginate; lower lip 3-lobed. **Stamens** 4, included, didynamous; anther locules separate. **Style** filiform; stigma bilobed. **Capsule** ovoid to ellipsoid, dehiscent both loculicidally and septically, 4-valved. **Seeds** numerous, small, reticulate.

About 15 species in tropical E Asia and Australia (Fischer, 2004). Seven species in Thailand (Yamazaki, 1990). Only 1 species recorded from Doi Phu Kha National Park.

Adenosma caerulea R. Br.

Prodr.: 443. 1810; Kerr in Fl. Siam. Enum. 3(2): 155. 1954; Yamazaki in Fl. Thailand 5 (2): 147, fig. 43: 7-8. 1990. – *A. cordifolia* Bonati, Not. Syst. Paris 1: 331. 1911. – *A. caerulea* var. *grandiflora* auct. non Benth.: Bonati in Fl. Gén. I.-C. 4: 371. 1927. – *A. caerulea* var. *urticifolia* Bonati and var. *racemosa* Bonati in Fl. Gén. I.-C. 4: 371. 1927.

Perennial herb, 40-100 cm high; stem simple or laxly branched, terete, densely covered with long glandular hairs. **Leaves** lanceolate to elliptic, 3-9 cm long, 1-5 cm wide, glandular pilose on both surfaces; base cuneate, attenuate on to the petiole; apex acute; petioles 1-15 mm long, glandular pilose. **Inflorescence** in terminal lax leafy racemes or flower solitary and axillary. Bracteoles linear, 4-7 mm long. Pedicels 1-6 mm long. **Calyx** 6-10 mm long, glandular pilose. **Corolla** dark blue, 8-25 mm long; upper lip rounded or slightly emarginate at apex; lower lip with narrowly oblong lobes. **Capsule** ovoid, 6-8 mm long, 4-6 mm wide.

Thailand.— Northern: Nan, Tak; North-eastern: Loei, Mukdahan; Eastern: Chaiyaphum; South-eastern: Trat; Central: Saraburi; South-western: Kanchanaburi; Peninsular: Satun.

Distribution.— India, S China, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Australia (type).

Ecology.— Lower montane forest, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-September.

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2081.

2. *ALECTRA* Thunb.

Nov. Gen. Pl.: 81: 1781; Yamazaki in Fl. Thailand 5(2): 222. 1990; Fischer in Fam. Gen. Vasc. Pl. 7: 411. 2004. – *Melasma* sect. *Alectra* (Thunb.) Wettst. in Pflanzenfam. 4(3b): 91. 1891.

Annual, hemiparasitic herbs; stem simple or branched above, erect, quadrangular. **Leaves** opposite, occasionally alternate above, serrate. **Inflorescence** in terminal racemes or spikes or flower solitary and axillary. Bracteoles 2 at the base of the calyx. **Calyx** campanulate, membranous, 5-lobed. **Corolla** campanulate or tubular-campanulate, obscurely bilabiate, subequally 5-lobed, lower three lobes exterior in bud; lobes spreading. **Stamens** 4, included, didynamous; the lower 2 larger than the upper; filaments filiform, adnate to the base of corolla tube; anther locules parallel, confluent above, mucronate at base. **Ovary** subglobose; style filiform; stigma elongate. **Capsule** globose, dehiscent both loculicidally and septocidally, 4-valved. **Seeds** numerous, minute, linear-cylindric.

About 40 species in tropical regions of Africa, Asia and America (Fischer, 2004). Only 1 species in Thailand (Yamazaki, 1990).

Alectra avensis (Benth.) Merr.

Philipp. J. Sci. Bot. 12: 109. 1917, “*arvensis*”; Barnett in Fl. Siam. Enum. 3(3): 187. 1962; Yamazaki in Fl. Thailand 5(2): 222, pl. IX: 1. 1990. – *Glossostyles avensis* Benth., Scroph. Ind.: 49. 1835. – *Alectra indica* Benth. in DC., Prodr. 10: 339. 1846.

Erect herb, 20-80 cm high; stem pubescent. **Leaves** lanceolate to ovate, membranous, 1-5 cm long, 0.5-2 cm wide, hirsute on both surfaces; base cuneate, attenuate onto the petiole; apex acute; prominent primary veins 3 from the base; petioles 1-2 mm long, pubescent. **Inflorescence** in terminal lax spikes or flower solitary and axillary. Bracteoles filiform, 4-6 mm long, hirsute on margin. **Calyx** 4-5 mm long and wide, 10-nerved; lobes deltoid-ovate, acuminate at apex, ca. 2 mm long, hirsute on margin. **Corolla** yellow, 6-7 mm long; lobes broadly elliptic, 2-3 mm long and wide. **Stamens**: posterior ca. 3 mm long, filaments glabrescent; anterior ca. 4 mm long, filaments lanate. **Capsule** subglobose, 5-6 mm long and wide (Fig. 71).

Thailand.— Northern: Chiang Mai, Nan, Phitsanulok; North-eastern: Loei; South-western: Kanchanaburi.

Distribution.— W to E Himalayas, India, Myanmar (type), S China, Laos, Vietnam, Malesia, Philippines.

Ecology.— Lower montane forest and lower montane scrub, often in open areas, alt. 1,500-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: October-December.

Voucher specimens.— *P. Srisanga* 405, 1223, 1795.

3. *CYRTANDROMOEA* Zoll.

Syst. Verz. Ind. Arch. 3: 58. 1855; Burtt, Bull. Bot. Surv. India 7: 73. 1965; Yamazaki in Fl. Thailand 5(2): 154. 1990; Fischer in Fam. Gen. Vasc. Pl. 7: 426. 2004.

Perennial herbs or undershrubs; stem erect, woody at base, quadrangular. **Leaves** opposite, petiolate, serrate. **Inflorescence** cymose, few- to many-flowered or flower solitary in upper leaf axils. Bracts small, membranous. **Calyx** tubular, truncate at apex, with 5 short teeth, enlarged in fruit. **Corolla** infundibuliform, 5-lobed, upper two lobes exterior in bud; lobes orbicular. **Stamens** 4, didynamous, fused at base of the corolla tube; anther locules divergent, confluent at apex. **Ovary** conical or cylindrical; style filiform; stigma bilamellate. **Capsule** globose or ellipsoid, thin walled, dehiscing loculicidally, included within enlarged calyx. **Seeds** numerous, ellipsoid, reticulate.

About 10 species in S China, Myanmar, Thailand and W Malesia. Three species in Thailand (Yamazaki, 1990). Only 1 species recorded from Doi Phu Kha National Park.

Cyrtandromoea grandiflora C. B. Clarke

In DC., Monogr. Phan. 5: 186. 1883; Barnett in Fl. Siam. Enum. 3(3): 210. 1962; Burtt, Bull. Bot. Surv. India 7: 86. 1965; Yamazaki in Fl. Thailand 5(2): 155, fig. 44. 1990.

Perennial herbs up to 2 m high; stem densely pubescent. **Leaves** lanceolate, oblong to elliptic, membranous, 8-20 cm long, 3-6 cm wide; base cuneate; apex acuminate, sparsely pilose above, subdensely and softly pilose on the nerves beneath; petioles 1-4 cm long, with minute soft hairs. **Inflorescence** in 2-6-flowered cymes in upper leaf axils, 4-7 cm long; peduncles and pedicels with minute soft hairs. **Calyx** tubular, 8-30 mm long, 4-10 mm wide, soft hairy. **Corolla** white with yellow patch at the base of lower lip, 3-5.5 cm long, sparsely glandular pilose outside. **Capsule** ellipsoid, 13-20 mm long, 5-10 mm wide (Fig. 147).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Myanmar (type), S China, Indonesia (Sumatra).

Ecology.— Lower montane forest, alt. 1,700-1,800 m (Doi Phu Kha).

Phenology.— Flowering: June-August; fruiting: August-January.

Vernacular.— ตักนมหิน Phak nom hin (Chiang Mai).

Voucher specimens.— *P. Srisanga* 926, 1982.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

4. *LINDENBERGIA* Lehm.

Linnaea 5(litt.): 45. 1829; Yamazaki in Fl. Thailand 5(2): 219. 1990; Fischer in Fam. Gen. Vasc. Pl. 7: 387. 2004.

Annual or perennial herbs; stem terete, erect or diffuse. **Leaves** opposite, serrate or crenate. **Inflorescence** in terminal spike or raceme or flower solitary and axillary. **Calyx** campanulate, 5-lobed, ebracteolate. **Corolla** yellow, tubular, bilabiate, lower three lobes exterior in bud; tube cylindrical; upper lip triangular or narrowly ovate, bilobed; lower lip longer than the upper one, distinctly 3-lobed, spreading, with two gibbous plaits. **Stamens** 4, included, didynamous, inserted at the base of corolla tube; anther locules separate, stipitate, one cell frequently reduced. **Style** filiform; stigma capitate. **Capsule** ovoid or oblong-ovate, acuminate, included within the persistent calyx, loculicidally bivalved, separating from the placentiferous column. **Seeds** numerous, small, oblong to narrowly ellipsoid.

Twelve species in tropical Asia and Africa (Fischer, 2004). Two species in Thailand (Yamazaki, 1990). Both species also recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Inflorescence in leafy racemes, lax-flowered or flower solitary and axillary; rachis sparsely glandular pilose. Upper lip of corolla slightly shorter than the lower; lobes obtuse **1. *L. indica***
1. Inflorescence in terminal spike-like racemes, dense-flowered; rachis densely glandular villous. Upper lip of corolla much shorter than the lower; lobes acute to acuminate **2. *L. philippensis***

1. *Lindenbergia indica* (L.) Vatke

In Oesterr., Bot. Zeits. 25: 10. 1875; Yamazaki in Fl. Thailand 5(2): 221. 1990. – *Stemodia indica* L., Sp. Pl.: 633. 1753. – *S. ruderalis* Retz., Obs. Bot. 5: 25. 1789. – *S. muraria* Roxb. ex D. Don, Prodr. Fl. Nepal.: 89. 1825. – *Lindenbergia urticifolia* Lehm. in Link & Otto, Ic. Pl. Rar. 95, t. 48. 1831. – *L. ruderalis* (Retz.) Voigt, H. Suburb. Calc.: 501. 1845; Kerr in Fl. Siam. Enum. 3(2): 154. 1954. – *L. muraria* (Roxb. ex D. Don) Bruhl, J. Dept. Sci. Univ. Calc. 2: 27. 1920.

Annual herb, 10-50 cm high; stem ascending, simple to much branched, glandular pilose. **Leaves** elliptic to ovate, membranous, 1-6 cm long, 0.7-3.5 cm wide, sparsely pilose on both surfaces; base cuneate, attenuate onto the petiole; apex acute, obtuse to rounded; petioles 0.5-2.5 cm long, pilose. **Inflorescence** in leafy racemes, lax-flowered or flower solitary and axillary; rachis sparsely glandular pilose; pedicels 1-3 mm long, glandular pilose. **Calyx** campanulate, 4-6 mm long, 3-5 mm wide, glandular pilose; lobes ovate, obtuse or rounded at apex. **Corolla** yellow, 9-14 mm long, pilose outside; upper lip 2-3 mm long, shallowly bilobed, lobes broadly ovate, obtuse; lower lip slightly longer than the upper, 3-3.5 mm long, sparsely glandular pilose on gibbous palate, 3-lobed, lobes ovate, obtuse to subacute. **Capsule** narrowly ovate, acuminate at apex, 4-5 mm long, 2-3 mm wide, densely hirsute. **Seeds** ellipsoid, minute (Fig. 72).

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan, Sukhothai, Tak; South-western: Kanchanaburi.

Distribution.— India, Nepal (type), Sikkim, Bhutan, Myanmar, S and W China, Laos, Cambodia, Vietnam.

Ecology.— Deciduous dipterocarp forest, alt. 400-500 m (Wiang Peian Waterfall, Doi Phu Kha).

Phenology.— Flowering and fruiting: July-December.

Vernacular.— หญ้ากึ่งลิ้นหอย Ya kled hoi (Chiang Mai).

Voucher specimens.— *P. Srisanga* 2290.

2. *Lindenbergia philippensis* (Cham.) Benth.

In DC., Prodr. 10: 377. 1846; Bonati in Fl. Gén. I.-C. 4: 363. 1927, excl. fig. 42: 10-14, incl. var. *bracteosa* Bonati and var. *ramosissima* Bonati; Kerr in Fl. Siam. Enum. 3(2): 153. 1954; Yamazaki in Fl. Thailand 5(2): 220, fig. 47: 1-2. 1990. — *Stemodia philippensis* Cham., Linnaea 3: 5. 1828. — *Lindenbergia siamensis* Teysm. & Binn., Nat. Tijds. Ned. Ind. 25: 441. 1863; Kerr in Fl. Siam. Enum. 3(2): 153. 1954. — *Adenosma thorelii* Bonati, Not. Syst. Paris 1: 331. 1911. — *Lindenbergia macrostachya* auct. non Benth.: Bonati in Fl. Gén. I.-C. 4: 364. 1927.

Perennial herb up to 2.5 m high; stem erect, glandular villous. **Leaves** lanceolate, elliptic to ovate, papyraceous, 2-8 cm long, 1-4 cm wide, glandular pilose on both surfaces; base cuneate, attenuate onto the petiole; apex acute to acuminate; petioles 1-3 cm long, densely glandular villous. **Inflorescence** in terminal spike-like racemes, dense-flowered; rachis stout, densely glandular villous. **Flowers** subsessile. **Calyx** campanulate, 5-8 mm long, 4-5 mm wide, glandular villous; lobes triangular, acuminate at apex. **Corolla** yellow with dark red dots at lower lip, 12-18 mm long, pilose outside; upper lip deltoid-ovate, 4-5 mm long, bilobed, lobes lanceolate, acute to acuminate; lower lip much longer than the upper, densely villous on gibbous palate, 3-lobed, lobes ovate, cuspidate. **Capsule** ovoid, acuminate at apex, 4-5 mm long, 2.5-3 mm wide, hirsute apically. **Seeds** oblong, minute (Fig. 73).

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lampang, Nan, Phitsanulok, Tak; Eastern: Ubon Ratchathani; Central: Ang Thong, Saraburi, Krung Thep, Samut Prakan; South-western: Kanchanaburi, Ratchaburi.

Distribution.— Myanmar, S China, Laos, Cambodia, Vietnam, Philippines (type).

Ecology.— Dry evergreen and lower montane forest, along streams and open places, alt. 900-1,500 m (Ton Tong Waterfall, Doi Phu Kha).

Phenology.— Flowering and fruiting: November-March.

Vernacular.— บัวฮาพา Bua ha pa (Northern).

Voucher specimens.— *P. Srisanga* 599, 1771, 2202.

5. *LINDERNIA* Allioni

Mélang. Philos. Math. Soc. Roy. Turin. (Misc. Taur.) 3: 178, t. 5.1. 1766; Yamazaki in Fl. Thailand 5(2): 178. 1990; Fischer in Fam. Gen. Vasc. Pl. 7: 392. 2004.

Annual or perennial herbs; stem erect to prostrate, quadrangular. **Leaves** opposite, pinnately or palmately nerved. **Inflorescence** in terminal or axillary racemes, or in subumbellate fascicles or flower solitary and axillary. **Calyx** deeply to shallowly 5-lobed, 5-nerved, each nerve with an obscure or distinct rib, or a narrow wing. **Corolla** tubular, bilabiate, upper two lobes exterior in bud; upper lip ovate or oblong, emarginate or shallowly bilobed; lower lip 3-lobed, spreading. **Stamens** 2 or 4, posterior pair usually fertile, anterior pair fertile, sterile, or reduced to staminodes; anterior filaments ordinarily each with a distinct spur or a geniculum arising at or near the base; anthers touching in pairs under the upper lip, anther locules divaricate. **Ovary** obliquely or symmetrically ovate, oblong or cylindrical, glabrous all over; style filiform; stigma bilamellate. **Capsule** septicidally bivalved. **Seeds** numerous, small.

About 100 species, widely distributed throughout the warm regions of both the Old and New World. Thirty-two species in Thailand (Yamazaki, 1990; Chuakul, 1999). Eight species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|-----------------------------|
| 1. Fertile stamens 4 | |
| 2. Calyx lobes about as long as or shorter than calyx tube | |
| 3. Flower solitary and axillary or in lax racemes | |
| 4. Capsule about as long as or shorter than the persistent calyx | |
| 5. Calyx campanulate | 1. <i>L. crustacea</i> |
| 5. Calyx bilabiate | 7. <i>L. sp. 1</i> |
| 4. Capsule much longer than the persistent calyx | 5. <i>L. nummularifolia</i> |
| 3. Flowers of 2-10 in subumbellate fascicles | 2. <i>L. dictyophora</i> |
| 2. Calyx lobes longer than calyx tube | |
| 6. Leaves up to 2 cm long. Corolla 4-5 mm long | 3. <i>L. elata</i> |
| 6. Leaves 3-10 cm long. Corolla 9-12 mm long | 4. <i>L. latifolia</i> |
| 1. Fertile stamens 2, posterior; staminodes 2, anterior | |
| 7. Calyx lobes longer than calyx tube. Capsule much longer than the persistent calyx | 6. <i>L. ruelloides</i> |
| 7. Calyx lobes shorter than calyx tube. Capsule enclosed within the persistent calyx | 8. <i>L. sp. 2</i> |

1. *Lindernia crustacea* (L.) F. v. M.

Syst. Census Austral. Pl. 1: 97. 1882; Kerr in Fl. Siam. Enum. 3(2): 174. 1954; Yamazaki in Fl. Thailand 5(2): 193, fig. 48: 9-10. 1990. – *Capararia crustacea* L., Mant. Pl. 1: 87. 1767.

Annual herb, 5-20 cm high; stem ascendent or diffuse, quadrangular, sparsely pubescent on the angles and the nodes. **Leaves** ovate to broadly ovate, 6-20 mm long, 4-15 mm wide, pinnately nerved, glabrous on both surfaces except for pubescent on the nerves beneath; base rounded or subtruncate; apex obtuse to broadly acute; margin serrate; petioles 1-7 mm long, pubescent. **Flower** solitary and axillary; pedicels 4-18 mm long, glabrous or sparsely pubescent. **Calyx** campanulate, 3-4 mm long in

flower, 4-6 mm long in fruit, glabrous or shortly pubescent on the main nerves; lobes triangular, very short, acute at apex. **Corolla** blue to purple, 7-10 mm long; upper lip ovate, shallowly bilobed; lower lip with 3 rounded lobes. **Stamens** 4, all fertile; anterior filaments each with a blunt linear spur, ca. 0.5 mm long, arising near the base. **Capsule** ellipsoid to subglobose, 3-5 mm long, 2-3 mm wide, enclosed within persistent calyx. **Seeds** ellipsoidal, scrobiculate, minute.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Lampang, Phrae, Nan, Phitsanulok, Tak; Eastern: Chaiyaphum; South-eastern: Prachin Buri, Chon Buri, Trat; Central: Saraburi; South-western: Kanchanaburi, Prachuap Khiri Khan; Peninsular: Surat Thani, Nakhon Si Thammarat, Ranong, Trang, Satun, Narathiwat.

Distribution.— India, Nepal, Sri Lanka, China (type), Japan, Myanmar, Laos, Cambodia, Vietnam, Philippines, Malaysia, Indonesia, Australia, Micronesia, Polynesia.

Ecology.— Dry evergreen and lower montane forest, alt. 900-1,200 m (Nan Watershed, Doi Phu Kha).

Phenology.— Flowering and fruiting: May-December.

Voucher specimens.— *P. Srisanga* 315.

2. *Lindernia dictyophora* Tsoong ex Tsoong & Ku

In Fl. Reip. Pop. Sin. 67(2): 397, fig. 12: 2-4. 1979; Yamazaki in Fl. Thailand 5(2): 197. 1990.

Annual herb, 8-30 cm high; stem erect, quadrangular, sparsely pubescent. **Leaves** ovate to broadly ovate, 10-40 mm long, 7-20 mm wide, pinnately nerved, glabrescent or sparsely pubescent on both surfaces; base rounded or subtruncate; apex acute; margin serrate; petioles 5-12 mm long, glabrescent or sparsely pubescent. **Flowers** of 2-10 in subumbellate fascicles, axillary and terminal; pedicels 3-15 mm long, glabrous. **Calyx** campanulate, 4-5 mm long, glabrous or sparsely pubescent on ridges; lobes oblong-ovate, about as long as or one third of the calyx length, acuminate at apex. **Corolla** blue to purple, 7-10 mm long; upper lip ovate, emarginate; lower lip with 3 rounded lobes. **Stamens** 4, all fertile; anterior filaments without spur and each with an obscure knob at base. **Capsule** ellipsoid, 3-5 mm long, 2-3 mm wide, enclosed within persistent calyx. **Seeds** ellipsoidal, scrobiculate, minute (Fig. 74).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— S China (Yunnan-type).

Ecology.— Lower montane forest, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: August-October.

Vernacular.— หญ้าดอกโคม Ya dok khom (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1636, 1669.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

3. *Lindernia elata* (Benth.) Wettst.

In Pflanzenfam. 4(3b): 79. 1891; Kerr in Fl. Siam. Enum. 3(2): 175. 1954; Yamazaki in Fl. Thailand 5(2): 187. 1990. – *Vandellia elata* Benth., Scroph. Ind.: 36. 1835. – *V. urticifolia* Hance, J. Bot. 6: 301. 1868. – *Lindernia urticifolia* (Hance) Bonati in Fl. Gén. I.-C. 4: 421. 1927. – *L. noei* Kerr ex Barnett, Kew Bull. 16: 488. 1963.

Annual herb, 10-40 cm high; stem erect, sparsely pubescent. **Leaves** ovate to deltoid-ovate, 4-20 mm long, 3-15 mm wide, pinnately nerved, pubescent on both surface; base rounded or subtruncate; apex obtuse to broadly acute; margin serrate; petioles 2-10 mm long, pubescent. **Inflorescence** in terminal short raceme or flower solitary and axillary; pedicels 2-10 mm long, sparsely pubescent. **Calyx** deeply lobes, 3-5 mm long, shortly pubescent; lobes linear-lanceolate, acuminate at apex. **Corolla** white to bluish, 4-5 mm long; upper lip broadly ovate, shortly bilobed; lower lip with 3 rounded lobes. **Stamens** 4, all fertile; anterior filaments each with a short linear spur, ca. 0.5 mm long, arising at the base. **Capsule** broadly ellipsoid, 3-4 mm long, 1.5-2 mm wide, shorter than the persistent calyx. **Seeds** shortly cylindric, scrobiculate, minute.

Thailand.— Northern: Mae Hong Son, Nan; South-eastern: Trat; Central: Nakhon Nayok; Peninsular: Surat Thani, Satun.

Distribution.— Myanmar (type), S China, Cambodia, Vietnam, Malaysia, Indonesia.

Ecology.— Lower montane forest, alt. 1,100-1,200 m (Nan Watershed, Doi Phu Kha).

Phenology.— Flowering and fruiting: July-September.

Vernacular.— พืชหนกปีก Ya nok piek (General).

Voucher specimens.— *P. Srisanga & C. Maknoi* 2082.

4. *Lindernia latifolia* (Bl.) Koord.

Exk. Fl. Java 3: 179. 1912; Kerr in Fl. Siam. Enum. 3(2): 175. 1954; Yamazaki in Fl. Thailand 5(2): 183. 1990. – *Diceros latifolius* Bl., Bijdr.: 752. 1826.

Annual herb, 20-40 cm high; stem erect, quadrangular, pubescent. **Leaves** elliptic to ovate, 3-10 cm long, 2-5 cm wide, pinnately nerved, shortly puberulent on both surfaces; base cuneate; apex obtuse to broadly acute; margin serrate; petioles 0.5-2 cm long, pubescent. **Inflorescence** in terminal raceme, 5-13 cm long; pedicels 10-25 mm long, sparsely pubescent. **Calyx** deeply lobed, 6-8 mm long in flower, 10-13 mm long in fruit; lobes linear-lanceolate, shortly puberulent, acuminate at apex. **Corolla** blue, 9-12 mm long; upper lip broadly ovate, shortly bilobed; lower lip with 3 rounded lobes. **Stamens** 4, all fertile; anterior filaments each with a large, swollen, papillose geniculum, arising near the base. **Capsule** ellipsoid, 4-6 mm long, 2.5-3 mm wide, shorter than the persistent calyx. **Seeds** shortly cylindric, scrobiculate, ca. 0.5 mm long and wide (Fig. 75).

Thailand.— Northern: Chiang Rai, Lamphun, Lampang, Nan; North-eastern: Loei; Eastern: Chaiyaphum; South-eastern: Chon Buri, Rayong; Peninsular: Ranong, Trang.

Distribution.— Myanmar, Laos, Vietnam, Indonesia (Java-type).

Ecology.— Dry evergreen forest, alt. 800-900 m (Tham Pha Kong, Doi Phu Kha).

Phenology.— Flowering and fruiting: May-July.

Vernacular.— ผักชีเรือ Phak chi ruea (General).

Voucher specimens.— *P. Srisanga* 2538.

5. *Lindernia nummularifolia* (D. Don) Wettst.

In Pflanzenfam. 4(3b): 79. 1891; Kerr in Fl. Siam. Enum. 3(2): 177. 1954; Yamazaki in Fl. Thailand 5(2): 193. 1990. – *Vandellia nummularifolia* D. Don, Prodr. Fl. Nepal.: 86. 1825.

Annual herb, 4-10 cm high; stem erect, quadrangular, with short hispid hairs on the angles. **Leaves** ovate to suborbicular, 4-20 mm long and wide, pinnately nerved, glabrous on both surfaces or sparsely hirsute on the nerves beneath; base broadly cuneate to subcordate; apex obtuse to broadly acute; margin crenate to serrate, subsessile. **Inflorescence** in terminal lax raceme or flower solitary and axillary; pedicels 3-15 mm long, glabrous or sparsely pubescent. **Calyx** 2-3 mm long, sparsely pubescent; lobes lanceolate, acute at apex, about as long as or shorter than the tube. **Corolla** white to bluish, 6-8 mm long; upper lip broadly ovate, emarginate; lower lip with 3 rounded lobes. **Stamens** 4, all fertile; anterior filaments each with a densely papillose thick geniculum at the base. **Capsule** narrowly ellipsoid, 5-6 mm long, 1.5-2 mm wide, 1.5-2 times as long as the persistent calyx. **Seeds** ellipsoidal, scrobiculate, minute.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— Nepal (type), China, Myanmar, Vietnam.

Ecology.— Lower montane forest, open places and by roadsides, alt. 1,100-1,400 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: June-October.

Vernacular.— หญ้ากีสลัดหอย Ya kled hoi (Loei).

Voucher specimens.— *P. Srisanga* 748, 1606.

6. *Lindernia ruelloides* (Colsm.) Pennell

Brittonia 2: 182. 1936; Yamazaki in Fl. Thailand 5(2): 201. 1990. – *Gratiola ruelloides* Colsm., Prodr. Descr. Gratiola: 12. 1793. – *Ilysanthes ciliata* auct. non Colsm.: Barnett in Fl. Siam. Enum. 3(3): 182. 1962.

Perennial herb, 10-50 cm high; stem creeping and rooting at nodes, sparsely pubescent. **Leaves** elliptic to orbicular-elliptic, 1-5 cm long, 0.8-2.5 cm wide, pinnately nerved, scabrid on both surfaces; base cuneate, attenuate onto the petiole;

apex rounded to broadly acute; margin dentate; petioles 4-15 mm long, sparsely pubescent. **Inflorescence** in terminal lax raceme; pedicels 3-6 mm long, glabrous. **Calyx** cylindrical, deeply lobed, 6-9 mm long, glabrous; lobes linear-lanceolate, acuminate at apex. **Corolla** blue to purple, 12-15 mm long; upper lip ovate, rounded at apex; lower lip with 3 rounded lobes. **Fertile stamens** 2, posterior; staminodes 2, anterior, 2-3 mm long, uncinately curved at apex. **Capsule** cylindrical, 10-20 mm long, 2-3 mm wide, acute at apex, 2-2.5 times as long as the persistent calyx. **Seeds** ellipsoidal, scrobiculate, minute (Fig. 76).

Thailand.— Northern: Chiang Mai, Nan, Phitsanulok, Tak; North-eastern: Phetchabun; Central: Nakhon Nayok; South-western: Kanchanaburi; Peninsular: Nakhon Si Thammarat, Trang, Satun, Yala.

Distribution.— India, Nepal, S China, Japan (Ryukyu Is.), Myanmar, Laos, Cambodia, Vietnam, Philippines, Malaysia, Indonesia (Java-type), New Guinea.

Ecology.— Dry evergreen and lower montane forest, alt. 900-1,200 m (Nan Watershed, Doi Phu Kha).

Phenology.— Flowering and fruiting: October-December.

Vernacular.— ผักคอกกระบอง Phak dok krabok (General).

Voucher specimens.— *P. Srisanga* 1118.

7. *Lindernia* sp. 1

Annual herb, 5-20 cm high; stem erect, quadrangular, sparsely pubescent on the angles and the nodes. **Leaves** ovate to broadly ovate, 5-15 mm long, 3-10 mm wide, pinnately nerved, sparsely pubescent on both surfaces; base rounded to broadly cuneate; apex obtuse to broadly acute; margin serrate; petioles 1-5 mm long, sparsely pubescent. **Flower** solitary and axillary; pedicels 7-13 mm long, glabrous or sparsely pubescent. **Calyx** bilabiate, 5-8 mm long in flower, 7-9 mm long in fruit, glabrous or shortly pubescent on the main nerves; lobes about as long as or shorter than calyx tube, acute at apex. **Corolla** blue, 10-15 mm long; upper lip ovate, shallowly bilobed; lower lip with 3 rounded lobes. **Stamens** 4, all fertile; filaments without spur. **Capsule** oblong, 7-8 mm long, 2-3 mm wide, enclosed within persistent calyx. **Seeds** subglobose, scrobiculate, minute.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,700-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-December.

Voucher specimens.— *P. Srisanga* 1154.

Notes.— Possibly new species. Its characterize by calyx bilabiate; lobes about as long as or shorter than calyx tube; stamens 4, all fertile and filaments without spur.

8. *Lindernia* sp. 2

Annual herb, 8-14 cm high; stem laxly branched, erect, ridged, hirsute. **Leaves** elliptic, 5-18 mm long, 3-10 mm wide, pinnately nerved, hirsute on both

surfaces; base cuneate to truncate; apex obtuse to broadly acute; petioles less than 1 mm long or sessile. **Flower** solitary and axillary; pedicels 3-10 mm long, hirsute. **Calyx** tubular, slightly bilabiate, 5-7 mm long, keeled, hirsute; lobes shorter than calyx tube, acute at apex. **Corolla** blue, 5-6 mm long. **Fertile stamens** 2, posterior; staminodes 2, anterior, 1-1.5 mm long; rudimentary anthers present; filaments without spur. **Capsule** oblong-lanceolate, 4-6 mm long, ca. 2 mm wide, enclosed within persistent calyx. **Seeds** angulate, ca. 0.2 mm long and wide, verrucose.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-October.

Voucher specimens.— *P. Srisanga* 1647.

Notes.— Possibly new species. Closed to *Lindernia hookeri* (Clarke ex Hook.f.) Wettst. but differs in anterior filaments without spur.

6. *MAZUS* Lour.

Fl. Cochinch.: 385. 1790; Yamazaki in Fl. Thailand 5(2): 159. 1990; Fischer in Fam. Gen. Vasc. Pl. 7: 404. 2004.

Annual or perennial herbs. **Leaves** opposite below, sometimes alternate above, often rosulate, toothed or entire, pinnately nerved. **Inflorescence** in terminal racemes, pedicellate, ebracteolate. **Calyx** broadly campanulate, 5-angled, 5-lobed, enlarged in fruit. **Corolla** tubular, distinctly bilabiate, upper two lobes exterior in bud; upper lip bilobed, shorter than lower, lobes lanceolate to ovate acute; lower lip 3-lobed, with papillate palate, lobes broadly orbicular. **Stamens** 4, didynamous; anther locules divaricate, confluent at apex; filaments arising from the lower half of corolla tube. **Ovary** ovoid; style filiform; stigma bilamellate. **Capsule** subglobose, more or less compressed, included in the cup-shaped persistent calyx, loculicidally bivalved. **Seeds** numerous, minute, ellipsoidal, with thin reticulate testa.

About 30 species in tropical to temperate regions of E Asia, Australia and Micronesia. Only 1 species with 2 varieties in Thailand (Yamazaki, 1990).

Mazus pumilus (Burm.f.) Steenis

Nov. Guinea n.s. 9: 31. 1958; Yamazaki in Fl. Thailand 5(2): 159, fig. 45: 3-8. 1990. — *Lobelia pumila* Burm.f., Fl. Ind.: 186, fig. 60.3. 1768. — *Lindernia japonica* Thunb., Fl. Jap.: 253. 1784. — *Mazus rugosus* Lour., Fl. Cochinch.: 385. 1790. — *M. japonicus* (Thunb.) Kuntze, Rev. Gen.: 462. 1891; Kerr in Fl. Siam. Enum. 3(2): 153. 1954.

Annual herb, not stoloniferous; stem erect or diffuse, 5-20 cm high, glabrous or sparsely pubescent. **Leaves** opposite, clustered towards the base, obovate to spatulate, 1.5-5 cm long, 0.7-2 cm wide, glabrous on both surfaces; base attenuate; apex rounded; margin coarsely crenate-dentate. **Inflorescence** erect, 5-15 cm long, glabrous or sparsely pubescent, 5-25-flowered; pedicels 2-5 mm long, glabrous or sparsely pubescent. **Calyx** 3-5 mm long in flower, 5-8 mm long in fruit, glabrous or

glandular; lobes about as long as the calyx tube, lanceolate, acute at apex. **Corolla** bluish white with yellow patch on lower lip, 7-8 mm long. **Capsule** 2.5-3.5 mm long and wide, glabrous. **Seeds** ca. 0.5 mm long (Fig. 77).

Thailand.— Northern: Chiang Mai, Nan; Central: Bangkok.

Distribution.— Widespread weeds in tropical to temperate regions in E and SE Asia.

Ecology.— Lower montane forest, by roadsides and open areas, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: November-January.

Vernacular.— ม่วงลาย Muang lai (General).

Voucher specimens.— *P. Srisanga* 1216.

7. SCOPARIA L.

Sp. Pl.: 116. 1753; Yamazaki in Fl. Thailand 5(2): 217. 1990; Fischer in Fam. Gen. Vasc. Pl. 7: 385. 2004.

Annual herbs; stem erect, branched, 4-6-striate. **Leaves** opposite or whorled, linear to obovate, entire or serrate, glandular dotted beneath. **Flower** solitary and axillary or in fascicles at the nodes, ebracteolate. **Calyx** campanulate, 4-5-lobed. **Corolla** rotate, lower three lobes exterior in bud, 4-5-lobed, throat densely hairy. **Stamens** 4, subequal; filaments filiform; anther locules parallel, confluent. **Style** filiform; stigma capitate. **Capsule** globose or ovoid, loculicidally and septically 4-valved; valves thin. **Seeds** numerous, small, ellipsoidal or cylindrical, ridged, with thin reticulate testa.

About 20 species in tropical America, few species occurring as widespread weeds in the tropics. Only 1 species in Thailand (Yamazaki, 1990).

Scoparia dulcis L.

Sp. Pl.: 116. 1753; Kerr in Fl. Siam. Enum. 3(3): 186. 1962; Yamazaki in Fl. Thailand 5(2): 218. 1990.

Annual herb, 20-60 cm high; stem glabrous. **Leaves** opposite or 3-4-whorled, oblanceolate to obovate, 0.5-3 cm long, 0.2-1.5 cm wide, glabrous above, glandular dotted beneath; base cuneate, attenuate onto the petiole; apex acute; margin coarsely serrate; petioles, 2-5 mm long. **Flowers** 1-4 in fascicles at the nodes; pedicels 3-7 mm long, glabrous. **Calyx** 4, ca. 1.5 mm long in flower, 2.5 mm long in fruit; lobes almost to the base, oblong-ovate, subacute at apex, ciliate on margin. **Corolla** white, deeply 4-lobed, 2-3 mm long, throat with dense long white hairs; lobes oblong, obtuse at apex. **Capsule** globose, 2-3 mm long and wide. **Seeds** ca. 0.5 mm long and wide (Fig. 78).

Thailand.— Throughout the country.

- Distribution.— A native of tropical America, naturalized throughout the tropics.
 Ecology.— Lower montane forest, by roadsides and open areas, alt. 1,600-1,700 m (Doi Phu Kha).
 Phenology.— Flowering and fruiting: August-November.
 Vernacular.— หู้าหัวแมงฮุน Ya hua maeng hun (Northern), กระต่ายจาม Kratai cham (Bangkok), Macao tea.
 Voucher specimens.— *P. Srisanga* 1721.

8. *TORENIA* L.

Sp. Pl.: 619. 1753; Yamazaki in Fl. Thailand 5(2): 206. 1990; Fischer in Fam. Gen. Vasc. Pl. 7: 391. 2004.

Annual or perennial herbs; stem erect or prostrate, quadrangular. **Leaves** opposite, simple, serrate. **Inflorescence** in terminal or axillary racemes, or in subumbellate fascicles or flower solitary and axillary; pedicels 4-angled. **Calyx** tubular, bilabiate, 5-winged or keeled; upper lip 3-nerved and 3-lobed; lower lip 2-nerved and bilobed. **Corolla** bilabiate, upper two lobes exterior in bud; tube cylindric; upper lip broadly orbicular, entire or bilobed; lower lip with three spreading lobes. **Stamens** 4, all fertile, didynamous, anterior filaments each with or without a spur arising slightly above the base; anthers cohering in pairs, anther locules divaricate. **Ovary** obliquely lanceolate, apiculate, shortly scabrid hairs at the upper part; style filiform; stigma bilamellate. **Capsule** narrowly oblong or ellipsoidal, enclosed within persistent calyx, septicidally bivalved. **Seeds** numerous, small, shortly cylindrical or ellipsoidal, scrobiculate, rarely longitudinally ridged.

About 40 species in tropical to subtropical Asia. Eleven species in Thailand (Maxwell, 1989; Yamazaki, 1990). Five species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Anterior filaments each with a clavate spur arising slightly above the base
 2. Flower small, less than 1.5 cm long, yellow 2. *T. flava*
 2. Flower larger, more than 2 cm long, blue
 3. Calyx distinctly winged, wing 1-2 mm wide 1. *T. asiatica*
 3. Calyx keeled
 4. Corolla 3-4 cm long, glabrous except with long papillose around the upper half of the ovary inside the tube 3. *T. siamensis*
 4. Corolla 2.2-2.5 cm long, glabrous all over 5. *T. sp.*
1. Anterior filaments without spur 4. *T. violacea*

1. *Torenia asiatica* L.

Sp. Pl. 2: 619. 1753; in Fl. China 18: 39. 1998. – *T. glabra* Osbeck, Dagbok Ostind. Resa.: 210. 1757.

Annual herb, 10-30 cm high; stem prostrate, ridged, rooting at the nodes, sparsely hairy. **Leaves** elliptic to ovate, 15-35 mm long, 7-20 mm wide, sparsely hairy on both surfaces; base rounded or broadly cuneate; apex broadly acute; petioles 3-6 mm long, sparsely hairy. **Inflorescence** in terminal lax raceme or flower solitary and axillary. Bract linear, 2-4 mm long, sparsely hairy; pedicels 10-15 mm long, sparsely hairy. **Calyx** tubular, 10-15 mm long in flower, 14-17 mm long in fruit, 1-2 mm wide winged, sparsely hairy along wings. **Corolla** blue, 2-2.5 cm long. **Anterior filaments** each with a clavate spur arising slightly above the base; spur ca. 1 mm long. **Capsule** oblong-lanceolate, 12-15 mm long, 2-3 mm wide. **Seeds** ellipsoidal, ca. 0.3 mm long and wide, scrobiculate.

Thailand.— Northern: Nan.

Distribution.— India (Assam), Nepal, Bhutan, Sikkim, China, Vietnam.

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Span Waterfall, Doi Phu Kha).

Phenology.— Flowering and fruiting: June-October.

Voucher specimens.— *P. Srisanga* 1548, 2579.

Notes.— New recorded for Thailand.

2. *Torenia flava* Ham. ex Benth.

Scroph. Ind.: 38. 1835; Kerr in Fl. Siam. Enum. 3(2): 170. 1954; Yamazaki in Fl. Thailand 5(2): 207. 1990.

Annual herb, 10-30 cm high; stem laxly branched or simple, erect, ridged, patently hirsute. **Leaves** elliptic to ovate, 15-35 mm long, 7-20 mm wide, sparsely hirsute on both surfaces; base cuneate to rounded; apex acute; petioles up to 10 mm long, hirsute or sessile upwards. **Inflorescence** in terminal raceme or flower solitary and axillary. Bracts linear-lanceolate, 3-7 mm long, hirsute; pedicels 4-7 mm long, hirsute. **Calyx** tubular, 5-9 mm long in flower, 10-15 mm long in fruit, keeled, pubescent. **Corolla** yellow, 8-10 mm long. **Anterior filaments** each with a clavate spur arising slightly above the base; spur ca. 1 mm long. **Capsule** oblong-lanceolate, 8-10 mm long, 2-3 mm wide. **Seeds** ellipsoidal, ca. 0.3 mm long and wide, scrobiculate.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Phitsanulok, Sukhothai; Eastern: Nakhon Ratchasima; South-western: Kanchanaburi; Peninsular: Chumphon, Surat Thani, Ranong, Satun.

Distribution.— India (Assam-type), Myanmar, S China, Laos, Vietnam, Malaysia, Indonesia.

Ecology.— Dry evergreen forest, open shady ground, alt. 800-900 m (Span Waterfall, Doi Phu Kha).

Phenology.— Flowering and fruiting: June-September.

Voucher specimens.— *P. Srisanga* 1966.

3. *Torenia siamensis* Yamazaki

J. Jap. Bot. 53: 103, fig. 5-6. 1978; in Fl. Thailand 5(2): 209, fig. 50: 2-4, pl. XVI:10. 1990.

Annual herb, 20-60 cm high; stem erect or prostrate, simple or laxly branched at base, ridged, rooting at the nodes or not, glabrous or sparsely hairy at the nodes. **Leaves** broadly lanceolate to elliptic, 2.5-4.5 cm long, 1-2.5 cm wide, scabrous above, glabrous or sparsely hairy on the nerves beneath; base truncate to subcordate; apex acute; petioles up to 1.5 mm long or sessile. **Inflorescence** in 2-6-flowered fascicles at the nodes or at the ends of the branches or flower solitary and axillary. Bracts linear, 1-4 mm long; pedicels 7-20 mm long, sparsely hairy. **Calyx** tubular, 16-23 mm long, keeled, minutely scabrous. **Corolla** blue, 3-4 cm long, glabrous except with long papillose around the upper half of the ovary inside the tube. **Anterior filaments** each with a clavate spur arising 2-3 mm above the base; spur 2-3 mm long. **Capsule** oblong-lanceolate, 11-16 mm long, 2-3 mm wide. **Seeds** ellipsoidal, 0.3-0.5 mm long and wide, scrobiculate.

Thailand.— Northern: Nan, Phitsanulok (type: *Murata et al.* T. 1715: KYO); North-eastern: Phetchabun; Eastern: Chaiyaphum.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, alt. 1,100-1,200 m (Nan Watershed, Doi Phu Kha).

Phenology.— Flowering and fruiting: July-September.

Vernacular.— มณฑลเชียรสยาม Mon tien siam (Phitsanulok).

Voucher specimens.— *P. Srisanga & C. Maknoi* 2079.

Notes.— Rare species.

4. *Torenia violacea* (Azaola ex Blanco) Pennell

J. Arn. Arb. 24: 255. 1943; Yamazaki in Fl. Thailand 5(2): 212, fig. 50: 7-9. 1990. — *Mimulus violaceus* Azaola ex Blanco, Fl. Philip. ed. 2: 357. 1845. — *Torenia peduncularis* Benth. ex Hook.f. in Fl. Br. Ind. 4: 276. 1884; Bonati in Fl. Gén. I.-C. 4: 394. 1927, incl. var. *harmandii* Bonati. — *T. edentula* Griff. ex Benth. in DC., Prodr. 10: 410. 1846; Kerr in Fl. Siam. Enum. 3(2): 169. 1954.

Annual herb; stems erect to diffuse, 10-40 cm high, sparsely hirsute on angles. **Leaves** elliptic to ovate, membranous, 1-3.5 cm long, 0.6-2.5 cm wide, sparsely pubescent above, glabrous or sparsely pubescent on the nerves beneath; base broadly cuneate, rounded to subtruncate; apex acute to broadly acute; petioles 5-13 mm long, sparsely pubescent. **Inflorescence** of 2-4-flowered in terminal subumbels or flower solitary and axillary. Bracts linear, 1-3 mm long; pedicels 0.5-2 cm long, glabrous or sparsely pubescent. **Calyx** ovate or oblong-ovate, 10-15 mm long, 5-7 mm wide including 1.5-2 mm wide winged, base decurrent into the pedicel, pubescent on the ridge of the wings. **Corolla** white with a part of the lobes blue, 18-25 mm long.

Anterior filaments without spur. **Capsule** oblong, 8-10 cm long, 2.5-3 mm wide. **Seeds** globose-ellipsoidal, ca. 0.3 mm long and wide, scrobiculate.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Nan; North-eastern: Loei; South-eastern: Chanthaburi; Central: Saraburi; South-western: Kanchanaburi, Prachuap Khiri Khan; Peninsular: Phangnga, Yala, Satun.

Distribution.— India, Sikkim, Bhutan, China, Cambodia, Laos, Vietnam, Malaysia, Indonesia, Philippines (type), New Guinea.

Ecology.— Lower montane forest, open marshy places, alt. 1,100-1,200 m (Nan Watershed, Doi Phu Wae, Doi Phu Kha).

Phenology.— Flowering and fruiting: July-October.

Vernacular.— หล้าหิ้งน้อย Ya hing noi (Northern), แวมยูรา Waeo mayura (Central).

Voucher specimens.— *P. Srisanga* 2171; *P. Srisanga* & *C. Maknoi* 2080.

5. *Torenia* sp.

Annual herb, 10-30 cm high; stem erect or prostrate, simple or laxly branched at base, ridged, rooting at the nodes or not, sparsely pubescent. **Leaves** chartaceous, elliptic to ovate, 1.2-4 cm long, 0.6-2 cm wide, scabrous on both surfaces; base broadly cuneate, rounded to subtruncate; apex acute; petioles 1-3 mm long, sparsely pubescent. **Inflorescence** in 2-4-flowered fascicles at the nodes or at the ends of the branches or flower solitary and axillary. Bracts linear, 1-2 mm long; pedicels 9-17 mm long, pubescent. **Calyx** tubular, 10-15 mm long, keeled, scabrous. **Corolla** blue, 2.2- 2.5 cm long, glabrous. **Anterior filaments** each with a clavate spur arising ca. 1 mm above the base; spur 1-2 mm long. **Capsule** oblong-lanceolate, 10-15 mm long, 2-3 mm wide. **Seeds** cylindrical, ca. 0.3 mm long and wide, scrobiculate.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-December.

Voucher specimens.— *P. Srisanga* 1120.

Notes.— Possibly new species. Closed to *Torenia pierreana* Bonati but differs in the degree of hairiness on the stem and leaves; and the corolla size and colour.

9. *WIGHTIA* Wall.

Pl. As. Rar. 1: 71, fig. 81. 1830; Yamazaki in Fl. Thailand 5(2): 142. 1990; Fischer in Fam. Gen. Vasc. Pl. 7: 374. 2004.

Hemi-epiphytic, evergreen trees or pseudo-lianas. **Leaves** opposite, petiolate, coriaceous, entire, with conspicuous glands near the nerve axils beneath. **Inflorescence** in axillary thyrses. **Flowers** densely stellate tomentose. **Calyx**

campanulate, 3-5-lobed. **Corolla** tube incurved, distally gradually enlarged; upper lip erect, bilobed, lower lip spreading, 3-lobed. **Stamens** 4, didynamous, exerted, pilose near the base; anthers oblong-ovate, glabrous. **Ovary** oblong-ovate, glabrous. **Capsule** oblong or oblong-lanceolate, septicidally bivalved. **Seeds** numerous, linear, with hyaline winged testa.

Two species from Himalayas, Myanmar to SW China and Malesia. One species in Thailand (Yamazaki, 1990).

Wightia speciosissima (D. Don) Merr.

J. Arn. Arb. 19: 67. 1938; Yamazaki in Fl. Thailand 5(2): 142, pl. XVI: 11. 1990. – *Gmelina speciosissima* D. Don, Prodr. Fl. Nepal.: 104. 1825. – *Wightia gigantea* Wall., Pl. As. Rar. 1: 71, fig. 81. 1830; Kerr in Fl. Siam. Enum. 3(2): 152. 1954. – *W. elliptica* Merr., J. Arn. Arb. 19: 66. 1938. – *Gmelina siamica* Mold., Phytologia 5: 226. 1955.

Hemi-epiphytic tree, up to 15 m high. **Leaves** elliptic or ovate-elliptic, 10-25 cm long, 7-13 cm wide, glabrous above, glabrous or stellate tomentose beneath; base cuneate to rounded; apex acute; petioles 1.5-3 cm long. **Inflorescence** 10-20 cm long, many-flowered; peduncles and pedicels densely stellate tomentose. **Calyx** 6-7 mm long, densely stellate tomentose, 3-5-lobed; lobes orbicular or ovate, rounded to obtuse or broadly acute at apex. **Corolla** pink, 2.5-3.5 cm long, densely stellate tomentose; upper lip 6-8 mm long, bilobed, lobes ovate; lower lip 6-7 mm long, 3-lobed, lobes orbicular. **Stamens** 2-3 cm long. **Capsule** oblong to lanceolate, 2.5-4 cm long, 0.7-1 cm wide, smooth. **Seeds** 6-7 mm long, 1-1.5 mm wide, including wing.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Phitsanulok; North-eastern: Loei; Eastern: Nakhon Ratchasima; South-eastern: Chanthaburi.

Distribution.— Nepal (type), Sikkim, Bhutan, India, Myanmar, S China, N Vietnam.

Ecology.— Lower montane scrub, on limestone rocks, alt. 1,600-1,700 m (Doi Phu Wae).

Phenology.— Flowering: October-December; fruiting: December-February.

Vernacular.— ชมพูพาน Chom phu phan (Chiang Mai).

Voucher specimens.— *P. Srisanga* 422, 423.



Figure 71. *Alectra avensis* (Benth.) Merr.

A. habit; B. opened corolla; C. fruiting calyx and capsule.

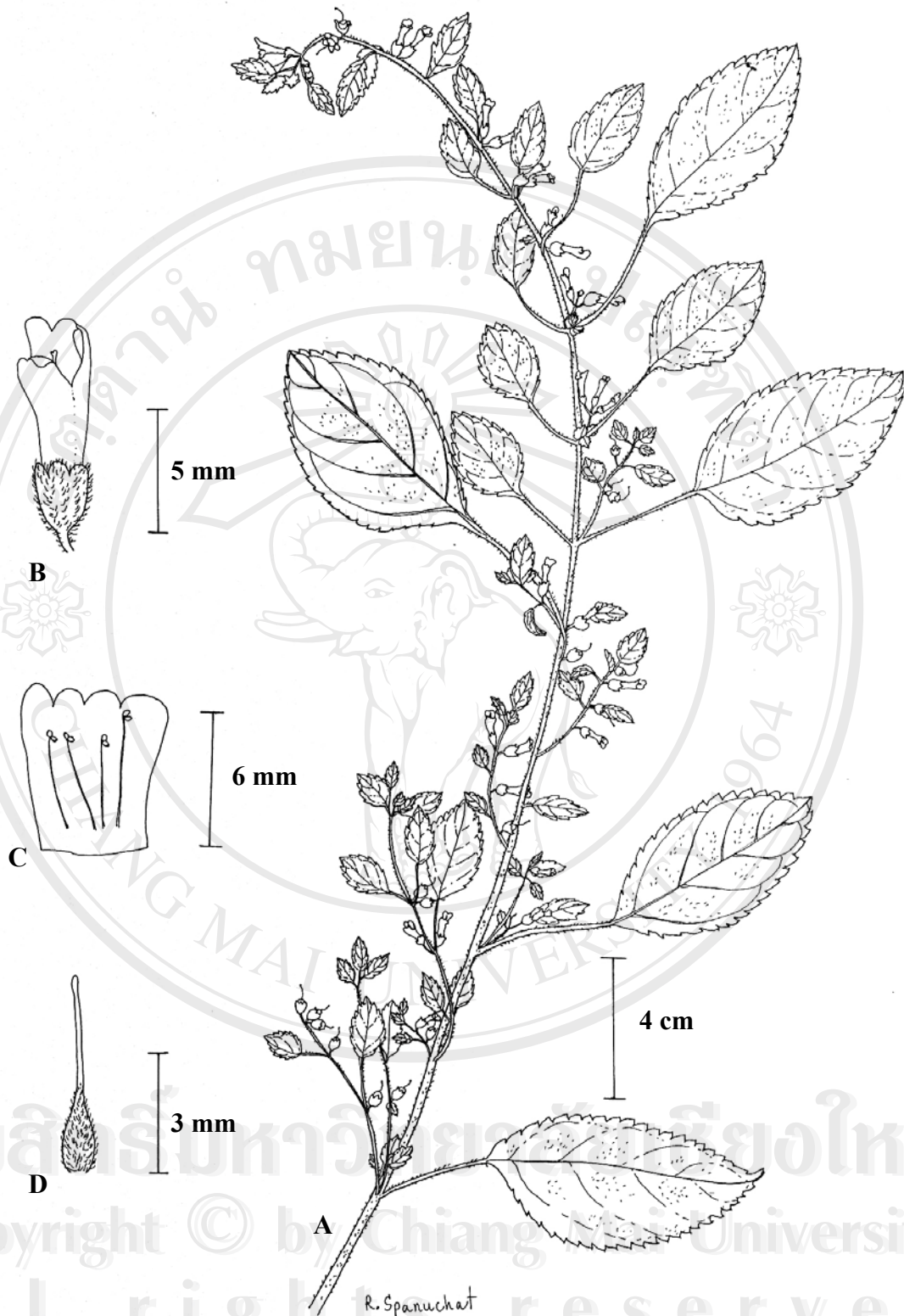


Figure 72. *Lindenbergia indica* (L.) Vatke

A. habit; B. flower; C. opened corolla; D. pistil.

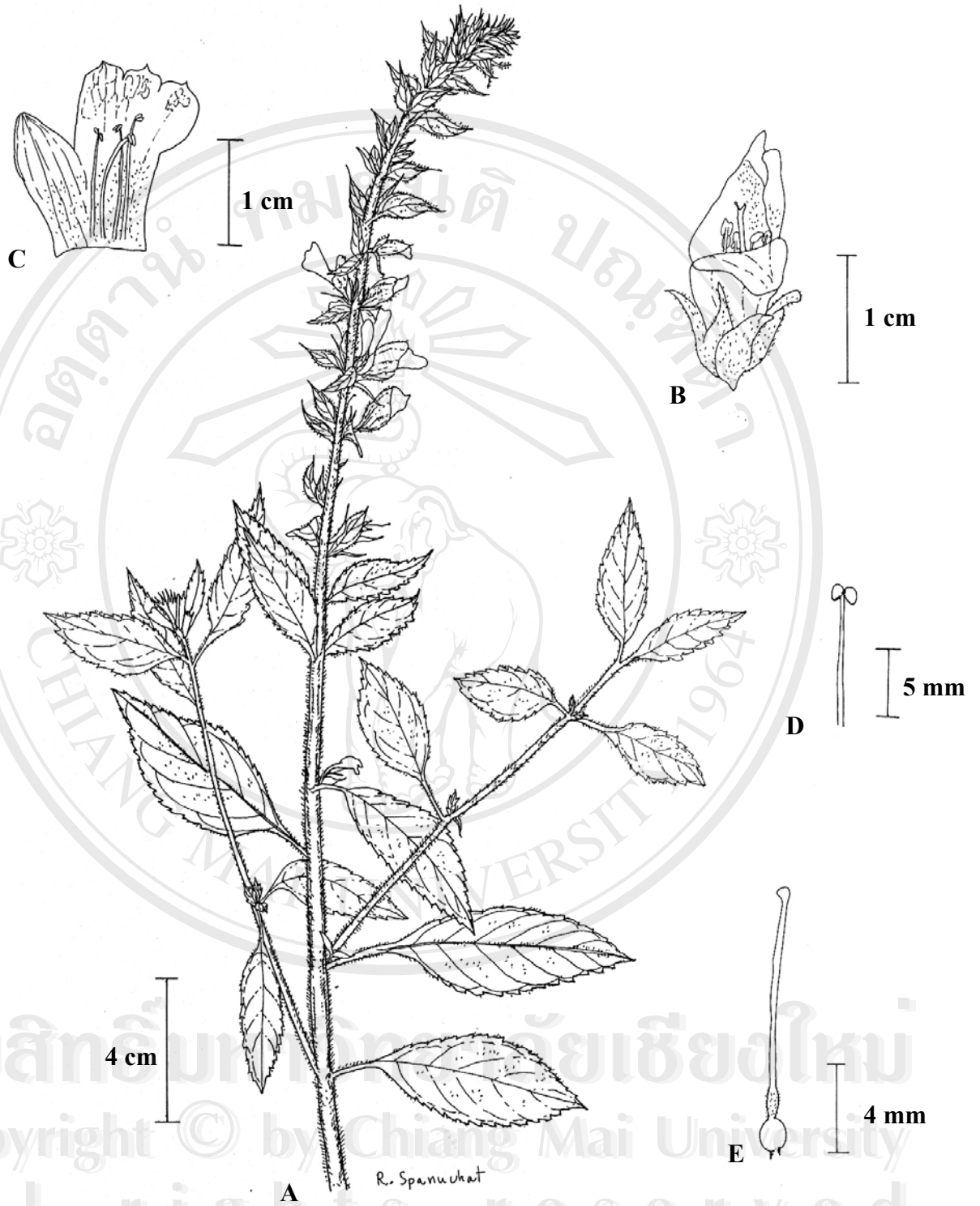


Figure 73. *Lindenbergia philippensis* (Cham.) Benth.

A. habit; B. flower; C. opened corolla; D. stamen; E. pistil.



Figure 74. *Lindernia dictyophora* Tsoong ex Tsoong & Ku

A. habit; B. flower; C. opened corolla; D. capsule with fruiting calyx; E. ovary cross-section.

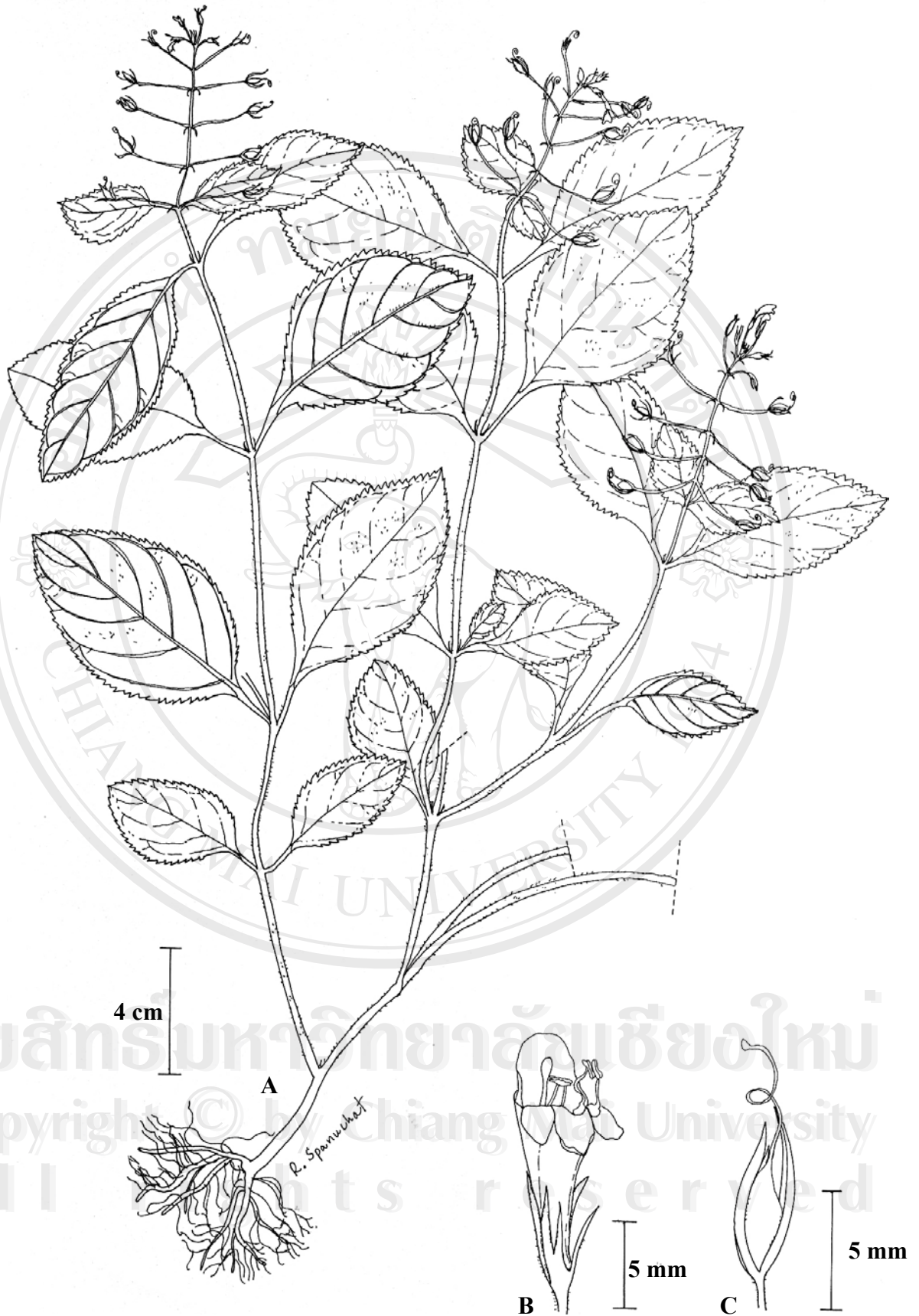


Figure 75. *Lindernia latifolia* (Bl.) Koord.

A. habit; B. flower; C. capsule with fruiting calyx.

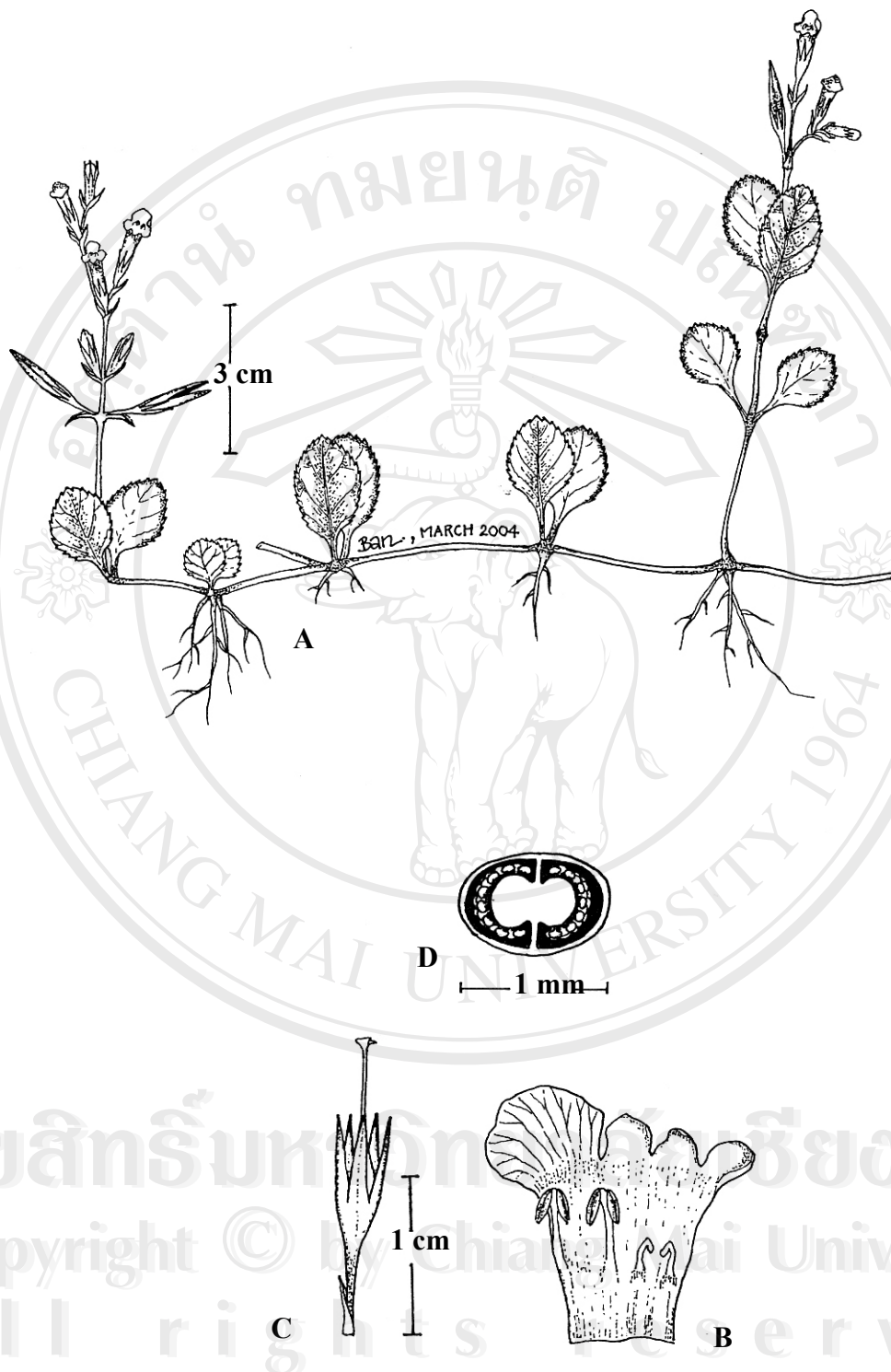


Figure 76. *Lindernia ruelloides* (Colsm.) Pennell

A. habit; B. opened corolla; C. calyx and pistil; D. ovary cross-section.

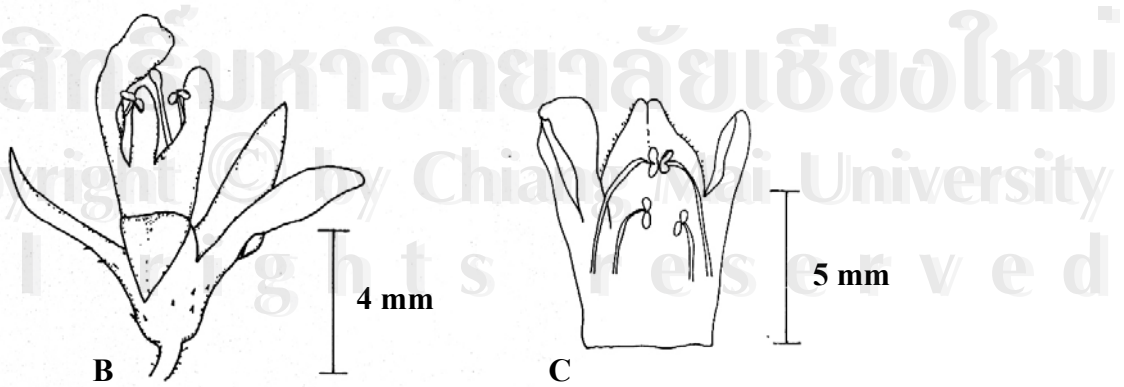


Figure 77. *Mazus pumilus* (Burm.f.) Steenis

A. habit; B. flower; C. opened corolla.

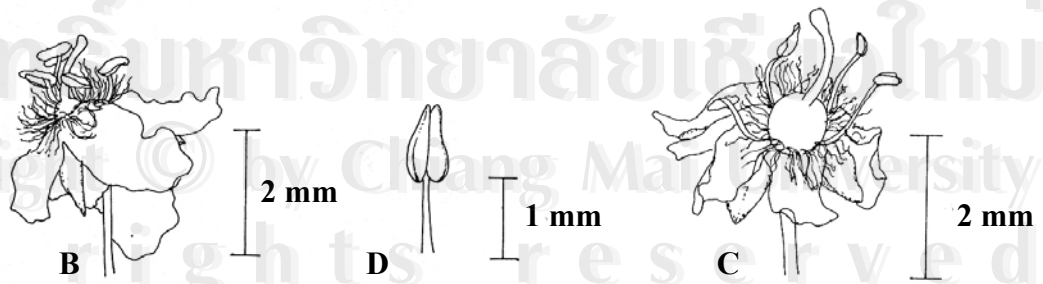


Figure 78. *Scoparia dulcis* L.

A. habit; B-C. flower; D. stamen.

SIMAROUBACEAE

Trees or shrubs, usually with a bitter bark. **Leaves** pinnately compound or unifoliolate, rarely simple, alternate, rarely opposite; stipules sometimes present. **Inflorescence** axillary, rarely terminal, racemes, cymes or thyrses. **Flowers** bisexual or unisexual, actinomorphic. **Sepals** 3-5, almost always partly connate, valvate to slightly imbricate. **Petals** 3-5, free, imbricate or valvate. **Stamens** the same as or twice the number of the petals, rarely numerous, inserted at the base of an intrastaminal disc, sometimes with a scale at the base; anthers 2-locular, opening by longitudinal slits. **Ovary** superior, 1-5-locular or carpels free; styles 1-5; ovules usually 1-2 rarely more in each loculus, apical or basal. **Fruit** drupaceous or samara.

Thirteen genera and about 110 species mainly in the tropical region, with the centers in the New World. Five genera and 7 species in Thailand (Nooteboom, 1981a). Two genera and 2 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Stipule absent. Inflorescence a narrow thyrses. Petals small and not enlarged in fruit
1. *Brucea*
1. Stipule present, caducous. Inflorescence a compound cymose. Petals distinct, persistent and enlarged in fruit
2. *Picrasma*

1. *BRUCEA* J.E. Mill.

Icon.: t. 25. 1779, nom. cons.; Nooteboom in Fl. Thailand 2(4): 441. 1981.

Monoecious or dioecious shrubs or small trees; stipules absent. **Leaves** imparipinnate; leaflets 3-15, opposite, more or less oblique at base. **Inflorescence** a narrow thyrses. **Flowers** 4-merous. **Sepals** connate at the base, imbricate, small. **Petals** free, imbricate, small. Disc thick with 4 lobes. **Stamens** with an adaxial scale; filaments short, inserted between the lobes under the outer margin of the disc; anthers cordate-ovate. **Carpels** free; ovule 1 in each loculus; stigmas club-shaped. **Fruit** drupaceous.

Eight species in the Old World tropics (Mabberley, 1997). Two species in Thailand (Nooteboom, 1981a). Only 1 species recorded from Doi Phu Kha National Park.

Brucea mollis Wall. ex Kurz

J. As. Soc. Beng. 42(2): 64. 1873; Craib in Fl. Siam. Enum. 1: 241. 1926; Nooteboom in Fl. Thailand 2(4): 442. 1981.

Shrub or small tree, 1-8 m high. **Leaves** 20-60 cm long; leaflets 3-13, lanceolate, elliptic to ovate, 4-10 cm long, 1-5 cm wide, pubescent; base cuneate and broadly oblique; apex acuminate; margin entire or coarsely serrate; primary veins 4-9 (-11) pairs; petioles 2-13 cm long; lateral petiolules 2-10 mm long; terminal one 3-40

mm long. **Inflorescence** axis 7-60 cm long, pubescent. **Flowers** green, pubescent; pedicels of the female flower up to 6 mm long. **Sepals** lanceolate, 0.5-1 mm long, pubescent. **Petals** ovate to obovate, 1-2 mm long, pubescent. **Filaments** subulate, ca. 0.5 mm long; anthers ca. 0.5 mm long. **Carpels** ovate, ca. 1 mm long, pubescent. **Drupes** 1-2(-3) together, 9-13 mm long.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Tak; South-western: Kanchanaburi.

Distribution.— India, Myanmar, Laos, Cambodia, Philippines (type).

Ecology.— Lower montane scrub, open ground among limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering: February-April; fruiting: October-December.

Voucher specimens.— *P. Srisanga et al.* 2442.

2. *PICRASMA* Bl.

Bijdr.: 247. 1825; Nootboom in Fl. Thailand 2(4): 446. 1981.

Monoecious or dioecious trees or shrubs; stipules triangular, ovate or orbicular, early caducous. **Leaves** imparipinnate; leaflets opposite or subopposite; base of the petiole and the rachis nodes swollen, shrunken when dry. **Inflorescence** a compound cymose. **Flowers** 4-5-merous; the female flower usually twice as large as the male; pedicels articulated in the lower half. **Sepals** free to united halfway up, persistent. **Petals** valvate or subvalvate, persistent and enlarged in fruit. **Stamens** without an adaxial scale; filaments inserted at the base of the disc. **Carpels** up to 7, free; ovule 1 in each loculus, basal; stigmas filiform. **Fruit** drupaceous.

Eight species: 6 species in tropical America and 2 species in E and SE Asia (Nootboom, 1962; Mabberley, 1997). One species in Thailand (Nootboom, 1981a).

Picrasma javanica Bl.

Bijdr.: 248. 1825; Craib in Fl. Siam. Enum. 1: 240. 1926; Nootboom in Fl. Thailand 2(4): 447. 1981.

Tree up to 20 m high; bark grey to brown, smooth, fissured; stipules suborbicular, foliaceous, flabellately veined, acute at base, rounded at apex, 7-25 mm long, 5-20 mm wide, early caducous, leaving a rather large scar. **Leaves** 6-15 cm long; leaflets 5-9, lanceolate to elliptic, 4-20 cm long, 1-10 cm wide; base cuneate and broadly oblique; apex acuminate to cuspidate; margin entire; primary veins 3-8 pairs; petioles 2-6 cm long; lateral petiolules 0-7 mm; terminal one 5-25 mm long. **Inflorescence** axis up to 20 cm long; bracts obovate, rounded, very early caducous. **Flowers** 4-merous, white, yellow or green; pedicels up to 7 mm long in male and ca. 10 mm long in female flowers. **Sepals** triangular to ovate, ca. 1 mm long, glabrous to puberulous. **Petals** ovate-oblong or oblong, 2-5 mm long, 1-2 mm wide in male and 3-7 mm long, 3-5 mm wide in female flowers and enlarged to 7-13(-17) mm long, 5-9 mm wide in fruit, glabrous to sparsely hairy. Disc 4-lobed, 0.5-1 mm high, hairy.

Stamens usually longer than petals in male, shorter than petals in female flowers; filaments hairy at the base, 1-5 mm long in male and 0.5-2 mm long in female flowers; anthers 1-2 mm long in male and up to 1 mm long in female flowers. **Carpels** up to 4, ovate, glabrous or puberulous; styles 1-1.5 mm long, stigmas ca. 2 mm long. **Drupes** 1-4 together, green to red or dark blue, ovoid to depressed globose, 7-12 mm long and wide.

Thailand.— Northern: Chiang Mai, Lampang, Phrae, Nan, Tak, Phitsanulok; North-eastern: Phetchabun, Loei; South-eastern: Chon Buri, Chanthaburi; South-western: Kanchanaburi; Peninsular: Nakhon Si Thammarat, Trang.

Distribution.— India, Sikkim, SE Asia, and southwards to Malesia. Indonesia (Java-type).

Ecology.— Deciduous and dry evergreen forest, often by streams, alt. 700-900 m (Doi Phu Kha).

Phenology.— Flowering: February-April; fruiting: May-August.

Uses.— The bark used as febrifuge.

Vernacular.— กอหม่อม Kom khom (Northern).

Voucher specimens.— *P. Srisanga* 562, 582, 1474; *P. Srisanga & C. Maknoi* 2101.

SOLANACEAE

Trees, shrubs, herbs or climbers with simple, branched or stellate hairs, sometimes glandular and often prickles. **Leaves** simple, 3-foliolate or pinnately compound, alternate; stipules absent. **Inflorescence** terminal or axillary, cymose, racemose, paniculate, umbellate, clusters or flower solitary. **Flowers** bisexual, actinomorphic. **Sepals** (4-)5(-9) or subtruncate with 5-10 teeth, mostly persistent. **Petals** (4-)5(-9), sympetalous; lobes usually plicate, imbricate or valvate. **Stamens** 5 (-9), rarely 4 or 2 fertile with 2 staminodes, alternate with the corolla lobes and inserted within corolla tube; anthers 2-locular, loculi parallel, opening by longitudinal slits or by terminal pores. **Ovary** superior, 2(-5)-locular, the loculi sometimes again divided by a false septum, axile placentation; style terminal; ovules usually numerous. **Fruit** a berry or capsule.

An almost cosmopolitan family with about 94 genera and 2,950 species especially S America (Mabberley, 1997). Twelve genera and about 36 species in Thailand. A family contains many important foods: *Lycopersicon esculentum* Mill. (Tomato), *Solanum tuberosum* L. (Potato), *Solanum* spp. (Egg plant) etc.; spices: *Capsicum* spp. (Chili and Sweet pepper); medicines: *Atropa belladonna* L., *Datura* spp., *Solanum* spp.; ornamentals: *Brugmansia* spp., *Brunfelsia* spp., *Cestrum* spp., *Petunia hybrida* (Hook.) Vilm., *Solanum* spp. etc. and economical plants: *Nicotiana tabacum* L. (Tobacco). Two genera and 5 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Calyx more or less truncate with 5-10 teeth 1. *Lycianthes*
 1. Calyx distinctly divided into tube and lobes 2. *Solanum*

1. *LYCIANTHES* (Dunal) Hassler

Annuaire Conserv. Jard. Bot. Genève 20: 180. 1917; Zhang, Lu & D'Arcy in Fl. China 17: 325. 1994. – *Solanum* subgenus *Lycianthes* Dunal in DC., Prodr. 13(1): 161. 1852. – *Solanum* sect. *Lycianthes* (Dunal) Wettst. in Pflanzenfam. 4 (36): 22. 1891.

Shrubs or herbs, unarmed, glabrous or pubescent. **Leaves** simple, mostly entire. **Inflorescence** 1-10-flowered fascicles in leaf axils or flower solitary. **Flowers** pedicellate. **Calyx** cup-shaped or campanulate, more or less truncate with 5-10 teeth. **Corolla** rotate or stellate, shallowly to deeply divided to 5 lobes. **Stamens** 5; filaments short, equal; anthers often connivent or connate around the style, opening by terminal pores. **Ovary** 2-locular; style glabrous; ovules small, numerous. **Fruit** a berry.

About 200 species in tropical and subtropical regions especially S America but except from Africa (Mabberley, 1997). About 4 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Branchlets, leaves, pedicels and calyx pubescent 1. *L. biflora*
 1. Branchlets, leaves, pedicels and calyx glabrous or subglabrous 2. *L. neesiana*

1. *Lycianthes biflora* (Lour.) Bitter

Abh. Naturwiss. Vereine Bremen 24: 461. 1920; Kerr in Fl. Siam. Enum. 3(2): 145. 1954; Zhang, Lu & D'Arcy in Fl. China 17: 326. 1994. – *Solanum biflorum* Lour., Fl. Cochinch.: 129. 1790. – *S. decemdentatum* Roxb., Fl. Ind. ed. Carey & Wall. 2: 247. 1824.

Small shrub up to 1.5 m high; stem rather zig-zag; branchlets densely brown pubescent of moniliform hairs. **Leaves** elliptic to ovate, usually in pair with different size: larger leaves 6-15 cm long, 3-7.5 cm wide; smaller leaves 2-4 cm long, 1.5-2 cm wide, sparsely to densely pubescent especially below; base cuneate, more or less oblique; apex acuminate; petioles of larger leaves 1-2 cm long, of smaller leaves 0.1-0.4 cm long, pubescent. **Inflorescence** 2-6-flowered fascicles in leaf axils or rarely flower solitary; pedicels 5-10 mm long, pubescent. **Calyx** tube cup-shaped, truncate, 3-5 mm long, pubescent; teeth 10, linear-subulate, equal, 2-3 mm long, pubescent. **Corolla** pink to purple, 8-10 mm long, sparsely hairy; lobes deeply divided. **Filaments** 0.5-1 mm long; anthers 3-4 mm long, glabrous to sparsely pubescent.

Style 7-8 mm long. **Berry** red, globose, 6-9 mm long and wide. **Seeds** pale yellow, obliquely kidney-shaped, 1-2 mm long and wide.

Thailand.— Northern: Chiang Mai, Nan; Central: Bangkok; Peninsular: Surat Thani, Pattani.

Distribution.— India, China, Japan, SE Asia (Vietnam-type) to New Guinea.

Ecology.— Lower montane forest and lower montane scrub, alt. 1,600-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: August-January.

Voucher specimens.— *P. Srisanga* 1754, 2651; *P. Srisanga* & *C. Maknoi* 1994.

2. *Lycianthes neesiana* (Wall. ex Nees) D'Arcy & Z.Y. Zhang

Novon 2: 126. 1992; Zhang, Lu & D'Arcy in Fl. China 17: 327. 1994. — *Solanum neesiana* Wall. ex Nees, Trans. Linn. Soc. London 17: 42. 1837. — *S. subtruncata* Wall. ex Dunal in DC., Prodr. 13(1): 180. 1852. — *Lycianthes subtruncata* (Wall. ex Dunal) Bitter, Abh. Naturwiss. Vereine Bremen 24: 478. 1920; Kerr in Fl. Siam. Enum. 3(2): 147. 1954.

Small shrub up to 2 m high; branchlets glabrous to subglabrous. **Leaves** lanceolate to elliptic, usually in pair with different size: larger leaves 4-16 cm long, 2.5-7 cm wide; smaller leaves 3-7 cm long, 1-3 cm wide, glabrous; base cuneate, slightly oblique; apex acuminate; petioles of larger leaves 1.5-2.5 cm long, of smaller leaves 0.3-0.8 cm long, glabrous. **Inflorescence** 2-6-flowered fascicles in leaf axils; pedicels 1-2.5 cm long, glabrous. **Calyx** campanulate, subtruncate, 2.5-3.5 mm long, glabrous; teeth 5-10, lanceolate, slightly thick, unequal, 0.5-1 mm long, glabrous. **Corolla** pink to purple, 9-11 mm long, glabrous; lobes deeply divided. **Filaments** ca. 0.5 mm long; anthers 3-4 mm long, glabrous. **Style** 7-8 mm long. **Berry** red, globose, 5-8 mm long and wide. **Seeds** pale yellow, obliquely kidney-shaped, 1-2 mm long and wide.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India (type), China, SE Asia.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: May-June; fruiting: August-December.

Voucher specimens.— *P. Srisanga* 1385.

2. *SOLANUM* L.

Sp. Pl.: 184. 1753; Zhang, Lu & D'Arcy in Fl. China 17: 325. 1994.

Trees, shrubs, herbs or climbers with simple, branched or stellate hairs, sometimes glandular and often prickles. **Leaves** simple or pinnately compound, alternate, entire dentate or lobed. **Inflorescence** terminal or axillary, cymose, racemose, paniculate, umbellate, clusters or flower solitary. **Flowers** usually 5-merous. **Calyx** cup-shaped or campanulate, distinctly lobes. **Corolla** campanulate,

rotate or stellate; lobes usually plicate. **Filaments** short, equal; anthers often connivent or connate around the style, opening by terminal pores, often later splitting longitudinally. **Ovary** 2(-5)-locular; style glabrous or pubescent; ovules small, numerous. **Fruit** a berry, sometimes fruiting calyx enlarged and enclosing berry.

About 1,700 species subcosmopolitan especially S America (Mabberley, 1997). About 21 species, native, introduced or naturalized in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|-------------------------|
| 1. Plants glabrous or pubescent but not stellate hairs | |
| 2. Herb. Filaments and style pubescent | 1. <i>S. americanum</i> |
| 2. Small shrub. Filaments and style glabrous | 3. <i>S. spirale</i> |
| 1. Plants with densely stellate hairs | 2. <i>S. erianthum</i> |

1. *Solanum americanum* Mill.

Gard. Dict. ed. 8, no. 5. 1768; Zhang, Lu & D'Arcy in Fl. China 17: 317. 1994.

Erect annual herb up to 1 m high; branchlets glabrous to puberulous. **Leaves** lanceolate to ovate, membranous, (2-)4-10 cm long, (1-)2-3.5 cm wide, glabrous to sparsely puberulous; base cuneate, attenuate onto the petiole, slightly oblique; apex acute to acuminate; petioles 0.5-1.5 cm long, glabrous to puberulous. **Inflorescence** subumbellate, 3-6(-10)-flowered; peduncle 1-2 cm long, puberulous; pedicels 5-10 mm long, puberulous. **Calyx** cup-shaped, 1-1.5 mm long, puberulous; lobes about halfway, not enlarged in fruit. **Corolla** white, 3-4 mm long, sparsely hairy, ciliate at margin; lobes about halfway. **Filaments** ca. 0.5 mm long, sparsely pubescent; anthers 1-1.5 mm long, glabrous. **Style** ca. 2 mm long, pubescent. **Berry** black, globose, 5-8 mm long and wide. **Seeds** discoid, ca. 1 mm long and wide.

Thailand.— Almost throughout the country.

Distribution.— Widespread in all tropical and temperate regions (USA-type).

Ecology.— A common weeds of cultivation especially in high elevation, by roadsides and open areas, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: almost throughout the year.

Uses.— Leaves edible.

Voucher specimens.— *P. Srisanga* 1485.

2. *Solanum erianthum* D. Don

Prodr. Fl. Nepal.: 96. 1825; Zhang, Lu & D'Arcy in Fl. China 17: 316. 1994. – *S. verbascifolium* sensu Kerr in Fl. Siam. Enum. 3(2): 144. 1954 non L.

Shrub up to 5 m high, unarmed, all parts densely stellate tomentose. **Leaves** elliptic to broadly ovate, 10-30 cm long, 5-12 cm wide; base broadly cuneate, more or

less oblique; apex acute to acuminate; petioles 2-7 cm long. **Inflorescence** in terminal or axillary panicles; peduncle 3-10 cm long; pedicels 2-5 mm long. **Calyx** campanulate, 5-7 mm long; lobes nearly about halfway, slightly or not enlarged in fruit. **Corolla** white; tubes 2-3 mm long; lobes 6-8 mm long. **Filaments** ca. 1 mm long; anthers 2-3 mm long. **Style** 4-6 mm long, glabrous. **Berry** yellowish brown, globose to subglobose, 0.8-1.3 cm long and wide. **Seeds** discoid, 1-2 mm long and wide.

Thailand.— Almost throughout the country.

Distribution.— Native from S America, widespread in tropical Asia and Oceania.

Ecology.— Dry evergreen forest, disturbed areas, alt. 600-700 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering and fruiting: almost throughout the year.

Vernacular.— ฟานเป้ง Fa paeng (Northern).

Voucher specimens.— *P. Srisanga* 329.

3. *Solanum spirale* Roxb.

Fl. Ind. ed. Carey & Wall. 2: 247. 1824; Kerr in Fl. Siam. Enum. 3(2): 142. 1954; Zhang, Lu & D'Arcy in Fl. China 17: 317. 1994.

Small shrub up to 2 m high; branchlets angulate, glabrous to glabrescent. **Leaves** lanceolate to ovate, usually in pair with different size: larger leaves 9-15 cm long, 3.5-5 cm wide; smaller leaves 4-7 cm long, 1-3 cm wide, glabrous; base cuneate, attenuate onto the petiole, slightly oblique; apex acute to acuminate; petioles 5-13 mm long, glabrous. **Inflorescence** in simple scorpioid racemes; peduncle 3-10 mm long, glabrous; pedicels 6-11 mm long, glabrous to sparsely puberulous. **Calyx** cup-shaped, 1-2 mm long, glabrous to sparsely puberulous; lobes short, not enlarged in fruit. **Corolla** white, 5-6 mm long, sparsely hairy, ciliate at margin; lobes deeply divided. **Filaments** ca. 0.5 mm long, glabrous; anthers 2.5-3 mm long, glabrous. **Style** 5-6 mm long, glabrous. **Berry** yellowish orange, globose, 1-1.5 cm long and wide. **Seeds** discoid, 2-3 mm long and wide.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India (Assam-type), Myanmar, China, Laos, Vietnam.

Ecology.— Lower montane forest, by roadsides and open areas, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: May-July; fruiting: June-December.

Uses.— Leaves edible.

Vernacular.— ผักดีด Phak dit (Northern).

Voucher specimens.— *P. Srisanga* 1437.

SONNERATIACEAE

Trees, evergreen or deciduous for a short period. Pneumatophores conspicuous (*Sonneratia* L.f.) or lacking (*Duabanga* Buch.-Ham.). **Leaves** simple, opposite or whorled, coriaceous, entire, glabrous. **Inflorescence** terminal, 3- or more-flowered cymes or flower solitary. **Flowers** large, showy, actinomorphic. **Calyx** 4-8, valvate, connate into a tube, thick. **Petals** free, as many as calyx-lobes or lacking. **Stamens** numerous, inflexed in bud, inserted on calyx-tube. **Ovary** superior, 4-20-celled; ovules numerous on thick axile placentas. **Fruit** an indehiscent berry or loculicidal capsule on accrescent calyx-tube. **Seeds** numerous, embedded in firm pulp or not.

Two small genera: *Duabanga* Buch.-Ham., 2 species, component of tropical evergreen rain forests and *Sonneratia* L.f., 6 species, characteristic of mangrove formations. Two genera and 5 species in Thailand (Santisuk, 1992). Only 1 species recorded from Doi Phu Kha National Park.

DUABANGA Buch.-Ham.

Trans. Linn. Soc. London 17: 177. 1835; Santisuk in Fl. Thailand 5(4): 434. 1992.

Trees with buttress; branches alternate on trunk and drooping. **Leaves** opposite. **Inflorescence** terminal, many-flowered corymbs. **Flowers** 4-8-merous. **Calyx** tube obconical or cup-shaped. **Petals** broadly obovate or suborbicular, short clawed, wrinkled. **Stamens** 12-50, or more. **Ovary** partially fused to calyx-tube, 4-8-celled; stigma thick, lobed. **Fruit** a loculicidal capsule on accrescent calyx-tube. **Seeds** linear, tailed.

Two species from the SE Himalayas to New Guinea; one species in Thailand (Santisuk, 1992).

Duabanga grandiflora (Roxb. ex DC.) Walp.

Reperf. 2: 114. 1843; Santisuk in Fl. Thailand 5(4): 435, pl. XXVIII: 41. 1992. – *Lagerstroemia grandiflora* Roxb. (Hort. Beng.: 38. 1814, nom. nud.) ex DC., Mém. Soc. Hist. Nat. Genève 3: 84. 1826. – *Duabanga sonneratioides* Buch.-Ham., Trans. Linn. Soc. London 17: 177. 1835.

Tree, 15-35 m high, all parts glabrous; young branchlets quadrangular. **Leaves** oblong to ovate, 10-24 cm long, 4-10 cm wide; base broadly rounded to slightly cordate; apex acuminate; secondary veins 12-28 pairs, prominent below, arcuate into intramarginal veins, dark green above, glaucous below; petioles stout, 3-10 mm long. **Flowers** nocturnal, white, showy, with an offensive smell, 4-7 cm across, in a drooping lax corymb; pedicels stout, 3-4 cm long. **Calyx** tube broadly cup-shaped, 1.5-2.4 cm across; lobes 6(-7), triangular-ovate, 1.2-3 cm long, 0.7-1.5 cm wide, spreading. **Petals** 6(-7), white, ca. 4 cm long, 3 cm wide; claw 2-4 mm long. **Stamens** 50 or more, biseriate; anthers curved, versatile. **Capsule** ovoid-globose, 2.7-3.5 cm long, 3-4 cm wide, green turning brown, with persistent calyx-lobes.

Thailand.— Northern: Chiang Mai, Chiang Rai, Phrae, Nan; North-eastern: Nong Khai; Eastern: Nakhon Ratchasima, Ubon Ratchathani; South-eastern: Chon Buri; Central: Saraburi; South-western: Kanchanaburi; Peninsular: Chumphon, Satun, Yala.

Distribution.— India (Sikkim & Assam, type), Myanmar, S China (Yunnan), Indochina, W Malaysia.

Ecology.— Lower montane forest, occurring sporadically in open, disturbed moist areas, alt. 1,000-1,500 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: April-May.

Uses.— Wood for indoor construction.

Vernacular.— ตุ่มเต็น Tum ten (Northern); เต็น Ten (Lua-Nan).

Voucher specimens.— *P. Srisanga* 453.

STAPHYLEACEAE

Trees or shrubs. **Leaves** trifoliolate, pinnate, rarely unifoliolate or simple, alternate or opposite; leaflets usually serrate or dentate; stipules present or not. **Inflorescence** terminal or axillary, racemes or panicles. **Flowers** bisexual or unisexual, actinomorphic, 5-merous. **Sepals** imbricate, free, sometimes connate, often petaloid. **Petals** imbricate, inserted on or below the disk. **Stamens** inserted with the petals and alternate with them, free; anthers 2-locular, opening by longitudinal slits. **Ovary** superior, 2-3(-4)-locular, axile or basal-axile placentation; ovules (1-)6-12, anatropous and in 2 rows; styles free or united. **Fruit** a berry, drupe or inflated capsule. **Seeds** 1-2 in each loculus.

Five genera and about 27 species which sporadic distribution: *Euscaphis japonica* (Thunb.) Kanitz in temperate E Asia; *Huerteia* Ruiz & Pavon in West Indies to Peru; *Staphylea* L. in N temperate region; *Tapiscia* Oliv. in China and Vietnam and *Turpinia* Vent. in Indo-malayan to Japan and tropical America (Mabberley, 1997). *Huerteia* Ruiz & Pavon and *Tapiscia* Oliv. are sometimes separated as their own family, Tapisciaceae (Kubitzki, 2003). One genus and about 5 species in Thailand.

TURPINIA Vent.

Choix: 31, t. 31, 1803, nom. cons.; Gagnep. in Fl. Gén. I.-C. Suppl. 1: 991. 1950; Linden in Fl. Mal. I.(6): 51. 1960. — *Triceros* Lour., Fl. Cochinch. 1: 184. 1790. — *Dalrympelea* Roxb., Pl. Corom. 3: 76, t. 279. 1820.

Evergreen trees or shrubs. **Leaves** imparipinnate or simple, opposite, decussate; stipules interpetiolar, usually caducous. **Flowers** bisexual. **Sepals** free, persistent. **Petals** free, caducous. Disk annualar, glabrous, crenate. **Ovary** (2-)3(-4)-locular, axile placentation; styles closely appressed but not connate; stigma combined into 3-lobed; ovules 1-many in each loculus. **Fruit** a berry, more or less with fleshy pericarp, but rather hard in dry state, globose, slightly 3-lobed, sometimes crowned by the horn-like conical style remains. **Seeds** 1-many in each cell.

About 10 species in Indo-malayan to Japan and tropical America (Mabberley, 1997). Only 1 species recorded from Doi Phu Kha National Park.

***Turpinia pomifera* (Roxb.) DC.**

Prodr. 2: 3. 1825; Craib in Fl. Siam. Enum. 1: 339. 1926; Gagnep. in Fl. Gén. I.-C. Suppl. 1: 993. 1950; Linden in Fl. Mal. I.(6): 58, fig. 1: j-k. 1960. – *Dalrympelea pomifera* Roxb., Pl. Corom. 3: 76, t. 279. 1820.

Tree 5-10 m high. **Leaves** imparipinnate; leaflets 3-7(-9), oblong, lanceolate to elliptic, 10-20 cm long, 3-8 cm wide, glabrous; base cuneate; apex acuminate; margin dentate; lateral petiolules 3-10 mm long; terminal petiolules 2.5-5 cm long. **Inflorescence** in terminal and axillary panicles, 10-30 cm long. **Sepals** ovate, 2-3 mm long, unequal, glabrous. **Petals** white, oblong, 3-3.5 mm long, glabrous. **Filaments** 1.5-2 mm long, glabrous; anthers 0.5-0.75 mm long, glabrous. **Ovary** conical, glabrous; style ca. 1 mm long, glabrous; ovules 4 in each loculus. **Fruit** green, globose, 2-3 cm long and wide; pericarp thick, ca. 5 mm. **Seeds** brown, angulate, 5-7 mm long and wide, shiny.

Thailand.— Northern: Chiang Mai, Chiang Rai, Phayao, Nan, Phitsanulok; Peninsular: Phuket, Trang.

Distribution.— India (type), SE Asia.

Ecology.— Lower montane forest, alt. 1,400-1,700 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: May-August.

Vernacular.— มะกอกพาน Makok faan (Northern).

Voucher specimens.— *P. Srisanga* 474, 911, 985, 1420; *P. Srisanga et al.* 763.

STERCULIACEAE

Trees, shrubs, climbers or rarely herbs, with stellate hairs or scales. **Leaves** simple, palmate or digitately compound, alternate or spirally arranged. Stipules mostly caducous. **Inflorescence** various, usually axillary and compound. **Flowers** unisexual or bisexual, (3-)5-merous, actinomorphic, rarely zygomorphic. **Calyx** (3-)5, valvate, united or free. **Corolla** 5 or absent, free or adnate at the base to the staminal tube. **Stamens** free or connate into a narrow tube, sometimes with staminodes; anthers 2-locular, dehiscing by longitudinal slits, rarely by terminal pores. **Ovary** superior, (1-)2-5, rarely 10-12, united or free carpels; ovules (1-)2 or more in each carpel; style simple or lobed or rarely free. **Fruit** dehiscent or not, winged or wingless, fleshy to leathery or woody. **Seeds** sometimes arillate, winged or not.

A family of 67 genera and about 1,500 species widely distributed in the tropical region. Twenty-one genera, 58 species and 6 varieties including 2 introduced genera and 3 species in Thailand (Phengklai, 2001b). Recently, Sterculiaceae has been included within Malvaceae (Bayer & Kubitzki, 2003). Six genera, 9 species and 2 varieties recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- 1. Climber or scandent shrub. Fruit with spiny tubercles 1. *Byttneria*
- 1. Tree or shrub. Fruit otherwise
 - 2. Sepals and petals present. Seed winged or wingless
 - 3. Stamens 5; ovary sessile or subsessile. Fruit leathery 4. *Melochia*
 - 3. Stamens 10 or more; ovary stipitate or supported on an androgynophore. Fruit more or less woody
 - 4. Sepals united. Seed wingless 3. *Helicteres*
 - 4. Sepals free. Seed winged 5. *Pterospermum*
 - 2. Only sepals present. Seed wingless
 - 5. Stamens 15-25. Fruit membranous with conspicuous nerves 2. *Firmiana*
 - 5. Stamens 10. Fruit more or less woody with indistinct nerves 6. *Sterculia*

1. *BYTTNERIA* Loefl.

Iter. Hisp.: 313. 1758, nom. cons.; Phengklai in Fl. Thailand 7(3): 544. 2001; Bayer & Kubitzki in Fam. Gen. Vasc. Pl. 5: 244. 2003.

Climbers or scandent shrubs. **Leaves** simple, alternate, usually lobed at apex; margin dentate, serrate or entire. **Inflorescence** axillary, umbel-like cymes. **Flowers** bisexual, small. **Calyx** 5, free or nearly so. **Petals** 5, hooded, with a concave claw at the base, the limb long, more or less adnate to the staminode, strap-shaped, 2-clefted. **Stamens** 5, connate below into a membranous tube, free above, opposite the petals; staminodes 5, opposite the sepals. **Ovary** sessile, 5-locular; ovules 2 in each loculus; style simple or 5-clefted. **Fruit** a globose capsule with spiny tubercles, septicidally 5-partite breaking away from a central column. **Seeds** wingless.

More than 130 species, pantropical which centred in America (Bayer & Kubitzki, 2003). Four species in Thailand (Phengklai, 2001b). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- 1. Leaves tri-lobed; margin dentate or double serrate 1. *B. andamanensis*
- 1. Leaves cordate; margin entire 2. *B. aspera*

1. *Byttneria andamanensis* Kurz

J. As. Soc. Beng. 40(2): 47. 1871; Craib in Fl. Siam. Enum. 1: 180. 1920; Phengklai in Fl. Thailand 7(3): 545, fig. 59. 2001.

Climber or scandent shrub. **Leaves** tri-lobed, chartaceous, 10-18 cm long, 5-15 cm wide; base cordate; apex cuspidate at each lobes; margin dentate or doubly serrate; 5-7 main nerves from base; secondary nerves 5-8 pairs, ascending; veins distinct on lower surface, scalariform; petioles 4-13 cm long. **Inflorescence** a bundle

of compound umbels, axillary, lax, up to 15 cm long, stellate hairs. **Flowers** creamy yellow, reddish tinged. **Calyx** cup-shaped, with narrow triangular to lanceolate segments, hairy on both surfaces. **Petals** free, 4-5 mm long, 1-2 mm wide, glabrous except along median line of inner side. **Stamens** and staminodes united at base by a cup-like membrane. **Ovary** ovoid with 5 longitudinal grooves; style subulate, glabrous. **Capsule** globose, 2.5-3 cm in diam. (including spiny tubercles), glabrous; spiny tubercles pointed or hooked at apex; fruit stalk 1-3 cm long, glabrescent. **Seeds** ellipsoid with 3 longitudinal grooves, black.

Thailand.— Throughout the country.

Distribution.— India, Myanmar (type).

Ecology.— In old clearings, by roadsides, alt. 1,100-1,200 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: June-September.

Vernacular.— สาครือ Sa khreua (Northern).

Voucher specimens.— *P. Srisanga* 746.

2. *Byttneria aspera* Colebr.

In Roxb., Fl. Ind. ed. Carey 2: 383. 1824; Phengklai in Fl. Thailand 7(3): 545, fig. 60. 2001. — *B. grandifolia* A. DC., Prodr. 1: 486. 1824. — *B. integrifolia* Lace, Kew Bull. 1915: 396. 1915; Craib in Fl. Siam. Enum. 1: 181. 1925. — *B. siamensis* Craib, Kew Bull. 1920: 300. 1920.

Woody climber or scandent shrub. **Leaves** chartaceous to subcoriaceous, cordate, 6-18 cm long, 4-14 cm wide; base cordate; apex cuspidate; margin entire; 5 main nerves from base; secondary nerves 5-8 pairs, ascending; veins distinct on lower surface, scalariform; petioles 4-17 cm long. **Inflorescence** a bundle of compound umbels, axillary, lax, up to 10 cm long, stellate hairs. **Flowers** greenish. **Sepals** free, lanceolate or narrowly triangular, hairy on both surfaces. **Petals** free, 4-5 mm long, 1-2 mm wide, glabrous except along the dorsal inner surfaces. **Stamens** short, with plicate filaments; staminodes longer, united at base by a cup-like membrane. **Ovary** ovoid with 5 longitudinal grooves; style subulate, glabrous. **Capsule** globose, 3-5 cm in diam. (including spiny tubercles), sparsely stellate hairs; spiny tubercles pointed; fruit stalk 0.5-3 cm long, glabrescent. **Seeds** ellipsoid with 3 longitudinal grooves, black (Fig. 148).

Thailand.— Northern: Mae Hong Son, Chiang Mai, Lampang, Phrae, Nan; Eastern: Chaiyaphum; South-eastern: Chanthaburi, Trat.

Distribution.— India (type), China, Vietnam.

Ecology.— Dry evergreen and lower montane forest, alt. 800-1,300 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: May-October.

Vernacular.— สาเดื่อ Sa deau (Northern).

Voucher specimens.— *P. Srisanga* 297, 1454.

2. *FIRMIANA* Marsigli

In Saggi, Sci. Lett. Accad. Padova 1: 114, 116. 1786; Phengklai in Fl. Thailand 7(3): 555. 2001; Bayer & Kubitzki in Fam. Gen. Vasc. Pl. 5: 265. 2003.

Trees. **Leaves** simple, tri-lobed, often cordate at base; margin entire or undulate. **Inflorescence** in cymes or panicles, with few- to many-flowered, terminal and axillary. **Flowers** unisexual or bisexual. Bracts awl-shaped, ca. 1 cm long, caducous. **Calyx** 5, funnel-shaped, 5-lobed to the middle or less, hairy on both surfaces. **Petals** absent. **Stamens** 15-25, in groups on a column enclosing the pistil. **Carpels** 5; ovules 2-6 in each carpel; styles 5, free. **Fruit** 5 follicles, pendent, oblong, dehiscent into papery valves. **Seeds** (1-)2-6, borne at the margin of the carpel, which open long before maturity.

About 12 species in Asia and Pacific islands (Bayer & Kubitzki, 2003). Three species in Thailand (Phengklai, 2001b). Only 1 species recorded from Doi Phu Kha National Park.

Firmiana colorata (Roxb.) R. Br.

In Benn. & R. Br., Pl. Jav. Rar.: 235. 1844; Phengklai in Fl. Thailand 7(3): 557, fig. 60, pl. XXII: E. 2001. – *Sterculia colorata* Roxb., Pl. Corom. 1: 26, t. 25. 1795; Craib in Fl. Siam. Enum. 1: 166. 1925. – *Erythropsis colorata* (Roxb.) Burk., Gard. Bull. Sing. 5: 231. 1931. – *E. roxburghiana* Schott & Endl., Melet. Bot.: 33. 1832. – *Firmiana rubriflora* Kosterm., Reinwardtia 6: 293, fig. 12. 1962.

Deciduous tree up to 25 m high. **Leaves** cordate, sometimes tri-lobed, chartaceous, 8-20 cm long, 8-18 cm wide; base cordate to broadly cordate; apex acute to cuspidate; margin entire or undulate; 5(7) main nerves from base; secondary nerves 3-7 pairs, distinct on both surfaces, glabrescent; petioles 5-20 cm long. **Inflorescence** terminal and at upper leaf scars panicle, 5-15 cm long. **Calyx** 1-1.5 cm long, 0.8-1 cm wide; lobes about ¼ of calyx length, hairy on both sides, brown to orange-red indumentum outside. **Stamens** 15, in 5 groups of 3; staminal column sparsely hairy, 1-3 cm long. **Carpels** hairy; ovules 2-4 in each carpel; style very short. **Follicles** 12-16 cm long. **Seeds** ellipsoid, 1-1.3 cm long, brown.

Thailand.— Northern: Chiang Mai, Lamphun, Lampang, Nan; North-eastern: Loei, Sakon Nakhon; South-eastern: Chon Buri; Central: Saraburi; Peninsular: Chumphon, Ranong, Surat Thani, Phangnga, Nakhon Si Thammarat, Pattani, Yala.

Distribution.— India (type), China, Malaysia.

Ecology.— Lower montane forest, alt. 1,400-1,600 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: January-June.

Vernacular.— ปอขาว Po khao (Northern).

Voucher specimens.— *P. Srisanga* 2344.

3. *HELICTERES* L.

Sp. Pl.: 963. 1753; Phengklai in Fl. Thailand 7(3): 562. 2001; Bayer & Kubitzki in Fam. Gen. Vasc. Pl. 5: 260. 2003.

Shrubs or small trees. **Leaves** simple, alternate, dentate or serrate. **Inflorescence** axillary, usually 2-flowered in short helicoid cymes, rarely terminal. **Flowers** bisexual. **Calyx** 5, united at base. **Petals** 5, free, clawed. **Stamens** 10 or more, adnate to the androgynophore. **Ovary** at top of the column, 5-locular, many ovules in each loculus; style slender; stigma 5 teeth. **Fruit** a capsule, oblong or cylindrical, valves spirally twisted or straight, with stiff hairs. **Seeds** globose, many, wingless.

About 60 species in the tropics of Asia and America (Bayer & Kubitzki, 2003). Seven species in Thailand (Phengklai, 2001b). Only 1 species recorded from Doi Phu Kha National Park.

Helicteres elongata Wall. ex Boj.

In Hort. Maurit.: 35. 1837; Craib in Fl. Siam. Enum. 1: 171. 1925; Phengklai in Fl. Thailand 7(3): 563, fig. 70. 2001. – *H. plebeja* Kurz, J. As. Soc. Beng. 39(2): 67. 1870; Craib in Fl. Siam. Enum. 1: 174. 1925. – *H. glabriuscula* Wall. ex Mast. in Fl. Br. Ind. 1: 366. 1874.

Shrub, 1-2 m high, stellate hairs on all parts. **Leaves** ovate-oblong, chartaceous, 5-15 cm long, 1.5-6 cm wide; base obtuse or slightly oblique; apex acute to acuminate; margin serrate; basal nerves 3(5); secondary veins 4-6 pairs, scalariform; petioles 5-10 mm long. **Inflorescence** lax, axillary, opposite the leaves or terminal, 2-2.5 cm long. **Calyx** funnel-shaped, unequal lobes. **Petals** pale violet, spatulate or wedge-shaped, 8-10 mm long, 3-4 mm wide. **Stamens** 10, on a horn-like column. **Ovary** ovoid, surrounded by the ring of stamens, hairy, with 5 longitudinal lobes. **Capsule** cylindrical, straight, 2-3 cm long, 0.5-1 cm wide, with 5 longitudinal lobes, hairy. **Seeds** many.

Thailand.— Northern: Chiang Mai, Chiang Rai, Phrae, Nan, Sukhothai; North-eastern: Phetchabun, Loei, Sakon Nakhon, Khon Kaen; Eastern: Chaiyaphum; South-eastern: Prachin Buri, Chon Buri; Central: Saraburi; South-western: Uthai Thani, Kanchanaburi.

Distribution.— India, Myanmar, S China, Vietnam (type).

Ecology.— Dry evergreen forest, alt. 800-1,000 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: June-December.

Vernacular.— ^๓ขี้หนู Khi on (Central).

Voucher specimens.— *P. Srisanga* 2559.

4. *MELOCHIA* L.

Sp. Pl.: 674. 1753; Phengklai in Fl. Thailand 7(3): 590. 2001; Bayer & Kubitzki in Fam. Gen. Vasc. Pl. 5: 247. 2003.

Undershrubs to small trees. **Leaves** simple, alternate. **Flowers** 5-merous, bisexual, in clusters or loose panicle, axillary or at the end of twigs. **Sepals** united. **Petals** free. **Stamens** 5, opposite the petals. **Ovary** 5-locular; ovules 2 in each loculus; styles 5, subulate, free. **Fruit** a capsule, globose or ellipsoid, with 5 longitudinal lobes, dehiscent along ridges. **Seeds** triangular, stony, winged.

About 60 species mainly in the tropical America (Bayer & Kubitzki, 2003). Two species in Thailand. (Phengklai, 2001b). One species recorded from Doi Phu Kha National Park.

Melochia umbellata (Houtt.) Stapf

Kew Bull. 1913: 317. 1913; Craib in Fl. Siam. Enum. 1: 179. 1925; Phengklai in Fl. Thailand 7(3): 592, fig. 87, pl. XXI: C. 2001. – *Visenia umbellata* Houtt., Handl. 8: 309. 1777.

Small tree up to 10 m high; young twigs densely hairy. Stipules ovate or oblong, caducous. **Leaves** cordate, 10-24 cm long, 8-20 cm wide; base cordate, truncate or broadly obtuse; apex acuminate; margin dentate, densely and softly hairs on both surfaces; 5 nerved at base; petioles 5-15 cm long, hairy. **Inflorescence** a panicle of compound umbels, terminal or axillary, up to 20 cm long; peduncle 2-15 cm long; pedicels 3-4 mm long. **Flowers** pinkish. **Sepals** united at base, divided into 5 narrow, triangular lobes, with acuminate apex, hairy on both surfaces. **Petals** oblong to lanceolate, 5-6 mm long, 1-2 mm wide. **Stamens** inserted at the base of petals. **Ovary** ovoid, with 5 longitudinal lobed, hairy. **Capsule** ellipsoid, 1-1.5 cm long, 0.5-1 cm wide. **Seeds** 6-8 mm long including wing.

Thailand— Northern: Phrae, Nan, Tak; Eastern: Nakhon Ratchasima; South-eastern: Chanthaburi, Trat; Peninsular: throughout.

Distribution.— India (type), Sri Lanka, Myanmar, Vietnam, Malaysia, Philippines, Australia to Polynesia.

Ecology.— Along edges of deciduous forest, alt. 300-400 m (Doi Phu Huat).

Phenology.— Flowering and fruiting: November-February.

Vernacular.— เต้าชายม่อมหลวง Thao yai mom luang (Northern).

Voucher specimens.— *P. Srisanga* 510.

5. *PTEROSPERMUM* Schreber

Gen. Pl. 2: 461. 1791, nom. cons.; Phengklai in Fl. Thailand 7(3): 599. 2001; Bayer & Kubitzki in Fam. Gen. Vasc. Pl. 5: 267. 2003.

Trees. **Leaves** simple, alternate or spirally arranged. **Flowers** bisexual, solitary, rarely paired, axillary or at upper leaf scars, rarely terminal, not less than 5 cm in diam. **Sepals** 5, free or nearly so. **Pepals** 5, free or nearly so. **Stamens** (12)15, surrounding the ovary on the top of androgynophore; staminodes 5. **Ovary** at the top of column, 5-locular; ovules 4-22 in each loculus; style slender; stigmas with 5 linear lobes, spreading or twisted. **Fruit** a capsule, cylindrical, ovoid, oblong or ellipsoid, woody, smooth or angled, dehiscent into 5 parts. **Seeds** winged in the upper part.

About 18 species in tropical Asia (Bayer & Kubitzki, 2003). Nine species in Thailand. (Phengklai, 2001b). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Style hairy on the lower half. Fruit oblong with straight angles **1. *P. diversifolium***
 1. Style hairy all over. Fruit ellipsoid with wavy wings **2. *P. littorale***

1. *Pterospermum diversifolium* Bl.

Bijdr.: 88. 1825; Craib in Fl. Siam. Enum. 1: 176. 1925; Phengklai in Fl. Thailand 7 (3): 604, fig. 93. 2001.

Tree, 8-30 m high; twigs densely hairy. **Leaves** obovate, ovate to elliptic, 15-30 cm long, 10-17 cm wide; base cordate to slightly oblique; apex acute to broadly acute; margin entire, hairy then glabrescent on upper surface. **Flower** buds tubular, 2-5 cm long, 0.5-1 cm wide, surrounded by 3 caducous lanceolate bracts. **Sepals** lanceolate-oblong, 6-8 cm long, hairy on both surfaces. **Petals** white, oblanceolate, 5-7 cm long, ca. 1 cm wide, hairy outside. **Stamens** 15, 4-6 cm long; staminodes 5, 4-7 cm long, pellucid glands along filaments. **Ovary** ovoid, ca. 10 mm long, 4 mm wide; style 3-4 cm long, densely hairy on the lower half; stigmas twisted. **Capsule** oblong, 8-15 cm long, 4-6 cm wide, 5 straight longitudinal angles, hairy. **Seeds** ovate with a thin wing, 2-5 cm long, ca. 1 cm wide (Fig. 149).

Thailand.— Northern: Nan; South-eastern: Chon Buri, Chanthaburi; Central: Saraburi, Nakhon Nayok; Peninsular: Surat Thani, Trang, Narathiwat.

Distribution.— India, Vietnam, Malaysia, Indonesia (type).

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: February-April; fruiting: March-May and persistent throughout the year.

Voucher specimens.— *P. Srisanga* 494; *P. Srisanga* & *S. Watthana* 720.

Notes.— New locality recorded from Nan, in Thailand.

2. *Pterospermum littorale* Craib

Kew Bull. 1912: 147. 1912; in Fl. Siam. Enum. 1: 176. 1925; Phengklai in Fl. Thailand 7(3): 610, fig. 97, Pl. XXII: B. 2001.

Tree, 5-15 m high; twigs hairy then glabrescent. **Leaves** palmate in juvenile to wedge-shaped, ovate in mature stage, 8-16 cm long, 4-7 cm wide; base oblique or obtuse; apex acute to acuminate, hairy and glaucous on lower surface, lobes or entire; nerves prominent on lower surface. **Flower** buds oblong, 1.5-2 cm long, 0.5-1 cm wide, surrounded by 3 caducous lanceolate bracts. **Sepals** lanceolate, 5-6 cm long, 0.5-1 cm wide, hairy on both surfaces. **Petals** white to yellow, 5-6 cm long, ca. 1 cm wide, hairy on outer surface. **Stamens** 15, 2-2.5 cm long; staminodes 5, 2.5-3 cm long, pellucid glands along filaments. **Ovary** ovoid, 5-6 mm long, ca. 3 mm wide; style 2.5-3 cm long, hairy all over; stigmas twisted. **Capsule** ellipsoid, 5 longitudinal wavy, up and down wings, densely indumentum, 8-12 cm long, 5-7 cm wide including wings. **Seeds** ovate with a thin wing, ca. 2 cm long, 0.5 cm wide.

Thailand.— Northern: Chiang Mai, Nan, Phitsanulok; North-eastern: Loei; South-eastern: Chon Buri (type: *Kerr* 2097); Central: Nonthaburi, Bangkok; South-western: Kanchanaburi, Prachuap Khiri Khan; Peninsular: throughout.

Distribution.— Endemic to Thailand.

Ecology.— Dry evergreen forest, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: September-December; fruiting: November-March and persistent throughout the year.

Vernacular.— กวามขาว Kuam Khao (Lua-Nan), จำปาเทศ Cham pa thet (Central).

Voucher specimens.— *P. Srisanga* 2551.

6. *STERCULIA* L.

Sp. Pl.: 1007. 1753; Phengklai in Fl. Thailand 7(3): 623. 2001; Bayer & Kubitzki in Fam. Gen. Vasc. Pl. 5: 263. 2003.

Trees or shrubs, deciduous or evergreen. **Leaves** simple, palmate or digitately compound, spirally arranged, usually crowded at end of twigs, entire. **Inflorescence** axillary, at upper leaf-scars or terminal. **Flowers** unisexual, 5-merous. **Calyx** 5, pink, red, yellowish or white, free or united at base, sometimes cohering at apex. **Corolla** absent. **Male flowers** with 10(-15) anthers, on a globose head at the end of a slender straight or curved glabrous staminal column. **Female flowers** with 5 free carpels, each with 2-many ovules; styles free or connate or cohering; stigmas free, mostly curved. **Fruit** (2-)3-5 follicles, coriaceous, woody, usually with sparsely stellate hairs, wingless. **Seeds** 1-20, ellipsoid or obovoid, wingless.

About 200-300 species, pantropical (Bayer & Kubitzki, 2003). Thirteen species and 3 varieties in Thailand. (Phengklai, 2001b). Two species, one with 2 varieties recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|--|
| 1. Deciduous tree. Leaves 3-nerved at base | 1. <i>S. balanghas</i> |
| 1. Evergreen shrub. Leaves penni-nerved | |
| 2. Leaves lanceolate, glabrous or glabrescent | 2.1 <i>S. lanceolata</i> var. <i>lanceolata</i> |

2. Leaves broadly oblanceolate to elliptic, hirsute especially on lower surface

2.2 *S. lanceolata* var. *principis*

1. *Sterculia balanghas* L.

Sp. Pl.: 1007. 1753; Phengkklai in Fl. Thailand 7(3): 626, fig. 104. 2001. – *S. rubiginosa* Vent., Jard. Malm. 2: t. 91. 1804; Craib in Fl. Siam. Enum. 1: 169. 1925. – *S. angustifolia* Roxb., Fl. Ind. 3: 148. 1832; Craib in Fl. Siam. Enum. 1: 165. 1925. – *S. ensifolia* Mast. in Fl. Br. Ind. 1: 359. 1874. – *S. rubiginosa* var. *ensifolia* (Mast.) Ridl., Fl. Mal. Pen. 1: 273. 1922; Craib in Fl. Siam. Enum. 1: 169. 1925.

Deciduous tree, 3-6 m high; twigs rusty red tomentose then glabrescent. **Leaves** elliptic, 10-30 cm long, 3-15 cm wide; base slightly cuneate or obtuse; apex acuminate to caudate, densely stellate hairs on both surfaces; 3-nerved at base; secondary nerves 8-14 pairs; petioles 2-5 cm long, swollen at both ends, geniculate, hairy. **Inflorescence** axillary and terminal, panicle, lax and pendulous, 5-10 cm long. **Calyx** campanulate, red, 7-10 mm long; lobes $\frac{1}{2}$ or nearly to the base, always cohering by hairs at apex, hairy. **Male flowers** with 10 stamens; anthers sessile. **Female flowers**: carpels hairy; styles cohering. **Follicles** (2-5) on one stalk, oblong, narrowed at both ends, curved upward, 5-9 cm long, 2-3 cm wide, densely dark brown tomentose. **Seeds** ellipsoid, 1-1.5 cm long, 1-1.2 cm wide, black.

Thailand.— Throughout the country.

Distribution.— India, Nepal, Sri Lanka (type), Myanmar, Malaysia, Indonesia.

Ecology.— Lower montane scrub, alt. 1,750 m (Doi Phu Wae).

Phenology.— Flowering: January-March; fruiting: February-June.

Vernacular.— มั๊กลิ้นจี่ Mak lein ang (Northern).

Voucher specimens.— P. Srisanga et al. 2425.

2.1 *Sterculia lanceolata* Cav. var. *lanceolata*

Diss. 5: 287, t. 145, fig. 1. 1788; Craib in Fl. Siam. Enum. 1: 167. 1925; Phengkklai in Fl. Thailand 7(3): 635, fig. 109, Pl. XXIII: E. 2001. – *S. tonkinensis* A. DC., Bull. Herb. Boiss. ser. 2(3): 368. 1903.

Evergreen shrub, 1-3 m high; twigs glabrous or glabrescent. Stipules lanceolate, caducous. **Leaves** lanceolate, chartaceous to subcoriaceous, 8-27 cm long, 3-7 cm wide; base cuneate; apex acute, acuminate to caudate, glabrous or glabrescent; secondary nerves 10-17 pairs; petioles 1-5 cm long, swollen and dark at both ends. **Inflorescence** axillary on upper leaf scars and terminal, panicle, lax and pendulous, 5-10 cm long. **Calyx** pink, white or creamy yellow, spreading, free or united at base, glabrous or glabrescent; lobes 6-20 mm long, 1-2 mm wide. **Male flowers** with 10 stamens; anthers sessile. **Female flowers**: carpels hairy; styles cohering. **Follicles** (2-5) on one stalk, oblong, narrowed at both ends, curved upward, 5-9 cm long, 1.5-2.5

cm wide, red or dark brown pubescent. **Seeds** ellipsoid, 1-1.5 cm long, 7-9 mm wide, black.

Thailand.— Throughout the country.

Distribution.— Sri Lanka, China (type), Vietnam, Laos, Malaysia.

Ecology.— Dry evergreen and lower montane forest, along streams, alt. 700-1,200 m (Doi Phu Kha).

Phenology.— Flowering: September-December; fruiting: June-July.

Voucher specimens.— *P. Srisanga* 565, 1163, 1247, 1599.

2.2 *Sterculia lanceolata* Cav. var. *principis* (Gagnep.) Phengklai

In Fl. Thailand 7(3): 638, fig. 111. 2001. – *S. principis* Gagnep., Not. Syst. Paris 1: 82. 1909; Craib in Fl. Siam. Enum. 1: 169. 1925.

This variety differs from var. *lanceolata* in broadly oblanceolate to elliptic leaves, hirsute especially on lower surface.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Phrae, Nan, Tak; North-eastern: Loei.

Distribution.— Myanmar, Laos (type).

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: March-May.

Vernacular.— ลิ่นม่วง Lein nguang (Northern).

Voucher specimens.— *P. Srisanga* 503, 957, 1267, 1347; *P. Srisanga et al.* 757, 2472.

STRYCHNACEAE

Trees, shrubs or woody climbers, sometimes armed with spines or hooks. **Leaves** simple, opposite, entire, penninerved or 3-5-nerved from the base. **Inflorescence** terminal or axillary, cymose, corymbose or paniculate, rarely flower solitary. **Flowers** bisexual, actinomorphic, 4-5-merous. **Calyx** united or free. **Corolla** connate or not, valvate. **Stamens** inserted in the tube or throat; anthers 1-2-locular, opening by longitudinal slits. **Ovary** superior, rarely half-inferior, 2-locular, axile placentation; ovules 1-numerous in each loculus; style solitary, usually short; stigma capitate or bilobed. **Fruit** a berry or drupe, often globose, sometimes rather large and often with a hard or fibrous endocarp.

Eight genera and about 260 species mostly in tropical and subtropical regions (Mabberley, 1997). Two genera and 16 species in Thailand (Griffin & Parnell, 1997). Two genera and 3 species recorded from Doi Phu Kha National Park.

Strychnaceae, often included in the Loganiaceae *sensu lato* as tribe Strychneae, is here treated as a distinct family according to Mabberley (1997).

KEY TO THE GENERA

1. Leaves penninerved. Hooks absent 1. *Gardneria*
 1. Leaves 3-5-nerved from the base. Hooks usually present 2. *Strychnos*

1. *GARDNERIA* Wall.

In Roxb., Fl. Ind. 1: 400. 1820; Leenhouts in Fl. Mal. I.(6): 361. 1962; Griffin & Parnell in Fl. Thailand 6(3): 206. 1997.

Woody climbers; twigs terete. **Leaves** penninerved, petiolate. Stipules forming a small rim. **Inflorescence** axillary, dichasial or flower solitary. **Flowers** 4-5-merous, pedicellate. **Calyx** small, deeply lobed. **Corolla** creamy, yellow or orange. **Filaments** very short; anthers 2-locular. **Ovary** superior, glabrous; ovules 1-4 in each loculus. **Fruit** a berry, globose. **Seeds** patelliform.

Five species in E and SE Asia. One species in Thailand (Griffin & Parnell, 1997).

Gardneria ovata Wall.

In Roxb., Fl. Ind. 1: 400. 1820; Kerr in Fl. Siam. Enum. 3: 63. 1951; Leenhouts in Fl. Mal. I.(6): 363, fig. 33. 1962; Griffin & Parnell in Fl. Thailand 6(3): 206. 1997.

Woody climber. **Leaves** lanceolate, elliptic to ovate, chartaceous to thin-coriaceous, 6-13 cm long, 2.5-5 cm wide, glabrous; base broadly acute to cuneate; apex acute, acuminate to caudate; primary veins 4-10 pairs, raised and prominent below; petioles 0.7-1.5 cm long, glabrous. **Inflorescence** axillary, dichasial, 4-8 cm long; bracteoles 2, lanceolate, 1-2 mm long, glabrous; peduncle 1-2 cm long. **Flowers** 4-merous; pedicels 1-2 cm long. **Calyx** rounded, 1-2 mm long and wide, glabrous, ciliolate. **Corolla** yellow or orange, 5-7 mm long, divided virtually to base; tube usually almost absent or about 1 mm long; lobes thick, fleshy, strongly coherent in bud, glabrous outside, papillose pubescent inside. **Stamens** with minute, scarcely evident filaments, attached towards base of corolla tube; anthers cohering, erect, oblong, 3-4 mm long. **Ovary** narrowly ellipsoid, 0.5-1.5 mm long; style 0.5-1.5 mm long. **Fruit** 8-10 mm long and wide, black. **Seeds** 1-2, 5-7 mm long and wide, patelliform.

Thailand.— Northern: Chiang Mai, Nan; South-western: Kanchanaburi; Peninsular: Krabi.

Distribution.— India (type), Sri Lanka, S China, Malaysia, Indonesia.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: April-June; fruiting: November-January.

Voucher specimens.— *P. Srisanga* 1184, 1212, 1264, 1428.

Notes.— New locality recorded from Nan, in Thailand.

2. *STRYCHNOS* L.

Sp. Pl.: 189. 1753; Leenhouts in Fl. Mal. I.(6): 343. 1962; Griffin & Parnell in Fl. Thailand 6(3): 208. 1997.

Woody climbers, shrubs or small trees, often with hooks, sometimes with axillary spines. **Leaves** 3-5-nerved from the base. Stipules reduced to a rim connecting the leaf base. **Inflorescence** axillary or terminal thyrsoid. **Flowers** 5-merous. **Calyx** divided nearly to the base. **Corolla** rotate to salverform, yellowish or greenish. **Anthers** basifixed or sub-basifixed. **Ovary** superior; ovules many in each loculus; stigma faintly bilobed. **Fruit** a berry with a hard outer wall. **Seeds** few to many.

About 190 species, worldwide in tropical and subtropical regions. Fifteen species in Thailand (Griffin & Parnell, 1997). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Hooks solitary. Leaves pubescent at least at the midrib on lower surface.
Fruit less than 1.5 cm long and wide, thin-walled **1. *S. axillaris***
1. Hooks paired. Leaves glabrous. Fruit more than 3.5 cm long and wide,
thick-walled, woody **2. *S. nitida***

1. *Strychnos axillaris* Colebr.

Trans. Linn. Soc. 12: 356. 1819; Leenhouts in Fl. Mal. I.(6): 358, fig. 30g. 1962; Griffin & Parnell in Fl. Thailand 6(3): 210. 1997. – *S. pubescens* C.B. Clarke in Fl. Br. Ind. 4: 89. 1883. – *S. schmidtii* Gilg., Bot. Tidsskr. 32: 312. 1915; Hill in Fl. Siam. Enum. 3: 61. 1951. – *S. quintuplinervis* Hill, Kew Bull. 1917: 166. 1917. – *S. plumosa* Hill, Kew Bull. 1917: 171. 1917; in Fl. Siam. Enum. 3: 60. 1951. – *S. penicillata* Hill, Kew Bull. 1917: 178. 1917. – *S. mucronata* Hill, Kew Bull. 1917: 181. 1917; in Fl. Siam. Enum. 3: 58. 1951. – *S. viridiflora* Hill, Kew Bull. 1925: 424. 1925. nom. illeg., non de Wild., 1923. – *S. kawbet* Hill, Kew Bull. 1925: 425. 1925; in Fl. Siam. Enum. 3: 58. 1951. – *S. chloropetala* Hill, Kew Bull. 1930: 175. 1930; in Fl. Siam. Enum. 3: 57. 1951.

Woody climber or scrambling shrub; twigs grey-green to blackish brown, glabrous to densely pubescent; axillary spines sometimes present; hooks solitary, pubescent. **Leaves** lanceolate, elliptic to ovate, chartaceous to thin-coriaceous, 3-8 cm long, 1.5-4 cm wide, pubescent at least at the midrib on lower surface; base acute, truncate to subcordate; apex acute to acuminate; petioles 1-7 mm long, glabrous or pubescent. **Inflorescence** axillary or terminal, 0.5-2 cm long. **Flowers** subsessile or short pedicellate. **Calyx** small, 1-2 mm long; lobes ovate to orbicular, glabrous to tomentose outside, glabrous inside. **Corolla** white or green, 2-4 mm long, glabrous or rarely tomentose outside, inside with a ring of short bristle-like hairs at mouth of corolla tube, otherwise glabrous; tube about 2 times as long as lobes. **Stamens**

inserted at the middle of corolla tube; filaments short; anthers ovate, barbate, 0.5-1 mm long. **Ovary** and style 1.5-2 mm long, glabrous. **Fruit** globose or ovoid, 0.5-1.5 cm long and wide, orange or red, thin-walled, glabrous. **Seeds** 1-2, suborbicular, 5-8 mm long and wide, 2-3 mm thick.

Thailand.— Northern: Chiang Rai, Lampang, Nan, Phitsanulok, Nakhon Sawan; North-eastern: Phetchabun, Loei, Udon Thani, Khon Kaen; Eastern: Chaiyaphum, Nakhon Ratchasima; South-eastern: Prachin Buri, Chon Buri, Rayong, Trat; South-western: Kanchanaburi, Ratchaburi; Central: Saraburi; Peninsular: Chumphon, Phangnga, Phattalung, Satun, Pattani.

Distribution.— India, Bangladesh (E Bengal-type), SE Asia to Australia.

Ecology.— Dry evergreen forest, alt. 800-900 m (Tham Pha Kong, Doi Phu Kha).

Phenology.— Flowering: March-August; fruiting: June-December.

Vernacular.— ตึงเครือดำตัวแม่ Tueng khreua dam tua mae (Lampang).

Voucher specimens.— *P. Srisanga* 2535.

2. *Strychnos nitida* G. Don

Gen. Hist. 4: 66. 1837; Griffin & Parnell in Fl. Thailand 6(3): 219. 1997. — *S. kerrii* Hill, Kew Bull. 1925: 426. 1925; in Fl. Siam. Enum. 3: 58. 1951.

Woody climber; twigs brownish grey with few scattered lenticels, glabrous, terete to subquadrangular, finely fluted; axillary spines sometimes present; hooks paired, glabrous to sparsely pubescent. **Leaves** lanceolate, elliptic to ovate, chartaceous to thin-coriaceous, 5-15 cm long, 2-6 cm wide, glabrous; base cuneate to rounded; apex acuminate to caudate; midrib slightly sunken to flat above, rounded below; petioles 3-7 mm long, sparsely pubescent. **Inflorescence** terminal, dense-flowered, 3.5-6 cm long. **Flowers** with pedicels up to 3 mm long. **Calyx** small, 0.5-1 mm long; lobes ovate to oblong, tomentose outside, glabrous inside. **Corolla** greenish, 1-1.5 cm long, glabrous outside, hairy inside, densely woolly in mouth; tube more than 5 times as long as lobes. **Stamens** inserted in mouth of corolla tube; filaments short; anthers oblong, 0.8-1 mm long, glabrous. **Ovary** and style 10-13 mm long, ovary glabrous, bottom 2/3 of style pubescent. **Fruit** globose, 3.5-6 cm long and wide, thick-walled (4-6 mm), woody, glabrous. **Seeds** 10-12, lenticular, 1.2-3 cm long, 1.7-2.3 cm wide.

Thailand.— Northern: Chiang Mai, Lampang, Nan; North-eastern: Phetchabun.

Distribution.— India, Bangladesh (E Bengal-type), Myanmar, Laos, S Vietnam, Malay Peninsula.

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Span Waterfall, Doi Phu Kha).

Phenology.— Flowering: March-July; fruiting: January-December.

Vernacular.— สานดีลอก San di lok (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1569, 1967.

STYRACACEAE

Trees or shrubs, often with stellate or lepidote indumentum. **Leaves** simple, alternate; stipules absent. **Inflorescence** axillary or terminal, racemose, cymose, panicles or rarely flower solitary. **Flowers** bisexual, rarely polygamo-dioecious, actinomorphic. **Calyx** tube more or less adnate to the ovary; lobes (2-)4-5(-7), open or valvate. **Petals** 2-5(-7), sympetalous or rarely free, imbricate or valvate. **Stamens** equal or double numbers of petals; filaments adnate to the corolla tube or rarely free; anthers 2 locular, opening by longitudinal slits. **Ovary** superior or inferior, (2-)3-5-locular, axile placentation; style slender, capitate or 3-5-lobed; ovules 1 to many in each loculus. **Fruit** a capsule, samaroid or drupe, with persistent calyx. **Seeds** 1 to many, winged or not.

Eleven genera and about 160 species in tropical and warm temperate regions (Mabberley, 1997). Two genera and about 12 species in Thailand. One genus with 2 species recorded from Doi Phu Kha National Park.

STYRAX L.

Sp. Pl.: 444. 1753; Svengsuksa & Vidal in Fl. C.L.V. 26: 149. 1992; Hwang & Grimes in Fl. China 15: 253. 1996; Fritsch in Fam. Gen. Vasc. Pl. 6: 440. 2004. – *Cyrta* Lour., Fl. Cochinch. 278. 1790.

Trees or shrubs, often with stellate or lepidote indumentum. **Inflorescence** axillary or terminal, racemose, cymose, panicles or rarely flower solitary. **Flowers** bisexual; bracteoles caducous. **Calyx** cup-shaped; lobes (2-)5(-6), sometimes subtruncate with minute teeth. **Corolla** campanulate; lobes 5(-7). **Stamens** (8-)10(-13), equal or rarely unequal; filaments flattened, free or basally adnate to the corolla tube; anthers oblong. **Ovary** superior, 3-locular; ovules 1-4 in each loculus. **Fruit** a capsule or drupe. **Seeds** 1(-2).

About 120 species in Asia, America and Europe (Mabberley, 1997). About 11 species in Thailand.

KEY TO THE SPECIES

1. Leaves densely stellate tomentose below; nerves parallel; margin entire.
Calyx subtruncate with indistinct teeth. Fruit subglobose, dehiscent from apex **1. *S. benzoides***
1. Leaves sparsely stellate pubescent below; nerves reticulate; margin serrate.
Calyx subtruncate with distinct 5 teeth. Fruit ellipsoid, irregular dehiscent **2. *S. serrulatus***

1 *Styrax benzoides* Craib

Kew Bull. 1912: 267. 1912; Contr. Fl. Siam 57: 126. 1912; Hook. Icon. Pl.: tab. 2999. 1913; Fletcher in Fl. Siam. Enum. 2: 391. 1938; Svengsuksa & Vidal in Fl. C.L.V. 26:

165, pl. 29: 9-13. 1992; Hwang & Grimes in Fl. China 15: 260. 1996. – *S. benzoin* auct. non Dryander: Craib, Kew Bull. 1911: 409. 1911.

Tree, 6-12 m high; brachlets terete, stellate tomentose. **Leaves** lanceolate, elliptic to ovate, papery, (5-)7-15 cm long, (2-)3-7 cm wide, glabrescent above, densely grayish white stellate tomentose below; base broadly cuneate, obtuse to rounded, slightly oblique; apex acute to acuminate; margin entire; primary veins 5-8 pairs; nerves parallel; petioles 4-10 mm long, stellate tomentose. **Inflorescence** axillary or terminal panicles, 1-5 cm long, densely stellate tomentose; pedicels 2-4 mm long. **Calyx** green, subtruncate, 3-4 mm long; teeth indistinct, densely stellate tomentose. **Corolla** white; tube 2-2.5 mm long; lobes valvate, oblong, 8-10 mm long, acute at apex, glabrous inside except at apex, densely stellate tomentose outside. **Stamens** subequal; filaments basally adnate to the corolla tube, free part 3-3.5 mm long, densely stellate tomentose; anthers 2-2.5 mm long. **Ovary** conical, ca. 2 mm high, densely stellate tomentose; style 9-12 mm long, glabrous. **Fruit** subglobose, 1-1.5 cm long and wide, densely stellate tomentose, 3-valved, dehiscent from apex. **Seeds** 1(-2), subglobose, brown, glabrous.

Thailand.— Northern: Chiang Mai (type), Chiang Rai, Nan; North-eastern: Nakhon Phanom; South-western: Kanchanaburi.

Distribution.— Myanmar, S China (Yunnan), Laos, Vietnam.

Ecology.— Dry evergreen and lower montane forest, alt. 800-1,200 m (Doi Phu Kha, Nan Watershed, Tham Pha Kaow).

Phenology.— Flowering: May-July; fruiting: July-September.

Uses.— Wood for construction.

Vernacular.— กำยาน Kam yan (General), ไม้เอื้อง Mai Eak (Lua-Nan).

Voucher specimens.— *P. Srisanga* 2560; *P. Srisanga* & *C. Maknoi* 2076; *P. Srisanga et al.* 889.

2. *Styrax serrulatus* Roxb.

Fl. Ind. 2: 415. 1832; Fletcher in Fl. Siam. Enum. 2: 393. 1938; Svengsuksa & Vidal in Fl. C.L.V. 26: 171, pl. 31: 5-6. 1992; Hwang & Grimes in Fl. China 15: 261. 1996. – *Cyrta serrulata* (Roxb.) Miers, Contr. Bot. 1: 182, t. 29. 1851.

Small tree, 5-7 m high; brachlets terete, stellate tomentose, glabrescent. **Leaves** lanceolate, elliptic to narrowly ovate, papery, 4.5-9 cm long, 2-4 cm wide, sparsely stellate pubescent on both surfaces, glabrescent above; base cuneate to rounded, slightly oblique; apex acuminate; margin serrate; primary veins 4-7 pairs; nerves reticulate; petioles 3-5 mm long, canaliculated, stellate tomentose. **Inflorescence** axillary or terminal leafy panicles, 3-9 cm long, densely stellate tomentose. **Flowers** in group of 2-5; pedicels 4-5 mm long, densely stellate tomentose. **Calyx** subtruncate, ca. 4 mm long; teeth 5, distinct, densely stellate tomentose. **Corolla** white; tube 3-3.5 mm long; lobes valvate, oblong, 7-8 mm long, acute at apex, glabrous inside except at apex, densely stellate tomentose outside. **Stamens** subequal; filaments adnate to the corolla tube, free part 2.5-3.5 mm long,

flexuous, curved, densely stellate tomentose; anthers 3-4 mm long. **Ovary** conical, ca. 2 mm high, densely stellate tomentose; style 9-12 mm long, glabrous, except at the base. **Fruit** ellipsoid, 1.2-1.4 cm long, 0.8-1 cm wide, densely stellate tomentose, irregular dehiscent. **Seed** 1, ellipsoid, brown, glabrous.

Thailand.— Northern: Nan; Peninsular: Surat Thani, Phangnga, Krabi, Phatthalung, Satun.

Distribution.— India, Bangladesh (Chittagong-type), Myanmar, China, Taiwan, Laos, Vietnam.

Ecology.— Dry evergreen and lower montane forest, alt. 900-1,000 m (Doi Phu Kha).

Phenology.— Flowering: February-March; fruiting: August-September.

Uses.— Wood for construction.

Vernacular.— ไม้มื่น Mai Leak (Lua-Nan).

Voucher specimens.— *P. Srisanga* 1555; *P. Srisanga et al.* 2494.

Notes.— *Styrax casearifolius* Craib, endemic to Thailand which only known from Nan (*Kerr* 2432 (type), Doi Wao, ca. 900 m and *Kerr* 4986, 4986a, Ban Tin, ca. 1,000-1,200 m), possibly conspecific with *S. serrulatus* Roxb.

SYMPLOCACEAE

Monogeneric family. Description as in the genus.

SYMPLOCOS Jacq.

En. Pl. Carib.: 5. 1760; Nooteboom, Rev. Symploc.: 33. 1975 (Leiden Bot. Ser. 1. 1975); in Fl. Thailand 2(4): 448. 1981; in Fam. Gen. Vasc. Pl. 6: 448. 2004.

Trees or shrubs. **Leaves** simple, alternate; midrib mostly impressed in the upper surface; stipules absent. **Inflorescence** terminal or axillary, spike, raceme or panicle, sometimes condensed to dense clusters. **Flowers** bisexual, actinomorphic, supported by a bract and 2 bracteoles. **Calyx** 3-5, imbricate or valvate, persistent, sometimes splitting into 2 parts and seemingly 2-lobed; tube adnate to the ovary. **Corolla** (3-)5(-11), sympetalous. **Stamens** many, connate in a short or long tube, inserted on the base of corolla tube; anthers globose, 2-locular, opening by longitudinal slits. **Ovary** inferior or rarely half-inferior, axile placentation, 2-5-locular; style 1; ovules 2-4 in each loculus. **Fruit** a drupe with persistent calyx lobes, frequently bluish when ripe. **Seeds** straight or curved, 1 in each developed locule.

About 300 species mainly in tropical region of the Old and the New World, but not in Africa. Eighteen species in Thailand (Nooteboom, 1981b). Seven species, one with 2 subspecies recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Inflorescence a spike
 2. Inflorescence axis tomentose or pubescent. Drupe globose to ampulliform
 3. Calyx lobes pubescent and enlarged in fruit
 - 1.1. *S. cochinchinensis* subsp. *cochinchinensis*
 3. Calyx lobes glabrous and not enlarged in fruit
 - 1.2. *S. cochinchinensis* subsp. *laurina*
 2. Inflorescence axis glabrous. Drupe ellipsoid to ovoid
 4. Bract 3-4 mm long. Calyx lobes 1.5-2 mm long. Disc shortly pubescent; style hairy at base
 3. *S. longifolia*
 4. Bract 5-10 mm long. Calyx lobes 3-5 mm long. Disc and style glabrous
 5. *S. megalocarpa*
1. Inflorescence a raceme, panicle or fascicle
 5. Stamens more than 50
 6. Leaves obovate, 14-22 cm long, 4-12 cm wide. Bract 5-8 mm long. Drupe 13-24 mm long, 5-9 mm wide
 2. *S. hookeri*
 6. Leaves elliptic, 8-15 cm long, 1.5-5(-8) cm wide. Bract 3-4 mm long. Drupe 8-11 mm long, 4-6 mm wide
 6. *S. racemosa*
 5. Stamens less than 50
 7. Leaves pubescent. Disc and ovary densely hairy. Drupe ellipsoid to cylindrical
 4. *S. macrophylla* subsp. *sulcata*
 7. Leaves glabrous. Disc glabrous; ovary glabrous to sparsely hairy. Drupe ovoid to ampulliform
 7. *S. sumuntia*

1.1 *Symplocos cochinchinensis* (Lour.) S. Moore subsp. *cochinchinensis*

J. Bot. 52: 148. 1914; Nooteboom, Rev. Symploc.: 141, t. 2 c. 1975; in Fl. Thailand 2 (4): 455. 1981. — *Dicalix cochinchinensis* Lour., Fl. Cochinch.: 663. 1790. — *Symplocos ferruginea* Roxb., Fl. Ind. ed. Carey 2: 542. 1832; Fletcher in Fl. Siam. Enum. 2: 386. 1938.

Tree or shrub up to 15 m high; twigs pubescent or glabrous. **Leaves** lanceolate, ovate, elliptic to obovate, (6-)12-25 cm long, 3-10 cm wide, glabrous or pubescent on midrib and nerves; base cuneate, rarely rounded; apex acuminate; margin glandular dentate or crenulate; primary veins (8-)10-14(-16) pairs, meeting in an intramarginal vein or not; petioles (2-)5-17 mm long, glabrous. **Inflorescence** a spike, 3-15 cm long; axis tomentose or pubescent. **Flowers** slightly fragrant; bract ovate, 3-4 mm long, tomentose or pubescent, persistent; bracteoles ovate, ca. 2 mm long, tomentose or pubescent, persistent. **Calyx** pubescent; lobes 1-3 mm long. **Corolla** white, 3-5 mm long, glabrous, divided nearly to the base. **Stamens** 30-70. Disc glabrous. **Ovary** 0.5-1 mm long, glabrous; style 3-5 mm long, glabrous. **Drupe** globose or ampulliform, 5-7 mm long, 4-5 mm wide, ribbed when dry, with enlarged calyx lobes which form a conical beak on top. **Seed** 1, curved (Fig. 79).

Thailand.— Northern: Nan, Tak; South-eastern: Chanthaburi, Trat; Central: Nakhon Nayok; Peninsular: throughout.

Distribution.— India, Myanmar, China, Japan, Indo-China (type), Malaysia, Indonesia, Philippines, New Guinea.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: September-November; fruiting: July-September.

Voucher specimens.— *P. Srisanga* 1719; *P. Srisanga* & *C. Maknoi* 2034.

1.2 *Symplocos cochinchinensis* (Lour.) S. Moore subsp. *laurina* (Retz.) Nootboom

Rev. Symploc.: 156. 1975; in Fl. Thailand 2(4): 456. 1981. – *Myrtus laurinus* Retz., Ob. Bot. 4: 26. 1786.

This subspecies differs from subsp. *cochinchinensis* in glabrous calyx lobes and not enlarged in fruit.

Thailand.— Northern: Chiang Mai, Lampang, Nan, Phitsanulok; North-eastern: Loei, Phetchabun, Nong Khai; Eastern: Chaiyaphum, Nakhon Ratchasima; South-eastern: Chon Buri, Rayong, Chanthaburi, Trat; South-western: Kanchanaburi, Prachuap Khiri Khan; Peninsular: Chumphon, Surat Thani, Phattalung, Songkhla, Nakhon Si Thammarat.

Distribution.— India, Sri Lanka (type), Myanmar, China, Japan, Taiwan, Cambodia, Laos, Vietnam, Malaysia.

Ecology.— Lower montane forest, alt. 1,200-1,400 m (Doi Phu Kha).

Phenology.— Flowering: September-November; fruiting: June-September.

Vernacular.— หม้อดหลวง Mueat luang (Northern).

Voucher specimens.— *P. Srisanga* 1613, 1617, 1639, 1880.

2. *Symplocos hookeri* C.B. Clarke

In Fl. Br. Ind. 3: 578. 1882; Fletcher in Fl. Siam. Enum. 2: 386. 1938; Nootboom, Rev. Symploc.: 207, t. 17 b-e, fotogr. 4. 1975; in Fl. Thailand 2(4): 459. 1981. – *S. sempervirens* Fletcher, Kew Bull. 1937: 508. 1938; in Fl. Siam. Enum. 2: 389. 1938.

Tree or shrub up to 15 m high; twigs glabrous. **Leaves** obovate, 14-22 cm long, 4-12 cm wide, glabrous; base cuneate; apex acuminate; margin dentate; primary veins 6-11 pairs, meeting in an intramarginal vein; petioles 12-30 mm long, glabrous. **Inflorescence** a raceme, 3-5 cm long, forming a cone in bud, conspicuous by the light grey appressed pubescent bract or cone dark brown and glabrous bract. Bract ovate, 5-8 mm long, caducous; bracteoles 1-3 mm long, caducous; pedicels 1-3 mm long. **Calyx** glabrous; lobes 1-3 mm long. **Corolla** white, 6-9 mm long, glabrous, divided nearly to the base. **Stamens** ca. 80. Disc flattened or cylindrical, shortly pubescent. **Ovary** 1-2 mm long, glabrous; style 5-8 mm long, glabrous. **Drupe** ellipsoid to cylindrical, 13-24 mm long, 5-9 mm wide. **Seed** 1, straight (Fig. 80).

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Tak; South-eastern: Trat; South-western: Kanchanaburi.

Distribution.— India (type), S China (Yunnan), Laos, Vietnam.

Ecology.— Lower montane forest, by streams, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: August-October.

Vernacular.— เหมือนดอกคดเกี้ยว Mueat yod kliang (Northern).

Voucher specimens.— *P. Srisanga* 1662, 1695, 1696.

3. *Symplocos longifolia* Fletcher

Kew Bull. 1937: 505. 1938; in Fl. Siam. Enum. 2: 388. 1938; Nootboom, Rev. Symploc.: 217, t. 20 f-h. 1975; in Fl. Thailand 2(4): 459. 1981.

Tree or shrub up to 10 m high; twigs glabrous. **Leaves** narrowly elliptic to narrowly obovate, 14-40 cm long, 4-9 cm wide, glabrous; base cuneate; apex acuminate; margin dentate; primary veins 6-11 pairs, meeting in an intramarginal vein; petioles 5-15 mm long, glabrous. **Inflorescence** a spike, 4-7 cm long; axis glabrous. Bract ovate, 3-4 mm long, sparsely hairy, caducous; bracteoles ca. 2 mm long, sparsely hairy, caducous. **Calyx** pubescent; lobes 1.5-2 mm long. **Corolla** white, 5-6 mm long, glabrous, divided nearly to the base. **Stamens** ca. 70. Disc flattened, shortly pubescent. **Ovary** 1-2 mm long, glabrous; style 5-8 mm long, hairy at the base. **Drupe** ellipsoid to ovoid, 13-20 mm long, 5-9 mm wide. **Seed** 1, straight.

Thailand.— Northern: Lamphun, Lampang (type), Nan.

Distribution.— Cambodia, Laos, Vietnam.

Ecology.— Lower montane forest, by streams, alt. 1,100-1,400 m (Doi Phu Kha).

Phenology.— Flowering: September-November; fruiting: February-April.

Vernacular.— เหมือนคดง Mueat dong (Northern).

Voucher specimens.— *P. Srisanga* 2203; *P. Srisanga et al.* 2466.

Notes.— New locality recorded from Nan, in Thailand.

4. *Symplocos macrophylla* Wall. ex DC. subsp. *sulcata* (Kurz) Nootboom

Rev. Symploc.: 230. 1975; in Fl. Thailand 2(4): 460. 1981. — *S. sulcata* Kurz, J. As. Soc. Beng. 40(2): 65. 1870. — *S. hossei* Brand. ex Hosseus, Beih. Bot. Centralbl. 28 (2): 424. 1911. — *S. kerrii* Craib, Kew Bull. 1920: 304. 1920; Fletcher in Fl. Siam. Enum. 2: 387. 1938, incl. var. *glabra*.

Tree or shrub up to 15 m high; twigs tomentose. **Leaves** lanceolate, narrowly elliptic to ovate, 7-20 cm long, 2.5-6.5 cm wide, pubescent; base cuneate; apex acuminate to caudate; margin glandular dentate; primary veins 6-17 pairs, meeting in an intramarginal vein; petioles (3-)6-13 mm long, pubescent. **Inflorescence** a fascicle or raceme, up to 3 cm long, forming a cone in bud; axis pubescent to appressed pilose. Bract 3-5 mm long, pubescent, caducous; bracteoles 1.5-4 mm long, pubescent, caducous; pedicels 1-2 mm long, pubescent. **Calyx** sericeous; lobes elliptic, 1-2.5 mm long. **Corolla** white, 2.5-6 mm long, glabrous, divided nearly to the base. **Stamens** 30-50. Disc 5 angular, densely hairy. **Ovary** 1-1.5 mm long, sericeous; style

glabrous or with some hairs towards the base. **Drupe** ellipsoid to cylindrical, 7-9 mm long, 3-5 mm wide. **Seed** 1, straight (Fig. 81).

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Phrae, Nan, Tak; North-eastern: Loei.

Distribution.— India (type), Myanmar, S China (Yunnan), Cambodia, Vietnam.

Ecology.— Lower montane forest, also found in open areas, alt. 1,500-1,800 m (Doi Phu Kha).

Phenology.— Flowering: September-November; fruiting: September-February.

Vernacular.— เหมือนดออย Mueat doi (Northern).

Voucher specimens.— *P. Srisanga* 264, 378, 470, 1151, 1157, 1619.

5. *Symplocos megalocarpa* Fletcher

Kew Bull. 1937: 507. 1938; in Fl. Siam. Enum. 2: 388. 1938; Nooteboom, Rev. Symploc.: 238. 1975; in Fl. Thailand 2(4): 461. 1981.

Tree or shrub up to 10 m high; twigs glabrous. **Leaves** elliptic to obovate, 12-19 cm long, 4-9 cm wide, glabrous; base cuneate; apex shortly acuminate; margin glandular dentate; primary veins 9-13 pairs, meeting in an intramarginal vein; petioles 15-20 mm long, glabrous. **Inflorescence** a spike, up to 4 cm long; axis glabrous. Bract ovate, 5-10 mm long, pubescent, caducous; bracteoles elliptic, ca. 5 mm long, caducous. **Calyx** pubescent; lobes 3-5 mm long. **Corolla** 4-5 mm long, glabrous, divided nearly to the base. **Stamens** ca. 70. Disc flattened, glabrous. **Ovary** 1-2 mm long, glabrous; style 5-8 mm long, glabrous. **Drupe** ellipsoid to ovoid, 12-20 mm long, 5-8 mm wide. **Seed** 1, straight.

Thailand.— Northern: Nan; North-eastern: Loei (type).

Distribution.— Vietnam.

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: May-June.

Voucher specimens.— *P. Srisanga* 1465.

Notes.— Rare species, few specimens collected. New locality recorded from Nan, in Thailand.

6. *Symplocos racemosa* Roxb.

Fl. Ind. ed. Carey 2: 539. 1832; Fletcher in Fl. Siam. Enum. 2: 388. 1938; Nooteboom, Rev. Symploc.: 271. 1975; in Fl. Thailand 2(4): 462. 1981. — *S. impressa* Fletcher, Kew Bull. 1937: 505. 1938; in Fl. Siam. Enum. 2: 387. 1938.

Small tree or shrub up to 7 m high; twigs glabrous or rarely hairy. **Leaves** elliptic, 8-15 cm long, 1.5-5(-8) cm wide, glabrous or young leaves hairy; base attenuate, cuneate to rounded; apex rounded to acuminate; margin dentate; primary veins 5-9 pairs, sometimes an intramarginal vein present; petioles 7-15 mm long,

glabrous to glabrescent. **Inflorescence** an axillary raceme or panicle, up to 15 cm long; axis pubescent to tomentose. **Flowers** slightly fragrant; bract ovate, 3-4 mm long, pubescent, caducous; bracteoles elliptic, 2-3 mm long, pubescent, caducous; pedicels (0.5-)1-3(-8) mm long, pubescent. **Calyx** glabrous; lobes 1-3 mm long. **Corolla** white, 5-6 mm long, glabrous, divided nearly to the base. **Stamens** ca. 100. Disc low cylindrical, hairy. **Ovary** 1-2 mm long, glabrous; style glabrous or hairy towards the base. **Drupe** ellipsoid, 8-11 mm long, 4-6 mm wide. **Seed** 1, straight (Fig. 82).

Thailand.— Northern: Chiang Mai, Chiang Rai, Lamphun, Lampang, Phare, Nan, Kamphaeng Phet; North-eastern: Loei, Sakhon Nakhon, Nakhon Phanom, Phetchabun, Udon Thani; Eastern: Chaiyaphum, Si Sa Ket; South-eastern: Prachinburi, Chon Buri, Chanthaburi; Central: Saraburi; South-western: Kanchanaburi, Ratchaburi, Phetchaburi.

Distribution.— India (type), Myanmar, China, Cambodia, Laos, Vietnam.

Ecology.— Dry evergreen and lower montane forest, also by roadsides, alt. 550-1,200 m (Doi Phu Wae).

Phenology.— Flowering: November-December; fruiting: March-April.

Vernacular.— เหมือนดอหม Mueat hom (Northern).

Voucher specimens.— *P. Srisanga* 404, 1248, 2625.

7. *Symplocos sumuntia* Buch.-Ham. ex D. Don

Prodr. Fl. Nepal.: 145. 1825; Nootboom, Rev. Symploc.: 284. 1975; in Fl. Thailand 2 (4): 463. 1981. — *S. caudata* Wall. ex G. Don, Gen. Hist. 4: 3. 1837; Fletcher in Fl. Siam. Enum. 2: 385. 1938.

Tree or shrub up to 8 m high; twigs glabrous or rarely hairy. **Leaves** lanceolate to elliptic, 2-12 cm long, 1-4.5 cm wide, glabrous; base attenuate; apex acuminate to caudate; margin glandular dentate to crenate or subentire; primary veins 5-8 pairs, an inconspicuous intramarginal vein present; petioles 2-10 mm long, glabrous. **Inflorescence** an axillary raceme or panicle, 1-6 cm long; axis glabrous to pubescent. Bract 2-5 mm long, pubescent, caducous; bracteoles 0.5-4 mm long, pubescent, caducous; pedicels 1-13 mm long, glabrous to pubescent. **Calyx** glabrous to sparsely hairy; lobes 0.5-1.5 mm long. **Corolla** white, 4-8(-11) mm long, glabrous, divided nearly to the base. **Stamens** 25-40. Disc annular, glabrous. **Ovary** 1-2 mm long, glabrous to sparsely hairy; style glabrous. **Drupe** ovoid to ampulliform, 6-10 mm long, 3-6 mm wide. **Seed** 1, curved (Fig. 83).

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; North-eastern: Loei; Eastern: Nakhon Ratchasima, Ubon Ratchathani, Chaiyaphum; South-eastern: Chanthaburi, Trat; Peninsular: Ranong.

Distribution.— India, Nepal (type), Sikkim, Myanmar, China, Taiwan, Korea, Japan, Laos, Cambodia, Vietnam, Malaysia.

Ecology.— Lower montane forest, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering: September-October; fruiting: February-March.

Voucher specimens.— *P. Srisanga* 1668.

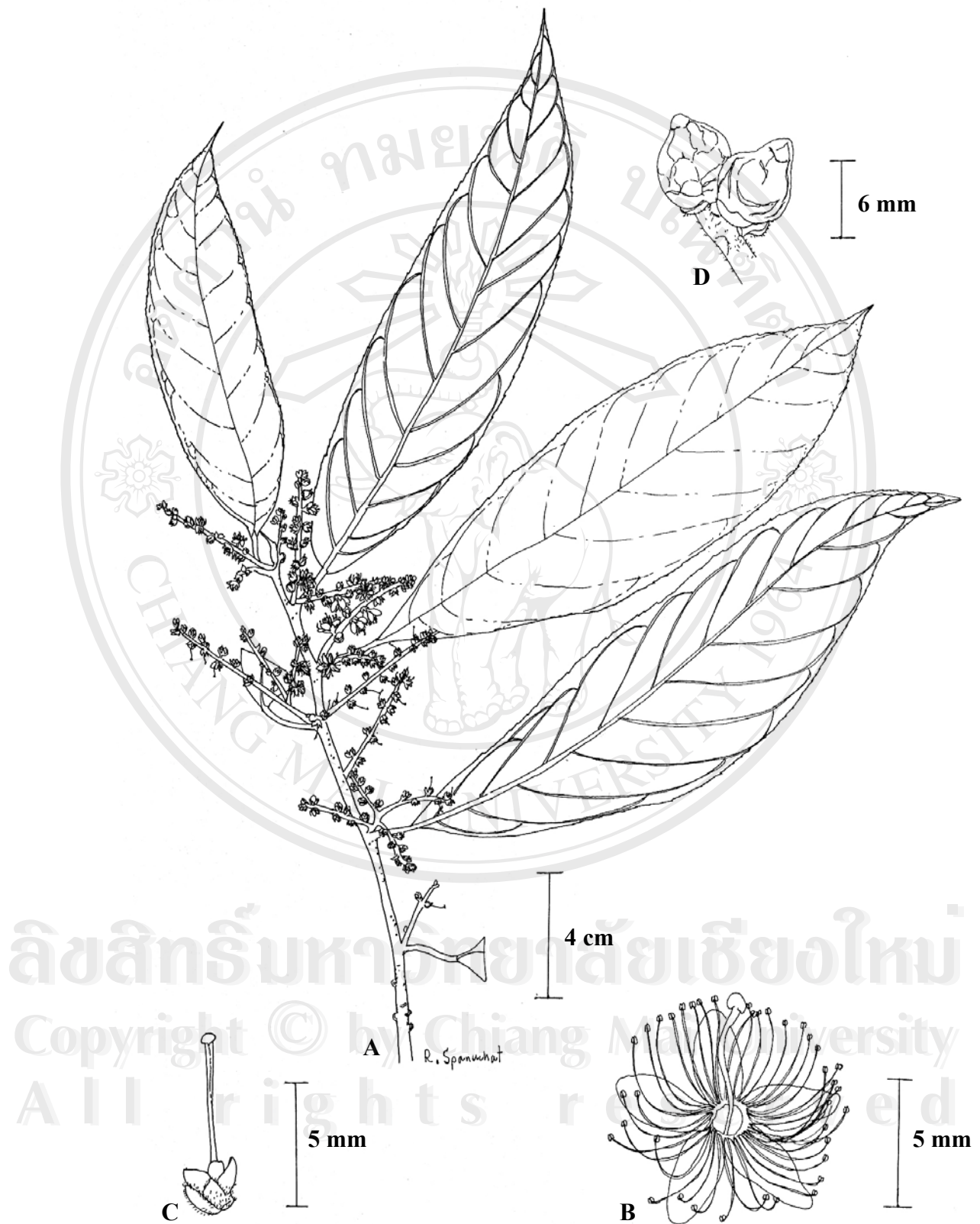


Figure 79. *Symplocos cochinchinensis* (Lour.) S. Moore subsp. *cochinchinensis*

A. flowering branch; B. flower; C. calyx and pistil; D. fruits.

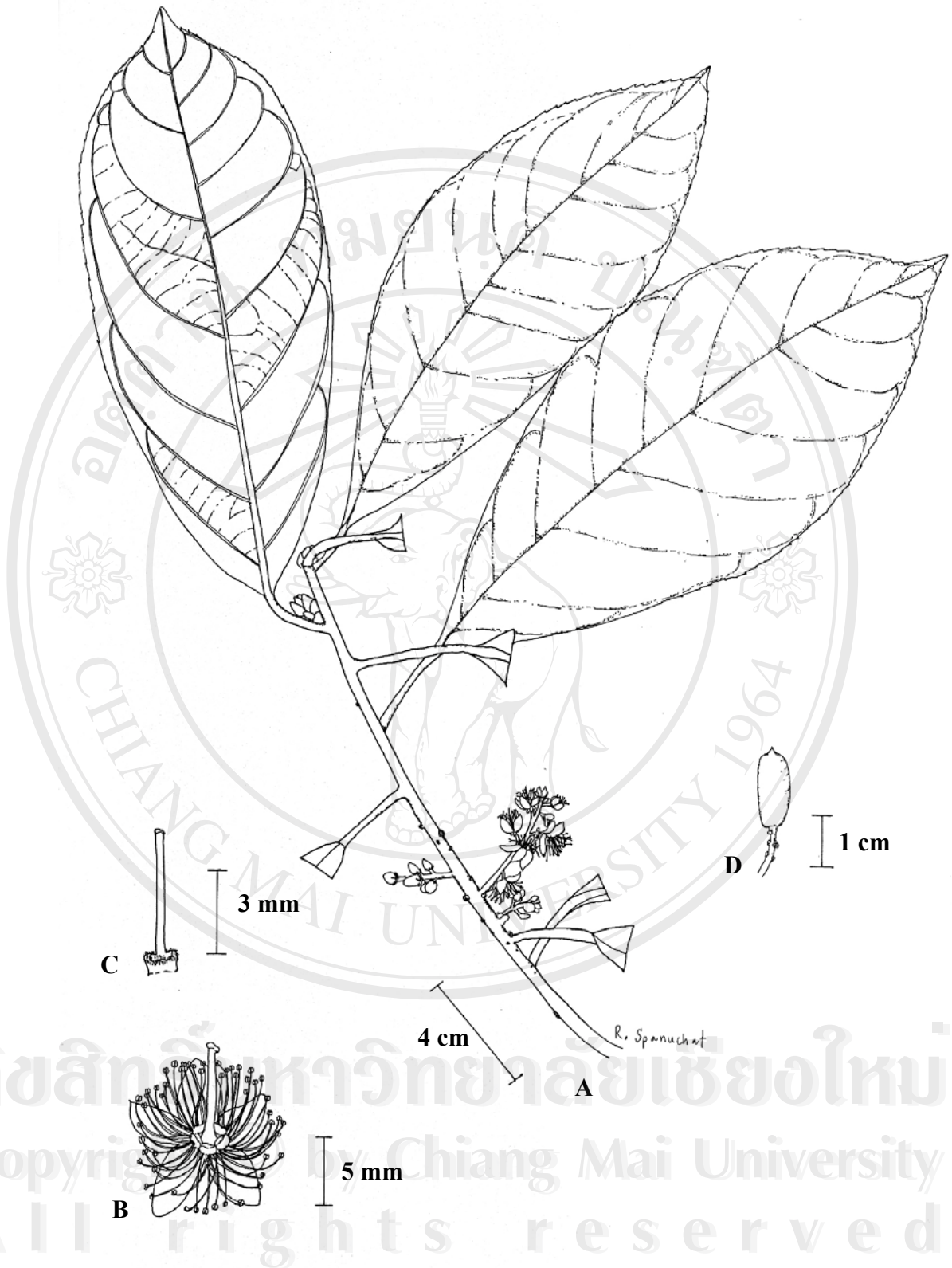


Figure 80. *Symplocos hookeri* C.B. Clarke

A. flowering branch; B. flower; C. pistil; D. fruit.

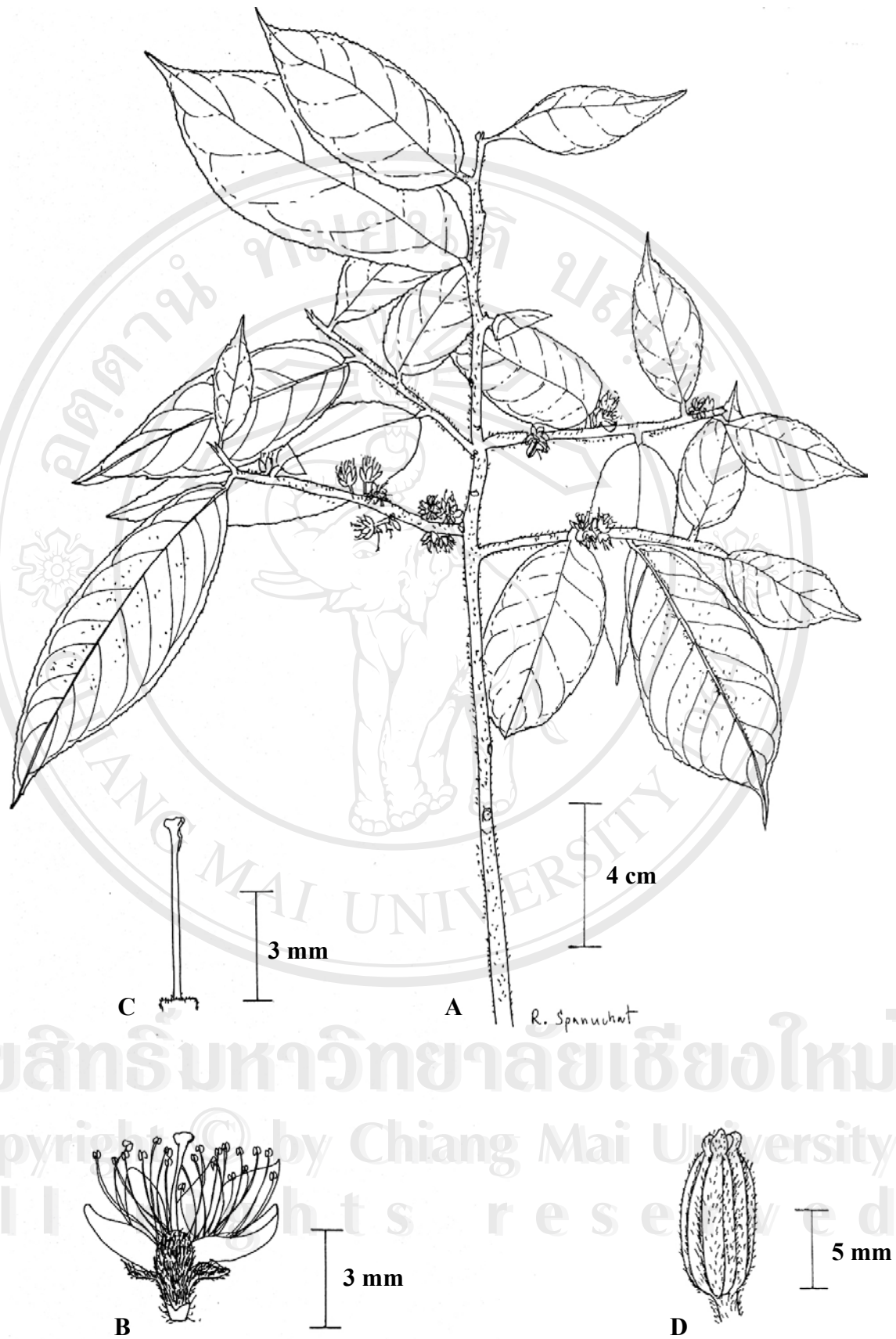


Figure 81. *Symplocos macrophylla* Wall. ex DC. subsp. *sulcata* (Kurz) Nootboom

A. flowering branch; B. flower; C. pistil; D. fruit.

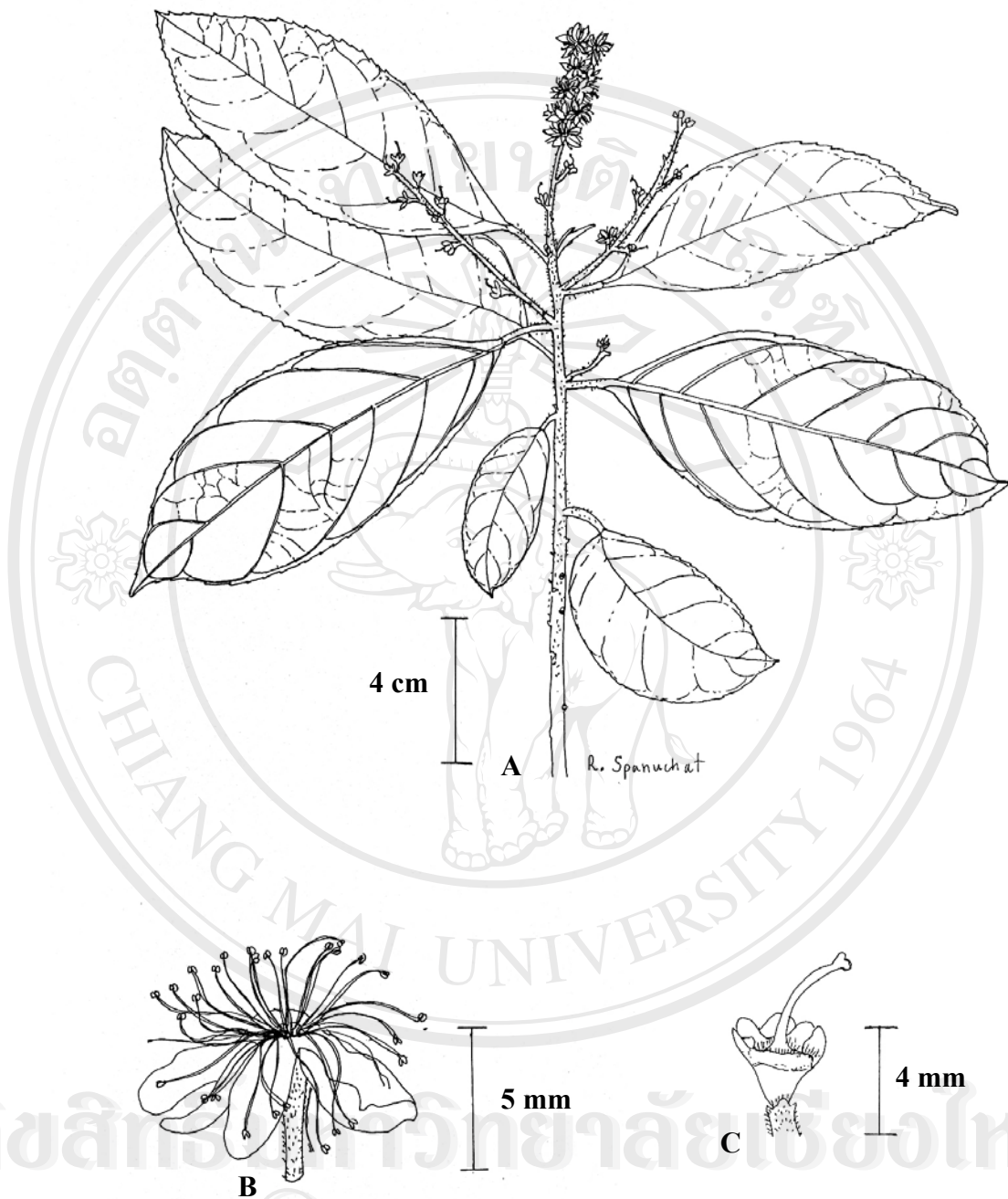


Figure 82. *Symplocos racemosa* Roxb.

A. flowering branch; B. flower; C. pistil.

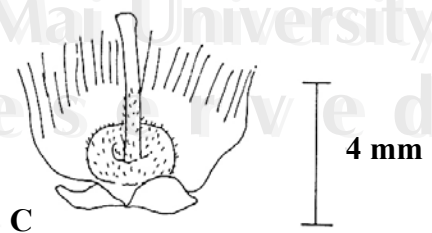
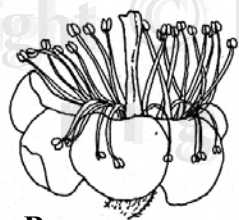
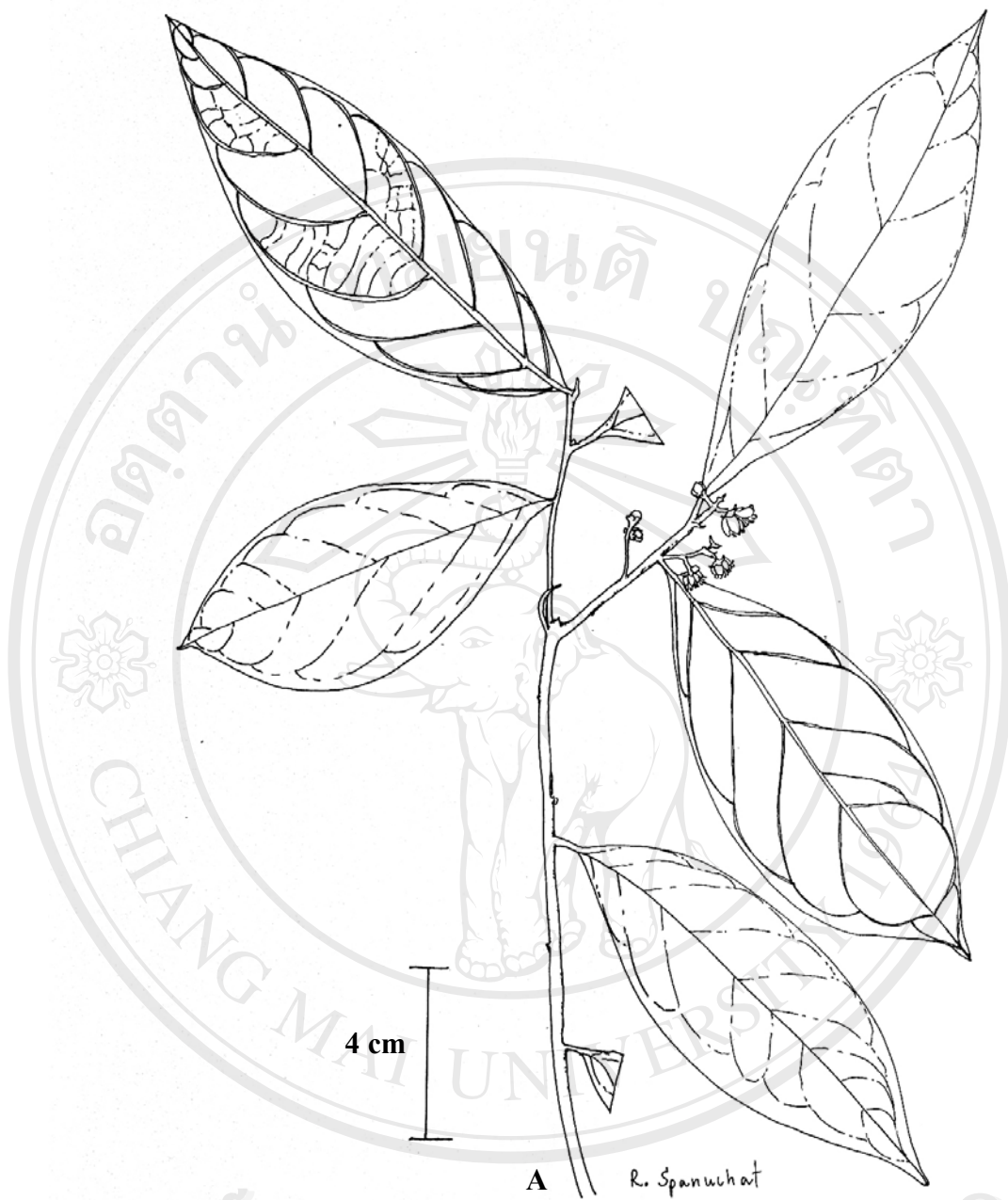


Figure 83. *Symplocos sumuntia* Buch.-Ham. ex D. Don

A. flowering branch; B. flower; C. pistil.

THEACEAE

Trees or shrubs, mostly evergreen. **Leaves** simple, alternate; stipules absent. **Flowers** solitary, rarely in racemose, paniculate or fascicles, regular, bisexual, sometimes unisexual; bracteoles 2 to numerous below the calyx. **Calyx** mostly 5, imbricate, free or connate. **Petals** mostly 5, imbricate, often slightly connate at base. **Stamens** many to numerous in several whorls, free or shortly connate; anthers basifixed or versatile, opening by longitudinal slits. **Ovary** superior, rarely half-inferior, 2-5-locular, axile placentation; styles 2-5, free or united; ovules 2 or more in each loculus. **Fruit** a berry or capsule, rarely pome-like.

Twenty-two genera and about 600 species, in tropical and subtropical regions with the centres in C America and E Asia. Nine genera and 21 species in Thailand (Keng, 1972c). Six genera and 9 species recorded from Doi Phu Kha National Park. In this treatment, Ternstroemiaceae is included within Theaceae.

KEY TO THE GENERA

- | | |
|---|-------------------------------|
| 1. Ovary half-inferior. Fruit a pome-like | 1. <i>Anneslea</i> |
| 1. Ovary superior. Fruit a berry or capsule | |
| 2. Anthers basifixed. Fruit a berry | |
| 3. Leaves distichous. Flowers and fruits up to 5 mm across | 3. <i>Eurya</i> |
| 3. Leaves spirally arranged. Flowers and fruits more than 5 mm across | 6. <i>Ternstroemia</i> |
| 2. Anthers versatile. Fruit a capsule | |
| 4. Capsule cylindrical, ellipsoid | 4. <i>Gordonia</i> |
| 4. Capsule subglobose | |
| 5. Seeds globose or plano-convex, not winged | 2. <i>Camellia</i> |
| 5. Seeds flattened, winged | 5. <i>Schima</i> |

1. *ANNESLEA* Wall.

Pl. As. Rar. 1: 5, t. 5. 1829, nom. cons.; Kobuski, J. Arn. Arb. 33: 79. 1952; Keng in Fl. Thailand 2(2): 157. 1972; Weitzman, Dressler & Stevens in Fam. Gen. Vasc. Pl. 6: 456. 2004.

Trees or shrubs. **Leaves** alternate, coriaceous. **Inflorescence** terminal, umbel-like, several to many-flowered. **Flowers** bisexual. **Calyx** 5, persistent. **Petals** 5, connate at base, deeply constricted at the middle. **Stamens** 30-40; anthers basifixed, cordate at base, glabrous, with a linear connective. **Ovary** half-inferior, 2-3-locular; ovules 2-10 in each loculus, pendulous; styles 3, united. **Fruit** a pome-like. **Seeds** 1-3 in each loculus, arillate.

Three species in China and SE Asia. One species in Thailand (Keng, 1972c).

***Anneslea fragrans* Wall.**

Pl. As. Rar. 1: 5, t. 5. 1829; Craib in Fl. Siam. Enum. 1: 123. 1925; Kobuski, J. Arn. Arb. 33: 79. 1952; Keng in Fl. Thailand 2(2): 157. 1972.

Tree, 5-15 m high. **Leaves** lanceolate, elliptic to ovate, 7-15 cm long, (2.5-)4-7 cm wide, glabrous, with black dots throughout lower surface; base cuneate; apex acute, rarely rounded or obtuse; petioles 2-3 cm long, glabrous. **Flowers** slightly fragrant; bracteoles 2, subtending the calyx; pedicels 2-3 cm long, covered with granular. **Calyx** coriaceous; lobes ovate or rounded, 1-1.5 cm long, unequal. **Petals** yellowish white, ovate, 1.5-2 cm long, acute at the apex, shortly connate at the base. **Stamens** 1.2-1.5 cm long. **Fruit** globular to ovoid, ca. 2 cm in diam. (Fig. 150).

Thailand.— Northern: Chiang Mai, Chiang Rai, Lamphun, Nan; North-eastern: Loei, Phetchabun, Sakon Nakhon; Eastern: Surin; South-western: Kanchanaburi.

Distribution.— Myanmar (type), S. China, Laos, Vietnam, Cambodia, Malaysia.

Ecology.— Dry evergreen forest, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: November-March; fruiting: March-May.

Vernacular.— สารภีดอย Saraphi doi (Chiang Mai).

Voucher specimens.— *P. Srisanga* 352.

2. *CAMELLIA* L.

Sp. Pl.: 698. 1753; Sealy, Rev. Gen. Camellia: 14. 1958; Keng in Fl. Thailand 2(2): 145. 1972; Stevens, Dressler & Weitzman in Fam. Gen. Vasc. Pl. 6: 468. 2004. – *Thea* L., Sp. Pl.: 515. 1753.

Trees or shrubs. **Leaves** alternate, chartaceous or coriaceous. **Inflorescence** axillary, rarely terminal, 2-3 in a cluster or flower solitary. **Flowers** bisexual. **Calyx** 5-21. **Petals** 5-7(-12), slightly connate at the base. **Stamens** numerous, the outer ones connate below and adnate to corolla, the inner ones free; anthers versatile. **Ovary** superior, 3-5-locular; ovules 4-6 in each loculus; styles 2-5, free or united. **Fruit** a loculicidal capsule. **Seeds** globose or plano-convex, not winged.

More than 100 species distributed from Nepal, India, S China to SE Asia and Malesia but with concentrations in S China. Tea (*Camellia sinensis* (L.) Kuntze) is an important cultivated beverage plant. Several species are also cultivated as ornamentals. Six species in Thailand (Keng, 1972c). Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Flowers sessile or subsessile

1. *C. oleifera* var. *confusa*

1. Flowers pedicellate; pedicels generally over 5 mm long

2. Styles 2-3-fid above. Petals 5-6(-8). Flowers 2.5-3.5 cm across

2. *C. sinensis* var. *assamica*

2. Style 5-fid above. Petals 9-11. Flowers 5-6 cm across

3. *C. taliensis*

1. *Camellia oleifera* Abel var. *confusa* (Craib) Sealy

Rev. Gen. *Camellia*: 209, fig. 210. 1958; Keng in Fl. Thailand 2(2): 147. 1972. – *Thea confusa* Craib, Kew Bull. 1914: 5. 1914. – *Camellia confusa* (Craib) C. Stuart, Meded. Proefstn Thee, Buitenz. 40: 130, fig. 14. 1916; Craib in Fl. Siam. Enum. 1: 131. 1925.

Shrub or small tree up to 8 m high. **Leaves** coriaceous, oblong to elliptic, 6-11 cm long, 2.5-6 cm wide, glabrous or sparsely hairy along midrib above; base cuneate; apex acuminate; margin serrulate; petioles 4-8 mm long. **Flowers** sessile or subsessile. Bracteoles 2-3, ovate to orbicular, 2-8 mm long. **Sepals** ovate to orbicular, 2-8 mm long. **Petals** white, oblong or obovate, 2-3 cm long, retuse or emarginate at apex. **Stamens** yellow, 8-12 mm long. **Ovary** 3-4 mm long, silky tomentose; styles 2-3-fid above. **Capsule** 3-lobed, subglobose, tomentose, ca. 3 cm long and wide. **Seed** 1 in each loculus.

Thailand.— Northern: Chiang Mai (type), Nan, Sukhothai; North-eastern: Loei; Eastern: Nakhon Ratchasima; South-eastern: Chanthaburi; South-western: Prachuap Khiri Khan; Peninsular: Ranong.

Distribution.— India (Assam), Myanmar, S China (Yunnan), Indo-China.

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: September-November; fruiting: July-December.

Vernacular.— เมืองงา Miang arm (Northern).

Voucher specimens.— *P. Srisanga* 293, 294; *P. Srisanga et al.* 762.

2. *Camellia sinensis* (L.) Kuntze var. *assamica* (Mast.) Kitamura

Acta Phytotax. Geobot. 14: 59. 1950; Sealy, Rev. Gen. *Camellia*: 119, fig. 55. 1958; Keng in Fl. Thailand 2(2): 148. 1972. – *Thea assamica* Mast., J. Agri. Hort. Soc. 3: 63. 1844. – *C. theifera* Griff., Not. Pl. As. 4: 558. 1854; Craib in Fl. Siam. Enum. 1: 132. 1925.

Shrub or small tree up to 8 m high. **Leaves** subcoriaceous, elliptic, 8-14(-22) cm long, 3.5-5.5(-7.5) cm wide, glabrous on upper surface, pubescent on lower surface; base broadly cuneate to rounded; apex acuminate; margin serrate. Pedicels 5-7 mm long. Bracteoles 2-3, ovate, 2-3 mm long. **Sepals** 5-6, ovate to orbicular, 3-5 mm long. **Petals** yellowish white, 5-6(-8), broadly ovate to orbicular, 1-2 cm long. **Stamens** yellow, 10-15 mm long. **Ovary** 3-4 mm long, densely hairy; styles 2-3-fid above. **Capsule** 3-lobed, depressed globose. **Seeds** 1-2 in each loculus.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan.

Distribution.— India (Assam-type), S China, Myanmar,

Ecology.— Dry evergreen and lower montane forest, often by streams and shade areas, alt. 900-1,300 m (Doi Phu Kha).

Phenology.— Flowering: June-August; fruiting: May-November.

Uses.— Cultivated for conventional tea and fermented tea for chewing in restricted areas in northern Thailand.

Vernacular.— เมือง Miang (Northern), Tea.

Voucher specimens.— *P. Srisanga* 261.

3. *Camellia taliensis* (W.W. Sm.) Melchior

In Pflanzenfam. ed. 2. 21: 131. 1925; Sealy, Rev. Gen. Camellia: 127, fig. 57. 1958; Keng in Fl. Thailand 2(2): 148. 1972. – *Thea taliensis* W.W. Sm., Notes Roy. Bot. Gard. Edinb. 10: 73. 1917.

Shrub or small tree up to 13 m high. **Leaves** chartaceous to thin coriaceous, elliptic, (7-)9-15 cm long, 3-6.5 cm wide, glabrous on both surfaces; base cuneate; apex acute to shortly acuminate; margin serrulate or subentire. Pedicels 6-12 mm long. Bracteoles 2-3, caducous. **Sepals** 5, orbicular, 4-6 mm long. **Petals** white, 9-11, ovate or obovate, 2-3.5 cm long. **Stamens** yellow, 9-12 mm long. **Ovary** 2-3 mm long, hairy, glabrescent; styles 5-fid above. **Capsule** 4-6-lobed, depressed globose, 2-3.5 cm long and wide. **Seed** 1 in each loculus.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— S China (Yunnan-type).

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: October-December; fruiting: almost throughout the year.

Vernacular.— เมืองช่อ Miang cho (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1190, 1429, 1769, 1774; *P. Srisanga & C. Maknoi* 2027; *P. Srisanga & S. Watthana* 685.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

3. *EURYA* Thunb.

Nov. Gen. Pl. 1: 67. 1783; Keng in Fl. Thailand 2(2): 155. 1972; Weitzman, Dressler & Stevens in Fam. Gen. Vasc. Pl. 6: 457. 2004.

Shrubs or trees, mostly dioecious. **Leaves** membranous or coriaceous, distichous. **Inflorescence** axillary, in small clusters or flower solitary. **Flowers** unisexual, mostly dioecious, small. Bracteoles 2, persistent. **Calyx** 5. **Petals** 5, mostly connate at the base. **Stamens** (5-)15-25; anthers basifixed, glabrous. **Ovary** superior, 3-5-locular; ovules several in each loculus; styles 3-5. **Fruit** a berry, up to 5 mm across, many-seeded.

About 70 species in tropical and subtropical Asia, tropical America and Pacific. Two species each with 2 varieties in Thailand (Keng, 1972c). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Calyx pubescent outside, glabrous inside. Ovary glabrous
 1. *E. acuminata* var. *wallichiana*
1. Calyx glabrous outside, pubescent inside. Ovary pubescent
 2. *E. nitida* var. *siamensis*

1. *Eurya acuminata* DC. var. *wallichiana* Dyer

In Fl. Br. Ind. 1: 285. 1874; Craib in Fl. Siam. Enum. 1: 126. 1925; Keng in Fl. Thailand 2(2): 156. 1972.

Shrub or small tree up to 7 m high. Terminal leaf-buds and branchlets pubescent. **Leaves** narrowly lanceolate to lanceolate, 5-10 cm long, 1-3 cm wide, glabrous above, pubescent beneath; base cuneate; apex acuminate; midrib depressed on upper surface, raised and prominent on lower surface; veins distinct on lower surface; margin serrulate; petioles ca. 1 mm long, pubescent. **Inflorescence** axillary, in small clusters, 2-5-flowered. **Sepals** elliptic to ovate, 1-2 mm long, pubescent outside, glabrous inside. **Petals** creamy yellow or yellowish green, oblong to narrowly obovate, 3-4 mm long, glabrous, connate at the base. **Stamens** 15-20. **Ovary** ovoid to subglobose, 1.5-2 mm in diam., glabrous; styles 3, ca. 2 mm long. **Fruit** globose. 3-4 mm across, with persistent calyx at base and styles at top, black. **Seeds** angulate, ca. 1 mm, brown, with a honeycombed surface.

Thailand.— Northern: Chiang Mai, Lampang, Nan, Tak.

Distribution.— India (type), S China (Yunnan), Indo-China.

Ecology.— Lower montane forest, often along the roadsides and open areas, alt. 1,200-1,500 m (Doi Phu Kha).

Phenology.— Flowering: September-November; fruiting: March-April.

Vernacular.— แฮปันจัน Hae phan chan (Chiang Mai).

Voucher specimens.— *P. Srisanga* 285, 601, 1633, 2312; *P. Srisanga* & *S. Watthana* 665.

2. *Eurya nitida* Korth. var. *siamensis* (Craib) H. Keng

In Fl. Thailand 2(2): 157. 1972. – *E. japonica* Thunb. var. *siamensis* Craib in Fl. Siam. Enum. 1: 127. 1925;

Tree up to 20 m high. Terminal leaf-buds pubescent; branchlets pubescent or sparsely hairy. **Leaves** lanceolate, 6-15 cm long, 2-4.5 cm wide, glabrous above, glabrous, sparsely hairy to pubescent beneath; base cuneate; apex acuminate; midrib depressed on upper surface, raised and prominent on lower surface; veins distinct on lower surface; margin serrulate; petioles 1-6 mm long, glabrous to sparsely hairy. **Inflorescence** axillary, in small clusters, 2-6-flowered. **Sepals** broadly ovate to suborbicular, ca. 2 mm long, glabrous outside, pubescent inside. **Petals** creamy

yellow or yellowish green, ovate to narrowly obovate, 4-5 mm long, rounded or emarginate at apex, glabrous, connate at the base. **Stamens** 10-15. **Ovary** ovoid, 1.5-2 mm in diam., pubescent; styles 3-5, ca. 2 mm long. **Fruit** ovoid to ellipsoid, 4-5 mm long, pubescent, with persistent calyx at base and styles at top, black. **Seeds** angulate, ca. 1 mm, brown, with a honeycombed surface.

Thailand.— Northern: Chiang Mai (type), Nan; North-eastern: Loei; Eastern: Chaiyaphum, Nakhon Ratchasima; Peninsular: Nakhon Si Thammarat, Surat Thani.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: August-October; fruiting: June-July.

Vernacular.— ไคร้มด Khrai mot (Chiang Mai).

Voucher specimens.— *P. Srisanga* 978, 1511; *P. Srisanga & C. Maknoi* 2022; *P. Srisanga & C. Puff* 1097; *P. Srisanga et al.* 829.

4. *GORDONIA* Ellis

Phil. Trans. R. Soc. 60: 518, t. 11. 1770, nom. cons.; Keng in Fl. Thailand 2(2): 143. 1972; Stevens, Dressler & Weitzman in Fam. Gen. Vasc. Pl. 6: 468. 2004.

Trees or shrubs. **Leaves** coriaceous. **Flowers** axillary, solitary, bisexual. Bracts 2-5, caducous. **Sepals** mostly 5, unequal. **Petals** mostly 5, united at the base. **Stamens** numerous, united below, in 5 bundles and opposite the petals; anthers versatile. **Ovary** superior, 3-5-locular; ovules 4-8 in each loculus; style 1; stigma 3-5-lobed. **Capsule** woody, cylindrical, ellipsoid, often angulate, dehiscent loculicidally, with a persistent central column. **Seeds** flattened, obliquely winged above.

About 70 species in tropical and subtropical Asia and N America. Two species in Thailand (Keng, 1972c). One species recorded from Doi Phu Kha National Park.

Gordonia axillaris (Roxb. ex Ker-Gawl.) Dietr.

Syn. Pl. 4: 863. 1847; Keng in Fl. Thailand 2(2): 144. 1972. – *Camellia axillaris* Roxb. ex Ker-Gawl., Bot. Reg. 4, t. 349. 1819.

Tree up to 20 m high. **Leaves** oblong to elliptic, 12-18 cm long, 4-5 cm wide, glabrous; base cuneate; apex acute or obtuse; petioles 1-1.5 cm long. **Sepals** ovate to orbicular, 1-1.5 cm long. **Petals** yellowish white, orbicular, 3.5-5.5 cm long and wide; emarginate or bilobed at apex. **Stamens** 2.5-3 cm long; anthers 2-2.5 mm long. **Ovary** 5-6 mm long, densely pubescent; style 1-2 cm long; stigma 5-lobed. **Capsule** cylindrical or ellipsoid with short acumen, yellow tomentose when young, almost glabrous later, 5-8 cm long, 2.5-3 cm wide (Fig. 151).

Thailand.— Northern: Nan; North-eastern: Loei.

Distribution.— S & E China (type), Vietnam, Taiwan.

Ecology.— Lower montane forest, alt. 1,700-1,800 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting remained almost throughout the year.

Vernacular.— เมืองหลวง Miang luang (Northern).

Voucher specimens.— *P. Srisanga* 460.

Notes.— Rare species. New locality recorded from Nan, in Thailand.

5. *SCHIMA* Reinw. ex Bl.

Bijdr.: 129. 1825; Bloembergen, Reinwardtia 2: 134. 1952; Keng in Fl. Thailand 2(2): 144. 1972; Gard. Bull. Sing. 46(1): 80. 1994; Stevens, Dressler & Weitzman in Fam. Gen. Vasc. Pl. 6: 469. 2004.

Trees. **Leaves** coriaceous, spirally arranged, entire, serrate or crenate. **Inflorescence** axillary, crowded at the branch ends and raceme-like or flower solitary. **Flowers** bisexual. Bracteoles 2. **Sepals** 5, subequal, persistent. **Petals** 5, slightly connate below, the outermost one enveloping the others. **Stamens** numerous, adnate to the base of corolla; anthers versatile. **Ovary** superior, 5-locular; ovules (2-)3(-5) in each loculus; style simple, with 5 very short stigmatic lobes. **Capsule** woody, subglobose, opening longitudinally, with a persistent column. **Seeds** flattened, reniform, expanded at the outer edge into a narrow wing.

About 10-15 species (Keng, 1994) or 1 polymorphic species (Mabberley, 1997) in E and SE Asia. One species in Thailand (Keng, 1972c).

Schima wallichii (DC.) Korth.

In Temminck, Verh. Nat. Gesch. Bot. 3: 143. 1840; Craib in Fl. Siam. Enum. 1: 130. 1925; Keng in Fl. Thailand 2(2): 144. 1972; Gard. Bull. Sing. 46(1): 85. 1994. — *Gordonia wallichii* DC., Prodr. 1: 528. 1824. — *Schima noronhae* Reinw. ex Bl., Bijdr.: 130. 1825; Craib in Fl. Siam. Enum. 1: 130. 1925. — *S. crenata* Korth. in Temminck, Verh. Nat. Gesch. Bot. 3: 143. 1840; Craib in Fl. Siam. Enum. 1: 129. 1925. — *S. brevipes* Craib, Kew Bull. 1915: 423. 1915; in Fl. Siam. Enum. 1: 129. 1925.

Tree up to 45 m high; branchlets lenticellate, sparsely hairy. **Leaves** subcoriaceous, lanceolate, oblong to broadly elliptic, 7-15 cm long, 2-5.5 cm wide, glabrous above, sparsely hairy beneath; base attenuate, cuneate or rounded; apex acute or acuminate; margin mostly entire, rarely serrate or crenate; petioles 1-3 cm long, hairy. Pedicels 1.5-4 cm long, sparsely hairy. **Flowers** fragrant. **Sepals** suborbicular, 1-3 mm long, ciliate. **Petals** white, ovate, obovate, unequal, 2-3.5 cm long, rounded at apex. **Stamens** 5-7 mm long, glabrous. **Ovary** globose, silky tomentose, 2-4 mm long; style 0.5-2 mm long. **Capsule** subglobose, 2-4 cm across, silky when young, glabrous later.

Thailand.— Almost throughout the country.

Distribution.— India, S China, SE Asia.

Ecology.— Lower montane forest, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering: February-April; fruiting: November-March.

Vernacular.— ทะโล้ Talo (Northern).

Voucher specimens.— *P. Srisanga* 602.

6. *TERNSTROEMIA* Mutis ex L.f.

Suppl. Pl.: 39. 1781, nom. cons.; Keng in Fl. Thailand 2(2): 153. 1972; Weitzman, Dressler & Stevens in Fam. Gen. Vasc. Pl. 6: 456. 2004.

Trees or shrubs. **Leaves** coriaceous, spirally arranged, often subverticillate. **Flowers** unisexual, rarely bisexual, axillary, solitary. Bracteoles 2. **Sepals** 5, persistent. **Petals** 5, connate at base. **Stamens** 20 to numerous; filaments connate at the base; anthers basifixed, glabrous, with connective shortly projecting at tip. **Ovary** superior, usually 2-locular; ovules few, pendulous. **Fruit** a berry. **Seeds** usually 2 in each loculus, arillate.

About 85 species in E and SE Asia and tropical America. Two species in Thailand (Keng, 1972c). One species recorded from Doi Phu Kha National Park.

Ternstroemia gymnanthera (Wight & Arn.) Bedd.

Fl. Sylv.: 91. 1871; Keng in Fl. Thailand 2(2): 154. 1972. – *Cleyera gymnanthera* Wight & Arn., Prodr.: 87. 1834. – *T. japonica* auct. non. (Thunb.) Thunb.: Sieb. & Zucc., Fl. Jap. 1: 148, t. 80. 1841; Craib in Fl. Siam. Enum. 1: 124. 1925.

Tree up to 15 m high. **Leaves** oblong-lanceolate to oblanceolate, 5-12 cm long, 2-4 cm wide, glabrous; base cuneate; apex acute to acuminate; margin entire; petioles 1-1.5 cm long. **Sepals** ovate, 3-4 mm long. **Petals** yellow or pale yellow, obovate, 7-10 mm long, rounded at apex. **Stamens** numerous, 2-3 mm long. **Ovary** ovoid; styles 2-branched. **Fruit** ovoid or subglobose, 1-1.5 cm long and wide.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Nan; Eastern: Chaiyaphum; Nakhon Ratchasima; Peninsular: Songkhla.

Distribution.— India (type), Japan, Taiwan, Myanmar, S China, Indo-China, Philippines.

Ecology.— Lower montane forest, alt. 1,400 m (Doi Phu Wae).

Phenology.— Flowering: May-July; fruiting: August-September.

Vernacular.— ไต้แดง Kai daeng (Chiang Mai).

Voucher specimens.— *P. Srisanga et al.* 861.

THYMELAEACEAE

Trees, shrubs, rarely climbers or herbs with tenacious bark. **Leaves** simple, alternate or opposite, entire, exstipulate. **Inflorescence** terminal or axillary, spike,

raceme, umbel or head. **Flowers** bisexual, polygamous or dioecious. **Calyx** campanulate, cylindrical or tubular, 4-5-lobed. **Petals** inserted in the throat of the calyx-tube, 4, 5 or 10, sometimes scale-like, often reduced to fleshy glands or absent. **Stamens** 2-numerous; anther 2-locular, opening by longitudinal slits. Disc hypogynous, annular, scale-like or lacking. **Ovary** superior, 1-5-locular; ovule 1 in each loculus. **Fruit** a berry or drupe, sometimes a loculicidal capsule.

Forty-five genera and about 800 species, cosmopolitan with centres in Australia and Africa. Six genera and 16 species in Thailand (Peterson, 1997; Maxwell, 2000). Two genera and 4 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Erect shrub or small tree. Peduncles without leafy bracts. Petals absent **1. *Daphne***
1. Erect or straggling shrub or woody climber. Peduncles with 2(-4) leafy bracts. Petals present **2. *Linostoma***

1. *DAPHNE* L.

Gen. Pl. ed. 5: 167. 1754; Peterson in Fl. Thailand 6(3): 243. 1997; Herber in Fam. Gen. Vasc. Pl. 5: 390. 2003.

Shrubs or small trees. **Leaves** alternate, sometimes subopposite. **Inflorescence** terminal or axillary, capitate; involucre bracts 2; peduncle sometimes with linear bracteoles at base. **Flowers** 4-merous, sessile or shortly pedicelled. **Calyx** tube cylindrical or tubular. **Petals** absent. **Stamens** 8, in two whorls, subsessile; anthers linear. **Ovary** ellipsoid or ovoid; style sessile or very short; stigma capitate; disc cup-shaped, membranous, crenulated or lobed, glabrous, sometimes absent. **Fruit** a berry, ellipsoid or ovoid. **Seeds** ellipsoid.

About 95 species, mainly in Europe and northern Africa extending to India, eastern Asia and Malesia. Two species in Thailand (Peterson, 1997).

KEY TO THE SPECIES

1. Inflorescence axillary; peduncle 2-5 cm long. Calyx tube 6-11 mm long; lobes 2.5-4 mm long. Ovary pilose at the top. Fruit black or purplish black **1. *D. composita***
1. Inflorescence terminal; peduncle less than 0.5 cm long. Calyx tube 8-13 mm long; lobes 4-7 mm long. Ovary glabrous. Fruit orange-red **2. *D. sureil***

1. *Daphne composita* (L.f.) Gilg

In Pflanzenfam. 3 (6a): 238. 1894; Peterson in Fl. Thailand 6(3): 243, fig. 95: C-D, pl. XXIII: 2. 1997. – *Scopolia composita* L.f., Suppl.: 409. 1781.

Shrub up to 4 m high. **Leaves** lanceolate to narrowly elliptic, chartaceous to thinly coriaceous, (4-)6-12(-15) cm long, 1.5-4.5 cm wide, glabrous, glaucous below; base cuneate; apex acuminate to long-acute; petioles 2-5 mm long, glabrous. **Inflorescence** in axillary head; involucre bracts green, often red tinged, broadly ovate, 8-10 mm long, 10-12 mm wide, minutely pubescent especially towards the top, caducous; peduncle 2-5 cm long, glabrous, slightly pilose at top. **Flowers** 6-14, pale yellow or white, slightly fragrant, sessile. **Calyx** yellowish or sericeous pilose outside; tube 6-11 mm long; lobes ovate, 2-4 mm long, 1.2-3 mm wide. **Stamens** included or the upper whorl slightly exerted; filaments ca. 0.5 mm long; anthers 1-1.5 mm long. **Ovary** 1.5-2 mm long, pilose at the top; style 1-2.5 mm long; disc often lobed, 0.5-2 mm. **Fruit** 8-12 mm long, 4-7 mm wide, black or purplish black.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan; Eastern: Nakhon Ratchasima; South-eastern: Chanthaburi; South-western: Kanchanaburi; Peninsular: Phangnga, Nakhon Si Thammarat.

Distribution.— India, Myanmar, S China (Yunnan), Vietnam, Cambodia, Malaysia, Sumatra, Borneo, W Java (type).

Ecology.— Lower montane forest, alt. 1,400-1,600 m (Doi Phu Kha).

Phenology.— Flowering: December-February.

Vernacular.— เข็มขาวป่า Khem khao pa (Northern).

Voucher specimens.— *P. Srisanga* 2318.

2. *Daphne sureil* W.W. Smith & Cave

Rec. Bot. Surv. India 6: 51, fig. 2. 1913; Peterson in Fl. Thailand 6(3): 244. 1997.

Shrub up to 4 m high. **Leaves** lanceolate to narrowly elliptic, thinly coriaceous, (6-)9-15 cm long, 2-4.5 cm wide; glabrous; base cuneate; apex acute to acuminate; petioles 5-10 mm long, glabrous. **Inflorescence** terminal capitate; involucre bracts caducous; peduncle short, up to 5 mm long, hirsute. **Flowers** 5-14, white or creamy white, slightly fragrant; pedicels 1-2 mm long. **Calyx** pubescent outside; tube 8-13 mm long; lobes narrowly ovate, acute to acuminate at apex, 4-7 mm long, 2-4 mm wide. **Stamens** subsessile; anthers 1-2 mm long. **Ovary** 2-3 mm long, glabrous; style 1.5-2 mm long; disc slightly crenulate, ca. 1 mm. **Fruit** 8-11 mm long, 4-7 mm wide, orange-red.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— E Nepal, India, Sikkim (type), Bangladesh.

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: August-November; fruiting: November-January.

Voucher specimens.— *P. Srisanga* 1913, 2263; *P. Srisanga* & *C. Maknoi* 2048.

Notes.— New locality recorded from Nan, in Thailand.

2. *LINOSTOMA* Wall. ex Endl.

Gen. Pl.: 331. 1837; Peterson in Fl. Thailand 6(3): 234. 1997; Herber in Fam. Gen. Vasc. Pl. 5: 387. 2003.

Erect or straggling shrubs or woody climbers. **Leaves** opposite to subopposite. **Inflorescence** terminal or rarely axillary, subumbelliform, few-flowered, rarely flower solitary; bracts 2(-4), leafy. **Flowers** 5-merous, pedicellate. **Calyx** tube urceolate or tubular; lobes erect or reflexed. **Petals** 10, club-shaped, clavate or filiform, sometimes with a minute annulus at the base. **Stamens** 10, in 1 or 2 whorls, the upper whorl antisepalous; anthers basifixed. **Ovary** oblong, densely hairy; style filiform; stigma capitate; disc with minute lobes or ring-shaped. **Fruit** drupaceous, ovate or globose, sometimes surrounded by the persistent enlarged calyx.

Four species in E India, Bangladesh and SE Asia. Three species in Thailand (Peterson, 1997). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Woody climber. Leaves (3.5-)5-8(-10) cm long, (1.5-)2-4 cm wide. Calyx lobes reflexed **1. *L. decandrum***
1. Erect or straggling shrub. Leaves 2-4 cm long, 1-2 cm wide. Calyx lobes erect **2. *L. persimile***

1. *Linostoma decandrum* (Roxb.) Wall. ex Meisn.

Denkschr. Bot. Ges. Regensburg 3: 293, t. 7. 1841; Peterson in Fl. Thailand 6(3): 235. 1997. – *Nectandra decandra* Roxb., Hort. Beng. 90. 1814, nom. nud.; Fl. Ind. ed. Carey 2: 425. 1832.

Woody climber up to 10 m long or more. **Leaves** elliptic to ovate-elliptic, subcoriaceous, (3.5-)5-8(-10) cm long, (1.5-)2-4 cm wide, glabrous; base cuneate to obtuse; apex acute, acuminate to caudate; petioles 3-6 mm long, glabrous. **Inflorescence** terminal, (3-)4-6(-12)-flowered; peduncle 2-5 cm long; bracts elliptic to ovate, rounded at base, broadly acute at apex, 2-4.5 cm long, 1-2 cm broad, creamy white or pale green, membranous, glabrous, opposite at the middle of the peduncle or slightly below. **Flowers** fragrant. **Calyx** reddish green; tube 5-10 mm long, glabrous outside, villous or sometimes glabrous inside; lobes 5, 6-9 mm long, 1.5-2.5 mm wide, glabrous, reflexed. **Petals** white, club-shaped, 4-6 mm long, sometimes with a minute annulus at the base. **Stamens** in one whorl below the petals; antisepalous filaments 6-10 mm long; alternisepalous ones 4-8 mm long. **Ovary** 3-4 mm long, sericeous; style 8-11 mm long, sericeous at the base. **Fruit** ovoid, 8-12 mm long, 4-8 mm wide, sericeous, surrounded by the persistent enlarged calyx.

Thailand.— Northern: Nan, Nakhon Sawan; North-eastern: Nakhon Phanom; Eastern: Nakhon Ratchasima; South-eastern: Prachin Buri, Rayong, Chanthaburi, Trat; Peninsular: Narathiwat.

Distribution.— E India, Bangladesh (type), Myanmar, Laos, Vietnam, Cambodia.

Ecology.— Dry evergreen forest, by streams, alt. 700-800 m (Span Waterfall, Doi Phu Kha).

Phenology.— Flowering: November-December; fruiting: December-February.

Vernacular.— มหากาน Mahakan (Northern).

Voucher specimens.— *P. Srisanga* 1242.

2. *Linostoma persimile* Craib

Kew Bull. 1911: 452. 1911; Maxwell, Nat. Hist. Bull. Siam Soc. 40: 187. 1992; Peterson in Fl. Thailand 6(3): 236, fig. 94: C-D. 1997.

Erect or straggling shrub up to 4 m high. **Leaves** elliptic to obovate, coriaceous, 2-4 cm long, 1-2 cm wide, glabrous, darker above, somewhat glaucous below; base broadly cuneate; apex obtuse to mucronulate; petioles 1-2.5 mm long, glabrous. **Inflorescence** terminal, 2-4(-6)-flowered; peduncle 1.5-3 cm long; bracts elliptic to ovate, rounded at base, broadly acute to mucronulate at apex, 1.7-3 cm long, 1-2 cm wide, yellowish to whitish, membranous, glabrous, opposite at the middle of the peduncle or slightly below. **Calyx** yellowish green or pale yellow; tube 8-10 mm long, glabrous; lobes 5, 3-5 mm long, 1-2 mm wide, glabrous, erect. **Petals** reddish, 3-4 mm long. **Stamens** in two whorls; upper antisepalous filaments 0.8-1 mm long with slightly exerted anthers; lower alternisepalous ones ca. 0.5 mm long with included anthers. **Ovary** ellipsoid, 2-3 mm long, densely sericeous; style 6-8 mm long, glabrous. **Fruit** ellipsoid-ovoid, 9-12 mm long, 5-7 mm wide, surrounded by the persistent enlarged calyx.

Thailand.— Northern: Chiang Mai (type: *Kerr* 814), Phrae, Nan; North-eastern: Phetchabun; South-western: Phetchaburi.

Distribution.— Myanmar.

Ecology.— Open areas in dry evergreen and pine forest, alt. 1,000-1,100 m (Doi Phu Huat).

Phenology.— Flowering: October-December; fruiting: December-February.

Vernacular.— มหากาน Mahakan (Northern).

Voucher specimens.— *P. Srisanga* 513.

TILIACEAE

Trees, shrubs and herbs, rarely scandent, with stellate hairs or scales. **Leaves** simple, alternate, distichous or spirally arranged. Stipules mostly caducous. **Inflorescence** terminal or axillary, cymose, panicle or flower solitary. **Flowers** bisexual, rarely unisexual, 5-merous, regular. **Sepals** valvate, sometimes basally connate. **Petals** alternate with the sepals, imbricate, valvate or absent. **Stamens** many, free or obscurely 5-bundled, inserted above the torus which is sometimes

developed on an androphore; anthers basifixed or dorsifixed, 2-locular, opening by longitudinal slits. Staminodes absent or present. **Ovary** superior, 2-10-locular; ovules 2-many in each loculus; style subulate or branched; stigma peltate, lobed or pointed. **Fruit** baccate, drupaceous or capsule, winged or wingless. **Seeds** 1-many, wingless.

About 55 genera and 1,130 species widely distributed in the tropical and temperate regions. Twelve genera and 46 indigenous species in Thailand (Phengklai, 1993). Recently, Tiliaceae has been included within Malvaceae (Bayer & Kubitzki, 2003). Three genera and 5 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|--|-----------------------------|
| 1. Inflorescence terminal paniculate. Fruit winged | 1. <i>Colona</i> |
| 1. Inflorescence in axillary cymes. Fruit wingless | |
| 2. Stigma peltate or lobed. Fruit with conspicuous lobes; exocarp smooth | 2. <i>Grewia</i> |
| 2. Stigma pointed. Fruit without conspicuous lobes; exocarp with spiny tubercles | 3. <i>Triumfetta</i> |

1. *COLONA* Cav.

Sc. 4: 47, t. 370. 1797; Phengklai in Fl. Thailand 6(1): 59. 1993; Bayer & Kubitzki in Fam. Gen. Vasc. Pl. 5: 250. 2003.

Trees. **Leaves** distichous, 3-7-nerved from base, serrate. **Inflorescence** terminal, paniculate. **Flowers** bisexual. **Sepals** free, hairy outside, glabrous inside. **Petals** free, glabrous, glandular at base. **Stamens** numerous, free; anther dorsifixed, subglobose. Staminodes absent. **Ovary** 3-5-locular; ovules 2-4 in each loculus; style subulate; stigma pointed. **Fruit** a capsule, with 3-5 longitudinal wings.

About 30 species, distributed in S and SE Asia. Seven species in Thailand (Phengklai, 1993). Only 1 species recorded from Doi Phu Kha National Park.

Colona elobata Craib

Kew Bull. 1925: 21. 1925; in Fl. Siam. Enum. 1: 189. 1925; Phengklai in Fl. Thailand 6(1): 60, fig. 38. 1993.

Tree up to 15 m high. **Leaves** elliptic to ovate, 8-20 cm long, 4-9 cm wide; base oblique, auriculate; apex acuminate to cuspidate; margin double serrate; 3-6-nerved from base; secondary nerves 4-6 pairs, hairy; petioles 0.5-1.5 cm long. **Inflorescence** 3-8 cm long. **Sepals** elliptic, ca. 4 mm long, 2 mm wide. **Petals** obovate, ca. 3 mm long, 2 mm wide. **Stamens** glabrous. **Ovary** globose, ca. 2 mm in diam., hairy. **Capsule** ellipsoid, brown, 2-4-winged, 1-1.5 cm long, 2-3.5 cm wide including wings.

Thailand.— Northern: Nan, Phitsanulok; North-eastern: Loei (type).
Distribution.— Laos.

Ecology.— Dry evergreen and secondary forest, alt. 600-1,000 m (Tham Pha Kong, Doi Phu Kha).

Phenology.— Flowering and fruiting: January-May.

Voucher specimens.— *P. Srisanga* 2405.

Notes.— New locality recorded from Nan, for Thailand.

2. *GREWIA* L.

Sp. Pl.: 964. 1753; Phengklai in Fl. Thailand 6(1): 14. 1993; Bayer & Kubitzki in Fam. Gen. Vasc. Pl. 5: 249. 2003.

Trees, shrubs or scandent shrubs. **Leaves** distichous, 3-5-nerved from base, serrate, serrulate, double serrulate or dentate. **Inflorescence** in axillary cymes. **Flowers** bisexual or unisexual. **Sepals** free, hairy outside, glabrous or hairy inside. **Petals** free, glabrous or hairy, glandular at base. **Stamens** numerous, free; anthers dorsifixed, curved. **Staminodes** absent in male flowers, many in female flowers. **Ovary** 2-4-locular; ovules 2 in each loculus; style subulate; stigma peltate or lobed. **Fruit** a capsule, wingless, 2-4-lobed, smooth, indehiscent.

About 280-300 species, widely distributed in tropical region. Eight species in Thailand (Phengklai, 1993). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves golden brown hairy on lower surface. Sepals less than 1 cm long **1. *G. lacei***
 1. Leaves glabrous or glabrescent. Sepals more than 1 cm long **2. *G. laevigata***

1. *Grewia lacei* Drumm. ex Craib

Kew Bull. 1911: 21. 1911; in Fl. Siam. Enum. 1: 185. 1925; Phengklai in Fl. Thailand 6(1): 22, fig. 14, pl. IV: 11. 1993.

Shrub up to 2 m high. **Leaves** narrowly lanceolate, 12-20 cm long, 1.5-3.5 cm wide, hairy, especially prominent golden brown hairs on lower surface; base acute with unequal-sided; apex acuminate; margin serrulate; 3-nerved from base; secondary nerves 6-11 pairs; petioles 2-5 mm long, densely hairy. **Inflorescence** erect, 1-2 cm long; pedicels 2-5 mm long. **Sepals** linear-oblong, 4-8 mm long, 1.5-2 mm wide. **Petals** oblong, ca. 1.5 mm long, 1 mm wide, hairy on lower half on both sides. **Stamens** glabrous. **Ovary** ovoid, ca. 3 mm long, 2 mm wide, hairy. **Fruit** rounded, 2-4-lobed, red, shiny; each lobe ca. 5 mm in diam.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Lamphun, Nan, Tak; North-eastern: Phetchabun, Loei; Eastern: Chaiyaphum, Nakhon Ratchasima; South-western: Kanchanaburi.

Distribution.— Myanmar (type), Laos.

Ecology.— Dry evergreen and secondary forest, alt. 600-1,000 m (Tham Pha Kong, Doi Phu Kha).

Phenology.— Flowering: May-September; fruiting: August-January.

Vernacular.— ทงนกก Hang nok (Northern).

Voucher specimens.— *P. Srisanga* 2396.

2. *Grewia laevigata* Vahl

Symb. Bot. 1: 34. 1791; Phengklai in Fl. Thailand 6(1): 26, fig. 16, pl. V: 13. 1993. – *G. disperma* Rottl. ex Spreng., Syst. Veg.: 579. 1825; Craib in Fl. Siam. Enum. 1: 183. 1925. – *G. umbellata* Roxb., Fl. Ind. 2: 591. 1832; Craib in Fl. Siam. Enum. 1: 187. 1925.

Shrub to small tree up to 10 m high. **Leaves** lanceolate to elliptic, 7-15 cm long, 2.5-5 cm wide, glabrous or glabrescent; base broadly acute with equal or slightly unequal-sided; apex acuminate to cuspidate; margin serrate to serrulate; 3-nerved from base; secondary nerves 4-8 pairs; veins distinct on lower surface; petioles 5-10 mm long, glabrescent. **Inflorescence** slender, loose, erect, 2-6 cm long. **Sepals** lanceolate, 10-20 mm long, 1.5-3 mm wide, hairy. **Petals** white or yellow, oblong, 3-7 mm long, 1-2 mm wide, glabrous except near the base on both sides, ciliate along the margin. **Stamens** glabrous. **Ovary** ovoid, ca. 4 mm long, 2 mm wide, hairy. **Fruit** rounded, 2-4-lobed, black; each lobe ca. 5 mm in diam.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Phrae, Nan, Kamphaeng Phet; North-eastern: Phetchabun, Loei; Eastern: Nakhon Ratchasima; South-eastern: Chanthaburi, Prachin Buri; Central: Saraburi; South-western: Kanchanaburi, Prachuap Khiri Khan; Peninsular: throughout.

Distribution.— India (type), Nepal, Myanmar, Vietnam, Malaysia, Indonesia, Philippines, Australia, Africa.

Ecology.— Dry evergreen and lower montane forest, alt. 1,000-1,400 m (Tham Pha Khaw, Doi Phu Kha).

Phenology.— Flowering and fruiting: July-December.

Vernacular.— ยาบขี้ไก่ Yab khi kai (Northern).

Voucher specimens.— *P. Srisanga* 1916; *P. Srisanga* & *C. Maknoi* 2002.

3. *TRIUMFETTA* L.

Sp. Pl.: 444. 1753; Phengklai in Fl. Thailand 6(1): 44. 1993; Bayer & Kubitzki in Fam. Gen. Vasc. Pl. 5: 253. 2003.

Annual herbs or undershrubs. **Leaves** spirally arranged, 3-5-nerved from base, serrate, with entire or lobed margins. **Inflorescence** in cymes, leaf-opposed. **Flowers** bisexual. **Sepals** free, hairy outside, glabrous inside. **Petals** free, united in a tube when young, glabrous, glandular at base. **Stamens** 4-numerous, free; anthers dorsifixed, subglobose. **Staminodes** absent. **Ovary** 2-5-locular; ovules 2 in each

loculus; style subulate; stigma pointed. **Fruit** a capsule, wingless, not lobed, indehiscent; exocarp with spiny tubercles.

About 150 species, widely distributed in the tropical region from Africa through Asia and South Pacific. Five species in Thailand (Phengklai, 1993). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- 1. Leaves tri-lobed
- 1. Leaves elliptic to ovate

- 1. *T. bartramia*
- 2. *T. pilosa*

1. *Triumfetta bartramia* L.

In Syst. Veg. ed. 10: 1044. 1759; Craib in Fl. Siam. Enum. 1: 190. 1925; Phengklai in Fl. Thailand 6(1): 49, fig. 32, pl. VIII: 18. 1993.

Annual herb or undershrub up to 1.5 m high. **Leaves** tri-lobed, 2-10 cm long, 1.5-8 cm wide, hairy; base obtuse to truncate; apex acute; secondary nerves 3-5 pairs; petioles 0.5-7 cm long, hairy. **Sepals** linear, 3-5 mm long. **Petals** yellow, spatulate, 3-5 mm long, 1-1.5 mm wide. **Stamens** glabrous. **Ovary** globose, hairy. **Fruit** globose, ca. 1 cm in diam.; spines hairy on the lower half.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Sukhothai, Tak, Nakhon Sawan; North-eastern: Loei; Eastern: Nakhon Ratchasima; South-eastern: Rayong; Central: Chai Nat; South-western: Uthai Thani, Kanchanaburi, Prachuap Khiri Khan; Peninsular: throughout.

Distribution.— India (type), Nepal, China, Japan, SE Asia, Australia, S Pacific, Africa.

Ecology.— Dry evergreen and secondary forest, alt. 600-800 m (Tham Pha Kong, Doi Phu Kha).

Phenology.— Flowering and fruiting: October-December.

Vernacular.— ปอสัง Po seng (Northern).

Voucher specimens.— *P. Srisanga* 2602.

2. *Triumfetta pilosa* Roth

Nov. Sp.: 223. 1821; Craib in Fl. Siam. Enum. 1: 191. 1925; Phengklai in Fl. Thailand 6(1): 46, fig. 29, pl. VIII: 19. 1993. – *T. pseudocana* Spr. & Craib, Kew Bull. 1911: 23. 1911; Craib in Fl. Siam. Enum. 1: 191. 1925.

Annual herb or undershrub up to 2 m high. **Leaves** elliptic to ovate, 4-9 cm long, 1.5-4 cm wide, hairy; base obtuse to rounded; apex acute to acuminate; secondary nerves 3-5 pairs; petioles 0.5-3 cm long, hairy. **Sepals** linear-lanceolate, 3-

6 mm long. **Petals** yellow, spatulate, 2-4 mm long, 0.5-1 mm wide. **Stamens** glabrous. **Ovary** globose, hairy. **Fruit** globose, 1.3-2 cm in diam.; spines hairy.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Phrae, Nan, Phitsanulok; North-eastern: Phetchabun, Loei; Eastern: Nakhon Ratchasima; South-eastern: Chon Buri; Central: Nakhon Nayok; South-western: Kanchanaburi; Peninsular: Songkhla, Pattani.

Distribution.— India (type), Nepal, China, SE Asia, Africa.

Ecology.— Dry evergreen, lower montane and secondary forest especially in open clearing, alt. 800-1,200 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: September-December.

Vernacular.— ปอหุ้มขี้ Po yum yu (Northern).

Voucher specimens.— *P. Srisanga* 396, 2175.

ULMACEAE

Trees or shrubs. **Leaves** simple, alternate, rarely opposite, often oblique at base; stipules in pair, lateral or interpetiolar, caducous. **Inflorescence** axillary, cymose, racemose or fasciculate or flower solitary. **Flowers** bisexual or unisexual and then plant monoecious, small. **Sepals** subcampaulate, imbricate, (2-)5(-9)-lobed, free or connate. **Petals** absent. **Stamens** the same number as the sepals and opposite or rarely more; anthers 2-locular, dorsifixed or versatile, opening by longitudinal slits. **Ovary** superior, composed of 2 connate carpels, 1-2-locular; style short or absent; stigmatic arms 2, divergent; ovule 1 in each loculus, pendulous from near the top. **Fruit** a drupe, nut or samara.

Eighteen genera and about 150 species widely distributed in tropical and temperate regions (Todzia, 1993b). Six genera and about 11 species in Thailand. Four genera and 4 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Flower bisexual or unisexual. Fruit a drupe
 2. Leaves triplinerved at base or with the basal pair more prominent
 3. Drupe ovoid-ellipsoid to globose, generally not compressed, more than 5 mm long **1. Celtis**
 3. Drupe ovoid to subglobose, compressed or lens-shaped in cross-section, less than 3 mm long **3. Trema**
 2. Leaves penninerved **2. Gironniera**
1. Flower bisexual. Fruit a dry, flat, winged samara **4. Ulmus**

1. *CELTIS* L.

Sp. Pl. 2: 1043. 1753; Soepadmo in Fl. Mal. I(8): 55. 1977; Todzia in Fam. Gen. Vasc. Pl. 2: 609. 1993.

Trees or shrubs. **Leaves** alternate, triplinerved at base or with the basal pair more prominent, entire or serrate; stipules caducous. **Inflorescence** axillary, racemes or panicles. **Flowers** bisexual or unisexual. **Sepals** 4-5-lobed, united at base. **Stamens** 4-5; filaments subulate; anthers ovoid to subreniform, dorifixed; staminodes usually present in female flowers. **Ovary** ovoid-ellipsoid, sessile; style short or absent. **Drupe** ovoid-ellipsoid or globose, generally not compressed.

About 100 species in tropical and temperate regions (Todzia, 1993b). Three species in Thailand (Phuphathanaphong, 1973). One species recorded from Doi Phu Kha National Park.

Celtis timorensis Span.

Linnaea 15: 343. 1841; Soepadmo in Fl. Mal. I(8): 65, figs. 20f, 23f-h. 1977. – *C. cinnamomea* Lindl. ex Planch., Ann. Sci. Nat. III 10: 303. 1848. – *C. reticulosa* Miq., Pl. Jungh.: 69. 1851.

Tree up to 20 m high. Innovations densely rufous pubescent. Branchlets glabrous, lenticellate. Stipules linear-lanceolate, 5-10 mm long. **Leaves** elliptic to ovate, subcoriaceous, 5-15 cm long, 3-6.5 cm wide, glabrous except for sparsely hairy on midrib and nerves; base broadly cuneate, oblique; apex acute to acuminate; margin coarsely serrate on the upper half; reticulation subscalariform; petioles 5-15 mm long. **Inflorescence** borne on the lower and leafless parts of the new shoots, much branched, 2-5 cm long, rufous pubescent. **Flowers** 5-merous, reddish green. **Sepals** oblong to narrowly obovate, 1-2 mm long, puberulous, obtuse or rounded at apex. **Filaments** 1-1.5 mm long, sparsely hairy. **Ovary** 1-2 mm long, glabrous, situated on the densely rufous receptacle; style absent; stigmatic arms 2-3 mm long. **Drupe** ovoid-ellipsoid, 5-10 mm long, 3-6 mm wide, slightly 4-angulated, glabrous.

Thailand.— Almost throughout the country.

Distribution.— India, Sri Lanka, Bangladesh, SE Asia (Timor-type).

Ecology.— Dry evergreen and lower montane forest, alt. 900-1,300 m (Doi Phu Kha).

Phenology.— Flowering: November-December; fruiting: May-July.

Vernacular.— เข็ดก้นพระร่วง Chet khon pra ruang (Nan).

Voucher specimens --- P. Srisanga 311, 1480.

2. *GIRONNIERA* Gaudich.

Voy. Bonite: t. 85. 1844; Soepadmo in Fl. Mal. I(8): 70. 1977; Todzia in Fam. Gen. Vasc. Pl. 2: 610. 1993.

Trees or shrubs. Innovations with distinctly golden yellow or yellowish brown, long hairs. **Leaves** alternate, penninerved, entire or serrate; stipules extrapetiolar, free but overlapping each other and completely enclosing the bud, caducous and leaving a circular scar around the node. **Inflorescence** axillary or borne on older leafless branches, racemes or panicles. **Flowers** unisexual. **Sepals** 5, united at base. **Stamens** 5; filaments subulate; anthers ovoid to subreniform, dorifixed or sub-basifixed; staminodes absent. **Ovary** ovoid-ellipsoid, sessile; style absent. **Drupe** ovoid-ellipsoid, convex elliptic len-shaped or subglobose.

About 6 species distributed in India, Sri Lanka, China, SE Asia to Micronesia, Melanesia and Polynesia (Todzia, 1993b). Two species in Thailand (Phupathanaphong, 1973). One species recorded from Doi Phu Kha National Park.

Gironniera subaequalis Planch.

Ann. Sci. Nat. III 10: 339. 1848, pro parte excl. var. *ceylanica*; Soepadmo in Fl. Mal. I (8): 75, fig. 26h, m, p-r. 1977. – *G. chinensis* Benth., Fl. Hongk.: 324. 1861. – *G. longifolia* Craib, Kew Bull. 1918: 10. 1918.

Tree up to 20 m high. Innovations densely yellowish brown long hairs. Branchlets sparsely pilose, obscurely lenticellate. Stipules linear-lanceolate, 1-2 cm long, pilose. **Leaves** elliptic to ovate, subcoriaceous, (6-)10-19(-20) cm long, (3.5-)5-8 cm wide, glabrous except for pilose on midrib and nerves beneath; base cuneate, oblique; apex long acute to acuminate; margin coarsely serrate on the upper half; midrib and veins raised and prominent on lower surfaces; primary veins 8-12 pairs; reticulation subscalariform; petioles 5-15 mm long, pilose. **Inflorescence** axillary or borne on the lower and leafless parts of the new shoots. **Male inflorescence** paniculate, 1-5 cm long; flowers in clusters of 3-5 or solitary, sessile. **Female inflorescence** raceme or paniculate; flower solitary, short stalked. **Sepals** ovate, 1-2 mm long, puberulous. **Filaments** 1.5-2 mm long. **Ovary** 2-3 mm long, pubescent, glabrescent; style absent; stigmatic arms 1-2 mm long. **Drupe** convex elliptic len-shaped, 8-10 mm long, 5-6 mm wide, orange, sparsely pubescent, glabrescent.

Thailand.— Northern: Nan (Doi Wao-type of *G. longifolia*: Kerr 2499, 2499a).

Distribution.— S China, Hong Kong, SE Asia.

Ecology.— Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: January-February; fruiting: October-December.

Voucher specimens.— *P. Srisanga* 1289, 2302.

3. TREMA Lour.

Fl. Cochinch.: 562. 1790; Soepadmo in Fl. Mal. I(8): 47. 1977; Todzia in Fam. Gen. Vasc. Pl. 2: 609. 1993.

Trees or shrubs. **Leaves** distichous, triplinerved at base or with the basal pair more prominent, entire or serrate; stipules caducous. **Inflorescence** axillary, cymose, fasciculate or rarely flower solitary. **Flowers** bisexual or unisexual. **Sepals** 4-5-

lobed, induplicate-valvate, united at base. **Stamens** 4-5; filaments short, erect, subulate, glabrous; anthers subglobose to reniform, dorifixed; staminodes mostly absent in female flowers. **Ovary** ovoid, sessile; style short or absent. **Drupe** ovoid to subglobose, compressed or lens-shaped in cross-section.

About 10-15 species in tropical and subtropical regions (Soepadmo, 1977; Mabberley, 1997). About 3-4 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Trema tomentosa* (Roxb.) Hara**

Fl. E. Himal. 2: 19. 1971; Soepadmo in Fl. Mal. I(8): 53, fig. 16. 1977 (see also for synonymy). – *Celtis tomentosa* Roxb. in Fl. Ind. ed. Carey 2: 66. 1832. – *C. orientalis* (non L.) Bl., Bijdr.: 485. 1825. – *Sponia griffithii* Planch., Ann. Sci. Nat. III 10: 324. 1848. – *S. tomentosa* (Roxb.) Planch., Ann. Sci. Nat. III 10: 336. 1848. – *S. velutina* (Roxb.) Planch., Ann. Sci. Nat. III 10: 32736. 1848, pro parte. – *Trema velutina* (Planch.) Bl., Mus. Bot. 2: 58. 1856.

Tree or shrub up to 10 m high. Branchlets, stipules, leaves beneath, petioles and inflorescence densely and thickly set with grayish, erect, velvety hairs. Stipules linear-lanceolate, 4-5 mm long. **Leaves** lanceolate, elliptic to ovate, subcoriaceous, 6-15 cm long, (1.5-)3-7(-9) cm wide, glandular hairy, scabrous on upper surfaces; base cordate, rarely rounded, strongly oblique; apex acute to acuminate; margin serrate; midrib and nerves raised and prominent beneath; reticulation subscalariform; petioles 8-15 mm long. **Inflorescence** cymose, many-flowered, 1.5-4 cm long. **Flowers** 4-5-merous, greenish. **Sepals** elliptic to obovate, ca. 1 mm long, puberulous. **Filaments** ca. 1 mm long, glabrous. **Ovary** ca. 1 mm long; style absent; stigmatic arms ca. 1 mm long. **Drupe** ovoid to subglobose, 2-3 mm long and wide, black.

Thailand.— Almost throughout the country.

Distribution.— Tropical E Africa, Madagascar, India, China to SE Asia, Australia (Queensland), Melanesia (New Caledonia), Micronesia and Polynesia.

Ecology.— Dry evergreen and lower montane forest, Pioneer fast-growing trees along roadsides, open places, secondary forest and disturbed areas, alt. 800-1,300 m (Doi Phu Kha).

Phenology.— Flowering: January-April; fruiting: July-December.

Voucher specimens.— *P. Srisanga* 2714.

4. ULMUS L.

Sp. Pl.: 225. 1753; Soepadmo in Fl. Mal. I(8): 39. 1977; Todzia in Fam. Gen. Vasc. Pl. 2: 608. 1993.

Trees or rarely shrubs. **Leaves** distichous, penninerved, serrate; stipules extrapetiolar, caducous. **Inflorescence** axillary or borne on older leafless branches, racemose or fasciculate. **Flowers** bisexual. **Sepals** 4-5(-9), more or less connate. **Stamens** the same number as the sepals; anthers reniform, dorifixed. **Ovary**

compressed, sessile or stipitate; style short. **Fruit** a dry, flat, winged samara. **Seed** ovate, compressed.

About 25-30 species mainly in temperate region of N Hemisphere (Todzia, 1993b). Only 1 species in Thailand (Phuphathanaphong, 1973).

Ulmus lanceaefolia Roxb. ex Wall.

Pl. As. Rar. 2: 86, t. 200. 1831; Soepadmo in Fl. Mal. I(8): 40, fig. 2, 4-7. 1977. – *U. hookeriana* Planch. in DC. Prodr. 17: 162. 1873. – *U. tonkinensis* Gagnep. in Fl. Gén. I.-C. 5: 674. 1927.

Tree up to 20 m high. Branchlets sparsely hairy, soon glabrescent. Stipules linear-lanceolate, 4-5 mm long, soon caducous. **Leaves** lanceolate, subcoriaceous, 4-10 cm long, 2-4 cm wide, glabrous or subglabrous, glossy on upper surface; base rounded to subcordate, oblique; apex long acute to acuminate; margin serrate-dentate; midrib and veins raised and prominent on lower surfaces; primary veins 8-13 pairs; reticulation subscalariform; petioles 3-5 mm long, grayish, short curly hairy. **Inflorescence** axillary fasciculate or borne on the lower and leafless parts of the new shoots, 3-10-flowered; pedicels puberulous. **Sepals** 5-6, elliptic, 1-2 mm long, subglabrous. **Filaments** 1-3 mm long, glabrous. **Ovary** obovate-elliptic, glabrous, stipitate; stigmatic arms 1-2 mm long. **Fruit** obovate-elliptic, 2-3 cm long, 1.3-1.7 cm wide, brown or pale creamy brown, glabrous; fruiting pedicels 5-10 mm long, puberulous.

Thailand.— Northern: Chiang Mai, Chiang Rai, Lampang, Phrae, Nan.

Distribution.— E Himalayas to China and SE Asia.

Ecology.— Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: February-April.

Vernacular.— ตะไคร้ Ta kai (Chiang Mai).

Voucher specimens.— *P. Srisanga & S. Watthana* 628; *P. Srisanga et al.* 2477.

URTICACEAE

Herbs, undershrubs, shrubs, small trees or rarely climbers, dioecious or monoecious, sometimes with stinging hairs. **Leaves** simple, alternate or opposite; stipules present. **Inflorescence** usually cymose sometimes reduced to solitary, axillary. **Flowers** small, unisexual. **Male flowers**: tepals free or united, (1-)4-5(-6), lobes imbricate or valvate; stamens same number as the tepals and opposite; anther 2-locular, opening by longitudinal slits; vestige of ovary usually present. **Female flowers**: tepals as in male flowers, often enlarged in fruit, rarely absent; staminodes scale like, opposite to the tepals or absent; ovary superior, free or adnate to the tepals, sessile or shortly stipitate, 1-locular; ovule solitary, erect, basal; style simple. **Fruit** achene, nut or drupe often enclosed in accrescent tepals.

A cosmopolitan family with 45 genera and about 1,000 species (Friis, 1993). About 15 genera and 100 species in Thailand. Five genera and 14 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Plants without stinging hairs
 2. Female perianth mostly tubular. Stigma variable but not brush-like
 3. Female perianth free and enclosing the achene **1. Boehmeria**
 3. Female perianth adnate to the achene **2. Debregeasia**
 2. Female perianth mostly 3-partite. Stigma brush-like
 4. Shoots flattened. Leaves alternate, oblique **4. Elatostema**
 4. Shoots not flattened. Leaves opposite **5. Pilea**
1. Plants with stinging hairs **3. Dendrocnide**

1. *BOEHMERIA* N.J. Jacq.

Enum. Pl. Carib.: 9, 31. 1760; Friis in Fam. Gen. Vasc. Pl. 2: 623. 1993.

Subshrubs, shrubs or small trees, dioecious or monoecious. **Leaves** alternate or opposite, equal or unequal sides, dentate, 3-nerved from base; stipules free or rarely connate at base, deciduous. **Inflorescence** axillary, clustered, along the rachis of the spikes. **Flowers** unisexual; bracts small, scarious. **Male flowers**: perianth (3-)4(-5)-lobed or partite; lobes valvate; stamens (3-)4(-5); rudimentary ovary clavate or subglobose. **Female flowers**: perianth tubular, compressed or ventricose, often contracted and 2-4-tooth at apex; ovary sessile or stipitate; stigma filiform, elongated, pilose on one side. **Achene** enclosed by the marcescent perianth.

About 80 species in warm parts of Old and New World and northern warm temperate region (Friis, 1993). About 14 species in Thailand (Yahara, 1981). Five species recorded from Doi Phu Kha National Park.

1. *Boehmeria macrophylla* D. Don

Prodr. Fl. Nepal.: 60. 1825; Hook.f. in Fl. Br. Ind. 5: 577. 1888; Craib, Kew Bull. 1911: 470. 1911; Gagnep. in Fl. Gén. I.-C. 5: 845. 1929; Yahara, Acta Phytotax. Geobot. 32: 13. 1981.

Shrub, 1.5-3 m high. **Leaves** opposite, lanceolate, 13-25 cm long, 2.5-5 cm wide, glabrous and rugose on upper surface, softly pubescent on lower surface; base obtuse; apex acuminate; margin serrulate; petioles 1-3 cm long. **Inflorescence** simple spicate, brown. Male spikes thin, 9-15 cm long. Female spikes thick with congested flower-clusters, 20-30 cm long. **Achene** obovate, 2-3 mm long, enclosed by perianth.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— E Himalayas, China, Myanmar, Indochina.

Ecology.— Lower montane forest, by roadsides, alt. 1,100 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: August-October.

Vernacular.— จ้าปาน Cha pan (Chiang Mai).

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2055.

2. *Boehmeria pilosiuscula* (Bl.) Hassk.

Cat. Pl. Hort. Bog.: 79. 1844; Yahara, Acta Phytotax. Geobot. 32: 13. 1981. – *Urtica pilosiuscula* Bl., Bijdr.: 491. 1825.

Subshrub, 30-50 cm high. **Leaves** opposite, unequal in size in each pair, elliptic to ovate, pubescent on both surfaces especially below; base obtuse to broadly cuneate; apex acuminate; margin serrate; the larger one 7-11 cm long, 3-4 cm wide, with 2-5 cm long petioles; the smaller ones 4-5 cm long, 3-4 cm wide, with 0.5-1 cm long petioles. **Inflorescence** simple spicate, yellowish brown, 1.5-2 cm long. Male flowers at the distal end of spikes. Female flowers clusters, densely congested. **Achene** obconical, turbinate, ca. 2 mm long, enclosed by perianth.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; North-eastern: Loei; Peninsular: Ranong.

Distribution.— S China, Taiwan, Indonesia (Java-type).

Ecology.— Lower montane forest, 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: September-October.

Voucher specimens.— *P. Srisanga* & *C. Puff* 1087.

3. *Boehmeria* sp. 1

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: December-February.

Voucher specimens.— *P. Srisanga* 475, 1263.

4. *Boehmeria* sp. 2

Ecology.— Lower montane forest, open places, alt. 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-August.

Voucher specimens.— *P. Srisanga* 921.

5. *Boehmeria* sp. 3

Ecology.— Lower montane forest, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-December.

Voucher specimens.— *P. Srisanga* 2314.

2. *DEBREGEASIA* Gaudich.

Voy. Monde Bonite, Bot., Atlas: t. 90. 1844; Wilmot-Dear, Kew Bull. 43(4): 673. 1988; Friis in Fam. Gen. Vasc. Pl. 2: 625. 1993.

Shrubs, dioecious or monoecious. **Leaves** alternate, rugose, petiolate, serrate, 3-nerved from base, often white or silvery below; stipules large, narrowly triangular, connate, 2-lobed. **Inflorescence** axillary, glomerate-capitate, dense-flowered. **Flowers** unisexual; bracts scarious. **Male flowers**: perianth (3-)4(-5)-partite, valvate or slightly imbricate; stamens (3-)4(-5); rudimentary ovary ellipsoid, glabrous or woolly at base. **Female flowers**: perianth tubular, ovoid to obovoid, adnate and envelopped ovary and achene, minutely tooth at apex; ovary ovoid to obovoid; stigma penicillate, early deciduous. **Achene** enclosed by and adnate to the fleshy perianth.

Four species in NE tropical Africa (Ethiopia), tropical Arabia, E Himalayas, S, E and SE Asia (Wilmot-Dear, 1988; Friis, 1993). Three species in Thailand (Wilmot-Dear, 1988). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|---------------------------------|
| 1. Leaves lanceolate, more than 3 times as long as wide | 1. <i>D. longifolia</i> |
| 1. Leaves ovate to orbicular, less than 2 times as long as wide | 2. <i>D. wallichiana</i> |

1. *Debregeasia longifolia* (Burm.f.) Wedd.

Monog.: 462. 1857; Wilmot-Dear, Kew Bull. 44: 189. 1989. – *Urtica longifolia* Burm.f., Fl. Ind.: 197. 1768. – *Debregeasia velutina* Gaudich., Voy. Monde Bonite, Bot., Atlas: t. 90. 1844; Hook.f. in Fl. Br. Ind. 5: 590. 1888; Gagnep. in Fl. Gén. I.-C. 5: 867. 1929; Wilmot-Dear, Kew Bull. 43(4): 675. 1988.

Thailand.— Almost throughout the country.

Distribution.— E Himalayas, S, E and SE Asia (Java-type).

Ecology.— Lower montane forest, by roadsides, alt. 1,300-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: September-December.

Vernacular.— ไผ่ป่า Khai pla (Loei).

Voucher specimens.— *P. Srisanga* & *C. Puff* 1101.

2. *Debregeasia wallichiana* (Wedd.) Wedd.

Monog.: 464. 1857; Hook.f. in Fl. Br. Ind. 5: 591. 1888; Gagnep. in Fl. Gén. I.-C. 5: 869. 1929; Wilmot-Dear, Kew Bull. 43(4): 689. 1988. – *Missiessya wallichiana* Wedd., Ann. Sci. Nat. 4 ser., 1: 195. 1854.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Bangladesh (type), Sri Lanka, Myanmar, Cambodia.

Ecology.— Lower montane forest, open places, alt. 1,300-1,700 m.

Phenology.— Flowering and fruiting: June-August.

Vernacular.— เต้ามด Tao mot (Chiang Mai).

Voucher specimens.— *P. Srisanga* 941, 1941.

3. *DENDROCNIDE* Miq.

Pl. Jungh.: 29. 1851; Chew, Gard. Bull. Sing. 25(1): 7. 1969; Friis in Fam. Gen. Vasc. Pl. 2: 621. 1993.

Trees or shrubs, dioecious, with stinging hairs. **Leaves** alternate, petiolate; stipules connate, intrapetiolar. **Inflorescence** axillary, racemose, bracteate. **Flowers** unisexual, in small fascicles or on flabellate receptacles. **Male flowers**: tepals 4(-5); stamens 4(-5). **Female flowers** sessile or pedicellate; tepals 4; stigma linear or ligulate. **Achene** ellipsoid to ovoid, compressed, usually strongly verrucose.

About 36 species in India, Sri Lanka, China, SE Asia, Malesia, Australia and Pacific Islands (Chew, 1969). About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

Dendrocnide stimulans (L.f.) Chew

Gard. Bull. Sing. 21: 206. 1965; Gard. Bull. Sing. 25(1): 11, fig. 2. 1969. – *Urtica stimulans* L.f., Suppl. Sp. Pl.: 418. 1781.

Tree, 5-7 m high. **Leaves** elliptic to obovate, coriaceous, 15-30 cm long, 6-10 cm wide, with stinging hairs; base cuneate; apex acuminate; margin entire; petioles 5-10 cm long. Stipules ovate, 0.5-1.5 cm long. **Inflorescence** 10-50 cm long, pubescent with stinging hairs. **Male flowers** small, 1-2 mm long, pubescent, sessile; tepals 4; stamens 4. **Female flowers** small, ca. 1 mm long, pubescent, sunken in a row on fleshy flabellate peduncular receptacle; stigma ligulate, 3-5 mm long. **Achene** ovoid, 2-4 mm long, with persistent perianth at base and persistent stigma at apex.

Thailand.— Northern: Chiang Mai, Nan; Peninsular: Nakhon Si Thammarat.

Distribution.— China, Laos, Vietnam, Malaysia, Indonesia, Philippines.

Ecology.— Dry evergreen and lower montane forest, in moist places or near streams, alt. 1,000 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-November.

Vernacular.— หานสา Han sa (Northern).

Voucher specimens.— *P. Srisanga* 312.

4. *ELATOSTEMA* J.R. & G. Forst

Char. Gen.: 105, t. 53. 1776; Friis in Fam. Gen. Vasc. Pl. 2: 621. 1993.

Annual or perennial herbs or small shrubs, monoecious or dioecious, often with juicy stems. Shoots flattened. **Leaves** alternate, distinctly oblique at base, coarsely serrate, rarely entire, sometimes with a small stipule-like opposite the leaves; stipules intrapetiolar, undivided. **Flowers** on a broad depressed capitate discoid or lobulate receptacle. **Male flowers**: perianth 4-5-partite, imbricate; stamens 4-5; rudimentary ovary small. **Female flowers**: perianth 3-5 segments or very reduced; staminodes small, scale-like, sometimes absent; ovary small; stigma sessile. **Achene** compressed.

About 300 species in warm parts of Old World (Friis, 1993). About 17 species in Thailand (Yahara, 1984). Four species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|--------------------------|
| 1. Male heads on a long peduncle | |
| 2. Stem erect, ascending | 1. <i>E. longipes</i> |
| 2. Stems creeping | 4. <i>E. repens</i> |
| 1. Male head sessile or subsessile | |
| 3. Plants without a small stipule-like opposite the leaves. | 2. <i>E. macintyreii</i> |
| Leaves more the 10 cm long | |
| 3. Plants with a small stipule-like opposite the leaves. | 3. <i>E. monandrum</i> |
| Leaves less than 5 cm long | |

1. *Elatostema longipes* W.T. Wang

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— China.

Ecology.— Lower montane forest, in moist places or by streams, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga et al.* 772.

2. *Elatostema macintyreii* Dunn

Thailand.— Northern: Chiang Mai, Nan, Tak; Peninsular: Ranong, Yala.

Distribution.— E Himalayas, S China.

Ecology.— Lower montane forest, in moist places or by streams, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: May-June.

Voucher specimens.— *P. Srisanga* 1409.

3. *Elatostema monandrum* (Buch.-Ham. ex D. Don) Hara

Thailand.— Northern: Chiang Mai, Nan; Peninsular: Nakhon Si Thammarat..

Distribution.— China, Laos, Vietnam, Malaysia, Indonesia, Philippines.

Ecology.— Dry evergreen and lower montane forest, on rocks, in moist places or by streams, alt. 1,000-1,700 m (Doi Phu Kha, Tham Pha Khaw).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 1932; *P. Srisanga et al.* 781.

4. *Elatostema repens* (Lour.) Hall.f.

Thailand.— Almost throughout the country.

Distribution.— S China, Laos, Vietnam, Malaysia, Indonesia, Philippines.

Ecology.— Dry evergreen and lower montane forest, on rocks or on ground, in moist places or near streams, alt. 800-1,000 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering : June-July.

Voucher specimens.— *P. Srisanga* 1970.

5. *PILEA* Lindl.

Collect. Bot.: t. 4. 1821, nom. cons.; Friis in Fam. Gen. Vasc. Pl. 2: 622. 1993.

Annual or perennial herbs, monoecious or dioecious, often with juicy stems. Shoots not flattened. **Leaves** opposite, equal or unequal in pairs, entire or dentate; stipules connate, intrapetiolar. **Inflorescence** axillary, head-like or paniculate. **Male flowers**: perianth (2-)4-partite, subclavate; stamens (2-)4; rudimentary ovary conical or oblong. **Female flowers**: perianth 3-partite, segments unequal, the larger sometimes gibbous or hooded; staminodes scale-like, minute; ovary small; stigma sessile. **Achene** ovate or orbicular, compressed.

About 250 species in tropical and warm parts of both Old and New World, lacking in Australia and New Zealand (Friis, 1993). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|---------------------------------|
| 1. Leaves lanceolate, glabrous, minutely serrate near apex | 1. <i>P. cf. scripta</i> |
| 1. Leaves elliptic, ovate to suborbicular, pubescent, sharply serrate | 2. <i>P. sp.</i> |

1. *Pilea cf. scripta* Wedd.

Ecology.— Lower montane forest, alt. 1,700 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2017.

2. *Pilea* sp.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 1506; *P. Srisanga* & *C. Maknoi* 2018.

VALERIANACEAE

Annual or perennial herbs, rarely shrubs. **Leaves** simple or pinnate, opposite; stipules absent. **Inflorescence** paniculate or cymose. **Flowers** unisexual or bisexual. **Calyx** absent, often pappus-like or rarely 5. **Corolla** (3-)5, imbricate. **Stamens** (1-)3 (-4), attached to the corolla tube; anthers versatile, dehiscing by longitudinal slits. **Ovary** inferior, composed of 3 carpels, 3-locular or only 1 locule developed and 2 abortion; ovule solitary in each loculus. **Fruit** an achene.

Thirteen genera and about 350 species, cosmopolitan but with a concentration in the Andes Mountains, S America. Only 1 species in Thailand (Larsen, 1987b).

VALERIANA L.

Sp. Pl.: 31. 1753; Larsen in Fl. Thailand 5(1): 127. 1987.

Perennial herbs with strong smelling rhizomes. **Leaves** simple, pinnatifid or imparipinnate. **Inflorescence** panicle or corymb; bracts present, small. **Flowers** numerous, small. **Calyx** pappus-like, persistent. **Stamens** 3. **Ovary** composed of 3 carpels, only 1 locule developed and 2 abortion. **Fruit** an achene.

About 250 species in N temperate region, S America, S Africa and W Malesia.

Valeriana hardwickii Wall.

In Fl. Ind. ed. Carey & Wall. 1: 166. 1820; Craib in Fl. Siam. Enum. 2: 234. 1934; Larsen, Dansk Bot. Ark. 23: 75. 1963; in Fl. Thailand 5(1): 127, fig. 40, pl. VIII: 2. 1987. – *V. javanica* Bl., Bijdr.: 919. 1826.

Erect rhizomatous herb up to 1.5 m high; stem terete, hollow, finely pubescent to glabrous. **Leaves** imparipinnate or deeply pinnatifid, 5-15 cm long, 2-8 cm wide, with 3-5 narrowly lanceolate, to broadly ovate-cordate, coarsely serrate segments, puberulous on both surfaces, very variable in leaf size and shape; apex acute to acuminate. **Inflorescence** a terminal panicle, 10-60 cm long, often richly branched. **Flowers** small, numerous; bracts subulate, 3-4 mm long. **Calyx** pappus-like, poorly developed during anthesis. **Corolla** white, tube ca. 2 mm long; lobes ca. 2 mm long, rounded at apex. **Stamens** 2-3 mm long; filaments inserted in the corolla tube. **Ovary** pubescent; style 2-3 mm long. **Achene** light brown, compressed with 6-8-ridged between which appressed, bristle-like, 3 mm long hairs occur; pappus segments ca. 10, plumose, 4-5 mm long.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— N Pakistan, Nepal and India (syntypes), China, N Vietnam, Laos, Indonesia (Sumatra, Java).

Ecology.— Lower montane scrub, among grasses, open ground among limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: September-December.

Vernacular.— แปงปองฟ้า Paew pong fa (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1826, 2145, 2662.

Notes.— New locality recorded from Nan, in Thailand.

VERBENACEAE

Trees, shrubs, herbs or woody climbers, sometimes thorny. **Leaves** simple, opposite; stipules absent. **Inflorescence** terminal or axillary, cymes, racemes or heads, often with coloured involucre bracts. **Flowers** bisexual, more or less zygomorphic. **Sepals** 4-5(-8), lobed or toothed, persistent. **Petals** 4-5(-18), sympetalous, irregular to 2-lipped; tube often slender; lobes imbricate. **Stamens** (2-)4 (-18), sometimes staminodes present; filaments arising from corolla tube and alternate with lobes; anthers 2-locular, opening by longitudinal slits; loculi often divergent. **Ovary** superior, usually 2-locular, sometimes subdivided by intrusive partitions into 4 uni-ovulate; ovules solitary or paired in each loculus, erect or pendulous; style terminal. **Fruit** a berry, drupe, capsule or nutlet.

Forty-one genera with about 950 species mainly in tropical region especially S America. The limits of the family have been much debated but recent evaluations of Lamiales remove many genera to Lamiaceae *sensu lato* and split off smaller groups as distinct families (Mabberley, 1997). About 10 genera and 22 species, native, introduced or naturalized in Thailand. Three genera and 3 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Shrub or woody climber. Inflorescence in capitate, subtended by involucre bracts
 2. Involucre 3-4-lobed, usually connate at base. Corolla 2-lipped. Stamens 4
1. *Congea*
 2. Involucre 5-6-lobed, free. Corolla slightly zygomorphic, 5(-7)-lobed. Stamens 5(-7)
2. *Sphenodesme*
1. Herbs. Inflorescence in elongate spike, not subtended by involucre bracts
3. *Verbena*

1. *CONGEA* Roxb.

Pl. Corom. 3: 90. 1820; Fletcher, Kew Bull. 1938: 439. 1938; Chen & Gilbert in Fl. China 17: 49. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 193. 2004.

Scandent shrubs or woody climbers; branchlets subterete, tomentose. **Inflorescence** in capitata, 3-9-flowered, subtended by 3-4-lobed involucre bracts which usually connate at base. **Calyx** funnelform or campanulate; lobes 5, slightly enlarged in fruit. **Corolla** 2-lipped, lower lip 3 cleft, upper lip 2 cleft; tube slender. **Stamens** 4, didynamous, inserted at corolla throat; anthers subglobose. **Ovary** obovate, imperfectly 2-locular; ovules 2 in each loculus; stigma capitata or shortly 2-lobed. **Fruit** a drupe.

About 7 species mostly in S and SE Asia. Four species in Thailand.

***Congea tomentosa* Roxb.**

Pl. Corom. 3: 90. 1820; Fletcher, Kew Bull. 1938: 440. 1938; Chen & Gilbert in Fl. China 17: 49. 1994.

Scandent shrub or woody climber; branchlets densely yellowish brown tomentose. **Leaves** elliptic to ovate, papery, 6-16 cm long, 3-9 cm wide, pilose to strigose on upper surface, densely pilose on lower surface; base broadly cuneate, rounded to subcordate; apex acute to acuminate; margin entire; primary veins 5-6 pairs, prominent below; petioles 5-10 mm long, densely pilose. **Inflorescence** in capitata, (5-)-7(-9)-flowered; involucre bracts pink to purple, 3(-4)-lobed, oblong, elliptic to narrowly obovate, 2-2.5 cm long, 0.8-1.2 cm wide, connate at base, obtuse to rounded at apex, densely white pilose especially at base on upper side. **Calyx** pink to purple, funnelform, 6-8 mm long; lobes triangular, about one third to as long as tube, densely long pilose outside, pubescent inside. **Corolla** white, glabrous except pilose in throat; tube longer than calyx. **Stamens** long exserted. **Ovary** glabrous; style long exserted. **Drupe** enclosed in an enlarged calyx.

Thailand.— Almost throughout the country.

Distribution.— India, Bangladesh, S China, SE Asia (Myanmar-type).

Ecology.— Deciduous and dry evergreen forest, alt. 350-1,000 m (Doi Phu Kha, Doi Phu Huat).

Phenology.— Flowering: February-April; fruiting: April-June.

Vernacular.— เครือออน Khrua on (Northern).

Voucher specimens.— *P. Srisanga* 511.

2. *SPHENODESME* Jack

Malayan Misc. 1: 19. 1820; Fletcher, Kew Bull. 1938: 441. 1938; Chen & Gilbert in Fl. China 17: 48. 1994; Harley et al. in Fam. Gen. Vasc. Pl. 7: 192. 2004.

Scandent shrubs or woody climbers; branchlets subterete, hairy. **Inflorescence** in capitata, 3-7-flowered, subtended by 5-6-lobed involucre bracts which free to the base. **Calyx** funnelform or campanulate; lobes 5, slightly enlarged in fruit. **Corolla** slightly zygomorphic; tube short, cylindrical; lobes 5(-7). **Stamens** 5(-7), inserted at corolla throat; anthers ovate. **Ovary** imperfectly 2-locular; ovules 2 in

each loculus, pendulous from apex of a placenta; stigma 2-lobed. **Fruit** a drupe. **Seeds** 1(-2).

About 14 species mostly in tropical and subtropical Asia. Seven species in Thailand.

Sphenodesme involucrata (Presl) B.L. Robinson

Proc. Amer. Acad. Arts 51: 531. 1916; Fletcher, Kew Bull. 1938: 441. 1938; Chen & Gilbert in Fl. China 17: 48. 1994. – *Vitex involucrata* Presl, Bot. Bemerkungen 148. 1844. – *Symphorema unguiculatum* Kurz in For. Fl. Burma 2: 255. 1877.

Woody climber; branchlets with brown stellate hairs, glabrescent. **Leaves** elliptic to ovate, chartaceous, 7-16 cm long, 3-8 cm wide, glabrous on upper surface, sparsely stellate hairs on lower surface; base broadly cuneate to rounded; apex acute; margin entire; primary veins 4-6 pairs, prominent below; petioles 7-15 mm long, densely brown stellate hairs. **Inflorescence** in capitate, 7-flowered; involucre bracts brown, 5(-6)-lobed, oblanceolate to narrowly obovate, 1.7-3.3 cm long, 0.4-1.2 cm wide, attenuate and free to the base, obtuse to rounded at apex, densely stellate hairs especially towards the base on both sides; peduncle densely brown stellate hairs. **Flowers** fragrant. **Calyx** brown, campanulate, 5-6 mm long; lobes triangular, 0.5-1 mm long, densely stellate hairs outside, brown pubescent inside. **Corolla** creamy white, 4-6 mm long, pubescent on both sides. **Stamens** included, sessile or subsessile. **Ovary** glabrous, glandular dotted at apex. **Drupe** enclosed in an enlarged calyx.

Thailand.— Northern: Lampang, Nan; North-eastern: Loei; South-eastern: Prachin Buri.

Distribution.— India, Myanmar (type), China, Vietnam, Malaysia.

Ecology.— Dry evergreen forest, alt. 600-700 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering: October-December; fruiting: December-April.

Vernacular.— ขาผี Kha pia (Lampang).

Voucher specimens.— *P. Srisanga* 324.

3 VERBENA L.

Sp. Pl.: 18. 1753; Fletcher, Kew Bull. 1938: 410. 1938; Chen & Gilbert in Fl. China 17: 3. 1994; Atkins in Fam. Gen. Vasc. Pl. 7: 460. 2004.

Annual or perennial herbs; branchlets quadrangular. **Leaves** sessile, dentate, lobed or pinnatifid. **Inflorescence** usually terminal, in elongate spikes, simple or branched. **Flowers** slightly zygomorphic; bracts small, persistent. **Calyx** tubular, membranous; lobes 5. **Corolla** tubular; lobes 5, unequal, spreading. **Stamens** 4, didynamous, inserted at middle of corolla tube, included; anthers ovate. **Ovary** 4-locular; ovule 1 in each loculus, erect. **Fruit** a capsule, dehiscent into 4 1-seeded pyrenes.

About 200 species mainly in tropical and temperate America. About 3 cultivated or naturalized species in Thailand.

Verbena officinalis L.

Sp. Pl.: 20. 1753; Fletcher, Kew Bull. 1938: 410. 1938; Chen & Gilbert in Fl. China 17: 3. 1994.

Erect herb, 30-70 cm high; branchlets sparsely pubescent. **Leaves** deeply lobed to pinnatifid, chartaceous, 2-8 cm long, 1-5 cm wide, sparsely pubescent to substrigose on both surfaces; base attenuate; apex acute. **Inflorescence** in elongate spikes, 10-30 cm long, pubescent; bracts subulate, 2-3 mm long. **Calyx** 2-4 mm long, pubescent; lobes short. **Corolla** blue, 4-8 mm long, pubescent. **Stamens** sessile or subsessile. **Ovary** glabrous. **Capsule** oblong, 2-3 mm long, enclosed in persistent calyx.

Thailand.— Naturalized. Northern: Chiang Mai, Nan.

Distribution.— Widespread as a weed in most parts of the world and probably naturalized in many areas.

Ecology.— Lower montane forest and lower montane scrub, alt. 1,500-1,600 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: July-December.

Voucher specimens.— *P. Srisanga* 407, 1775.

VIOLACEAE

Herbs, shrubs, small trees or lianas. **Leaves** simple, alternate, rarely opposite; stipules present, leafy or small. **Inflorescence** terminal or axillary, raceme, panicle or head or flower solitary in leaf axils. **Flowers** usually bisexual, actinomorphic or zygomorphic. **Sepals** 5, imbricate, free or sometimes connate at base, persistent. **Petals** 5, imbricate or convolute, free, the lowermost often with spur in zygomorphic flower. **Stamens** (3-)5, the abaxial stamen often spurred at the base; anthers erect, more or less connivent in a ring around the ovary, opening by longitudinal slits. **Ovary** superior; carpels (2-)3(-5), 1-locular, parietal placentation; style simple; ovules 1-2 or numerous in each placenta. **Fruit** a berry or loculicidal capsule, rarely nut. **Seeds** 1-many.

A pantropical family with about 20 genera and 800 species, only *Viola* L. is cold-loving mainly in temperate and subtropical regions or on tropical high mountains. Three genera and about 17 species in Thailand. One genus and 4 species recorded from Doi Phu Kha National Park.

VIOLA L.

Sp. Pl.: 933. 1753; Becker, Beih. Bot. Centralbl. 34, ii: 208. 1916; Beih. Bot. Centralbl. 34, ii: 373. 1917; Beih. Bot. Centralbl. 40, ii: 69. 1923; Jacobs & Moore in Fl. Mal. I(7): 198. 1971; Banerjee & Pramanik in Fasc. Fl. Ind. 12: 9. 1983.

Perennial, rarely annual herbs. **Leaves** simple, alternate, petiolate. Stipules free or adnate to petiole, persistent, often conspicuous, usually serrate or fimbriate.

Flowers bisexual, solitary, axillary, with a pair of bracteoles usually in the upper half of the pedicels. **Sepals** equal, entire to dentate, prolonged into appendages below the point of their insertion, persistent. **Corolla** zygomorphic. **Petals** unequal, the lower saccate or spurred and usually broader than the others, the lateral pair smaller than the upper pair, the lateral petals often bearded inside. **Stamens** 5; filaments connivent around the gynoecium; anthers 2-locular; connective produced into an apical appendage. **Ovary** glabrous or pubescent, with 3 placentas; ovules many; style straight, curved or geniculate, filiform to conspicuously clavate, often lobed at apex. **Fruit** a 3-valved loculidial capsule, subtended by calyx, globose to cylindrical or ellipsoidal; valves boat-shaped, usually with thick rigid keels, glabrous or pubescent. **Seeds** many, usually ellipsoidal, glabrous.

About 400 species distributed mainly in temperate and subtropical regions or tropical high mountains throughout the world. Many species are cultivated as ornamentals. About 7 indigenous species in Thailand.

KEY TO THE SPECIES

- | | |
|---|--------------------------|
| 1. Petioles conspicuously winged | 2. <i>V. diffusa</i> |
| 1. Petioles not or scarcely winged | |
| 2. Leaves twice or more as long as wide | 1. <i>V. curvistylis</i> |
| 2. Leaves up to 1 $\frac{3}{4}$ times as long as wide | |
| 3. Lateral petals bearded | 3. <i>V. pilosa</i> |
| 3. Lateral petals not bearded | 4. <i>V. sumatrana</i> |

1. *Viola curvistylis* Boissieu & Capitaine

Bull. Soc. Bot. France 57: 339. 1910; Becker, Beih. Bot. Centralbl. 40, ii: 168. 1923; Jacobs & Moore in Fl. Mal. I(7): 210, fig. 8. 1971. – *V. ovalifolia* Becker, Beih. Bot. Centralbl. 34, ii: 256. 1916. – *V. lecomteana* Becker ex Gagnep. in Suppl. Fl. Gén. I.-C. 1: 181. 1939.

Stoloniferous perennial herb, pubescent; stipules linear-lanceolate, 7-13 mm long, 1-3 mm wide, fimbriate, hairy or glabrescent. **Leaves** lanceolate to elliptic, or ovate on the stolon, 2-9 cm long, 0.8-4.5 cm wide, pubescent; apex acute; base cordate; margin crenate-serrate; petioles 0.5-10 cm long, pubescent, glabrescent. Pedicels 0.5-9 cm long, pubescent, glabrescent. **Sepals** linear-lanceolate, 4-6 mm long, 0.5-1 mm wide, entire, sparsely pubescent, glabrescent; appendage 0.5-1 mm long, rounded. **Petals** white with dark blue veins or pale blue, oblanceolate to narrowly obovate, 8-12 mm long, 3-5.5 mm long; lateral petals bearded; spur 1-1.5 mm long, cylindrical, obtuse, exceeding calycine appendage. **Style** 1.5-2 mm long, geniculate at base, clavate at apex, with 2 large marginal lobes and anterior stigmatic beak. **Capsule** oblong to ellipsoid, 5-7 mm long, pubescent, glabrescent.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— Myanmar, Vietnam (Tonkin-type of *V. lecomteana*), Malaysia, Indonesia (Sumatra-type).

Ecology.— Lower montane forest, in shades, alt. 1,280-1,550 m (Doi Phu Kha).

Phenology.— Flowering: May-June; fruiting: May-November.

Voucher specimens.— *P. Srisanga* 361, 1394, 2310.

2. *Viola diffusa* Ging.

In DC., Prodr. 1: 298. 1824; Becker, Beih. Bot. Centralbl. 40, ii: 114. 1923; Craib in Fl. Siam. Enum. 1: 87. 1925; Jacobs & Moore in Fl. Mal. I(7): 202, fig. 8. 1971; Banerjee & Pramanik in Fasc. Fl. Ind. 12: 20, fig. 21. 1983. — *V. tenuis* Benth. in Hook. Lond. J. Bot. 1: 482. 1842.

Stoloniferous perennial herb, pubescent; stipules linear-lanceolate, 5-9 mm long, 0.75-1 mm wide, dentate to fimbriate, glabrous. **Leaves** elliptic, ovate to suborbicular, 1.2-4.5 cm long, 1.2-3 cm wide, pubescent; apex rounded; base cuneate, subtruncate to subcordate, attenuate onto the petiole; margin crenate, ciliate; petioles 1.5-4.5 cm long, distinctly winged, sparsely pubescent, glabrescent. Pedicels 1.5-7 cm long, sparsely hairy, glabrescent. **Sepals** linear-lanceolate, 3-6 mm long, 0.5-1 mm wide, entire, sparsely hairy, glabrescent; appendage ca. 0.5 mm long, rounded. **Petals** white with dark blue veins or pale blue, oblanceolate to narrowly obovate, 8-10 mm long, 3-5 mm long; lateral petals not bearded; spur 0.5-1 mm long, cylindrical, obtuse, exceeding calycine appendage. **Style** ca. 1.5 mm long, geniculate at base, clavate at apex, with 2 stigmatic lobes. **Capsule** oblong to ellipsoid, 4-6 mm long, glabrous.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— Himalayas (Nepal-type), Myanmar, China, Laos, Vietnam, Japan, Taiwan, Philippines.

Ecology.— Lower montane forest, in shades, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: Almost throughout the year.

Voucher specimens.— *P. Srisanga* 1760, 2367.

3. *Viola pilosa* Bl.

Cat. Gew. Buitenzorg: 57. 1823; Bijdr.: 57. 1825; Jacobs & Moore in Fl. Mal. I(7): 207, figs. 8, 16, 17. 1971 (excl. syn. *V. hamiltoniana* D. Don and *V. glaucescens* Oudemans); Banerjee & Pramanik in Fasc. Fl. Ind. 12: 20, fig. 26. 1983. — *V. serpens* Wall. ex Ging. in DC., Prodr. 1: 296. 1824. — *V. serpens* Wall. in Fl. Ind. ed. Carey & Wall. 2: 449. 1824; Becker, Beih. Bot. Centralbl. 40, ii: 103. 1923; Craib in Fl. Siam. Enum. 1: 88. 1925.

Stoloniferous perennial herb, pubescent; stipules lanceolate to oblong, 7-18 mm long, 1-3.5 mm wide, fimbriate, hairy or glabrescent. **Leaves** ovate, 1.5-8 cm long, 1-5.5 cm wide, pubescent; apex acute; base deeply cordate; margin crenate-serrate; petioles 1.5-15 cm long, pubescent. Pedicels 2-8 cm long, pubescent. **Sepals** linear-lanceolate, 4-7 mm long, 0.5-1.5 mm wide, entire to denticulate, pubescent; appendage 1-2.5 mm long, pointed. **Petals** violet, blue or white, with dark blue veins, oblanceolate to narrowly obovate, 8-13 mm long, 3-5 mm long; lateral petals bearded;

spur 1-2 mm long, cylindrical, obtuse, slightly shorter than calycine appendage. **Style** 1.5-3 mm long, geniculate at base, subclavate with shortly 2 stigmatic lobes at apex. **Capsule** ovoid to subglobose, 5-6 mm long, pubescent.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— Afghanistan, Pakistan, Himalayas (Nepal-type of *V. serpens*), Sri Lanka, SE Asia, Malesia (Java-type).

Ecology.— Lower montane scrub, among limestone rocks, alt. 1,700-1,750 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: November-March.

Voucher specimens.— *P. Srisanga* 1819, 2668; *P. Srisanga et al.* 2427.

4. *Viola sumatrana* Miq.

Fl. Ind. Bat. Suppl. 1: 389. 1860; Becker, Beih. Bot. Centralbl. 40, ii: 108. 1923; Jacobs & Moore in Fl. Mal. I(7): 209, fig. 8. 1971. – *V. sumatrana* var. *caerulescens* Boissieu & Capitaine, Bull. Soc. Bot. France 57: 341. 1910. – *V. hossei* Becker; Beih. Bot. Centralbl. 34, ii: 257. 1916; Banerjee & Pramanik in Fasc. Fl. Ind. 12: 25. 1983. – *V. siamensis* Hosseus, nom. nud.

Stoloniferous perennial herb, pubescent; stipules linear-lanceolate, 6-14 mm long, 1-3 mm wide, fimbriate, glabrous. **Leaves** ovate, 1.5-6.5 cm long, 1-3.5 cm wide, sparsely pubescent, glabrescent; apex acute; base cordate to deeply cordate; margin crenate-serrate; petioles 1.5-7 cm long, glabrous. Pedicels 1.5-5 cm long, glabrous. **Sepals** linear-lanceolate, 4-6 mm long, 0.5-1 mm wide, entire, glabrous; appendage 0.5-1 mm long, rounded. **Petals** violet, blue or white, with dark blue veins, oblanceolate to narrowly obovate, 8-10 mm long, 2.5-4 mm long; lateral petals not bearded; spur 1-2 mm long, cylindrical, obtuse, exceeding calycine appendage. **Style** 1.5-2 mm long, geniculate at base, subclavate with shortly 2 stigmatic lobes at apex. **Capsule** ellipsoid, 4.5-8 mm long, glabrous.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Phitsanulok; North-eastern: Loei; South-eastern: Chanthaburi.

Distribution.— India, Myanmar, S China (Yunnan), Vietnam, Malaysia, Indonesia (Sumatra-type).

Ecology.— Lower montane forest, alt. 1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: November-May.

Voucher specimens.— *P. Srisanga* 1447.

VISCACEAE

Photosynthetic monoecious or dioecious parasites on tree-branches; haustoria penetrating and ramifying in host tissues; aerial branching often pseudo-dichotomous and jointed. **Leaves** simple, opposite, entire, or rudimentary; stipules absent. **Inflorescence** axillary or terminal, usually in dichasia or spikes or flower solitary.

Flowers bisexual or unisexual, actinomorphic, small, usually yellow or green. **Sepals** 3-4, valvate, but often merely teeth on ovary rim. **Petals** absent. **Stamens** the same number as the sepals and opposite with them; anthers 1- to many-celled, opening by longitudinal slits, terminal pores or transverse slits. Disk present or absent. **Ovary** inferior, usually 1-locular; ovules 2; style solitary or absent. **Fruit** a berry, usually with latex or mucilage. **Seeds** 1-2.

Seven genera and about 400 species, predominantly tropical, with fewer species in north and south temperate regions. Four genera and 12 species in Thailand (Barlow, 2002b). Only 1 species recorded from Doi Phu Kha National Park.

VISCUM L.

Sp. Pl. 2: 1023. 1753; Gen. Pl., ed. 5: 448. 1754; Barlow in Fl. Thailand 7(4): 711. 2002.

Monoecious or dioecious parasitic shrub. Stems much-branched; internodes terete or decussately compressed or flattened, often longitudinally ridged or striate. **Leaves** simple, opposite, normally developed or rudimentary; normally developed leaves entire, unifacial, curvined, 3-5(-9) veins visible; rudimentary leaves scale-like, ca. 1 mm long. **Inflorescence** axillary or rarely terminal, basically a 3-flowered cymule, sometimes reduced to 1-flowered or enlarged up to 7-flowered; bracts small, triangular, in pairs forming a boat-shaped cupule subtending each cymule. **Male flowers** 4-merous, flattened, 0.5-1.5 mm long; sepals triangular, valvate; anthers disc-shaped, many loculate, opening by terminal pores, sessile and fused to the sepals. **Female flowers** 4-merous, cylindrical, less than 2 mm long; sepals triangular, valvate; stigma small, nipple-shaped. **Fruit** narrowly ellipsoid to globose, smooth or tuberculate.

About 100 species distributed in Europe, throughout Africa, and eastwards to eastern Asia, Malesia and Australia. Nine species in Thailand (Barlow, 2002b).

***Viscum articulatum* Burm.f.**

Fl. Ind.: 211. 1768; Danser, Bull. Jard. Bot. Buitenzorg III, 11: 460. 1931; Blumea 4: 280. 1941; Barlow in Fl. Thailand 7(4): 712, fig. 1:A. 2002.

Monoecious, glabrous, pendulous parasitic shrub on tree-branches. Stems internodes at maturity decussately compressed or flattened, quadrangular or double-edged with a raised angular rib on each face, 15-50 mm long, 2-5 mm wide. **Leaves** rudimentary, scale-like, ca. 1 mm long. **Inflorescence** axillary, a sessile 3-flowered cymule subtended by a ca. 1 mm long cupule, with subsidiary cymules developing below and around the first one, each with the central flower female and the lateral flowers female or male; central female flower subtended by its own bracteal cupule oriented decussately to the lower one. **Sepals** green, small. **Fruit** globose, sessile, smooth, white to pale yellow.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Nakhon Phanom, Khon Kaen; South-eastern: Chon Buri, Chanthaburi, Trat; Central: Bangkok; South-western: Ratchaburi; Peninsular: Chumphon, Satun, Songkhla, Narathiwat.

Distribution.— India eastwards to S China and Vietnam, and southwards to eastern Australia. Indonesia (Java-type).

Ecology.— Lower montane forest, alt. 1,500 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: October-December.

Vernacular.— กากาดต้นเปา Ka fak ton pao (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1836.

VITACEAE

Mostly climbers with tendrils, often with watery juice, rarely succulent herbs or shrubs. **Leaves** simple often palmately lobed or veined, less often palmately or pinnately compound, alternate or the lower sometimes opposite, often pellucid-punctate; stipules usually present and deciduous. **Inflorescence** usually in leaf-opposed, cymes, panicles or spikes; peduncle often cirrhose. **Flowers** bisexual or unisexual, actinomorphic, small, (3-)4-5(-7) merous. **Sepals** small, usually reduced to a collar, toothed or lobed. **Petals** free or united, valvate. **Stamens** opposite to the petals; anthers 2-locular, opening by longitudinal slits. Disk annular, cupulate or glands, mostly very distinct. **Ovary** superior, 2-locular; ovules 2 in each loculus; style simple; stigma capitate, discoid or lobed. **Fruit** a berry. **Seeds** 1-4, sometimes with ruminant endosperm.

Fourteen genera and about 850 species in tropical and warm temperate regions (Mabberley, 1997). About 10 genera and 62 species in Thailand. Three genera and 7 species recorded from Doi Phu Kha National Park..

Cayratia sp. 1

Ecology.— Deciduous, dry evergreen and lower montane forest, by streams, alt. 750-1,200 m (Doi Phu Kha).

Phenology.— Flowering: March-April; fruiting: October-November.

Voucher specimens.— *P. Srisanga* 580, 1333, 2235.

Cayratia sp. 2

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: March-April.

Voucher specimens.— *P. Srisanga* & *S. Watthana* 646, 705; *P. Srisanga et al.* 824.

***Cayratia* sp. 3**

Ecology.— Lower montane forest, alt. 1,400 m (Doi Phu Wae).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga et al.* 845.

***Cissus discolor* Bl.**

Ecology.— Lower montane forest, alt. 1,800 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 1523.

***Cissus* sp.**

Ecology.— Dry evergreen forest, alt.900 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 1553.

***Tetrastigma* sp. 1**

Ecology.— Lower montane scrub, on limestone rocks, alt. 1,750 m (Doi Phu Wae).

Phenology.— Flowering: February-March.

Voucher specimens.— *P. Srisanga et al.* 2422.

***Tetrastigma* sp. 2**

Ecology.— Deciduous and dry evergreen forest, by streams, alt. 700-800 m (Doi Phu Kha).

Phenology.— Fruiting: March-April.

Uses.— Fruit edible.

Voucher specimens.— *P. Srisanga* 566.

MONOCOTYLEDONAE (LILIOPSIDA)

Twenty-seven families, 108 genera and 201 species recorded from Doi Phu Kha National Park.

Artificial Key to the Families on Doi Phu Kha National Park

1. Perianth absent, rudimentary or represented by bristles or scales, not petaloid
 2. Perianth absent or rudimentary, not represented by bristles or scales
 3. Herbaceous plants or woody climber. Leaves various, not spiny. Flowers in spadix, subtended by bract (spathe)
 4. Aquatic rhizomatous herbs. Leaves linear and distichous

Acoraceae (*Acorus*)
 4. Habit various. Leaves not linear and distichous

Araceae
 3. Woody plant. Stem erect. Leaves long, linear, spiny and spirally arranged. Flowers in head, not subtended by bract (spathe)

Pandanaceae (*Pandanus*)
 2. Perianth represented by bristles or scales
 5. Stem mostly solid, triangular, not jointed. Leaves often three-ranked, without ligules. Each floret usually subtended by a single bract (glume). Fruit an achene

Cyperaceae
 5. Stem mostly hollow, cylindrical or flattened, jointed. Leaves two-ranked, ligules often present. Each floret usually subtended by a pair of bracts (lemma and palea). Fruit a grain (caryopsis)

Poaceae
 1. Perianth present, usually of two series, not represented by bristles or scales, the inner whorl often petaloid
 6. Ovary superior or half-inferior
 7. Woody plants, mostly tree-like, sometimes climbing (Rattan)

Arecaceae
 7. Herbaceous plants
 8. Flowers usually small, in heads at the end of a stalk
 9. Bracts of flowering heads stiff, dark coloured. Flowers bisexual, yellow

Xyridaceae (*Xyris*)
 9. Bracts of flowering heads thin, pale coloured. Flowers unisexual, white

Eriocaulaceae (*Eriocaulon*)
 8. Flowers not as above
 10. Leaves overlapping or sheathing. Flowers mostly blue, pink or white

Commelinaceae
 10. Leaves not as above. Flowers various coloured
 11. Inflorescence a scapose umbel subtended by spatheous bract
 12. Bulbous herb, aromatic. Flowers bisexual

Alliaceae (*Allium*)
 12. Small shrub or climber with tendrils. Flowers unisexual

Smilacaceae (*Smilax*)
 11. Inflorescence not an umbel
 13. Leaves reduced, scale-like

Asparagaceae (*Asparagus*)
 13. Leaves well developed, not scale-like
 14. Rhizomatous herb. Leaves in pseudowhorl at stem apex. Petals

- mostly filiform to linear **Trilliaceae (*Daiswa*)**
14. Plants not as above
15. Ovule 1 in each carpel **Dracaenaceae (*Dracaena*)**
15. Ovules 2 or more in each carpel
16. Flowers bisexual
17. Tepals with basal sacs or spurs. Anthers dorsifixed.
Fruit baccate **Colchicaceae (*Disporum*)**
17. Plants not as above
18. Bulbous herb; bulb naked, of numerous
imbricate fleshy scales. Flowers in racemes or
solitary, showy. Anthers dorsifixed versatile.
Fruit capsule; seeds winged **Liliaceae (*Lilium*)**
18. Rhizomatous or tuberous herbs. Inflorescence in
axillary or terminal, spikes, racemes or panicles,
or 1-several-flowered in leaf axils. Anthers
basifixed or dorsifixed. Fruit berry or capsule;
seeds not winged
19. Acaulescent herb. Leaves in a basal rosette,
sessile, sheathing. Inflorescence in scapose
of pedunculate slender thyrses or racemes.
Fruit capsule; seeds flattened
Anthericaceae (*Chlorophytum*)
19. Plants various, but not as above
Convallariaceae
16. Flowers andromonoecious or polygamous
Melanthiaceae (*Veratum*)
6. Ovary inferior
20. Stamens one or two, rarely three, grown together with style to form a column
(gynandrium) **Orchidaceae**
20. Stamens and style distinct, not grown together
21. Plants with pseudo-stem, tree-like. Stamens five, the remaining one
transformed into staminodes **Musaceae (*Musa*)**
21. Plants without pseudo-stem
22. Flowers always zygomorphic. Stamen one, the remaining five
transformed into staminodes or reduced
23. Stamen with two anther-locules. Sepals united
24. Plants mostly aromatic. Leaves distichous **Zingiberaceae**
24. Plants not aromatic. Leaves spirally arranged
Costaceae (*Costus*)
23. Stamen with one anther-locule. Sepals free or at most connivent
Marantaceae
22. Flowers generally actinomorphic. Stamens three or six
25. Minute herb, mostly saprophytic **Burmanniaceae (*Burmannia*)**
25. Plant autotrophic
26. Plant twining. Leaves distributed along stem, never plicate
Dioscoreaceae (*Dioscorea*)
26. Plant erect, never twining. Leaves basal, usually plicate
Hypoxidaceae (*Molineria*)

ACORACEAE

Monogeneric family (Bogner & Mayo, 1998). Description as in the genus.

ACORUS L.

Sp. Pl.: 324. 1753; Mayo, Bogner & Boyce, The Genera of Araceae: 289. 1997; Bogner & Mayo in Fam. Gen. Vasc. Pl. 4: 7. 1998.

Rhizomatous herbs, much branched, lacunose, aromatic. **Leaves** simple, distichous, unifacial, ensiform, not differentiated into petiole and blade; venation strictly parallel. **Inflorescence** a spadix-like spike, terminal, solitary, borne laterally on leaf-like axis; spathe erect, persistent, longer than spadix, appearing merely as extension of leaf-like peduncle; spadix cylindrical, densely flowered throughout. **Flowers** bisexual, 3-merous. **Tepals** 6, in 2 whorls of 3, free. **Stamens** 6, in 2 whorls of 3, opposite to the tepals; filaments linear-elongate, flattened; anthers introrse; thecae rounded-elliptic, opening by longitudinal slits. **Ovary** superior, 2-3-locular, apical placentation; ovules several in each loculus, pendulous; stigma minute, sessile. **Fruit** a berry, oblong-obovoid, with thin leathery pericarp. **Seeds** 1-5(-9), oblong to ellipsoid.

Two (to four) species, distributed throughout the northern hemisphere (Bogner & Mayo, 1998). One species in Thailand.

***Acorus calamus* L.**

Sp. Pl.: 324. 1753; Noltie in Fl. Bhutan 3(1): 158, fig. 13: g. 1994.

Rhizome 8-15 mm in diam. **Leaves** 35-60 cm long, 0.6-1.2 cm wide, glabrous; apex acute. **Inflorescence**: peduncle 9-15 cm long, trigonous; spathe 13-40 cm long, 0.6-1.4 cm wide; spadix 3-5 cm long, 0.5-1 cm wide, straight or slightly curved, green. **Tepals** oblong, 1-2 mm long, 0.5-1 mm wide, keeled, membranous. **Filaments** 1-2 mm long; anthers ca. 0.5 mm long. **Ovary** hexagonal-cylindric, 1.5-3.5 mm long, 1-2 mm wide, conical at apex.

Thailand.— Almost throughout the country.

Distribution.— Throughout the northern hemisphere, introduced and naturalized in Europe.

Ecology.— By streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering: January-March; fruiting: April-June.

Vernacular.— ว่านน้ำ Wan nam (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1274.

ALLIACEAE

Acaulescent or short-stemmed biennial or perennial herbs, alliaceous odour often present; stem usually swollen and often forming a bulb, tuberous rhizome or rarely a corm. **Leaves** simple, usually linear, filiform or lanceolate, flat, angular, terete, or fistular, often fleshy, sometimes forming a pseudostem around the scape; veins parallel. **Inflorescence** usually umbel-like, scapose, formed of 1 or more contracted helicoid cymes, rarely reduced to a single flower, subtended by (1-)2(-several) membranous, sometimes united into spathaceous bracts, enveloping the young inflorescence; pedicels sometimes subtended by smaller membranous bracts; scape from apex of each shoot or bulb, sometimes lateral, terete, flat, angular or fistular. **Flowers** bisexual, mostly actinomorphic. **Tepals** mostly 6, in 2 whorls of 3, usually petaloid, free or connate. Corona present or absent. **Stamens** usually 6, rarely 2 or 3 and then the missing ones often transformed to staminodes; filaments inserted on the tepals, free from each other or united, often with appendices; anthers versatile, basifixed, introrse, opening by longitudinal slits. **Ovary** superior, 3-locular; ovules (1-)2-several in each loculus; style solitary, erect, at apex of ovary or gynobasic; stigmas capitate or 3-lobed. **Fruit** a loculicidal capsule. **Seeds** few to numerous.

Thirteen genera and about 600 species, subcosmopolitan excluded Australia, most genera occurred in S America (Rahn, 1998). Only 1 genus with about 10 species, native or cultivated in Thailand. Two indigenous species recorded from Doi Phu Kha National Park.

ALLIUM L.

Sp. Pl.: 294. 1753; Rahn in Fam. Gen. Vasc. Pl. 3: 76. 1998.

Mostly bulbous herbs with alliaceous odour, enveloped by sheathing, dry leaves or leaf bases. **Leaves** basal, sheathing bases forming a pseudostem. **Inflorescence** umbel-like, scapose, few-many-flowered; spathaceous bracts 1-2; pedicels sometimes subtended by smaller membranous bracts. **Flowers** actinomorphic. **Tepals** 6, free or slightly connate below. **Stamens** 6, rarely 3; filaments usually attached to the base of the tepals. Ovules (1-)2(-10) in each loculus; style gynobasic.

Between 260-690 species in N Africa, Europe, Asia and N America, especially abundant in Central Asia (Rahn, 1998). Many species are widely cultivated and used as vegetable, spices, medicines and ornamentals.

KEY TO THE SPECIES

1. Leaves terete, 20-35 cm long, 0.1-0.2 cm wide, angled; midvein absent.
Umbels 2-6-flowered 1. *A. mairei*
1. Leaves linear, 20-40 cm long, 0.2-0.5(-1) cm wide; midvein distinct.
Umbels (10-)15-30-flowered 2. *A. wallichii*

1. *Allium mairei* H. Lév.

Repert. Spec. Nov. Regni Veg. 7: 339. 1909; Xu & Kamelin in Fl. China 24: 176. 2000.

Bulbous herb; bulb solitary or clustered, cylindric; roots elongate, thick; tunic brown, fibrous. **Leaves** terete, 20-35 cm long, 0.1-0.2 cm wide, angled; midvein absent. Scape (10-)15-30 cm long, terete, 2-angled, covered with leaf sheaths at base. Spathe persistent. **Umbels** hemispheric, 2-6-flowered; pedicels 1.8-2.5 cm long, 3-angled, ascending. **Tepals** purplish pink, spreading, oblong-ob lanceolate, 8-12 mm long, ca. 2 mm wide, with median ridge outside, obtuse or retuse at apex. **Stamens** erect; filaments 3-5 mm long, connate at base and adnate to the tepals base; anthers ca. 1 mm long. **Ovary** broadly ovoid, 2-3 mm long and wide; style 2-3 mm long; ovules 2 in each loculus. **Capsule** broadly obovoid, 3-lobed, 3-4 mm in diam.

Thailand.— Northern: Nan.

Distribution.— S China.

Ecology.— Lower montane scrub, open places in crevice of limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering: August-October.

Voucher specimens.— *P. Srisanga* 2116.

Notes.— New recorded for Thailand.

2. *Allium wallichii* Kunth

Enum. Pl. 4: 443. 1843; Stearn in Fl. Bhutan 3(1): 79. 1994; Xu & Kamelin in Fl. China 24: 175. 2000.

Bulbous herb; bulb solitary or clustered, cylindric; roots elongate, thick; tunic brown, fibrous. **Leaves** linear, 20-40 cm long, 0.2-0.5(-1) cm wide; midvein distinct. Scape (10-)20-50 cm long, 3-angled, covered with leaf sheaths at base. Spathe deciduous. **Umbels** hemispheric, (10-)15-30-flowered; pedicels 2-3 cm long, ascending. **Tepals** purplish pink or white, spreading, oblong-lanceolate to oblong-elliptic, 5-9 mm long, 1-2 mm wide, obtuse or retuse at apex. **Stamens** erect; filaments 4-6 mm long, connate at base and adnate to the tepals base; anthers ca. 1 mm long. **Ovary** subglobose to broadly ovoid, 2-3 mm long and wide; style 3-5 mm long; ovules 2 in each loculus. **Capsule** subglobose to broadly obovoid, 3-lobed, 3-4 mm in diam. (Fig. 154).

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, Sikkim, China, Myanmar.

Ecology.— Lower montane scrub, open places among grasses or in crevice of limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: September-December.

Voucher specimens.— *P. Srisanga* 418, 428, 1793, 2148, 2653.

Notes.— New recorded for Thailand.

ANTHERICACEAE

Perennial rhizomatous herbs; roots fibrous or thickened and fleshy. **Leaves** simple, spirally arranged, rarely distichous, basal, sheathing, often surrounded by scarious leaf remnants; blades dorsiventral, linear to oblong-lanceolate; veins parallel. **Inflorescence** erect, mostly scapose, racemes or panicles, or with slender pedicels arising directly and umbel-like. **Flowers** bisexual, pedicellate, actinomorphic or zygomorphic, solitary or several per node; bracts 1 to several. **Tepals** 6, in 2 whorls of 3; both whorls more or less equal, free or united, persistent. **Stamens** 6, free or shortly united basally; anthers dorsifixed or basifixed, introse, dehiscent by longitudinal slits; thecae 2, oblong to elongate. **Ovary** superior, 3-locular, sessile or rarely stipitate, axile placentation; ovules 2-many in each loculus; style filiform; stigma minutely capitate. **Fruit** a loculicidal capsule. **Seeds** 2-many, black, rounded, angular, folded or flattened.

Nine genera and about 200 species, subcosmopolitan, distributed mainly in Africa, Europe, Asia and Americas, extending to N Australia (Conran, 1998). Only 1 genus with about 8 species in Thailand. Two species recorded from Doi Phu Kha National Park.

CHLOROPHYTUM Ker-Gawl.

Bot. Mag.: t. 1071. 1808; Conran in Fam. Gen. Vasc. Pl. 3: 119. 1998.

Herbs with short rhizomes and more or less fibrous, fleshy or tuberous roots. **Leaves** in a basal rosette, rosulate or distichous, usually sessile, conduplicate, sheathing, linear to linear-lanceolate or rarely ovate. **Inflorescence** in scapose or pedunculate slender thyrses or racemes; peduncles leafy or bracteate. **Flowers** usually several per node, always subtended by 2 or more bracts. **Tepals** free, white or greenish, sometimes with a reddish tinge or streak. **Filaments** free, smooth or scabrid, inserted a rimmed pit; anthers basifixed. **Ovary** ellipsoid to ovoid, glabrous, normally sessile, rarely stipitate; ovules 2-many in each loculus. **Capsule** ovoid to deeply 3-lobed. **Seeds** flattened, folded or compressed, papillate or smooth.

About 150 species, predominantly in Africa and Asia, extending to N Australia (Conran, 1998).

KEY TO THE SPECIES

- | | |
|---|------------------------|
| 1. Leaves (2-)3-6 cm wide. Inflorescence erect or long trailing | 1. <i>C. malayense</i> |
| 1. Leaves 0.8-2.3 cm wide. Inflorescence erect | 2. <i>C. sp.</i> |

1. *Chlorophytum malayense* Ridl.

In Fl. Mal. Pen. 5: 341. 1925; Jessop in Fl. Mal I(9): 206. 1979; Chen & Tamura in Fl. China 24: 206. 2000. – *C. orchidastrum* auct. non Lindl.: Hook.f. in Fl. Br. Ind. 6: 336. 1892; Ridl. in Fl. Mal. Pen. 4: 327. 1924; Gagnep. in Fl. Gén. I.-C. 6: 806. 1934;

Larsen, Dansk Bot. Ark. 20(1): 45. 1961; Charoenphol, Thai For. Bull. (Bot.) 7: 68. 1973; Tamura, Acta Phytotax. Geobot. 40: 4. 1989.

Leaves basal, rosulate, linear-lanceolate, (20-)30-60 cm long, (2-)3-6 cm wide, glabrous, sessile; apex long acuminate. **Inflorescence** erect or long trailing, 50-120 cm long, solitary or few-branched. **Flowers** usually 2-3-clustered, rarely solitary; pedicels 3-5 mm long. **Tepals** white, lanceolate, 8-10 mm long, 2-3 mm wide, acute at apex. **Filaments** 3-4 mm long; anthers oblong, 4-4.5 mm long. **Ovary** ovoid, 3-lobed, 1.5-2 mm long, glabrous; style 3-4 mm long. **Capsule** subglobose, deeply 3-lobed, 5-7 mm long, 7-9 mm wide.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei; South-western: Kanchanaburi; Peninsular: Surat Thani.

Distribution.— China, Laos, Vietnam, Malaysia.

Ecology.— Lower montane forest, moist places, alt. 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: February-May.

Voucher specimens.— *P. Srisanga* & *S. Watthana* 630; *P. Srisanga et al.* 229.

2. *Chlorophytum* sp.

Leaves basal, rosulate, linear-lanceolate, (10-)20-35 cm long, 0.8-2.3 cm wide, glabrous, sessile; apex acute. **Inflorescence** erect, 20-40 cm long, solitary. **Flowers** solitary or 2-3-clustered; pedicels 6-11 mm long. **Tepals** white, lanceolate, 10-12 mm long, 2-3 mm wide, acute at apex. **Filaments** 4-5 mm long; anthers oblong, 4-5 mm long. **Ovary** ellipsoid, 3-lobed, 2-3 mm long, glabrous; style 8-11 mm long. **Capsule** obovoid, deeply 3-lobed, 8-11 mm long, 6-7 mm wide.

Thailand.— Northern: Nan.

Ecology.— Lower montane scrub, open places among grasses or in crevice of limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: June-October.

Voucher specimens.— *P. Srisanga* 2135; *P. Srisanga et al.* 879.

ARACEAE

Herbs, diminutive to gigantic, terrestrial, epiphytic, or climbing, rarely aquatic, with true or false stems; underground stems often present; laticifers commonly present. **Leaves** simple or compound, alternate or distichous, usually differentiated into petiole and expanded blade of very variable shape; midrib compound; primary venation usually pinnate, sometimes pedate or arcuate from the base or strictly parallel. **Inflorescence** in spadix, usually terminal; spathe mostly conspicuous. **Flowers** bisexual or unisexual, when unisexual the female flowers occupying the proximal part and males in the median or distal part of the spadix, rarely unisexual inflorescence, ebracteate; perigone present or absent. **Tepals** 4, 6 or rarely 8, free, partly or completely connate, or reduced or absent in unisexual flowers. **Stamens** 4,

6, 8 or sometimes less or up to 12, always opposite to the tepals in bisexual flowers, free to connate; anthers opening by terminal pores or longitudinal slits. **Ovary** superior, usually 1-3(-47)-locular, syncarpous, usually axile placentation; ovules 1-numerous in each loculus; style usually inconspicuous or absent; stigma sometimes distinctly lobed. **Fruit** a berry, usually free and borne in cylindrical, dense, fleshy spike, rarely connate into syncarp. **Seeds** small to very large.

A subcosmopolitan family comprising 104 genera and over 3,300 species, but most diverse in tropical region (Mayo et al., 1997; 1998). A family contains many important foods, medicines and ornamentals. Twenty-three genera and about 150-170 native species in Thailand. Seven genera and 13 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Terrestrial herbs. Flowers unisexual
 2. Spadix without terminal appendix
 3. Leaves not peltate. Spathe not constricted
 4. Spadix: male flowers zone longer and contiguous with female flowers zone. Berry 1-seeded **1. *Aglaonema***
 4. Spadix: female and male zones contiguous or with sterile male flowers or naked zone in between. Berry many-seeded **4. *Homalomena***
 3. Leaves peltate. Spathe broad or narrow and very long, with 1-2 constrictions; spadix: female zone separated from male by much narrower zone of sterile synandrodes **6. *Remusatia***
 2. Spadix with terminal appendix
 5. Leaves simple **2. *Alocasia***
 5. Leaves usually compound: trisect, pedatisect or radiatisect **3. *Arisaema***
1. Climbers. Flowers bisexual
 6. Petioles broad, flattened winged **5. *Pothos***
 6. Petioles not winged **7. *Rhaphidophora***

1. *AGLAONEMA* Schott

Wiener Z. Kunst 1829(3): 892. 1829; Mayo, Bogner & Boyce, The Genera of Araceae: 223. 1997; in Fam. Gen. Vasc. Pl. 4: 62. 1998.

Rhizomatous herbs; laticifers present; stems creeping to erect; internodes distinct. **Leaves** alternate, not peltate, often variegated; primary veins pinnate. **Inflorescence** terminal, 1-9; peduncle deflexing in fruit; spathe boat-shaped, not constricted; spadix cylindrical to clavate, sessile to stipitate, without terminal appendix. **Flowers** unisexual; male flowers zone longer and contiguous with female flowers zone; perigone absent. **Male flowers** 1-androus, numerous; stamens free; anthers dehiscing by terminal pores. **Female flowers** few; ovary 1-locular, subglobose, basal placentation; ovule 1, anatropous; style short, narrower than ovary; stigma broad, discoid, concave. **Berry** ellipsoid, red. **Seed** 1, large.

Twenty-one species in tropical S and SE Asia to New Guinea (Mayo et al., 1997; 1998). *Aglaonema* is important ornamental foliage plant. About 10 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|-----------------------------|-------------------------------------|
| 1. Leaves variegated | 1. <i>A. aff. commutatum</i> |
| 1. Leaves concolorous green | 2. <i>A. sp.</i> |

1. *Aglaonema aff. commutatum* Schott

Ecology.— Terrestrial, Deciduous and dry evergreen forest, alt. 700-800 m (Doi Phu Kha).

Phenology.— Fruiting: February-March.

Voucher specimens.— *P. Srisanga* 567.

2. *Aglaonema sp.*

Ecology.— Terrestrial, Lower montane forest, by streams, alt. 1,200 m (Doi Phu Kha).

Phenology.— Flowering: March-April.

Voucher specimens.— *P. Srisanga* 1341.

2. *ALOCASIA* (Schott) G. Don

In Sweet, Hort. Brit. ed. 3: 631. 1839, nom. cons.; Mayo, Bogner & Boyce, The Genera of Araceae: 283. 1997; in Fam. Gen. Vasc. Pl. 4: 71. 1998. – *Colocasia* sect. *Alocasia* Schott in Schott & Endl., Melet. Bot.: 18. 1832.

Perennial herbs, sometimes stoloniferous; laticifers present; stems erect. **Leaves** alternate, ovate-cordate to sagittate, sometimes peltate. **Inflorescence** terminal, several, appearing with the leaves; spathe boat-shaped, erect, constricted; spadix: female zone separated from male by much narrower zone of sterile synandrodies, terminal appendix always present. **Flowers** unisexual; perigone absent. **Male flowers** 3-8-anded, numerous; stamens connate; anthers dehiscing by terminal pores. **Female flowers** lacking staminodes; ovary 1-locular or partially 3-4-locular at apex, ovoid to oblong, basal placentation; ovule 6-10; style distinct, narrower than ovary; stigma depressed capitate, 3-4-lobed. **Berry** ellipsoid to subglobose, usually reddish. **Seeds** 1-5.

About 60-70 species in tropical Asia to northern Australia, Melanesia and Pacific (Mayo et al., 1997; 1998). About 8 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves small, less than 13 cm long 1. *A. sp. 1*
 1. Leaves large, more than 30 cm long 2. *A. sp. 2*

1. *Alocasia sp. 1*

Ecology.— Terrestrial, Dry evergreen forest, in moist places, alt. 850 m (Sapan Waterfall).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 1957.

2. *Alocasia sp. 2*

Ecology.— Terrestrial, Lower montane forest, alt. 1,400-1,500 m (Doi Phu Kha).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga et al.* 790.

3. *ARISAEMA* Mart.

Flora 14: 459. 1831; Mayo, Bogner & Boyce, The Genera of Araceae: 270. 1997; in Fam. Gen. Vasc. Pl. 4: 69. 1998.

Herbs, usually tuberous, rarely rhizomatous or stoloniferous; laticifers present. **Leaves** alternate, usually compound: trisect, pedatisect or radiatisect, rarely cordate or trifid; petioles usually long, often forming false stem. **Inflorescence** terminal; peduncle short to long; spathe tube usually cylindric, mouth often flaring with revolute to grotesquely auriculate margins, blade usually fornicate, often with elongate or filamentous apex; spadix with terminal appendix; appendix often cylindric, clavate or elongate tapering or rarely absent, sometimes drawn out into an extremely long flexuose thread, rarely composed of several long threads. **Flowers** unisexual; male flowers zone usually laxly flowered, contiguous with female, sometimes separated from appendix by short zone of filamentous or subulate staminodes; perigone absent. **Male flowers** remote, 2-5-androus; stamens connate; synandrium sessile to long stipitate. **Female flowers**: ovary 1-locular, basal placentation; ovules 1-9, atropous. **Berry** red. **Seeds** few.

About 170 species in E and SE USA, N Mexico, E and NE Africa, Arabian Peninsula, temperate E Asia, tropical S, SE and E Asia, in the tropics only found at high altitudes (Mayo et al., 1997; 1998). About 8 species in Thailand. Four species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves radiatisect

- | | |
|---|--------------------|
| 2. Leaflets less than 2 cm wide | 1. <i>A. sp. 1</i> |
| 2. Leaflets more than 2.5 cm wide | 4. <i>A. sp. 4</i> |
| 1. Leaves trisect | |
| 3. Male flowers red; female flowers green | 2. <i>A. sp. 2</i> |
| 3. Flowers white | 3. <i>A. sp. 3</i> |

1. *Arisaema sp. 1*

Ecology.— Terrestrial, Lower montane scrub, on limestone mountain, alt. 1,700 m (Doi Phu Wae).

Phenology.— Fruiting: September-October.

Voucher specimens.— *P. Srisanga* 2119.

2. *Arisaema sp. 2*

Ecology.— Terrestrial, Lower montane forest, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering: November.

Voucher specimens.— *P. Srisanga* 2269.

3. *Arisaema sp. 3*

Ecology.— Terrestrial, Lower montane forest, alt. 1,650 m (Doi Phu Kha).

Phenology.— Flowering: January.

Voucher specimens.— *P. Srisanga* 2351.

4. *Arisaema sp. 4*

Ecology.— Terrestrial, Lower montane scrub, on limestone mountain, alt. 1,750 m (Doi Phu Wae).

Phenology.— Fruiting: July.

Voucher specimens.— *P. Srisanga et al.* 860.

4. *HOMALOMENA* Schott

In Schott & Endl., Melet. Bot.: 20. 1832; Mayo, Bogner & Boyce, The Genera of Araceae: 177. 1997; in Fam. Gen. Vasc. Pl. 4: 56. 1998.

Evergreen herbs; laticifers present. **Leaves** several, lanceolate, elliptic to sagittate, rarely peltate. **Inflorescence** 1-6, appearing with leaves; spathe usually green, ellipsoid to boat-shaped, not constricted; spadix: female and male zones contiguous or with sterile male flowers or naked zone in between, terminal appendix absent. **Flowers** unisexual; perigone absent. **Male flowers** 2-4-androus; stamens free; anthers dehiscent by longitudinal slits. **Female flowers** with 1(-3) staminodes;

ovary incompletely 2-4(-5)-locular, parietal placentation or parietal above and axile below; ovule many; style short, inconspicuous; stigma discoid or subcapitate. **Berry** obovoid to subglobose. **Seeds** ellipsoid, many.

About 110 species in tropical S and SE Asia to Melanesia and tropical America (Costa Rica to Bolivia) (Mayo et al., 1997; 1998). About 10 species in Thailand. One species recorded from Doi Phu Kha National Park.

***Homalomena* sp.**

Ecology.— Terrestrial, Dry evergreen forest, in moist places, alt. 800 m (Tham Pha Kong).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 2549.

5. *POTHOS* L.

Sp. Pl.: 968. 1753; Mayo, Bogner & Boyce, The Genera of Araceae: 98. 1997; in Fam. Gen. Vasc. Pl. 4: 45. 1998; Boyce, Blumea 45(1): 151. 2000.

Shrubby climbers; laticifers absent; lower branches of stem rooting. **Leaves** distichous, linear to lanceolate-ovate; petioles broad, flattened winged and auriculate apically or much narrower and involute. **Inflorescence** axillary or infra-axillary, usually with basal cataphylls; peduncle sometimes reflexed; spathe ovate to linear, not enclosing spadix; spadix globose, ellipsoid or narrowly cylindrical, sessile to long stipitate. **Flowers** bisexual, (2-)3-merous; perigone present. **Tepals** (4-)6. **Stamens** 6, free; anthers dehiscent by longitudinal slits. **Ovary** 3-locular, axile placentation; ovule 1 in each loculus; stigma sessile. **Berry** ellipsoid or obovoid, red. **Seeds** 1-3, compressed-ellipsoid.

About 70-80 species in Madagascar and Comores Islands, tropical S and SE Asia, New Guinea and NE Australia (Mayo et al., 1997; 1998; Boyce, 2000). Six species in Thailand (Boyce, 2000). One species recorded from Doi Phu Kha National Park.

***Pothos chinensis* (Raf.) Merr.**

Thailand.— Northern: Chiang Mai, Phrae, Nan, Tak, Phitsanulok; North-eastern: Loei, Phetchabun; Eastern: Nakhon Ratchasima; South-eastern: Prachin Buri, Chanthaburi; Central: Saraburi; South-western: Kanchanaburi; Peninsular: Phangnga.

Distribution.— India, Nepal, Bhutan, Bangladesh, Myanmar, China, Laos, Vietnam, Cambodia.

Ecology.— Epiphyte, Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: August-September; fruiting: January-April.

Voucher specimens.— *P. Srisanga* 538, 2353; *P. Srisanga* & *C. Maknoi* 2037; *P. Srisanga* & *S. Watthana* 701.

6. *REMUSATIA* Schott

In Schott & Endl., Melet. Bot.: 18. 1832; Mayo, Bogner & Boyce, The Genera of Araceae: 280. 1997; in Fam. Gen. Vasc. Pl. 4: 70. 1998.

Tuberous herbs, producing shoots bearing small ovoid tubercles, each invested by numerous, apically revolute or flexuose scales (cataphylls); laticifers present. **Leaves** 1-2, peltate, ovate-cordate to lanceolate-cordate. **Inflorescence** solitary, appearing with or without leaves; spathe with 1-2 constrictions, broad or narrow and very long, reflexed at anthesis or erect-sigmoid; spadix: female zone separated from male by much narrower zone of sterile synandrodes, terminal appendix absent. **Flowers** unisexual; perigone absent. **Male flowers** 2-3-androus; stamens connate; anthers dehiscing by terminal pores. **Female flowers** lacking staminodes; ovary 1-locular or partially 2-3-locular at apex, subcylindric to subglobose, basal or 2-4 parietal placentation; ovule many; style short; stigma depressed capitate or slightly 3-4-lobed. **Berry** obovoid to subglobose, within persistent spathe tube. **Seeds** many.

About 4 species in tropical Africa, Madagascar, S and SE Asia to northern Australia (Mayo et al., 1997; 1998). About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

Remusatia vivipara (Roxb.) Schott

Ecology.— Terrestrial, Dry evergreen and lower montane forest, in moist places, alt. 900-1,500 m (Doi Phu Wae, Thon Thong Waterfall).

Phenology.— Flowering: March-May.

Vernacular.— บอนไม้ Bon mai (Northern).

Voucher specimens.— *P. Srisanga* 2163; *P. Srisanga* & *C. Maknoi* 2096.

7. *RHAPHIDOPHORA* Hassk.

Flora 25(2), Beibl. 1: 11. 1842; Mayo, Bogner & Boyce, The Genera of Araceae: 118. 1997; in Fam. Gen. Vasc. Pl. 4: 47. 1998.

Woody climbers. **Leaves** distichous, entire or pinnately lobed; petioles geniculate apically. **Inflorescence** solitary or few; spathe erect and boat-shaped, enclosing spadix; spadix subcylindric, conical to clavate, often thick, sessile to stipitate. **Flowers** bisexual; perigone absent. **Stamens** 4, free; anthers dehiscing by longitudinal slits. **Ovary** 1- to partially 2-locular, parietal or basal placentation; ovules few to many; style distinct; stigma broadly elliptic to oblong. **Berry** red or yellow. **Seeds** many, oblong.

About 100-120 species in tropical Africa, tropical S and SE Asia, Melanesia, Australia and Pacific (Mayo et al., 1997; 1998). About 6 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---------------------------|---------------------|
| 1. Leaves entire | 1. <i>R. peepla</i> |
| 1. Leaves pinnately lobed | 2. <i>R. sp.</i> |

1. *Rhaphidophora peepla* (Roxb.) Schott

Ecology.— Epiphyte, Lower montane forest, alt. 1,550-1,700 m (Doi Phu Kha).

Phenology.— Flowering: September-November.

Vernacular.— พลุช้าง Phlu chang (Loei).

Voucher specimens.— *P. Srisanga* 356, 1176, 1711, 1764.

2. *Rhaphidophora sp.*

Ecology.— Epiphyte, Lower montane forest, by streams, alt. 1,100-1,200 m (Doi Phu Kha).

Phenology.— Flowering: October-November.

Voucher specimens.— *P. Srisanga* 2237.

ARECACEAE (PALMAE)

Evergreen, hapaxanthic or pleoanthic, hermaphroditic, polygamous, monoecious or dioecious, usually erect, solitary or clustered, mostly unbranched, rarely dichotomously branches, trees, shrubs or acaulescent woody plants (Palm), or lianas (Rattan). **Leaves** alternate or spirally arranged, rarely distichous or tristichous; sheath initially always tubular at the base, often splitting at maturity; blade palmate, costapalmate, pinnate, bipinnate or bifid, or entire and pinnately veined, plicate in bud, splitting during development into V-shaped (induplicate) or Λ -shaped (reduplicate) folds. **Inflorescence** mostly axillary, solitary or paniculate, spicate or branched, subtended by prophyll and bracts. **Flowers** bisexual or unisexual, sessile or stalked, borne singly or in cincinni of various forms. **Sepals** (2-)3, rarely more, free or connate, usually imbricate. **Petals** (2-)3, rarely more, free or connate, imbricate or valvate. **Stamens** typically 6, sometimes 3 or more than 6 to numerous; filaments erect or inflexed, free or connate or adnate to the petals; anthers basifixed or dorsifixed, dehiscing by longitudinal slits, rarely by pores; staminodes usually present. **Gynoecium** apocarpous with (1-)3(-4) carpels or syncarpous with 3 or rarely more up to 10 locules; **ovary** superior; ovule 1 in each loculus. **Fruit** mostly a drupe; mesocarp usually fleshy or fibrous. **Seeds** 1(-10).

An almost tropical and subtropical family with about 190 genera and over 2,000 species (Dransfield & Uhl, 1998). A family contains many economic important foods and beverages, construction, furniture and handicraft materials, medicines, perfumes, ornamentals etc. Palms are also conspicuous and important components in term of ecological factors of many vegetation types. Thirty-three genera and 161

native species in Thailand (Dransfield et al., 2004). Four genera and 6 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|-----------------------------------|-------------------------------|
| 1. Mostly woody climbers, armed | 1. <i>Calamus</i> |
| 1. Erect trees or shrubs, unarmed | |
| 2. Leaves pinnate or bipinnate | |
| 3. Leaves bipinnate | 2. <i>Caryota</i> |
| 3. Leaves pinnate | 4. <i>Wallichia</i> |
| 2. Leaves palmate | 3. <i>Trachycarpus</i> |

1. *CALAMUS* L.

Sp. Pl.: 325. 1753; Dransfield & Uhl in Fam. Gen. Vasc. Pl. 4: 342. 1998.

Acaulescent, erect or climbing, pleoanthic, dioecious. **Leaves** paripinnate; leaflets single-fold, linear to rhomboid; petioles kneed at junction with sheath in climbing species. Rachis developed into armed. Climbing whip (flagellum) sometimes present. **Staminate inflorescence** branched to 3 orders; pistillate to 2 orders; prophyll stricating tubular, persistent; other primary bracts as prophyll. **Flowers** distichous or rarely spiral, usually sessile. **Staminate flower** solitary; calyx much shorter than corolla; stamens 6, rarely 12; anther elongate, latrorse; pistillode short. **Pistillate flower** much larger than staminate. **Fruit** covered by rhombic, downward pointing, shining scales. **Seeds** 1-3.

About 400 species, one in equatorial Africa, the rest from India and S China to Fiji and Australia (Dransfield & Uhl, 1998). About 54 species in Thailand (Dransfield et al., 2004). Three species recorded from Doi Phu Kha National Park.

1. *Calamus erectus* Roxb.

Ecology.— Dry evergreen forest, alt. 1,000 m (Tham Pha Kaow).

Uses.— Shoot edible.

Vernacular.— หวายเถ็ด Wai ket (Lua-Nan).

Voucher specimens.— *P. Srisanga* 2563.

2. *Calamus* sp. 1

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Uses.— Shoot edible.

Voucher specimens.— *P. Srisanga* 1741.

3. *Calamus* sp. 2

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Uses.— Shoot edible.

Voucher specimens.— *P. Srisanga* 1743.

2. *CARYOTA* L.

Sp. Pl.: 1189. 1753; Dransfield & Uhl in *Fam. Gen. Vasc. Pl.* 4: 352. 1998.

Solitary or caespitose, hapaxanthic, monoecious. **Leaves** bipinnate; sheath extended beyond the petiole to form a ligule, eventually disintegrating into a mass of black fibers; leaflets wedge-shaped, induplicate. **Inflorescence** exerted from leaf sheaths, always bearing flowers of both sexes; prophyll and peduncular bracts conspicuous. **Flowers** borne in triads of a central pistillate flower and 2 lateral staminate flowers. **Staminate flowers**: sepals 3, free, imbricate; petals 3, valvate; stamens 6-100, anthers linear. **Pistillate flowers**: sepals 3, connate at base, imbricate; petals 3, connate; staminodes 0-6. **Gynoecium** syncarpous with 3 locules. **Fruit** with apical stigmatic remains; mesocarp fleshy. **Seeds** 1-2, globose.

About 12 species ranging from India, Sri Lanka, S China southwards through SE Asia to N Australia, Solomon Islands and Vanuatu (Dransfield & Uhl, 1998). About 5 species in Thailand (Hodel & Vatcharakorn, 1998; Dransfield et al., 2004). One species recorded from Doi Phu Kha National Park.

Caryota gigas Hahn ex Hodel

Palm Journ. 139: 51, figs. 1-2, 4. 1997; Hodel & Vatcharakorn in *The Palms and Cycads of Thailand*: 66, pl. 32: B-D, 33: A. 1998.

Solitary, erect tree, up to 40 m high, 50-80 cm in diam. **Leaves** 6-15, clustered and crowned at the top, spreading and drooping; sheath up to 4 m long, densely covered with grayish tomentum and dark brown hairs; petiole up to 1 m long; rachis 4-6 m long; pinnae 19-22 on each side of rachis, up to 3.5 m long; pinnules up to 27 on each side of pinna rachis; leaflets rhomboid, 20-35 cm long, 7-15 cm wide, obtusely jaggedly toothed at apex. **Inflorescence** 2-4 m long, pendulous; peduncle up to 1 m long. **Infrutescence** enlarged up to 5 m long (Fig. 152).

Thailand.— Northern: Nan (type).

Distribution.— Endemic to Doi Phu Kha.

Ecology.— Lower montane forest, alt 1,400-1,600 m.

Uses.— Heart edible.

Vernacular.— เต่าร้างยักษ์ดอยภูคา Tao rang yak doi phu kha (Nan).

Voucher specimens.— *P. Srisanga* s.n.

Notes.— Recently, *C. gigas* Hahn ex Hodel was reduced to a synonym of *C. obtusa* Griff. (Dransfield et al., 2004).

3. *TRACHYCARPUS* H. Wendl.

Bull. Soc. Bot. France 8: 429. 1861; Dransfield & Uhl in Fam. Gen. Vasc. Pl. 4: 328. 1998.

Solitary or clustered, acaulescent or erect, unarmed or armed, pleoanthic, dioecious or polygamous. **Leaves** palmate; sheath unarmed, fibrous; blade fan-shaped to circular, induplicate; segments single-fold, bifid; petioles tooth or unarmed. **Inflorescence** exerted from leaf sheaths; prophyll inflated; peduncular bracts 1-3. **Flowers** solitary or in cluster of 2-3, similar in both sexes. **Sepals** 3, connate at base. **Petals** 3, free, imbricate. **Stamens** 6 in 2 whorls; filaments free; staminodes present or not. **Gynoecium** apocarpous with 3 carpels; style short. **Fruit** kidney-shaped to oblong. **Seeds** arillate.

About 6 species ranging from the Himalayas to S China and N Thailand (Dransfield & Uhl, 1998). Only 1 species in Thailand (Gibbons & Spanner, 1997).

Trachycarpus oreophilus Gibbons & Spanner

Principes 41(4): 205. 1997; Hodel & Vatcharakorn in The Palms and Cycads of Thailand: 166, pl. 82: C-E. 1998; Dransfield, Barfod & Pongsattayapipat, Thai For. Bull. (Bot.) 32: 70. 2004.

Solitary, dioecious, erect tree, up to 10 m high. **Leaves** 10-20, clustered and crowned at the top, upright; sheath 20-30 cm long, fibrous; petioles 20-60 cm long, stiff, tooth; blade 70-100 cm long and wide. **Inflorescence** 3-5, interfoliar. **Staminate inflorescence** erect; peduncle short; prophyll two-keeled, 25 cm long. **Pistillate inflorescence** stiff, slightly arching or nearly horizontal in fruit, densely branched to three orders; peduncle ca. 50 cm long. **Fruit** on short stalks, reniform, ca. 12 mm long, 7 mm wide (Fig. 153).

Thailand.— Northern: Chiang Mai (type), Nan.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane scrub, alt 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering: February-March; fruiting: December-January.

Vernacular.— ค้อดอย Kho doi (Northern).

Voucher specimens.— *P. Srisanga* 2644; *P. Srisanga et al.* 2428.

4. *WALLICHIA* Roxb.

Pl. Corom. 3: 91. 1820; Dransfield & Uhl in Fam. Gen. Vasc. Pl. 4: 352. 1998.

Solitary or clustered, hapaxanthic, monoecious. **Leaves** pinnate; sheath extended beyond the petiole to form a ligule, eventually disintegrating into a mass of black fibers; leaflets wedge-shaped, induplicate. **Inflorescence** exerted from leaf sheaths, unisexual, dimorphic, staminate proximal with conspicuous bracts, pistillate

distal with inconspicuous bracts. **Staminate flowers:** sepals 3, connate, tubular; petals 3, connate at base, exceeding the sepals; stamens (3-)6(-15), anthers linear. **Pistillate flower** solitary: sepals 3, free, imbricate; petals 3, connate at base; staminodes 0-3. **Gynoecium** syncarpous with 3 locules. **Fruit** with apical stigmatic remains; mesocarp fleshy. **Seeds** 1-2(-3).

About 7 species ranging from E Himalayas to Myanmar and S China southwards to S Thailand (Dransfield & Uhl, 1998). Three species in Thailand (Hodel & Vatcharakorn, 1998; Dransfield et al., 2004). One species recorded from Doi Phu Kha National Park.

***Wallichia siamensis* Becc.**

Atti Soc. Tosc. Sci. Nat. Pisa Processi Verballi 44: 175. 1934; Hodel & Vatcharakorn in *The Palms and Cycads of Thailand*: 170, pl. 84: B-C. 1998; Dransfield, Barford & Pongsattayapipat, *Thai For. Bull. (Bot.)* 32: 71. 2004.

Clustered shrub, up to 4 m high; stem densely covered with leaf sheath fibres. **Leaves** 4-7, ascending to spreading; sheath 30-60 cm long, deeply split, margins with layer of tan, coarse fibres over layer of black, fine, hair-like fibres; petioles up to 1.5 m long; rachis up to 1.3 m long; sheath, petiole and rachis with reddish brown indument; pinnae 8-10 on each side of rachis; leaflets 25-60 cm long, 5-10 cm wide, silvery beneath, jaggedly toothed at apex. **Inflorescence** 2-3 per stem, interfoliar, staminate and pistillate similar, up to 60 cm long. **Fruit** ellipsoid, 13-20 mm long, 7-10 mm wide, red.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— S China (Yunnan).

Ecology.— Lower montane forest, alt. 1,600-1,700 (Doi Phu Kha).

Phenology.— Flowering: October-November; fruiting: June-August.

Uses.— Shoot edible.

Vernacular.— เขือง Khueang (Nan).

Voucher specimens.— *P. Srisanga* 987, 1742.

ASPARAGACEAE

Monogeneric family (Kubitzki & Rudall, 1998). Description as in the genus.

***ASPARAGUS* L.**

Sp. Pl.: 313. 1753; Kubitzki & Rudall in *Fam. Gen. Vasc. Pl.* 3: 125. 1998.

Perennial herbs or subshrubs, erect or scandent, mostly glabrous, with rhizomes or tubers. **Leaves** on long shoots and short shoots (if present) leaf-like

(cladodes); spines present or absent, formed from modified leaf spurs or branches. **Flowers** solitary or in fascicles, bisexual or unisexual, pendulous or erect; pedicels articulated. **Tepals** 6, free and spreading or basally fused and then forming a cup or tube. **Stamens** 6; filaments free; anthers sagittate, basifixed, dehiscing by longitudinal slits. **Ovary** superior, 3-locular, axile placentation; ovules 2-12 in each loculus; style 3-lobed or capitate. **Fruit** a berry, rarely a nut.

Only 1 genus with 170-300? species in Africa, Europe, Asia and Australia (Kubitzki & Rudall, 1998). About 3 native species in Thailand. One species recorded from Doi Phu Kha National Park.

Asparagus filicinus Buch.-Ham. ex D. Don

Prodr. Fl. Nepal.: 49. 1825; Noltie in Fl. Bhutan 3(1): 61. 1994; Chen & Tamanian in Fl. China 24: 210. 2000.

Perennial herb, dioecious; stem up to 1.5 m long, unarmed. Rootstock a short rhizome with a cluster of fusiform roots. **Cladodes** in fascicle of 3-6, linear, falcate, 3-10 mm long, ca. 1 mm wide, flat; midvein distinct. **Flowers** solitary or paired; pedicels 4-10 mm long, articulate near middle. **Tepals** green, oblanceolate, 2.5-3.5 mm long. **Filaments** ca. 2 mm long. **Ovary** obovoid to subglobose, ca. 1 mm in diam. **Berry** globose, 5-7 mm in diam., black.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Bhutan, Myanmar, China.

Ecology.— Lower montane scrub, open places on limestone mountain, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering: May-June; fruiting: July-August.

Vernacular.— มีสามต่อน Ma sam ton (Northern).

Voucher specimens.— *P. Srisanga* 2670.

BURMANNIACEAE

Small, saprophytic or rarely autotrophic herbs. **Leaves** simple, alternate, sessile, scale-like (saprophytic) or green and rosulate (autotrophic). **Inflorescence** in terminal, 1-many-flowered cyme. **Flowers** bisexual, usually actinomorphic. **Tepals** (3)6(8), in 2 whorls, united to a floral tube. **Stamens** 3 or 6, usually inserted in the apical part but sometimes below the middle of the floral tube; filaments mostly short or absent; anthers 2-thecate, 4-sporangiate, dehiscing by longitudinal slits or transversely. **Ovary** inferior, 3-locular with axile placentation or 1-locular with parietal placentation or with 3 free placental columns in the centre of the ovary; ovules numerous; style cylindric, usually 3-branched at apex. **Fruit** a capsule, sometimes crowned by the whole or part of the persistent perianth. **Seeds** numerous, minute.

A pantropical and warm-temperate family with 13 genera and about 130 species (Maas, 1998). Only 2 genera: *Burmannia* L. with about 7 species and *Thismia*

Griff. (Thismiaceae) with 2 species (Larsen, 1987a) in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

BURMANNIA L.

Sp. Pl.: 287. 1753; Maas in Fam. Gen. Vasc. Pl. 3: 161. 1998.

Saprophytic or autotrophic herbs. Leaves scale-like (saprophytic) or green and rosulate (autotrophic). **Inflorescence** in terminal, 1-27-flowered cyme. **Tepals** (3)6, tubular to salver-shaped, persistent, inner tepals smaller than the outer ones or rarely lacking; tube broadly 3-winged or wingless. **Stamens** 3, sessile. **Ovary** 3-locular, axile placentation. **Capsule** dehiscent transversely or longitudinally and septicidally or irregularly.

About 63 species, pantropical (Maas, 1998).

Burmannia wallichii (Miers) Hook.f.

In Fl. Br. Ind. 5: 666. 1888; Hajra in Fasc. Fl. Ind. 19: 14. 1988. – *Gonyanthes wallichii* Miers, Trans. Linn. Soc. London 18: 537. 1841.

Saprophytic herb, 8-15 cm high, erect, white. **Leaves** scale-like, lanceolate, ca. 2 mm long. **Flowers** 1-2, purplish white, 5-6 mm long, narrowly 3-winged. **Tepals**: outer lobes ca. 1 mm long, obtuse; inner lobes minute, rounded. **Ovary** obovoid, ca. 2 mm long; stigmas 3-lobed.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Myanmar.

Ecology.— Lower montane forest, open places among grasses, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering: November.

Voucher specimens.— *P. Srisanga* s.n.

COLCHICACEAE

Perennial herbs with an underground corm or rhizome; stems erect, leafy, simple or branching, sometimes scandent or scapose, or reduced to a short underground portion. **Leaves** simple, distichous, alternate, subopposite to verticillate or almost radical, sessile and often sheathing, or shortly petiolate; veins parallel. **Inflorescence** in terminal or axillary racemes or cymes, sometimes umbellate or capitate, or flower solitary. **Flowers** mostly bisexual, sessile or pedicellate, actinomorphic or somewhat zygomorphic; bracts present or absent. **Tepals** 6, rarely 7-12, equal or somewhat unequal, free or connate, usually with perigonal or androecial nectaries, caducous or persistent. **Stamens** 6, dorsifixed or versatile; anthers dehiscent by longitudinal slits;

thecae 2, elongate. **Ovary** superior, 3-locular, axile placentation; ovules few-many; styles 1 or 3. **Fruit** mostly a capsule, rarely berry.

Nineteen genera and about 225 species distributed in temperate to tropical zones of Africa, Europe, Asia, Australia and N America (Nordenstam, 1998). Many species are cultivated as ornamentals. Three genera and about 3-4 species, native or naturalized in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

***DISPORUM* Salisb. ex D. Don**

Prodr. Fl. Nepal.: 50. 1825; Hara, Bull. Univ. Mus. Univ. Tokyo 31: 165. 1988 (revision); Nordenstam in Fam. Gen. Vasc. Pl. 3: 184. 1998.

Rhizomatous herbs; stems erect, leafy. **Leaves** distichous, sessile or shortly petiolate. **Inflorescence** in umbellate, paired or flower solitary. **Flowers** bisexual, actinomorphic, often pendulous. **Tepals** 6, free, with basal sacs or spurs. **Anthers** dorsifixed, extrorse. **Style** 3-branched with recurved stylodia. **Fruit** a berry, globose or subglobose, blue-black or red. **Seeds** 1-many.

About 10 species in S, E and SE Asia. About 1-2 species in Thailand.

***Disporum cantoniense* (Lour.) Merr.**

Philip. Jour. Bot. 15: 229. 1919; Jessop in Fl. Mal. I(9): 218, fig. 12. 1979; Hara, Bull. Univ. Mus. Univ. Tokyo 31: 183. 1988; Noltie in Fl. Bhutan 3(1): 95, Pl. 7. 1994; Liang & Tamura in Fl. China 24: 156. 2000. – *Fritillaria cantoniense* Lour., Fl. Cochinch. 1: 206. 1790. – *Uvularia chinensis* Ker-Gawl., Bot. Mag.: t. 916. 1806. – *Disporum chinensis* Kuntze, Rev. Gen. Pl. 2: 708. 1891. – *D. pullum* Salisb., Trans. Hort. Soc. 1: 331. 1812; Charoenphol, Thai. For. Bull. (Bot.) 8: 89. 1974.

Herb up to 1.5 m high. **Leaves** lanceolate to elliptic, 7-12 cm long, 2-4 cm wide, glabrous on both surfaces; base obtuse to rounded, apex acuminate; margin entire; petioles 1-4 mm long. **Inflorescence** in terminal umbel, 3-10-flowered; peduncle 1-3 mm long. **Flowers** narrowly campanulate, pendulous; pedicels 6-15 mm long, papillose-scabrous. **Tepals** purplish pink, oblanceolate, 1.5-2.5 cm long, 0.4-0.5 cm wide, gibbous-spurred at base, acute at apex; spurs 1-3 mm long. **Stamens** included; filaments white, 10-15 mm long, flattened, dilated; anthers oblong, 3-4 mm long. **Ovary** ellipsoid, 2-3 mm long; style 7-15 mm long. **Berry** 8-10 mm in diam. **Seeds** 2-3.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— India, Nepal, Bhutan, Sikkim, Myanmar, China, Laos, Vietnam, Malaysia, Indonesia.

Ecology.— Lower montane forest, alt. 1,300-1,600 m (Doi Phu Kha).

Phenology.— Flowering: May-July; fruiting: August-October.

Vernacular.— ว่านหัวสับ Wan hua suep (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1412.

COMMELINACEAE

Perennial or occasionally annual herbs, monoecious or andromonoecious, rarely polygamomonoecious, terrestrial or rarely epiphytic, erect to ascending, diffusely spreading or stoloniferous, occasionally rhizomatous, rarely scandent shoots, often succulent with mucilage. **Leaves** simple, alternate or in pseudowhorls, entire, often narrowed into a false petiole, sheathing the stem at the base; sheaths closed, eligulate. **Inflorescence** terminal or axillary, commonly a panicle-like thyse composed of several to many helicoid, cymose branches (cincinni), sometimes reduced to a single cincinnus or rarely flower solitary, sometimes enclosed in or subtended by a leafy bract (spathaceous bract). **Flowers** usually bisexual or bisexual and male, rarely bisexual and female or bisexual, male and female, actinomorphic or zygomorphic. **Calyx** 3, equal or unequal, free or partly fused, sometimes petaloid. **Corolla** 3, equal to dimorphic, free or basally fused. **Stamens** 6, in 2 whorls of 3, all fertile and equal or unequal, or 2-3(-4) reduced to staminodes; filaments glabrous or hairy; anthers basifixed or versatile, dehiscing by longitudinal slits, rarely by apical or basal pores. **Ovary** superior, 2-3-locular, axile placentation; locules equal or dorsal locule reduced; style terminal, simple; ovules uniseriate or biseriate, 1-many in each loculus. **Fruit** a dehiscent or rarely indehiscent capsule or berry. **Seeds** usually arillate, rarely winged.

A mainly tropical and warm temperate family of about 41 genera and 650 species (Faden, 1998). Thirteen genera and 52 species indigenously in Thailand excluding few introduced for cultivated ornamentals (Thitimetharoch, 2004). Nine genera and 15 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Inflorescence axillary and perforating the sheaths, sessile or subsessile
 2. Creeping herb with proximal prostrate above ground stolon, rarely straggling.
Inflorescence 15-70-flowered **1. *Amischotolype***
 2. Scandent herb with underground rhizome and long, erect stem.
Inflorescence (2-)6-8(-10)-flowered **8. *Porandra***
1. Inflorescence various, but not perforating the sheaths
 3. Flowers enclosed in or subtended by spathaceous bracts
 4. Flowers zygomorphic. Petals free. Fertile stamens 3; staminodes 3
2. *Commelina*
 4. Flowers actinomorphic. Petals basally fused. Stamens 6, all fertile **3. *Cyanotis***
 3. Flowers neither enclosed in nor subtended by spathaceous bracts
 5. Inflorescence terminal. Fruit a berry-like, hard, crustaceous, indehiscent, usually lustrous metallic blue **7. *Pollia***
 5. Inflorescence terminal and axillary. Fruit a capsule
 6. Stamens 6, all fertile **5. *Floscopa***
 6. Fertile stamens 2-3
 7. Filaments bearded **6. *Murdannia***
 7. Filaments glabrous
 8. Petals white, not clawed. Capsules glabrous **4. *Dictyospermum***
 8. Petals blue, 2 posterior clawed. Capsules hairy **9. *Rhopalephora***

1. *AMISCHOTOLYPE* Hassk.

Flora 46: 391. 1863; Faden in Fam. Gen. Vasc. Pl. 4: 120. 1998. – *Forrestia* A. Rich. in Dumont d'Urville, Voy. Astrolabe 2: t. 1. 1834.

Perennial herbs, creeping, mostly decumbent with proximal prostrate above ground stolon, rarely straggling. **Leaves** alternate, petiolate, sheathing. **Inflorescence** in axillary compact and globose, perforating the sheaths, composed of 2-several cincinni, 15-70-flowered, sessile or subsessile. **Flowers** bisexual, rarely bisexual and male, actinomorphic, subsessile to shortly pedicellate. **Sepals** subequal, sepaloid or petaloid. **Petals** free, equal, not clawed. **Stamens** 6, all fertile, equal or subequal; filaments bearded or subglabrous; anthers dehiscing by longitudinal slits or by apical pores. **Ovary** 3-locular. **Fruit** a capsule, trivalved. **Seeds** uniseriate, 1-2 in each loculus, embedded in a red aril.

About 15 species in Central Africa and India to New Guinea (Faden, 1998). Eight species in Thailand (Thitimetharoch, 2004). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- 1. Leaves glabrous except pubescent along the midrib and margin beneath 1. *A. hispida*
- 1. Leaves softly pubescent beneath 2. *A. mollissima*

1. *Amischotolype hispida* (A. Rich.) D.Y. Hong

Acta Phytotax. Sin. 12(4): 461. 1974; Hong & DeFilipps in Fl. China 24: 23. 2000. – *Forrestia hispida* A. Rich. in Dumont d'Urville, Voy. Astrolabe 2: t. 1. 1834.

Creeping herb with erect shoot up to 1 m high. **Leaves** lanceolate to elliptic, 20-30 cm long, 4.5-7 cm wide, glabrous except pubescent along the midrib and margin beneath; base attenuate on to the petiole; apex acuminate; sheaths 2.5-4 cm long, brown hirsute. **Inflorescence** many-flowered, 2-3 cm in diam. **Sepals** purplish, oblanceolate, 6-10 mm long, 2-3 mm wide, accrescent, subglabrous or pubescent at apex. **Petals** white, oblanceolate, 6-10 mm long, 2-3 mm wide. **Filaments** 5-10 mm long, bearded. **Capsule** ovoid, slightly trigonous, 6-9 mm long, brown hirsute at least at apex, shorter than subtended calyx.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— China, Japan (Ryukyu Islands), SE Asia, New Guinea.

Ecology.— Lower montane forest, in moist places and along streams, alt. 1,200-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: July-October.

Voucher specimens.— *P. Srisanga* 1612; *P. Srisanga et al.* 811.

2. *Amischotolype mollissima* (Bl.) Hassk.

Flora 46: 392. 1863. – *Campelia mollissima* Bl., Enum. Pl. Java. 1: 7. 1827.

Creeping herb with erect shoot up to 1 m high. **Leaves** lanceolate to elliptic, 20-35 cm long, 5-8 cm wide, glabrous on upper surface, softly pubescent on lower surface; base attenuate on to the petiole; apex long acuminate; sheaths 2.5-4.5 cm long, brown hirsute. **Inflorescence** many-flowered, 2-3 cm in diam. **Sepals** green with purplish at apex, oblanceolate, 7-10 mm long, 3-4 mm wide, accrescent, pubescent. **Petals** white, oblanceolate, 7-8 mm long, 2-3 mm wide. **Filaments** 7-8 mm long, bearded. **Capsule** ellipsoid, trigonous, 8-12 mm long, glabrous or sparsely brown hirsute at apex, longer than subtended calyx.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Vietnam, Malaysia, Indonesia.

Ecology.— Dry evergreen forest, in moist places and along streams, alt. 700-900 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering and fruiting: June-August.

Voucher specimens.— *P. Srisanga* 2571.

2. **COMMELINA L.**

Sp. Pl.: 40. 1753; Faden in Fam. Gen. Vasc. Pl. 4: 126. 1998.

Annual or perennial herbs; roots usually fibrous. **Leaves** usually distichous. **Inflorescence** terminal and leaf-opposed, composed of 1-2 cincinni enclosed in a folded spathaceous bracts. **Flowers** bisexual or bisexual and male, strongly zygomorphic, mostly blue, pedicellate. **Sepals** free or anterior 2 fused. **Petals** free, unequal, posterior 2 larger and clawed, anterior one usually reduced. **Stamens** 3; filaments free, glabrous; staminodes 3, posterior, antherodes usually 4-6-lobed. **Ovary** 2-3-locular. **Fruit** a (1-)-2-3-locular capsule, bi- or trivalved. **Seeds** uniseriate, 1-2 in each loculus.

About 170 species, cosmopolitan (Faden, 1998). Seven species in Thailand (Thitimetharoch, 2004). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|-----------------------|
| 1. Proximal margin of involucre bracts folded but not connate,
cordate or rounded at base | 1. <i>C. diffusa</i> |
| 1. Proximal margin of involucre bracts connate, funnelliform | 1. <i>C. paludosa</i> |

1. *Commelina diffusa* Burm.f.

Fl. Ind.: 18. 1768; Noltie in Fl. Bhutan 3(1): 237, fig. 22: i-j. 1994; Hong & DeFilippis in Fl. China 24: 36. 2000.

Straggling perennial herb, glabrous or hispid. **Leaves** lanceolate, 2-10 cm long, 0.8-2 cm wide, glabrous or hispid, sessile; base rounded to subcordate; apex acute; sheaths 1.7-2.3 cm long, hispid, red; mouth ciliate. **Inflorescence** in cincinni dichotomously branched from base; one branch with 1.5-2 cm long peduncle and 1-4 long exerted male flowers; other branches with much shorter peduncle and 3-5 bisexual flowers included in involucre bracts; pedicels white, 2-3 mm long, thick and curved, 5-7 mm long in fruit. **Sepals** 3-4 mm long, membranous. **Petals** blue; posterior 2 deltoid, 6-7 mm long with long clawed; anterior 1 deltoid, 4-5 mm long, with short clawed. **Fertile stamens**: filaments 4-6 mm long; anthers 1-2 mm long. **Staminodes**: filaments 3-5 mm long; antherodes yellow, 4-lobed. **Ovary** subglobose, ca. 1 mm in diam; style 5-6 mm long. **Capsule** oblong, trigonous, 4-5 mm long, trivalved; posterior valve with 1-seeded, indehiscent; anterior valves 2, each with 2-seeded, dehiscent. **Seeds** ovoid to subglobose, ca. 2 mm in diam., black, reticulate.

Thailand.— Throughout the country.

Distribution.— Throughout tropical and subtropical regions.

Ecology.— Common weeds along trails in open and disturbed lower montane forest, also in moist places and along streams, alt. 1,200-1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: May-October.

Vernacular.— ฟักปลา Phak plap (General).

Voucher specimens.— *P. Srisanga* 1645.

2. *Commelina paludosa* Bl.

Enum. Pl. Java. 1: 2. 1827; Noltie in Fl. Bhutan 3(1): 235, fig. 22: d. 1994; Hong & DeFilipps in Fl. China 24: 37. 2000.

Straggling perennial herb; stem erect to decumbent, glabrous. **Leaves** lanceolate, 7-20 cm long, 2-7 cm wide, glabrous on both surfaces or hirsute on lower surface, sessile; base rounded to cuneate and broadly attenuate towards the sheaths; apex acute to acuminate; sheaths 1.5-3 cm long, sparsely dark brown hairy and densely in a line on one side and on mouth. Involucre bracts 4-10, forming terminal head, sessile, funnelform, 1.5-3 cm long, glabrous; proximal margin connate; apex acute. **Inflorescence** in solitary cincinni; peduncle 1-2 cm long, 1-several-flowered, nearly included in the bracts; pedicels 5-8 mm long, twisted. **Sepals** 3-6 mm long, membranous. **Petals** blue; posterior 2 orbicular, 10-13 mm long with long clawed; anterior 1 lanceolate-spathulate, 6-8 mm long, with short clawed. **Fertile stamens**: filaments 9-12 mm long; anthers 2-3 mm long. **Staminodes**: filaments 6-8 mm long; antherodes yellow, 4-lobed. **Ovary** ovoid, 1-2 mm in diam.; style 9-12 mm long. **Capsule** ovoid, trigonous, 4-5 mm long, trivalved, each with 1-seeded, dehiscent. **Seeds** ellipsoid, 3-4 mm long, slightly flattened, dark brown, reticulate.

Thailand.— Throughout the country.

Distribution.— E Himalayas, China, SE Asia.

Ecology.— Common weeds along trails in open and disturbed lower montane forest, also in moist places and along streams, alt. 1,200-1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: May-October.

Voucher specimens.— *P. Srisanga* 1609.

3. *CYANOTIS* D. Don

Prodr. Fl. Nepal.: 45. 1825; Faden in Fam. Gen. Vasc. Pl. 4: 120. 1998.

Perennial or occasionally annual herbs. **Leaves** mainly distichous, sessile. **Inflorescence** terminal or axillary, each cincinnus or group of cincinni usually subtended by a foliaceous bract, rarely the inflorescence enclosed in the leaf sheaths. **Flowers** bisexual, actinomorphic, subsessile. **Sepals** subequal. **Petals** united below into a tube. **Stamens** 6, all fertile, equal; filaments usually with a subapical swelling; anthers dehiscing by longitudinal slits but pollen usually released from base of anther sacs. **Ovary** 3-locular; ovules 2 in each loculus; style usually with a subapical swelling. **Fruit** a 3-locular capsule, trivalved. **Seeds** uniseriate, (1-)2 in each loculus, exarillate.

Fifty species in Old World tropic (Faden, 1998). Six species in Thailand (Thitimetharoch, 2004). One species recorded from Doi Phu Kha National Park.

Cyanotis vaga (Lour.) Schult. & Schult.f.

In Syst. Veg. 7: 1153. 1830; Noltie in Fl. Bhutan 3(1): 220, fig. 23: a-b. 1994; Hong & DeFilipps in Fl. China 24: 22. 2000. – *Tradescantia vaga* Lour., Fl. Cochinch. 1: 193. 1790.

Perennial herb; stem erect to decumbent, pubescent. **Leaves** linear-lanceolate, 2.5-6 cm long, 0.5-1 cm wide, glabrous or sparsely hairy on both surfaces, sessile; base rounded to amplexicaul; apex acute; sheaths 0.7-1.5 cm long, sparsely hairy and densely on margins and mouth. Involucral bracts spathe-like, sparsely long white hairy. **Inflorescence** in solitary cincinni. **Sepals** oblanceolate, 4-5 mm long, membranous, connate at base, acute at apex. **Petals** blue, 6-8 mm long. **Filaments** blue, lanate, 8-10 mm long, exserted; anthers oblong, ca. 1 mm long. **Ovary** oblong, ca. 1 mm long, pubescent; style 6-8 mm long. **Capsule** obovoid, trigonous, 2-3 mm long, hairy at apex. **Seeds** ca. 1 mm long, reticulate.

Thailand.— Almost throughout the country.

Distribution.— India, Nepal, Bhutan, Sikkim, Myanmar, China, Laos, Vietnam.

Ecology.— Lower montane scrub, open areas, in crevice of limestone rocks, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering: August-September; fruiting: September-October.

Voucher specimens.— *P. Srisanga* 2147.

4. *DICTYOSPERMUM* Wight

Icon. Pl. Ind. Orient. 6: 29, t. 2069-2071. 1853; Faden in Fam. Gen. Vasc. Pl. 4: 125. 1998.

Perennial herbs; roots fibrous or tuberous; stem erect or ascending. **Leaves** spirally arranged, mostly aggregated at apex of stem, petiolate. **Inflorescence** terminal and axillary thyrses; bracts and bracteoles caducous. **Flowers** bisexual, actinomorphic to slightly zygomorphic. **Sepals** free, boat-shaped. **Petals** free, white, not clawed. **Stamens** 3, equal; filaments free or shortly fused basally, glabrous; anthers dehiscing by longitudinal slits; staminodes usually absent. **Ovary** 3-locular; ovule 1 in each loculus. **Fruit** a 3-locular capsule, trivalved, glabrous. **Seed** 1 in each loculus.

About 5 species distributed in India, Sri Lanka through China and SE Asia to New Guinea (Faden, 1998). Two species in Thailand (Thitimetharoch, 2004). One species recorded from Doi Phu Kha National Park.

Dictyospermum ovatum Hassk.

Erect herb, up to 25 cm high; stem puberulous. **Leaves** elliptic to ovate, 4-12 cm long, 3-5.5 cm wide, glabrous on upper surface, minutely puberulous on lower surface; base rounded to cuneate; apex broadly acuminate; petioles 7-13 mm long, puberulous; sheaths 8-14 mm long, puberulous and more densely on margins and mouth. **Inflorescence** terminal or axillary in upper most leaf axils, 1.5-3 cm long. **Flowers** white. **Sepals** 3-4 mm long, glabrous, obtuse at apex. **Petals** broadly ovate, 2.5-3 mm long. **Filaments** 2-3 mm long; anthers yellow, ellipsoid, ca. 1 mm long. **Ovary** subglobose, ca. 1 mm long; style ca. 1 mm long. **Fruit** not known.

Thailand.— Northern: Chiang Mai, Phrae, Nan.

Distribution.— India, Vietnam.

Ecology.— Dry evergreen forest, alt. 800-900 m (Tham Pha Kong).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 2539.

5. *FLOSCOPA* Lour.

Fl. Cochinch.: 192. 1790; Faden in Fam. Gen. Vasc. Pl. 4: 124. 1998.

Annual or perennial herbs. **Leaves** spirally arranged, petiolate or sessile. **Inflorescence** terminal and axillary thyrses or reduced to 1-several cincinni, commonly forming compound inflorescences. **Flowers** bisexual, zygomorphic, shortly pedicellate. **Sepals** free, subequal, sepaloid, usually glandular pubescent. **Petals** free, unequal, not clawed, posterior petals broader than the anterior petal. **Stamens** 6, all fertile, posterior 3 different in form from the anterior 3; filaments fused basally, glabrous. **Ovary** 2-locular. **Fruit** a 2-locular capsule, bivalved. **Seed** 1 in each loculus, usually ribbed or tuberculate.

Twenty species, pantropical (Faden, 1998). One species in Thailand (Thitimetharoch, 2004).

Floscopa scandens Lour.

Fl. Cochinch.: 193. 1790; Noltie in Fl. Bhutan 3(1): 225, fig. 22: b. 1994; Hong & DeFilipps in Fl. China 24: 25. 2000.

Thailand.— Almost throughout the country (Fig. 155).

Distribution.— India, Bhutan, Sikkim, China, Myanmar, Laos, Vietnam, Oceania.

Ecology.— Dry evergreen forest, by streams, alt. 700 m (Sapan Waterfall).

Phenology.— Flowering and fruiting: August-November.

Vernacular.— ผักปลาบดอย Phak plap doi (Chiang Mai).

Voucher specimens.— *P. Srisanga* 333.

6. MURDANNIA Royle

Illus. Bot. Himal.: 403, tab. 95. 1839; Faden in Fam. Gen. Vasc. Pl. 4: 124. 1998.

Annual or perennial herbs; roots fibrous or tuberous. **Leaves** spirally arranged, sessile. **Inflorescence** terminal and axillary thyrses or variously reduced. **Flowers** bisexual, actinomorphic to somewhat zygomorphic, pedicellate. **Sepals** free, subequal, sepeloid. **Petals** free, subequal, not clawed. **Stamens** (2-)3, antesealous; filaments generally free, glabrous or bearded; staminodes 3(-4), rarely lacking, antepetalous (when 4, one antesealous), antherodes 3-lobed or hastate. **Ovary** (2-)3 locular. **Fruit** (2-)3-locular capsule, (bi-)trivalved. **Seeds** 1-many in each loculus, uni- or biseriate.

Fifty species, pantropical and warm temperate regions (Faden, 1998). Thirteen species in Thailand (Thitimetharoch, 2004). Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|--|---------------------------------|
| 1. Plants without basal rosettes; roots thin | |
| 2. Leaves linear-lanceolate. Flowers blue | 1. <i>M. nudiflora</i> |
| 2. Leaves elliptic to narrowly ovate. Flowers orange | 2. <i>M. pauciflora</i> |
| 1. Plants with basal rosettes; roots thick, tuberous | 3. <i>M. spectabilis</i> |

1. *Murdannia nudiflora* (L.) Brenan

Kew Bull. 7: 189. 1952; Noltie in Fl. Bhutan 3(1): 229. 1994; Hong & DeFilipps in Fl. China 24: 30. 2000. – *Commelina nudiflora* L., Sp. Pl.: 41. 1753.

Thailand.— Almost throughout the country.

Distribution.— E Himalayas, China, Japan, SE Asia, Indian Ocean and Pacific Islands.

Ecology.— Dry evergreen forest, moist places, alt. 900-1,000 m (Nan Watershed).

Phenology.— Flowering and fruiting: August-November.

Vernacular.— กิ่งน้อย Kin kung noi (Chiang Mai).

Voucher specimens.— *P. Srisanga* 319.

2. *Murdannia pauciflora* G. Brückn.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India.

Ecology.— Dry evergreen forest, moist places, alt. 900-1,000 m (Nan Watershed).

Phenology.— Flowering and fruiting: August-November.

Voucher specimens.— *P. Srisanga* 321.

3. *Murdannia spectabilis* (Kurz) Faden

Taxon 29(1): 74. 1980; Hong & DeFilipps in Fl. China 24: 27. 2000. — *Aneilema spectabile* Kurz, J. As. Soc. Beng. 40: 77. 1871.

Thailand.— Almost throughout the country.

Distribution.— Myanmar, China, Laos, Vietnam, Cambodia.

Ecology.— Deciduous and dry evergreen forest, open places, alt. 900-1,000 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: August-September.

Voucher specimens.— *P. Srisanga* 2181.

7. *POLLIA* Thunb.

Gen. Nov. 1: 11. 1781; Faden in Fam. Gen. Vasc. Pl. 4: 125. 1998.

Stoloniferous or rhizomatous perennial herbs; roots fibrous. **Leaves** spirally arranged, petiolate. **Inflorescence** in terminal thyrses. **Flowers** bisexual, actinomorphic to slightly zygomorphic, pedicellate. **Sepals** free, subequal, sepaloid or petaloid. **Petals** free, equal or posterior 2 slightly differentiated from the anterior one, sometimes shortly clawed. **Stamens** 6, all fertile, equal, or posterior 3 shorter than the anterior 3 and either fertile or staminodial; filaments free, glabrous. **Fruit** a berry-like, hard, crustaceous, indehiscent, 3-locular, usually lustrous metallic blue. **Seeds** (uni- or) biseriate, (1-)3-8 in each loculus.

Seventeen species, pantropical and warm temperate regions (Faden, 1998). Five species in Thailand (Thitimetharoch, 2004). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaf base undulate along margin. Inflorescence dense-flowered **1. *P. hasskarlii***
 1. Leaf base entire. Inflorescence lax-flowered **2. *P. siamensis***

1. *Pollia hasskarlii* R.S. Rao

Notes Roy. Bot. Gard. Edinb. 25(2): 188. 1964; Noltie in Fl. Bhutan 3(1): 232, fig. 23: i-k. 1994; Hong & DeFilipps in Fl. China 24: 33. 2000.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Bhutan, Myanmar, China, Laos, Vietnam.

Ecology.— Dry evergreen and lower montane forest, in shaded and moist places, alt. 700-1,700 m (Doi Phu Kha, Tham Pha Kong).

Phenology.— Flowering: June-July; fruiting: September-November.

Voucher specimens.— *P. Srisanga* 1175, 1694, 2520; *P. Srisanga et al.* 812.

2. *Pollia siamensis* (Craib) Faden ex D.Y. Hong

In Fl. Reip. Pop. Sin. 13(3): 89. 1997; Hong & DeFilipps in Fl. China 24: 34. 2000. — *Aneilema siamense* Craib, Kew Bull. 1912: 415. 1912.

Thailand.— Northern: Chiang Mai, Nan; South-eastern: Chon Buri (type).

Distribution.— China, Laos, Vietnam, Indonesia, Philippines, New Guinea.

Ecology.— Dry evergreen forest, in shaded and moist places, alt. 800 m (Doi Phu Kha, Huay Pong).

Phenology.— Flowering: June-July; fruiting: September-November.

Voucher specimens.— *P. Srisanga* 2589.

8. *PORANDRA* D.Y. Hong

Acta Phytotax. Sin. 12(4): 462. 1974; Faden in Fam. Gen. Vasc. Pl. 4: 120. 1998; Thitimetharoch, Chantaranothai & Faden, Thai For. Bull. (Bot.) 31: 141. 2003.

Perennial herbs, scandent, with underground rhizome and long, erect stem. **Leaves** alternate, petiolate, sheathing. **Inflorescence** in axillary compact and globose, perforating the sheaths, composed of 2-several cincinni, (2-)6-8(-10)-flowered, sessile or subsessile. **Flowers** bisexual, actinomorphic, subsessile. **Sepals** subequal, sepaloid. **Petals** free, equal, not clawed. **Stamens** 6, all fertile, equal; filaments bearded; anthers dehiscing by apical pores. **Ovary** 3-locular. **Fruit** a capsule, trivalved. **Seeds** uniseriate, 2 in each loculus, with orange arillate.

Three species from China to Thailand (Faden, 1998). All species are found in Thailand (Thitimetharoch et al., 2003). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves softly pubescent beneath. Sepals and capsules pubescent **1. *P. ramosa***
 1. Leaves glabrous except pubescent along margin beneath.
 Sepals and capsules glabrous or puberulent **2. *P. scandens***

1. *Porandra ramosa* D.Y. Hong

Acta Phytotax. Sin. 12(4): 462. 1974; Hong & DeFilipps in Fl. China 24: 24. 2000; Thitimetharoch, Chantaranothai & Faden, Thai For. Bull. (Bot.) 31: 142, figs. 1: G-L, 2: B. 2003.

Scandent herbs. **Leaves** lanceolate to narrowly elliptic, 12-16 cm long, 2.5-4 cm wide, glabrous on upper surface, softly pubescent on lower surface; base cuneate; apex long acuminate; petioles 3-6 mm long, pubescent; sheaths 3-5 cm long, pubescent. **Inflorescence** (4-)6-8-flowered, 1.5-2 cm in diam. **Sepals** purplish, elliptic, 7-8 mm long, 3-4 mm wide, pubescent. **Petals** pink, oblanceolate, 7-8 mm long, 2-3 mm wide. **Filaments** pink, 7-10 mm long, bearded; anthers purple, drip-shaped, ca. 2 mm long. **Ovary** subglobose, ca. 1 mm in diam., pubescent; style 10-13 mm long. **Capsule** ovoid, 7-10 mm long, pubescent.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— China.

Ecology.— Lower montane forest, in moist places and along streams, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: June-October.

Voucher specimens.— *P. Srisanga* 1666.

Notes.— New locality recorded from Nan, in Thailand.

2. *Porandra scandens* D.Y. Hong

Acta Phytotax. Sin. 12(4): 462. 1974; Hong & DeFilipps in Fl. China 24: 24. 2000; Thitimetharoch, Chantaranothai & Faden, Thai For. Bull. (Bot.) 31: 143, figs. 1: M-R, 2: C. 2003.

Scandent herbs. **Leaves** lanceolate, 15-25 cm long, 2.5-4.5 cm wide, glabrous except pubescent along margin beneath; base cuneate; apex long acuminate; petioles purple, 3-6 mm long, glabrous or sparsely pubescent; sheaths 3-4.5 cm long, pubescent. **Inflorescence** (4-)6-8(-10)-flowered, 1.5-2 cm in diam. **Sepals** green, elliptic, 6-8 mm long, 3-4 mm wide, glabrous or puberulent. **Petals** white, oblanceolate, 6-8 mm long, 2-3 mm wide. **Filaments** purple, 6-8 mm long, bearded; anthers purple, oblong, ca. 2 mm long. **Ovary** subglobose, ca. 1 mm in diam., sparsely pubescent; style 10-13 mm long. **Capsule** ovoid, trigonous, 8-10 mm long, glabrous or puberulent.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Lampang, Nan, Tak, Kamphaeng Phet; North-eastern: Loei; Eastern: Chaiyaphum; South-eastern: Chanthaburi; South-western: Kanchanaburi, Ratchaburi.

Distribution.— China, Laos, Vietnam.

Ecology.— Dry evergreen and lower montane forest, in moist places and along streams, alt. 800-1,200 m (Doi Phu Kha, Tham Pha Kong).

Phenology.— Flowering and fruiting: June-December.

Voucher specimens.— *P. Srisanga* 2228, 2544.

Notes.— New locality recorded from Nan, in Thailand.

9. *RHOPALEPHORA* Hassk.

In Bot. Zeit. (Berlin) 22: 58. 1864; Faden in Fam. Gen. Vasc. Pl. 4: 126. 1998.

Perennial herbs; roots fibrous. **Leaves** distichous or spirally arranged, usually petiolate. **Inflorescence** terminal and axillary, corymb-like thyrses, composed of several to many elongate cymes. **Flowers** bisexual, zygomorphic, pedicellate. **Sepals** free, sepaloid. **Petals** free, subequal, posterior 2 clawed, anterior one not clawed. **Stamens** 2-3, anterior; filaments fused basally, glabrous; staminodes 2-3 or absent, posterior, antherodes bilobed. **Fruit** 1- or 3-locular capsule, bivalved, stipitate, sticky pubescent. **Seeds** 1(-2) in each loculus.

Four species in Madagascar and India to Fiji (Faden, 1998). One species in Thailand (Thitimetharoch, 2004).

Rhopalephora scaberrima (Bl.) Faden

Phytologia 37: 480. 1977; Noltie in Fl. Bhutan 3(1): 230. 1994; Hong & DeFilipps in Fl. China 24: 35. 2000. – *Commelina scaberrima* Bl., Enum. Pl. Java. 1: 4. 1827.

Thailand.— Almost throughout the country.

Distribution.— India, Bhutan, Sikkim, China, SE Asia.

Ecology.— Lower montane forest, open places, alt. 1,700-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-November.

Voucher specimens.— *P. Srisanga* 1141.

CONVALLARIACEAE

Annual or perennial, terrestrial or rarely epiphytic herbs, caulescent or acaulescent, usually with an underground rhizome; roots fibrous or tuberous. **Leaves** simple, alternate, distichous, opposite or verticillate, sessile or petiolate, with or without sheathing base; blade entire, with 1-few prominent parallel main veins, and between them with parallel or transverse venation. **Inflorescence** axillary or terminal racemes, spikes, panicles, fascicles, paired or flower solitary. **Flowers** bisexual, rarely unisexual and dioecious, actinomorphic to slightly zygomorphic, erect to

pendulous. **Tepals** mostly 6, in 2 whorls of 3, equal to subequal, free or united to form a perianth tube, articulating at the base of the ovary or along the pedicel, often with septal nectaries. Corona present or absent. **Stamens** usually 6, sometimes 4, 8, 10 or 12; filaments free, connate, adnate to the tepals or attached to a corona; anthers introrse, basifixed or dorsifixed, dehiscent by longitudinal slits. **Ovary** superior or half-inferior, 2-5-locular, axile intrusive placentation; style erect, filiform or stout; stigmas capitate, 3-lobed or expanded into a shield-like structure; ovules few-many. **Fruit** a berry, capsule, drupe or dry, papery, indehiscent structure which ruptures during seed development. **Seeds** 1-many.

Seventeen genera and about 130 species distributed in N and Central America, Europe and Asia, southwards to Indonesia (Bali and Lombok) (Conran & Tamura, 1998). Many species are cultivated as ornamentals. Some species are medicines or locally vegetable. Eight genera and about 32 species in Thailand. Five genera and 8 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Caulescent herb, with upright, ascending or descending stem. Stem not sheathing or sheathing only at base
 2. Flowers fasciculate or solitary; corona present **1. *Disporopsis***
 2. Flowers in a raceme, sometimes umbel-like or solitary; corona absent **4. *Polygonatum***
1. Acaulescent or caulescent caespitose herb, usually tufted, rarely with procumbent stem. Stem sheathing at each node
 3. Plant sympodial. Inflorescence a reduced dibotyrium or a raceme. Fruit rupturing in early development, exposing the seeds with a sarcotesta
 4. Leaves longitudinally whitish striped, transverse veins inconspicuous. Tepals fused basally or free. Corona absent **2. *Ophiopogon***
 4. Leaves hollow along main longitudinal veins, transverse veins conspicuous. Tepals fused more than one third. Corona present **3. *Peliosanthes***
 3. Plant monopodial. Inflorescence a spike. Fruit a berry; seeds without a sarcotesta **5. *Tupistra***

1. *DISPOROPSIS* Hance

J. Bot. 21: 278. 1883; Conran & Tamura in Fam. Gen. Vasc. Pl. 3: 193. 1998.

Caulescent sympodial rhizomatous herbs. **Leaves** distichous, more or less sessile. **Inflorescence** axillary, fasciculate or flower solitary; floral bracts absent. **Flowers** bisexual, actinomorphic, campanulate to funnel-shaped; pedicels articulated at the apex. **Tepals** 6, united for about half way, white or yellowish, rarely brown-spotted inside. Corona present. **Stamens** 6, attached to the tepals by a corona at the apex of the perianth tube; anthers attached at the corona margin. **Ovary** superior, 3-locular; ovules 4-6 in each loculus; style 1; stigma capitate or 3-lobed. **Fruit** a berry, globose. **Seeds** 1-5.

About 6 species in S China, Taiwan, Indochina and Philippines (Conran & Tamura, 1998). Only 1 species in Thailand.

***Disporopsis longifolia* Craib**

Kew Bull. 1912: 410. 1912; Charoenphol, Thai For. Bull. (Bot.) 8: 90. 1974; Liang & Tamura in Fl. China 24: 232. 2000.

Erect herb, up to 1 m high. **Leaves** lanceolate, elliptic to ovate, (7-)10-20(-30) cm long, 2.5-6(-10) cm wide, glabrous on both surfaces; base broadly cuneate, attenuate on to the petiole; apex acuminate; veins from base; petioles up to 3 mm long or absent. **Flowers** in cluster of (3-)5-10; pedicels 1-1.5 cm long, glabrous. **Tepals** white, 8-10 mm long; tube 3-5 mm long, slightly constricted near mouth; lobes lanceolate to narrowly elliptic, 4-6 mm long, 2-3.5 mm wide, obtuse at apex. Corona 1.5-2 mm long. **Anthers** oblong, 2-3 mm long, cordate at base. **Ovary** ovoid, ca. 3 mm long; style 1-2 mm long. **Fruit** globose, 1-1.5 in diam. **Seeds** 2-5.

Thailand.— Northern: Chiang Mai (type), Chiang Rai, Nan.

Distribution.— Myanmar, S China, Laos, Vietnam.

Ecology.— Dry evergreen and lower montane forest, alt. 700-1,700 m (Doi Phu Kha, Tham Pha Khaw, Tham Pha Kong).

Phenology.— Flowering: June-July (January); fruiting: July-December.

Voucher specimens.— *P. Srisanga* 1196, 1931, 2514, 2517, 2358; *P. Srisanga et al.* 827.

2. OPHIOPOGON Ker-Gawl.

Bot. Mag. 27: tab. 1063. 1807, nom. cons.; Conran & Tamura in Fam. Gen. Vasc. Pl. 3: 194. 1998.

Acaulescent or caulescent caespitose, sympodial rhizomatous herbs; roots fibrous often tuberiferous or lignified; aerial stem if present, unbranched, usually procumbent. **Leaves** alternate, sheathing, linear, sessile (sect. *Ophiopogon*) to oblong, petiolate (sect. *Peliosanthoides*), whitish striped on the abaxial surface; transverse veins inconspicuous. **Inflorescence** a raceme or a reduced dibotyrum, more or less curved. **Flowers** bisexual, actinomorphic, campanulate to opening flat, drooping to ascending; pedicels articulated. **Tepals** 6, fused basally or free, white or violet. Corona absent. **Stamens** 6, sometimes connate, adnate to the tepals basally; filaments very short; anthers long-pointed, basifixed, adpressed to the style. **Ovary** half-inferior, 3-locular; ovules 2-6 in each loculus; style 1; stigma capitate. **Fruit** rupturing in early development, exposing the seed. **Seed** 1, globose or ellipsoidal, blue.

About 54 species, distributed in the Himalayas, India, China, Japan, Indochina and southwards to Malesia (Conran & Tamura, 1998). About 7 species in Thailand. Three species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|--------------------------|
| 1. Leaves grass-like or oblong, sessile | |
| 2. Acaulescent herb; stem absent | 1. <i>O. intermedius</i> |
| 2. Caulescent herb; stem distinct | 2. <i>O. siamensis</i> |
| 1. Leaves oblong-lanceolate to oblanceolate, distinctly petiolate | 3. <i>O. sp.</i> |

1. *Ophiopogon intermedius* D. Don

Prodr. Fl. Nepal.: 48. 1825; Larsen, Dansk Bot. Ark. 20(1): 39. 1961; Charoenphol, Thai For. Bull. (Bot.): 8: 92. 1974; Chen & Tamura in Fl. China 24: 260. 2000.

Acaulescent herb. **Leaves** in basal tuft, grass-like or oblong, 15-50 cm long, 0.5-1 cm wide, glabrous, sessile, sheathing at base; apex acute. **Inflorescence** a terminal dibotrys, 20-50 cm long, many-flowered; axis green; bracts subulate, linear to narrowly lanceolate, 1-2.5 cm long, acute at apex. **Flowers** 2-3 in each bract, sometimes solitary; pedicels 4-7 mm long, articulated about or slightly below the middle. **Perianth** campanulate, white or purplish white, 4-7 mm long; lobes lanceolate to ovate. **Filaments** ca. 0.5 mm long; anthers lanceolate, 2.5-4 mm long. **Style** 3-4 mm long. **Fruit** ovoid, 6-7 mm long and wide.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— India, Nepal, Bhutan, Sikkim, Bangladesh, Sri Lanka, Myanmar, China, Vietnam.

Ecology.— Lower montane scrub, among grasses on limestone rocks, alt. 1,600-1,700 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: May-August.

Voucher specimens.— *P. Srisanga et al.* 877.

2. *Ophiopogon siamensis* M.N. Tamura

Acta Phytotax. Geobot. 49(1): 27, figs. 1-4. 1998.

Perennial herb, 20-70 cm long; stem erect. Aerial roots often present, ligneous. **Leaves** oblong-linear to falcate, 13-40 cm long, 0.5-2 cm wide, glabrous, with white stripes on lower surface, sessile, sheathing at base; apex acute. Fascicles of 7-10 leaves arranged at intervals of 3-10 cm on stem. **Inflorescence** a terminal dibotrys, 10-27 cm long, (3-)15-30(-42)-flowered; axis compressed, white-purplish; bracts linear to narrowly lanceolate, 7-11 mm long, acute at apex. **Flowers** (1-)2(-5) in each bract; pedicels 3-5 mm long, articulated about or slightly above the middle. **Perianth** campanulate, purplish white, 5-6 mm long; lobes lanceolate, acute at apex. **Filaments** ca. 0.5 mm long; anthers lanceolate, ca. 2 mm long. **Ovary** ca. 2 mm long; ovules 2 in each loculus; style ca. 3 mm long. **Fruit** ovoid, 6-7 mm long and wide.

Thailand.— Northern: Chiang Mai (type), Chiang Rai, Nan.

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, alt. 1,300-1,800 m (Doi Phu Kha).

Phenology.— Flowering: June-August; fruiting: September-December.

Voucher specimens.— *P. Srisanga* 388, 901, 956, 1691, 1985; *P. Srisanga et al.* 808.

3. *Ophiopogon* sp.

Acaulescent herb. **Leaves** in basal tuft, oblong-lanceolate to oblanceolate, (9-) 12-18(-20) cm long, (2.5-)3-4(-5) cm wide, glabrous; base attenuate on to the petioles; apex bluntly acute; petioles (7-)13-25 cm long. **Inflorescence** a terminal dibotrys, 20-25 cm long, many-flowered; axis white-purplish; bracts lanceolate to elliptic, 7-10 mm long, with hyaline margin, acute at apex. **Flowers** 2 in each bract; pedicels 9-14 mm long, articulated about $\frac{1}{2}$ below the middle. **Perianth** campanulate, white, 10-12 mm long; lobes lanceolate to elliptic, obtuse at apex. **Filaments** ca. 0.5 mm long; anthers lanceolate, 5-7 mm long. **Ovary** ca. 1 mm long; ovules 3-4 in each loculus; style 6-8 mm long. **Fruit** not known (Fig. 156).

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: May-June.

Voucher specimens.— *P. Srisanga* 1410.

Notes.— Possibly new species. Its belongs to section *Piliosanthoides* (*O. marmoratus* group) characterized by oblong-lanceolate to oblanceolate leaves with distinct petioles. This plant has large pure white flowers and broader leaves than other species in this group known.

3. *PELIOSANTHES* Andrews

Bot. Repos. 10: t. 605. 1810; Jessop, Blumea 23: 141. 1976; in Fl. Mal. I(9): 227. 1979; Conran & Tamura in Fam. Gen. Vasc. Pl. 3: 194. 1998. – *Lourya* Baill., Bull. Soc. Linn. Paris 1: 743. 1888. – *Neolourya* Rodriguez, Bull. Mus. Hist. Nat. Paris II 6: 96. 1934.

Acaulescent, rarely caulescent, sympodial rhizomatous herbs; roots fibrous. **Leaves** alternate, sheathing, petiolate, sometimes stipulate; main longitudinal veins hollow; transverse veins conspicuous. **Inflorescence** a raceme or a reduced dibotyrum. **Flowers** bisexual, actinomorphic, erect; pedicels articulated at the apex. **Tepals** 6, fused more than one third. Corona present. **Stamens** 6; filaments very short, attached to an expanded, fleshy, epipetalous corona; anthers basifixed. **Ovary** half-inferior, 3-locular; ovules 1-5 in each loculus; style 1; stigma capitate or 3-lobed. **Fruit** rupturing in early development, exposing the seeds. **Seeds** 1-3, ellipsoidal, blue.

Monotypic genus with two subspecies: *P. teta* Andr. subsp. *teta* and subsp. *humilis* (Andr.) Jessop (Jessop, 1976) or about 10 species, distributed in India, S China, Taiwan, Indochina and southwards to Malesia (Conran & Tamura, 1998). Possibly 2 species recorded from Doi Phu Kha National Park. Both species belongs to *Peliosanthes teta* Andr. subsp. *humilis* (Andr.) Jessop Group (Jessop, 1976).

1. *Peliosanthes aff. sinica* F.T. Wang & Tang

Caulесcent herb; stem 5-20 cm long. **Leaves** lanceolate to elliptic, 10-20 cm long, 3-6 cm wide; base attenuate onto the petiole; apex acuminate; petioles 5-20 cm long. **Inflorescence** a raceme, 4-7 cm long; rachis purplish; bracts lanceolate, 5-12 mm long. **Flower** solitary in each subtended bract; pedicels 3-4 mm long. **Perianth** green-purple, 6-8 mm in diam.; lobes elliptic to ovate, 3-4 mm long, acute at apex. Corona purplish, ca. 1 mm wide. **Anthers** ca. 0.5 mm long. **Fruit** ovoid, 7-10 mm long.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen and lower montane forest, alt. 700-1,600 m (Doi Phu Kha, Tham Pha Kong).

Phenology.— Flowering: December; fruiting: June-October.

Voucher specimens.— *P. Srisanga* 1675, 2523, 2531, 2613.

2. *Peliosanthes aff. macrostegia* Hance

Acaulescent herb. **Leaves** broadly lanceolate, elliptic to narrowly ovate, 15-30 cm long, 6-9 cm wide; base attenuate onto the petiole; apex acuminate; petioles 15-30 cm long. **Inflorescence** a raceme, 15-25 cm long; rachis purplish; bracts ovate, 5-8 mm long. **Flower** solitary in each subtended bract; pedicels 2-3 mm long. **Perianth** purple, 8-10 mm in diam.; lobes ovate, ca. 4 mm long, acute at apex. Corona purplish, 1-2 mm wide. **Anthers** ca. 0.5 mm long. **Fruit** ovoid, 7-10 mm long.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: August-September; fruiting: October-December.

Voucher specimens.— *P. Srisanga* 1747; *P. Srisanga* & *C. Maknoi* 2029; *P. Srisanga* & *C. Puff* 1091.

4. *POLYGONATUM* Miller

Gard. Dict. Abridg. ed. 4. 1109. 1754; Conran & Tamura in Fam. Gen. Vasc. Pl. 3: 192. 1998.

Caulесcent, sympodial rhizomatous herbs. **Leaves** distichous, opposite or verticillate, more or less sessile. **Inflorescence** axillary, often racemose, sometimes umbel-like or flower solitary; floral bracts herbaceous, membranaceous or absent. **Flowers** bisexual, actinomorphic, tubular to campanulate, funnel-shaped or urceolate, usually pendulous; pedicels articulated at the apex. **Tepals** 6, valvate, united; lobes short. Corona absent. **Stamens** 6, adnate to the tepals; anthers basifixed to dorsifixed versatile. **Ovary** superior, 3-locular; ovules 4-6 in each loculus; style 1, filiform; stigma capitate. **Fruit** a berry, globose. **Seeds** subglobose, up to 18.

About 57 species in temperate parts of Eurasia and N America, but with concentrations in the Himalayas, China and Japan (Conran & Tamura, 1998). Only 1 species in Thailand.

Polygonatum kingianum Coll. & Hemsl.

J. Linn. Soc. Bot. 28: 138. 1890.; Maxwell, Nat. Hist. Bull. Siam Soc 46(2): 151, fig. 1. 1998; Chen & Tamura in Fl. China 24: 228. 2000.

Erect perennial herb, 1-3 m high. **Leaves** in whorl of 3-5, linear-lanceolate, 5-20 cm long, 0.5-1.5 cm wide, glabrous, sessile; apex cirrose. **Inflorescence** 2-8-flowered fascicle; pedicels 0.5-1.5 cm long. **Perianth** cylindric-campanulate, pink, 1.8-2.5 cm long; lobes 3-5 mm long. **Filaments** 2-5 mm long, glabrous; anthers 4-6 cm long. **Ovary** 4-6 mm long; style 1-1.4 cm long. **Fruit** subglobose, shallowly 3(-4)-lobed, 10-15 mm long and wide, orange. **Seeds** 6, subglobose, 4-5 mm long and wide, orange (Fig. 157).

Thailand.—Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan.

Distribution.—Myanmar (type), China, Vietnam.

Ecology.—Lower montane forest, open places, alt. 1,300-1,700 m (Doi Phu Wae).

Phenology.—Flowering: May-June; fruiting: September-December.

Voucher specimens.—*P. Srisanga* 2156, 2635; *P. Srisanga et al.* 840.

5. *TUPISTRA* Ker-Gawl.

Bot. Mag.: t. 1655. 1814; *T.* subgen. *Tupistra* J.L. Huang & H. Li, Acta Bot. Yunnan. Suppl. 3: 49. 1990; Conran & Tamura in Fam. Gen. Vasc. Pl. 3: 195. 1998.

Acaulescent, monopodial herbs with thick rhizome, sometimes tuberous, spreading. **Leaves** alternate, pseudopetiolate, basally dilated; midrib prominent. **Inflorescence** an axillary spike; floral bracts short, deltoid to oval. **Tepals** 6 or 8, fleshy, united. **Stamens** 6 or 8, attached to the tepals, sessile; anthers positioned lower than stigma. **Ovary** half-inferior, 3-4-locular; ovules 2 in each loculus; style 1; stigma large, fleshy, peltate to fungilliform. **Fruit** a berry. **Seed** solitary.

About 15 species, distributed in E Himalayas, S China, Indochina and southwards to Malesia (Conran & Tamura, 1998). About 2 species in Thailand. One species recorded from Doi Phu Kha National Park.

Tupistra albiflora K. Larsen

Dansk Bot. Ark. 20(1): 43, fig. 2. 1961.

Acaulescent herb. **Leaves** broadly oblanceolate to obelliptic, 30-70 cm long, 6-11 cm wide, glabrous on both surfaces; base attenuate onto the pseudopetiole; apex acute to bluntly acuminate; pseudopetioles 9-30 cm long. **Inflorescence** a raceme, 25-33 cm long; bracts ovate, 3-4 mm long. **Flower** solitary in each subtended bract, sessile. **Perianth** white with tinged purplish at apex, campanulate, 1.5-2 cm long; lobes 6, oblong, longer than tube, acute at apex. **Anthers** ca. 2 mm long, attached to the perianth lobed, 4-5 mm below the apex. **Ovary** 3-locular; style 8-10 mm long; stigma peltate, 6-lobed. **Fruit** subglobose, 1.7-2 cm in diam., verrucose, brown.

Thailand.— Northern: Chiang Mai (type), Nan.

Distribution.— Endemic to Thailand.

Ecology.— Dry evergreen and lower montane forest, sometimes by streams, alt. 750-1,350 m (Doi Phu Kha, Nan Watershed).

Phenology.— Flowering and fruiting: August-November.

Vernacular.— นางเลอ Nang leo (Chiang Mai).

Voucher specimens.— *P. Srisanga* 316, 1693; *P. Srisanga & C. Maknoi* 2070.

COSTACEAE

Perennial, rhizomatous, non-aromatic herbs, terrestrial or more rarely epiphytic. Stems terete, most often unbranched, leafy, sometimes spirally contorted; when branched, then secondary branches breaking through the leaf sheaths. **Leaves** simple, spirally arranged; sheaths closed, tubular; ligule present; petioles short; pulvinus absent; lamina rolled up from one side to the other in bud. **Inflorescence** a strobilaceous spike, terminal on the leafy shoot or on a separate, short, leafless shoot, or flower solitary and axillary. Bracts imbricate, with a linear, nectariferous callus below the tip, each subtending 1-2-flowered; bracteoles tubular or folded. **Flowers** bisexual, zygomorphic. **Calyx** tubular, shortly 2-3-lobed. **Corolla** 3-lobed, imbricate, unequal. **Stamen** 1, often petaloid; anthers 2-thecate, 4-sporangiate, dehiscing introrsely by longitudinal slits, often appendaged at the apex. Labellum petaloid, staminodial, opposite to the stamen, as long as or much longer than the corolla, 3-lobed, often with crisped margin; basal part of stamen and labellum united into a papillate tube. **Ovary** inferior, (2-)3-locular, axile placentation; ovules numerous, immersed in the apical part of the ovary; style filiform, commonly enclosed between the thecae; stigma with or without a dorsal appendage. **Fruit** usually a loculicidal capsule, crowned by the persistent calyx, rarely explosively, or indehiscent and irregularly breaking when old. **Seeds** numerous; aril white to yellow.

A pantropical family comprising 4 genera and about 100 species (Larsen, 1998). Some species are cultivated as ornamentals. One genus and about 4-5 species in Thailand. Three species recorded from Doi Phu Kha National Park.

COSTUS L.

Sp. Pl.: 2. 1753; Larsen in *Fam. Gen. Vasc. Pl.* 4: 131. 1998.

Herbs; stem unbranched. Ligule short or long, truncate or bilobed. **Inflorescence** a strobilaceous spike, terminal on the leafy shoot or on a separate, short, leafless shoot. Bracts densely imbricate, sometimes apically appendaged; bracteoles tubular or folded. **Calyx** longer or shorter than the bracts. **Corolla** and labellum variously coloured. Labellum large and spreading, or small and tubular. **Stamens** with the anther attached to the middle of the filament, rarely to the base. Basal part of stamen and labellum joined into a papillate tube. **Ovary** 3-locular;

ovules 2-seriate. **Capsule** white, ellipsoid or globose, often trigonous. **Seeds** glossy, black or brown; aril large, lacerate, rarely short and cushion-like.

About 90 species, pantropical, mostly in tropical America (Larsen, 1998).

KEY TO THE SPECIES

1. Inflorescence terminal on the leafy shoot. Flowers white or pinkish white
 2. Apical part of bracts soon disintegrating into fibres. Calyx lobes obtuse
1. *C. lacerus*
 2. Apical part of bracts never disintegrating into fibres. Calyx lobes acute
2. *C. speciosus*
1. Inflorescence on a separate, short, leafless shoot. Flowers creamy yellow
3. *C. tonkinensis*

1. *Costus lacerus* Gagnep.

Bull. Soc. Bot. France 50: 261. 1903; Maas, Blumea 25(2): 546, fig. 1. 1979; Smith in Fl. Bhutan 3(1): 209, fig. 21: a-c. 1994; Wu & Larsen in Fl. China 24: 321. 2000.

Herb, 1-2 m high. **Leaves**: sheaths hirsute, glabrescent, ciliate at apex; blade oblong-lanceolate to elliptic, 20-35 cm long, 5-11 cm wide, glabrescent on upper surface, hirsute on lower surface; base broadly cuneate to subtruncate; apex acuminate; petioles up to 5 mm long or nearly absent. **Inflorescence** terminal, ovoid, 6-11 cm long, 4-7 cm wide; bracts red, ovate, 3-5 cm long, 1.5-2 cm wide, hirsute, truncate at apex, soon disintegrating into fibres; bracteoles ovate, 0.8-1.7 cm long, hirsute. **Calyx** red, oblong, 2-3 cm long, hirsute, split to the base on one side; lobes 3, 1-1.5 cm long, obtuse at apex. **Corolla** white; tube 1.5-2 cm long; lobes oblong, 3.5-5 cm long, 2-3 cm wide. Labellum white or pinkish white, with yellow tinged in the middle inside, trumpet-shaped, 5-7 cm long, 6-9 cm wide; margin crisped. **Stamen** white, petaloid, oblong, 4-5 cm long, 0.7-1.2 cm wide. **Ovary** hirsute. **Capsule** ellipsoid, 2-3 cm long, red, hirsute, dehiscing loculicidally. **Seeds** black.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; North-eastern: Loei.

Distribution.— India (type), Bhutan, Sikkim, China.

Ecology.— Lower montane forest, moist places, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: May-July; fruiting: September-December.

Voucher specimens.— *P. Srisanga* 1195.

2. *Costus speciosus* (Koenig) J.E. Smith

Trans. Linn. Soc. London 1: 249. 1791; Maas, Blumea 25(2): 546. 1979; Smith in Fl. Bhutan 3(1): 210, fig. 21: d. 1994; Wu & Larsen in Fl. China 24: 321. 2000. — *Banksia speciosa* Koenig in Retzius, Observ. Bot. 3: 75. 1784.

Herb, 1-2 m high; branches spirally twisted at apex. **Leaves:** sheaths hirsute, glabrescent; blade oblong-lanceolate to narrowly elliptic, 15-20 cm long, (2.5-)4-8 cm wide, glabrescent on upper surface, densely sericeous on lower surface; base subtruncate; apex acuminate; petioles up to 5 mm long or nearly absent. **Inflorescence** terminal, ellipsoid to ovoid, 5-11 cm long, 3.5-6 cm wide; bracts red, elliptic to ovate, 2-3 cm long, 1-1.5 cm wide, hirsute to sericeous, sharply pointed at apex, not disintegrating into fibres; bracteoles pale red, 1.2-1.5 cm long, hirsute. **Calyx** red, oblong, 1.8-2.2 cm long, hirsute to sericeous, rigid; lobes 3, 0.6-1.2 cm long, sharply pointed at apex. **Corolla** white; tube 1-1.5 cm long; lobes oblong-elliptic, 3.5-5 cm long. Labellum white, with yellow tinged in the middle inside, trumpet-shaped, 5-9 cm long; margin crisped. **Stamen** white, petaloid, 4-5 cm long, 1-1.3 cm wide. **Ovary** hirsute to sericeous. **Capsule** ellipsoid, 1.5-2.5 cm long, red, hirsute, dehiscing loculicidally. **Seeds** black, glossy.

Thailand.— Almost throughout the country.

Distribution.— E Himalayas, China, SE Asia, Australia.

Ecology.— Lower montane forest, moist places, alt. 1,300-1,700 m (Doi Phu Kha).

Phenology.— Flowering: May-August; fruiting: September-December.

Vernacular.— เอื้องหมาขานา Ueang mai na (General).

Voucher specimens.— *P. Srisanga* s.n.

3. *Costus tonkinensis* Gagnep.

Bull. Soc. Bot. France 49: 248. 1902; Wu & Larsen in Fl. China 24: 320. 2000.

Herb, 1-2 m high. **Leaves:** sheaths glabrescent; blade oblong-lanceolate to elliptic, 15-30 cm long, 4-8 cm wide, glabrescent on both surfaces; base subrounded; apex acuminate; petioles 3-5 mm long. **Inflorescence** on a separate, short, leafless shoot, arising from rhizome, ovoid, 6-8 cm long, 4-6 cm wide; bracts creamy yellow, elliptic to ovate, 3-4 cm long, 1.5-2 cm wide, roughly hirsute, sharply pointed at apex, not disintegrating into fibres; bracteoles oblong, 2.3-2.7 cm long, roughly hirsute, sharply pointed at apex. **Calyx** creamy yellow, oblong, 2-3 cm long, roughly hirsute; lobes 3, 5-8 mm long, sharply pointed at apex. **Corolla** creamy yellow; tube 3-4 cm long; lobes oblong-lanceolate, 4-5 cm long, 1.5-2 cm wide. Labellum creamy yellow, trumpet-shaped, 5-7 cm long and wide; margin crisped. **Stamen** creamy yellow, petaloid, oblong, 3.3-4 cm long, 0.7-1.2 cm wide. **Ovary** hirsute. **Capsule** ellipsoid, hirsute, dehiscing loculicidally. **Seeds** black.

Thailand.— Northern: Nan.

Distribution.— China, Vietnam (type).

Ecology.— Dry evergreen forest, by streams, moist places, alt. 800 m (Sapan Waterfall).

Phenology.— Flowering: June-July; fruiting: September-December.

Voucher specimens.— *P. Srisanga* 2583.

CYPERACEAE

Annual or perennial, rhizomatous to stoloniferous herbs; stems (culms) simple, often 3-sided. **Leaves** basal and/or cauline, often 3-ranked, comprising blade and sheath, sometimes sheath only present; blade usually linear, grass-like; sheath open or closed; ligule often present. Involucral bracts 1-several, leaf-like or glume-like. **Inflorescence** unbranched to compoundly or decompoundly branched and umbel-like, or paniculate, comprising 1-many ultimate inflorescence units (spikelets or spicoids). **Spikelets** comprising 1-many glumes; glumes membranous to coriaceous, spirally arranged or 2-ranked, each subtending a single bisexual or unisexual flower or sterile, the spikelet sometimes reduced to a single flower and aggregated into spikes; spicoids comprising a terminal female flower, 2-12 membranous scale-like floral bracts on a much reduced axis, the lowest 2 bracts opposite and keeled, some of the bracts subtending a male flower, the spicoid subtended and usually hidden by a glume-like spicoid bract, these spirally arranged and aggregated into spikelet-like spikes. **Perianth** absent or reduced to bristles or scale-like segments. **Stamens** 1-3; anthers basifixed. **Ovary** 2-3-carpellate, 1-locular; ovule 1; stigmas 2-3, rarely style undivided. **Fruit** a nutlet, usually hard, 2-3-sided, rarely with a succulent or corky exocarp, sometimes partially or completely enclosed by an enlarged basal prophyll (utricle).

A cosmopolitan family comprising 104 genera and over 5,000 species (Goetghebeur, 1998). Twenty-nine genera and 248 species in Thailand (Simpson & Koyama, 1998). Three genera and 7 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Flowers unisexual
 2. Female flowers and nutlets hidden by an utricle; nutlets not bony, without cup-like or stripe-like structures at the base **1. *Carex***
 2. Female flowers and nutlets not hidden by an utricle; nutlets usually bony, often with a 3-lobed cup-like or stripe-like structures at the base **3. *Scleria***
1. Flowers bisexual or staminate in upper glumes **2. *Kyllinga***

1. *CAREX* L.

Sp. Pl.: 972. 1753; Goetghebeur in Fam. Gen. Vasc. Pl. 4: 187. 1998; Simpson & Koyama in Fl. Thailand 6(4): 449. 1998.

Perennial herbs. Culms trigonous to triquetrous, rarely terete. **Leaves** 3-ranked, basal and/or cauline; blade linear to lanceolate; sheath closed; radical sheaths often brown and disintegrating into fibres; ligule absent. Involucral bracts leaf-like to setaceous. **Inflorescence** paniculate, racemose or spicate, with 2-many spikes, or reduced to a single, terminal spike. **Spikes** male, androgynous or female, the male spikes usually terminal. **Glumes** spirally arranged, each subtended a single unisexual flower. **Male flowers** comprising 3 stamens. **Female flowers** comprising a bottle-shaped utricle, closed except at apex, with or without a short beak at apex, the beak

truncate or 2-toothed. **Perianth** absent. **Stigmas** 2-3; style continuous with ovary. **Nutlets** 2-3-sided, papillose.

Over 2,000 species, cosmopolitan. Forty species in Thailand (Simpson & Koyama, 1998). Four species recorded from Doi Phu Kha National Park.

1. *Carex baccans* Ness

Thailand.— Northern: Mae Hon Son, Chiang Mai, Chiang Rai, Nan, Tak; North-eastern: Loei; Eastern: Chaiyaphum, Nakhon Ratchasima; South-eastern: Chanthaburi; Peninsular: Ranong, Phangnga.

Distribution.— India (type), China, SE Asia, New Guinea.

Ecology.— Lower montane forest and lower montane scrub, open places, by roadsides, alt. 1,200-1,600 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: July-September; fruiting: November-December.

Vernacular.— หญ้าคมบาง Ya khom bang (Chanthaburi).

Voucher specimens.— *P. Srisanga* 1867, 2218.

2. *Carex* sp. 1

Ecology.— Lower montane forest and lower montane scrub, open areas, also on limestone, alt. 1,700-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: July-December.

Voucher specimens.— *P. Srisanga* 400, 938, 2127.

3. *Carex* sp. 2

Ecology.— Lower montane forest, open areas, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Fruiting: January-February.

Voucher specimens.— *P. Srisanga* 2374.

4. *Carex* sp. 3

Ecology.— Lower montane forest, open areas, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: March-April.

Voucher specimens.— *P. Srisanga* & *S. Watthana* 684.

2. *KYLLINGA* Rottb.

Descr. Icon. Rar. Nov. Pl.: 12. 1773; Goetghebeur in Fam. Gen. Vasc. Pl. 4: 172. 1998; Simpson & Koyama in Fl. Thailand 6(4): 396. 1998.

Perennial herbs. Rhizomes short or horizontally creeping. Culms scapos to few-noded, sometimes 6-angular or winged. **Leaves** basal, 3-ranked; ligule absent. Involucral bracts leaf-like. **Inflorescence** capitate. **Spikes** 1-few, sessile, cylindric, ellipsoid or globose. **Spikelets** numerous, falling entire, crowned, bilaterally flattened. **Glumes** several, 2-ranked, strongly laterally flattened. **Flowers** bisexual or staminate in upper glumes, 1-5 per spikelet. **Perianth** absent. **Stamens** 2-3. **Stigmas** 2. **Nutlets** 1-2 per spikelet, laterally biconvex with one margin facing the axis.

About 50 species in tropical, subtropical and warm temperate regions, with the highest number of species in Africa. Six species in Thailand (Simpson & Koyama, 1998). One species recorded from Doi Phu Kha National Park.

Kyllinga brevifolia Rottb.

Thailand.— Almost throughout the country.

Distribution.— Tropical, subtropical and warm temperate regions (India-type).

Ecology.— Lower montane scrub, open places on limestone mountain, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering and fruiting: Almost throughout the year.

Vernacular.— หญ้าดอกขาว Ya dok khao (Central).

Voucher specimens.— *P. Srisanga* 2142.

3. **SCLERIA** Berg.

Kongl. Vet. Akad. Handl. Stockh. 26: 142, t. 4-5. 1765; Goetghebeur in Fam. Gen. Vasc. Pl. 4: 184. 1998; Simpson & Koyama in Fl. Thailand 6(4): 426. 1998.

Annual or perennial herbs. Culms solitary or tufted, usually erect, sometimes climbing or scrambling. **Leaves** basal and/or cauline; blade mostly linear; sheath closed, often 3-winged; ligule absent. **Inflorescence** usually paniculate, occasionally reduced and spike-like or capitate. **Spikelets** unisexual or bisexual; bisexual spikelets with terminal female flower and 1-several lateral male ones; female spikelets with a single female flower and 1-several lateral glumes (reduced male flowers); male spikelets with several to many glumes. **Glumes** spirally arranged or 2-ranked. **Flowers** unisexual. **Perianth** absent. **Male flowers** comprising 3 stamens. **Female flowers**: stigmas 3; style continuous with ovary, caducous. **Nutlets** terete or subtrigonal, mostly globose, ovoid or subpyramidal, with bony pericarp and a stipe-like, 3-lobed or cup-like, rarely indistinct disk attached at the base.

About 200 species in tropical and subtropical regions, with the highest number of species in tropical America. Twenty-two species in Thailand (Simpson & Koyama, 1998). Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Nutlets shiny white, scrobiculate

1. *S. scrobiculata*

1. Nutlets shiny white-dark purplish, smooth

2. *S. terrestris*

1. *Scleria scrobiculata* Nees & Mey. ex Nees

Thailand.— Northern: Chiang Mai, Nan; Eastern: Nakhon Ratchasima; South-eastern: Chon Buri, Chanthaburi, Trat; Central: Bangkok; Peninsular: Satun.

Distribution.— Andaman Islands through Malesia (type) to Micronesia.

Ecology.— Lower montane forest, open places, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: October-November.

Vernacular.— หญ้าค่อมบาง Ya khom bang (Trat).

Voucher specimens.— *P. Srisanga* 2258.

2. *Scleria terrestris* (L.) Fassett

Thailand.— Almost throughout the country.

Distribution.— India, Sri Lanka, China, Japan, SE Asia, Australia.

Ecology.— Lower montane forest, open places, alt. 1,600-1,800 m (Doi Phu Kha).

Phenology.— Flowering: July-August; fruiting: October-December.

Vernacular.— หญ้าสามค่อม Ya sam khom (Chiang Mai).

Voucher specimens.— *P. Srisanga* 937, 1782.

DIOSCOREACEAE

Tuberous or rhizomatous perennial herbs; aerial shoot twining or sometimes erect or procumbent. **Leaves** simple, entire or palmately lobed, or palmately compound, alternate, opposite or partly whorled; stipules present or absent; principal veins palmate; secondary veins transversal, connected by reticulate veinlets. **Inflorescence** in axillary panicles, racemes or spikes; the ultimate inflorescence units monochasial but often reduced to a single flower. **Flowers** usually unisexual, rarely bisexual, actinomorphic, usually inconspicuous, pedicellate or sessile. **Tepals** 6, in 2 whorls of 3, usually basally connate. **Stamens** 6, in 2 whorls of 3 or the inner whorl sterile or wanting; filaments distinct or attached to the tepals, rarely connate into a staminal column; anthers tetrasporangiate, introrsely or extrorsely dehiscent. **Ovary** inferior, syncarpous, 3-locular, axile placentation; ovules 2(-numerous) in each loculus; style trifid or 3-lobed, rarely style branches 2-lobed or bifid, or stigmas nearly sessile; staminodes present or not. **Fruit** a capsule, usually 3-angled or -winged, or rarely berry or samara. **Seeds** 1(-numerous) in each loculus, usually winged.

A family of conventionally treated 3-4 to more than 20 genera and about 600 species, mostly in the tropics, poorly represented in Europe, Australia and Oceania (Huber, 1998). *Dioscorea* spp. (Yam) is one of important food for the people in the tropics. Two genera and about 50 species in Thailand. One genus and 4 species recorded from Doi Phu Kha National Park.

DIOSCOREA L.

Sp. Pl.: 1032. 1753; Ding & Gilbert in Fl. China 24: 276. 2000.

Tuberous or rhizomatous perennial herbs; aerial shoot twining. **Leaves** simple or palmately compound, alternate or opposite, petiolate; basal veins 3-9(-11). **Flowers** unisexual. **Stamens** 6, in 2 whorls of 3 or the inner whorl sterile or wanting. **Fruit** a capsule, usually 3-angled or -winged, dehiscent apically at maturity. **Seeds** membranous winged.

About 50 species in Thailand.

KEY TO THE SPECIES

- | | |
|---|---------------------------------|
| 1. Leaves simple | |
| 2. Leaves alternate | |
| 3. Basal veins 9 or 11. Capsule oblate, 2.2-2.8 cm long, 3.5-3.8 cm wide | 1. <i>D. althaeoides</i> |
| 3. Basal veins 5 or 7. Capsule oblong to narrowly obovate, 3.3-5.5 cm long, 1.5-2.3 cm wide | 3. <i>D. petelotii</i> |
| 2. Leaves opposite | 4. <i>D. wallichii</i> |
| 1. Leaves palmately compound | 2. <i>D. kamoensis</i> |

1. ***Dioscorea althaeoides* Kunth**

In Engl., Pflanzenr. 87 (IV. 43): 180. 1924; Ding & Gilbert in Fl. China 24: 279. 2000.

Stem twining to the left, sparsely hirsute, glabrescent. **Leaves** simple, alternate, sometimes 3-lobed, ovate, 6-13 cm long, 4-9 cm wide, minute puberulous on veins on upper surface, pubescent on lower surface especially along veins; base cordate; apex acuminate; basal veins 9 or 11; petioles 3-8 cm long, puberulous. **Male spikes** solitary or paired, sometimes branched, up to 20 cm long; rachis puberulous. **Male flowers** green, cup-shaped, ca. 1.5 mm long; lobes spreading; pedicels ca. 1 mm long; stamens 6, inserted at the base of perianth. **Female spikes** solitary or 2-3 together. **Female flowers**: staminodes filiform or absent. **Capsule** oblate, 2.2-2.8 cm long, 3.5-3.8 cm wide, straw-coloured, shiny. **Seeds** kidney-shaped, 2 in each loculus, 1.3-1.8 cm in diam. including all around winged.

Thailand.— Northern: Nan.

Distribution.— China.

Ecology.— Lower montane forest, open places, alt. 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering: June-August; fruiting: July-January.

Uses.— Tuber edible.

Vernacular.— มันทอก Mon kok (Lua-Nan).

Voucher specimens.— *P. Srisanga* 907, 908, 2680.

2. *Dioscorea kamoensis* Kunth

Enum. Pl. 5: 395. 1850; Prain & Burkill, Kew Bull. 1927: 236. 1927; Ding & Gilbert in Fl. China 24: 288. 2000.

Stem twining to the left, pubescent, glabrescent. Bulblets present. **Leaves** palmately compound; petioles 4-9 cm long, pubescent; leaflets 3-5, lanceolate to elliptic, 7-13 cm long, 3-5.5 cm wide, pubescent on both surfaces; base obliquely cuneate, attenuate onto the petiolule; apex acuminate; veins pinnate with prominently 3(-5)-veined at base; petiolules 1-3 mm long. **Male spikes** solitary or 2-3 together, rarely branched, up to 8 cm long; rachis pubescent. **Male flowers** green, 1.5-2.5 mm long, puberulous; lobes spreading; pedicels 0.5-1.5 mm long; stamens 3, inserted at the base of perianth. **Female spikes** solitary or paired, up to 24 cm long. **Capsule** oblong to oblanceolate, 1.5-2 cm long, pubescent.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Mukdahan.

Distribution.— Bhutan, Sikkim, Myanmar, China, Vietnam.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: July-September; fruiting: November-January.

Voucher specimens.— *P. Srisanga* 1785.

3. *Dioscorea petelotii* Prain & Burkill

Kew Bull. 1933: 240. 1933; in Fl. Gén. I.-C. 6: 717. 1933; Thapayai, Wilkin & Chayamarit, Thai For. Bull. (Bot.) 32: 160, figs. 1-3. 2004.

Stem twining to the left, pubescent, glabrescent. **Leaves** simple, alternate, ovate, 5-18 cm long, 3-11 cm wide, pubescent on both surfaces, glabrescent; base cordate to sagittate, truncate or rounded; apex acuminate; basal veins 5 or 7; petioles 2.5-10 cm long, pubescent. **Male spikes** solitary or paired, up to 20 cm long; rachis puberulous. **Male flowers** green, cup-shaped, 1.5-2.5 mm long; lobes spreading; pedicels 1-2.5 mm long; stamens 6, inserted at the base of perianth. **Female spikes** solitary, up to 18 cm long. **Female flowers**: staminodes 6, filiform. **Capsule** oblong to narrowly obovate, 3.3-5.5 cm long, 1.5-2.3 cm wide, straw-coloured, pubescent, glabrescent. **Seeds** winged at apex.

Thailand.— Northern: Chiang Mai, Nan, Uttaradit; North-eastern: Loei.

Distribution.— Vietnam (type).

Ecology.— Lower montane forest.

Phenology.— Flowering: April-May; fruiting: August-November.

Voucher specimens.— *P. Srisanga* & *S. Watthana* 635.

4. *Dioscorea wallichii* Hook.f.

In Fl. Br. Ind. 6: 295. 1892; Ding & Gilbert in Fl. China 24: 294. 2000.

Stem twining to the right, glabrous. **Leaves** simple, opposite, elliptic, ovate to suborbicular, 6-18 cm long and wide, glabrous on both surfaces; base cordate; apex acute to acuminate; basal veins 7 or 9; petioles 4-13 cm long. **Male spikes** 4-10 cm long; rachis glabrous. **Male flowers** purplish, cup-shaped, 1.5-2.5 mm long; lobes spreading; pedicels 1-2.5 mm long; stamens 6, inserted at the base of perianth. **Female spike** solitary, up to 12 cm long. **Capsule** oblate, 2.5-2.8 cm long, 4-4.5 cm wide, brown, glabrous, shiny. **Seeds** obcordate, 2 in each loculus, 1.5-2 cm in diam. including all around winged.

Thailand.— Northern: Chiang Mai, Nan, Uttaradit; North-eastern: Loei.

Distribution.— India, Bangladesh, Myanmar, China, Malaysia.

Ecology.— Lower montane forest, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering: April-May; fruiting: August-January.

Uses.— Tuber edible.

Vernacular.— มั่นตาย Mon lai (Lua-Nan).

Voucher specimens.— *P. Srisanga* 2676.

DRACAENACEAE

Monogeneric family (Bos, 1998). Description as in the genus.

DRACAENA L.

Syst. Nat. ed. 12, 2: 246. 1767; Bos in Fam. Gen. Vasc. Pl. 3: 240. 1998. – *Sansevieria* Thunb., Prodr. Fl. Cap.: 65. 1794. – *Pleomele* Salisb., Prodr. Stirp. Chap. Allerton: 245. 1796.

Trees, shrubs, sometimes scandent, unbranched suffrutices or rhizomatous geophytes, sometimes succulent, glabrous, from less than 10 cm to over 40 cm tall. Aerial stems often showing characteristic persistent leaf scars. **Leaves** alternate, distichously or spirally arranged, entire, ovate, strap-shaped or ensiform, usually amplexicaul with a sheathing base, occasionally exceeding 2 m in length, usually much shorter, sometimes variegated, the upper ones gradually to rather abruptly transformed into the inflorescence bracts. **Inflorescence** terminal, sometimes apparently axillary on leafless dwarf shoots, racemose, capitulate to paniculate; floral bracts and bracteoles often obsolescent. **Flowers** often grouped together on articulated pedicels with a longer or shorter pericladium, usually white, sometimes flushed with green or purple, fragrant, nocturnal. **Perianth** with a shorter or longer tube and 6 equal segments. **Stamens** 6, as long as the free perianth lobes and inserted at their base in the throat; filaments often inflated and spindle-shaped; anthers versatile, opening laterally. **Ovary** superior, cylindrical to bottle-shaped, 3-locular; ovule 1 in each loculus; septal nectaries present; style equalling the stamens; stigma capitulate to shallowly 3-lobed. **Fruit** a thin-walled berry, (depressed-) globose or

ellipsoid, sometimes 2- or 3-lobed, usually bright orange when ripe, containing up to 3 large seeds.

About 100 species native to the warmer regions of the Old World, odd species in Hawaii, Central America, Cuba and Macronesia. Widely introduced and established in tropical climates elsewhere (Bos, 1998). About 12 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

1. Leaves sword-shaped to linear-lanceolate, sessile or subsessile **1. *D. angustifolia***
 1. Leaves lanceolate to elliptic, distinctly petiolate **2. *D. terniflora***

1. *Dracaena angustifolia* Roxb.

Fl. Ind. ed. 2: 155. 1832; Noltie in Fl. Bhutan 3(1): 63, fig. 7: b-d. 1994; Chen & Turland in Fl. China 24: 216. 2000.

Shrub, 1.5-4 m high; stem single or few-branched. **Leaves** spaced along distal part of stem, sessile or subsessile, sword-shaped to linear-lanceolate, thinly coriaceous, 20-45 cm long, 1.5-4 cm wide; apex acuminate. **Inflorescence** in terminal panicle, 30-50 cm long; rachis glabrous. **Flowers** in clusters of 2-3, fragrant; pedicels 3-5 mm long, articulate near apex, glabrous. **Perianth** purplish white or greenish white, 1.5-2 cm long, glabrous. **Filaments** 6-8 mm long; anthers ca. 2 mm long. **Ovary** narrowly ellipsoid, 2-3 mm long; style 10-15 mm long; stigma capitate. **Berry** subglobose, sometimes 2-lobed, 8-15 mm in diam., orange-red. **Seeds** 1-2.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Bhutan, China, SE Asia, Papua New Guinea, N Australia.

Ecology.— Lower montane forest, alt. 1,400-1,700 m (Doi Phu Kha).

Phenology.— Flowering: March; fruiting: November-January.

Voucher specimens.— *P. Srisanga* 554, 2301, 2687.

2. *Dracaena terniflora* Roxb.

Fl. Ind. ed. 2: 159. 1832; Chen & Turland in Fl. China 24: 217. 2000.

Shrub, 1-2 m high; stem single or few-branched. **Leaves** spaced along distal part of stem, lanceolate to elliptic, thinly coriaceous, 13-23 cm long, 3-6.5 cm wide; apex acuminate; base attenuate onto the petiole; petioles 2-6 cm long, distinctly widened at base to form a persistent sheath concealing internode. **Inflorescence** in terminal raceme, 15-20 cm long; rachis glabrous. **Flowers** solitary or in clusters of 2-3; pedicels 3-4 mm long, articulate above the middle, glabrous. **Perianth** white, 1.5-2 cm long, glabrous. **Berry** subglobose, sometimes 2-3-lobed, 8-15 mm in diam. **Seeds** 1-3.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Bangladesh, China.

Ecology.— Dry evergreen and lower montane forest, sometimes on limestone areas, alt. 700-1,000 m (Doi Phu Kha, Sapan Waterfall, Tham Pha Khaw, Tham Pha Kong).

Phenology.— Flowering: March; fruiting: June-December.

Voucher specimens.— *P. Srisanga* 1238, 1936, 2547.

Notes.— Possibly conspecific with *D. elliptica* Thunb.

ERIOCAULACEAE

Annual or perennial herbs, mostly monoecious, usually rosulate, often tufted, rarely caulescent, with horizontal or erect rhizomes. **Leaves** simple, usually spirally arranged, rarely distichous. **Inflorescence** forming single head on thin peduncle (scape), or composed of many heads. Peduncles with a closed sheath at the base. **Heads** composed of 10- to numerous-flowered, subtended by involucre bracts. **Flowers** mostly unisexual, actinomorphic or slightly zygomorphic, 2-3-merous. **Sepals** 2-3, sometimes with basal tube or forming spathe. **Petals** 2-3 or absent, often hyaline. **Stamens** usually 2 or 3, oppositipetalous, or 4 or 6 in 2 whorls; anthers introrse, basifixed or dorsifixed, mostly 2-thecate, 4-sporangiate, dehiscing by longitudinal slits. **Ovary** superior, 2-3-locular; ovule 1 in each loculus, atropous pendulous; style terminal, branched. **Fruit** a loculicidal capsule.

An almost cosmopolitan family with 10 genera and about 700-1,400 species, best developed in S America (Stützel, 1998). One genus and about 34 species in Thailand. Only 1 species recorded from Doi Phu Kha National Park.

ERIOCAULON L.

Sp. Pl.: 87. 1753; Stützel in Fam. Gen. Vasc. Pl. 4: 204. 1998.

Mostly rosulate annual or perennial herbs. Submerged and floating species with elongated leafy stems; terrestrial species with stout, usually horizontal rhizomes. **Inflorescence** a single head or composed of 2-15 or more heads in the center of a rosette. **Flowers** unisexual, mostly 3-merous, subtended by involucre bracts. **Male flowers**: sepals free or fused to an adaxial spathe; anthophore between sepals and petals sometimes present, as long as sepals and longer than petals; petals free, with an epipetalous gland; stamens 4 or 6 in 2 whorls; filaments in the outer whorl free, in the inner whorl fused with petals up to the glands; anthers 2-thecate, 4-sporangiate. **Female flowers**: sepals free, sometimes fused to an adaxial spathe; petals free, with epipetalous glands; gynoecium with stigmas in carinal position.

About 400 species in tropical and subtropical regions (Stützel, 1998).

Eriocaulon aff. truncatum Buch.-Ham. ex Mart.

Rosulate herb. **Leaves** linear, 1.5-3 cm long, 3-4 mm wide, glabrous; apex acute. Scape 5-10 cm long, (4-)5(-6)-ribbed. **Head** straw-coloured, subglobose to hemispherical, ca. 5 mm in diam. Involucre bract broadly obovate to suborbicular, ca. 1.5 mm long, 2 mm wide, glabrous. Floral bract oblanceolate, white hairy at apex outside, subtruncate and apiculate at apex. **Female flowers** ca. 1.5 mm long; sepals 2, blackish, white hairy at apex outside; petals 3, white, sparsely white hairy at apex outside. **Ovary** 3-locular; style 3-branched.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, in damp places, alt. 900-1,000 m (Nan Watershed).

Phenology.— Flowering: October-November.

Voucher specimens.— *P. Srisanga* 313.

HYPOXIDACEAE

Perennial herbs, usually with tuberous rhizome or corm, often carrying fibrous remains of former leaves. **Leaves** basal, 1-many, rosulate, with a more or less sheathing base, sessile or with a distinct pseudopetiole, outermost leaves often reduced to cataphylls; blade linear, lanceolate to ovate, prominently parallel-veined, often V-shaped in cross-section, sometimes plicate. **Inflorescence** usually on hairy scapes, often several per plant, arising from leaf axils, spicate, racemose to corymbose or umbel-like, sometimes reduced to solitary flower. **Flowers** bisexual or rarely unisexual, actinomorphic, most often pedicellate, sometimes sessile, from the axils of small or larger and leafy bracts. **Tepals** 4 in 2 whorls of 2, or 6 in 2 whorls of 3, subequal, free or fused to form a tube, most often yellow to orange, sometimes reddish, pinkish or white. **Stamens** 4 or 6, most often uniseriate, sometimes biseriate, or only 3 and then opposite the inner tepals; filaments short to almost lacking, arising from the base of perianth segments or from the mouth of the perianth tube; anthers elongate, basifixed or dorsifixed, slightly versatile or not, opening introrsely or latrorsely by longitudinal slits, in some cases with apical appendages. **Ovary** inferior, 3-locular with axile placentation or 1-locular with 3 parietal placentation, often prolonged upwards into an epigynous beak; ovules mostly numerous; style 1, short; stigmas 3 or 6. **Fruit** a capsule with circumscissile or loculicidal dehiscence, or sometimes more or less fleshy and indehiscent or irregularly dehiscent, often beaked. **Seeds** globose to ellipsoid.

Nine genera and about 100 species, widely distributed in tropical and subtropical regions of all continents particularly of the southern hemisphere (Nordal, 1998). Three genera and about 10 species in Thailand. One genus and 2 species recorded from Doi Phu Kha National Park.

MOLINERIA Colla

Colla, Hort. Ripul. App. 2: 331. 1826; Nordal in Fam. Gen. Vasc. Pl. 3: 294. 1998.

Robust plants. Rhizome elongated. **Leaves** pseudopetiolate, sheathing at base, with a distinctly plicate lamina. **Inflorescence** in elongated raceme or densely capitate. **Flowers** bisexual or unisexual, yellow. **Tepals** 6, in 2 whorls of 3. **Stamens** 6, uniseriate; filaments short to almost lacking; anther basifixed or dorsifixed, opening introrsely. **Ovary** mostly without a beak, if present, only very short. **Fruit** baccate, covered by persistent bract.

About 5-7 species, in tropical and subtropical Asia (Nordal, 1998). About 2-3 species in Thailand.

KEY TO THE SPECIES

- | | |
|--------------------------------------|--------------------------------|
| 1. Inflorescence capitate | 1. <i>M. capitulata</i> |
| 1. Inflorescence in elongated raceme | 2. <i>M. gracilis</i> |

1. ***Molineria capitulata*** (Lour.) Herbert

Amaryll.: 84. 1837; Noltie in Fl. Bhutan 3(1): 67, fig. 7: k-n. 1994. – *Leucojum capitulatum* Lour, Fl. Cochinch.: 199. 1790. – *Curculigo capitulata* (Lour.) Kuntze, Rev. Gen. Pl. 2: 703. 1891; Geerinck in Fl. Mal. I(11): 367. 1993; Ji & Meerow in Fl. China 24: 271. 2000. – *C. recurvata* Dryand. in Aiton, Hort. Kew. ed. 2(2): 253. 1814. – *Molineria recurvata* (Dryand.) Herbert, Amaryll.: 84. 1837.

Herb, up to 1 m high. Rhizome tuberous, thick. **Leaves** 4-7, oblong-lanceolate, plicate, 40-90 cm long, 5-15 cm wide, pubescent along veins on both surfaces, glabrescent; base cuneate, attenuate onto the petiole; apex acuminate; petioles 30-80 cm long, densely tomentose. **Inflorescence** capitate, 2.5-5 cm in diam., dense-flowered, deflexed; scape 5-15 cm long, densely tomentose; bracts lanceolate, 1.5-2.5 cm long, hairy; pedicels 5-7 mm long. **Tepals** ovate, 7-9 mm long, 3-4 mm wide, obtuse at apex, hairy. **Filaments** very short; anthers linear, 5-6 mm long. **Ovary** ovoid to subglobose, 4-7 mm long, hairy; style 6-7 mm long. **Fruit** subglobose, 4-5 mm in diam., hairy. **Seeds** obovoid, ca. 1.5 mm in diam., black, with longitudinal stripes.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.

Distribution.— E Himalayas, China, SE Asia to New Guinea.

Ecology.— Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: April-June; fruiting: August-November.

Voucher specimens.— *P. Srisanga* 1446.

2. *Molineria gracilis* Kurz

In Miq., Ann. Mus. Lug.-Bat. 4: 177. 1869; Noltie in Fl. Bhutan 3(1): 68. 1994. — *Curculigo gracilis* Hook.f. in Fl. Br. Ind. 6: 278. 1892; Ji & Meerow in Fl. China 24: 272. 2000.

Herb, up to 70 cm high. Rhizome tuberous, thick. **Leaves** 4-7, oblong-lanceolate, plicate, 20-50 cm long, 5-10 cm wide, glabrous on both surfaces; base cuneate, attenuate onto the petiole; apex acuminate; petioles 7-15 cm long, glabrous. Scape 5-15 cm long, densely tomentose. **Inflorescence** in elongated raceme, 6-10 cm long, tomentose, 8-12-flowered; bracts lanceolate, 1.5-3.5 cm long, tomentose; pedicels 5-15 mm long, tomentose. **Tepals** elliptic, 7-10 mm long, 3-4 mm wide, obtuse at apex, hairy. **Filaments** ca. 2 mm long; anthers linear, 4-5 mm long. **Ovary** oblong, 10-13 mm long, tomentose; style 7-10 mm long. **Fruit** cylindrical-oblong, 1-2 cm long, hairy. **Seeds** obovoid, ca. 3 mm in diam., black, with longitudinal stripes.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, Sikkim, China, Vietnam, Cambodia.

Ecology.— Dry evergreen forest, alt. 800-900 m (Doi Phu Kha, Tham Pha Kong).

Phenology.— Flowering and fruiting: May-July.

Voucher specimens.— *P. Srisanga* 2536.

LILIACEAE

Bulbiferous or rhizomatous perennial herbs; aerial stem erect, not branching. **Leaves** simple, alternate, sometimes crowded at base of aerial stem. **Inflorescence** usually a raceme, sometimes umbelliform, or flower solitary. **Flowers** bisexual, usually actinomorphic. **Perianth** often infundibular, sometimes tubular, campanulate or cupular. **Tepals** 6, in 2 whorls of 3, free, often showy. **Stamens** 6; filaments free; anthers linear, ellipsoid to globose, dorsifixed versatile or pseudobasifixed. **Ovary** (1-)3-locular; ovules several to numerous. **Fruit** a loculicidal capsule or berry. **Seeds** often flattened, with or without a marginal wing.

Eleven genera and about 550 species, distributed in N Hemisphere, abundant in temperate Eurasia (Tamura, 1998b). One genus and about 2 native species in Thailand. One species recorded from Doi Phu Kha National Park.

LILIUM L.

Sp. Pl.: 302. 1753; Tamura in Fam. Gen. Vasc. Pl. 3: 352. 1998.

Bulbiferous perennial herbs; bulbs naked, of numerous imbricate fleshy scales. **Inflorescence** in raceme or flower solitary. **Perianth** usually infundibular, rarely tubular or cupular, sometimes recurved. **Anthers** linear to ellipsoid, dorsifixed versatile. **Ovary** 3-locular; ovules numerous; style with 3 stigmatic crests at apex. **Fruit** a loculicidal capsule. **Seeds** winged.

About 110 species in temperate regions of N Hemisphere, abundant in E Asia (Tamura, 1998b).

Lilium primulinum Baker var. ***burmanicum*** (W.W. Sm.) Stearn

Gard. Chron., ser. 3, 124: 13. 1948; Liang & Tamura in Fl. China 24: 143. 2000. – *L. nepalense* D. Don var. *burmanicum* W.W. Sm., Trans. Bot. Soc. Edinb. 28: 135. 1922.

Erect, bulbiferous perennial herbs, 1-1.5 m high; stem glabrous. **Leaves** alternate, lanceolate to narrowly elliptic, subcoriaceous, (5-)8-11 cm long, 1.2-2(-2.7) cm long, glabrous on both surfaces, 3-veined at base, sessile; apex acuminate; margin entire. **Inflorescence** in lax raceme, 4-9-flowered. **Tepals** yellow with dark red-purple blotches at base inside, oblong, revolute, 8-10 cm long, 1.3-1.7 cm wide. **Filaments** 5-5.5 cm long; anthers 1-1.3 cm long. **Ovary** cylindric, 1.5-1.8 cm long, glabrous; style 4-5 cm long. **Capsule** oblong, 3.5-5 cm long, 2-3 cm wide, brown. **Seeds** flattened 7-9 mm long, 4-5 mm wide, including wing.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— Myanmar (type), S China (Yunnan).

Ecology.— Lower montane forest, open places, alt. 1,600-1,700 m (Doi Phu Wae).

Phenology.— Flowering: July-September; Fruiting: November-December.

Vernacular.— แดงช้างเผือก Deng chang phueak (Chiang Mai).

Voucher specimens.— *P. Srisanga* 2636.

Notes.— Rare species.

MARANTACEAE

Terrestrial rhizomatous herbs, sometimes lianescent and high-climbing. **Leaves** simple, distichous, segregated into sheath, petiole, pulvinus and blade; midrib prominent; primary veins distinctly parallel. **Inflorescence** terminal or lateral, simple or a complex synflorescence; inflorescence unit (florescence) a usually spiciform or capitate thyse with distichous or spiral spathes subtending flower clusters which composed of 1-several (rarely numerous) 2-flowered cymules, rarely 1-flowered cymules, each with a prophyll on the dorsal side at base, sometimes also with a scale-like interphyll on the ventral side and 1 or 2 dorsal bracteoles. **Flowers** bisexual, zygomorphic. **Sepals** 3, not petaloid. **Petals** 3, connate and fused with androecial elements and style to form a corolla tube (floral tube). **Androecial** in 2 whorls; outer androecial whorl usually of 1 or 2 staminodes, which are usually petaloid and showy, but sometimes acicular or rudimentary; inner androecial whorl of 3 members, 1 fertile monothecic stamen which often with a petaloid appendage, 1 hood-shaped staminode (staminodium cucullatum), and 1 conspicuously firm and fleshy staminode (staminodium callosum); the inner staminodes basally fused to form a firm and fleshy staminal tube which exceeds the level where the corolla lobes separate from the corolla tube. **Ovary** inferior, 3-locular, but 2 locules often empty and compressed;

ovules 1 in each fertile loculus, basal; septa with completely sunken septal nectaries; style fused basally with the floral tube; stigmatic surface restricted to the inner side of a funnel-shaped depression in the apex of the style. **Fruit** usually a loculicidal capsule, rarely berry or caryopsis-like. **Seeds** mostly arillate.

A pantropical family with about 31 genera and 550 species, but absent from Australia, with a few members outside the tropics in S and N America (Andersson, 1998a). About 5 genera and 14 species in Thailand. Two genera and 3 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

- | | |
|---|---------------------------------|
| 1. Corolla tube half the length of lobes, rarely longer | 1. <i>Phrynium</i> |
| 1. Corolla tube at least twice the length of lobes | 2. <i>Stachyphrynium</i> |

1. *PHRYNIUM* Willd.

Sp. Pl. 1: 17. 1797, nom. cons.; Andersson in Fam. Gen. Vasc. Pl. 4: 287. 1998.

Rosulate herbs. **Inflorescence** a usually congested and richly branched synflorescence; florescences with spiral spathes; cymules 2-flowered; bracteoles absent. **Sepals** half the length of corolla tube or much longer. **Corolla** tube half the length of lobes, rarely longer. **Outer staminodes** 2, petaloid; cucullate staminode with appendage near apex. **Ovary** with 3 ovulate locules. **Fruit** dehiscent. **Seeds** arillate.

About 20 species in India and Sri Lanka eastwards to New Guinea (Andersson, 1998a). About 6 species in Thailand. Two species recorded from Doi Phu Kha National Park.

KEY TO THE SPECIES

- | | |
|---|------------------------------------|
| 1. Inflorescence sessile or subsessile. Bracts red | 1. <i>P. imbricatum</i> |
| 1. Inflorescence distinctly pedunculate. Bracts green | 2. <i>P. pedunculiferum</i> |

1. *Phrynium imbricatum* Roxb.

Fl. Ind. 1: 6. 1820; Baker in Fl. Br. Ind. 6: 259. 1892.

Herb, 1-1.7 m high. **Leaves** 3-5 in each shoot; sheath 30-50 cm long; petioles 40-70 cm long; pulvinus 3-9 cm long; blade elliptic to narrowly ovate, 25-50 cm long, 10-25 cm wide, glabrous on both surfaces; base broadly cuneate; apex shortly caudate. **Inflorescence** interfoliar, sessile or subsessile, capitata, congested, composed of 2-6 spikes; bracts 2-3.5 cm long, red, soon turning brown and withering into fibrous. **Flowers** white or creamy yellow. **Sepals** linear, ca. 10 mm long, 1 mm wide. **Corolla** tube 12-13 mm long; lobes oblong-elliptic, 6-7 mm long, ca. 3 mm wide. **Outer**

staminodes 2, unequal, larger one obovate, 4-5 mm long and wide, smaller one 4-5 mm long, 1.5-2 mm wide. **Fertile stamen** 1.5-3 mm long, with petaloid appendage. **Ovary** 3-4 mm long, glabrous. **Fruit** ellipsoid, trigonous. 12-15 mm long, 7-10 mm wide, brown, glabrous. **Seeds** 2-3, ellipsoid, 7-10 mm long, 4-6 mm wide.

Thailand.— Northern: Almost throughout; North-eastern: Loei.

Distribution.— Bangladesh (Chittagong-type), Myanmar, China, Laos, Vietnam.

Ecology.— Dry evergreen and lower montane forest, along streams, alt. 700-1,500 m (Doi Phu Kha, Tham Pha Kong).

Phenology.— Flowering and fruiting: June-November.

Uses.— Leaves for wrapping.

Vernacular.— สาคแดง Sard Daeng (Nan), ตองงู Tong Ngu (Lua-Nan).

Voucher specimens.— *P. Srisanga* 743, 1545, 2246, 2527.

2. *Phrynium pedunculiferum* D. Fang

J. Trop. Subtrop. Bot. 10: 250. 2002.

Herb, 1-1.5 m high. **Leaves** 3-5 in each shoot; sheath 30-40 cm long; petioles 20-50 cm long; pulvinus 3-6 cm long; blade oblong to elliptic, 30-50 cm long, 10-17 cm wide, glabrous on both surfaces; base broadly cuneate to obtuse; apex caudate. **Inflorescence** interfoliar, capitate, congested, composed of 4-8 spikes; peduncle 3-5 cm long; bracts 2-3 cm long, green, soon turning brown and slightly withering into fibrous. **Flowers** white or greenish white. **Sepals** linear, 10-13 mm long, ca. 2 mm wide. **Corolla** tube 3-4 mm long; lobes oblong, 9-11 mm long, 3-3.5 mm wide. **Outer staminodes** minute. **Fertile stamen** ca. 2 mm long, with petaloid appendage. **Ovary** 2-3 mm long, hairy. **Fruit** ovoid, trigonous. 9-13 mm long and wide, brown, hairy. **Seeds** 2-3, ellipsoid, 8-10 mm long, 5-7 mm wide.

Thailand.— Northern: Chiang Rai, Nan.

Distribution.— China (type), Vietnam.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: April-September.

Uses.— Leaves for wrapping.

Voucher specimens.— *P. Srisanga* 1441; *P. Srisanga* & *C. Maknoi* 2033; *P. Srisanga* & *S. Watthana* 710; *P. Srisanga et al.* 810.

2. *STACHYPHRINIUM* K. Schum.

In Pflanzenreich IV. 48: 45. 1902; Andersson in Fam. Gen. Vasc. Pl. 4: 288. 1998.

Rosulate plants. **Inflorescence** simple or a sparsely branched synflorescence; florescences coarsely spiciform; spathes distichous, persistent; cymules brachyblastic; interphyll present or absent; bracteoles absent. **Sepals** one third the length of corolla

tube or much shorter. **Corolla** tube twice the length of lobes or longer. **Outer staminodes** 2, petaloid. **Ovary** with 3 ovulate locules. **Fruit** dehiscent. **Seeds** arillate.

About 10 species in India, Sri Lanka eastwards to Indonesia (Andersson, 1998a). About 5 species in Thailand. One species recorded from Doi Phu Kha National Park.

Stachyphrynium placentarium (Lour.) Clausager & Borchs.

Kew Bull. 58(3): 672. 2003. – *Phyllodes placentaria* Lour., Fl. Cochinch.: 13. 1790. – *Phrynium parviflorum* Roxb., Fl. Ind. 1: 7. 1820; Baker in Fl. Br. Ind. 6: 259. 1892; K. Larsen, Dansk. Bot. Ark. 23(2): 178. 1965. – *P. placentarium* (Lour.) Merr., Philipp. J. Sci. 15. 230. 1919; Noltie in Fl. Bhutan 3(1): 215. 1994; Wu & Kennedy in Fl. China 24: 380. 2000.

Herb, 1-3 m high. **Leaves** 1-3 in each shoot; sheath 35-50 cm long; petioles 35-70 cm long; pulvinus 2.5-7 cm long; blade oblong-elliptic, 30-60 cm long, 10-30 cm wide, glabrous on both surfaces; base broadly cuneate; apex caudate. **Inflorescence** interfoliar, sessile or subsessile, capitate, congested, composed of several spikes; bracts 2-2.5 cm long, green to greenish yellow, spinescent at apex. **Flowers** creamy white or creamy yellow. **Sepals** linear, 3-5 mm long. **Corolla** tube 12-15 mm long; lobes elliptic, 5-6 mm long, ca. 2 mm wide. **Outer staminodes** 2, unequal, larger one obovate, 5-6 mm long and wide, smaller one 5-6 mm long, 2-3 mm wide. **Fertile stamen** ca. 1 mm long, with petaloid appendage. **Ovary** ca. 2 mm long, glabrous or puberulent at apex. **Fruit** oblong, 10-12 mm long, 4-5 mm wide, blue or violet, glabrous. **Seeds** 1, ellipsoid, 8-10 mm long, ca. 3 mm wide; aril orange.

Thailand.— Almost throughout the country.

Distribution.— India, Bhutan, China, SE Asia.

Ecology.— Dry evergreen forest, along streams, alt. 700-900 m (Doi Phu Kha, Tham Pha Kong).

Phenology.— Flowering and fruiting: June-October.

Uses.— Leaves for wrapping.

Vernacular.— สาคเขียว Sard Kheaw (Nan), ทองกาย Tong Gay (Lua-Nan).

Voucher specimens.— *P. Srisanga* 1544, 2529.

MELANTHIACEAE

Perennial herbs; underground stem usually a thick short rhizome or a bulb, rarely a corm. Roots fibrous. Aerial stem erect, simple, stout to slender, with foliage or scaly leaves, sometimes basally thickened, sometimes with fibrous leaf sheaths at the base. **Leaves** all cauline, or with large basal and small cauline leaves, or all leaves in a basal rosette, spirally arranged, bifacial, deciduous or evergreen, sometimes sheathing. **Inflorescence** often a raceme, sometimes a panicle, a spike, or umbel-like. **Flowers** bisexual, andromonoecious, polygamous, gynodioecious, androdioecious, or

dioecious, 3-merous, usually actinomorphic, funnel-shaped, cup-shaped to opening flat, bracteate or ebracteate, without bracteoles. **Tepals** 6, in 2 whorls of 3, generally with similar whorls, petaloid, free or connate in lower part, persistent, marcescent or caducous; nectaries when present perigonal. **Stamens** 6, free or inserted at the tepal base; filaments filiform to subulate; anthers dorsifixed or basifixed, dehiscent with slits or valves, extrorse, with distinct or confluent thecae. **Ovary** superior, rarely inferior or half-inferior, 3-carpellate, with the carpels connate only in lower part to fully syncarpous, provided with 3 ventrally stigmatic; ovules 2-numerous in each carpel. **Capsule** narrowly ellipsoidal, conical to globular, obovoid, often 3-lobed, septicidal, loculicidal or ventricidal. **Seeds** linear to ellipsoid.

Twelve genera and about 97 species, distributed mostly in temperate regions of N Hemisphere (Tamura, 1998c). Only 1 species in Thailand.

VERATRUM L.

Sp. Pl.: 1044. 1753; Tamura in Fam. Gen. Vasc. Pl. 3: 377. 1998.

Rhizomatous perennial herbs. Aerial stem erect, stout, basally thickened. **Leaves** spiral, only cauline or both basal and cauline, linear to broadly elliptic, plicately nerved, sheathing. **Inflorescence** in terminal panical, pubescent. **Flowers** funnel-shaped, cup-shaped to opening flat, white, yellowish, green, or dark purple-brown, andromonoecious or polygamous, actinomorphic. Bracts lanceolate to ovate. **Tepals** free or rarely connate at base, multinerved, marcescent, often without nectar glands, sometimes with glands at the base. **Stamens** inserted at the tepal base; anthers cordate-orbicular, dehiscent by valves, extrorse, with confluent thecae. **Ovary** superior to inferior, syncarpous except for the shortly papillose styluli; ovules 16-85 in each carpel. **Capsule** ventricidal. **Seeds** ellipsoid, flat, broadly winged.

About 50 species in temperate regions of N Hemisphere (Tamura, 1998c).

Veratrum mengtzeanum O. Loes.

Verh. Bot. Vereins Prov. Brandenburg 68: 145. 1926; Chen & Takahashi in Fl. China 24: 85. 2000; Tanaka, Acta Phytotax. Geobot. 51(2): 134, figs. 1-3. 2001. – *V. chiengdaoense* K. Larsen, Bot. Tidsskr. 56: 346. 1961.

Erect herb; stem up to 1 m high including inflorescence, villous. **Leaves** with both basal and cauline, oblong-lanceolate, 30-70 cm long including sheath, 1.5-4 cm wide, becoming smaller upwards, glabrous on both surfaces; apex acute to acuminate; margin entire. **Inflorescence** up to 50 cm long, villous. **Flowers** andromonoecious, green; bracts lanceolate, villous; pedicels 3-13 mm long, villous. **Tepals** elliptic, ovate to obovate, clawed at base, 6-10 mm long, 3-5 mm wide, with two nectaries below the middle, glabrous except sparsely villous at base outside, acute to obtuse at apex, persistent. **Stamens** inserted at the tepal base; filaments filiform, 2-3 mm long, glabrous; anthers suborbicular. **Ovary** superior, trigonous, 2-3 mm long, glabrous; styles 3, recurved. **Capsule** oblong, 3-lobed, (1-)1.5-2.5 cm long, 0.8-1.4 cm wide, glabrous. **Seeds** 10-13 mm long, 3-4 mm wide, including wing (Fig. 158).

Thailand.— Northern: Chiang Mai (type of *V. chiengdaoense*), Nan.

Distribution.— S China (Yunnan-type).

Ecology.— Lower montane scrub, open areas among grasses on limestone bedrock, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering: July-November; fruiting: November-January.

Voucher specimens.— *P. Srisanga* 1857, 2128; *P. Srisanga et al.* 884; *P. Suksathan* 1796.

Notes.— Rare species. In Thailand only known from two localities.

MUSACEAE

Mostly tall and robust, suckering or monocarpic herbs with gigantic leaves. Stem massive, corm-like; leaf sheaths forming pseudostem around scape; lateral buds absent or leaf-opposed. **Leaves** simple, alternate, spirally arranged, differentiated into sheath, petiole and blade; sheath without distinct ligule; blade entire but often split due to wind action; midrib prominent; primary veins closely parallel. **Inflorescence** a terminal thyrse, bearing cincinnate flower clusters in axils of spathaceous bracts on an indeterminate main axis. **Flowers** functionally unisexual with male flowers in distal part of inflorescence and female ones in proximal part, rarely bisexual flowers in proximal part, zygomorphic, ebracteate. **Perianth** 6, petaloid; 3 outer tepals fused mutually with 2 inner tepals into 5-dentate or 5-lobate lamina; adaxial inner tepal free, small. **Stamens** usually 5, the missing stamen then mostly staminodial, or occasionally 6; filaments free, narrow and filiform; anthers basifixed, elongate, 2-thecate, 4-sporangiate, dehiscing by longitudinal slits. **Ovary** inferior, 3-locular, axile placentation; ovules numerous, anatropous; style 1, filiform, often dilated distally. **Fruit** a baccate. **Seeds** operculate, exarillate.

Two genera: *Musa* L. with about 30-40 species in tropical Asia from the Himalayas and S China to SE Asia and N Australia and *Ensete* Horan. with 6 species, three in tropical Africa and three in tropical Asia from NE India, S China to SE Asia and New Guinea (Andersson, 1998b). Two genera and about 17 species in Thailand. One genus and 2 species recorded from Doi Phu Kha National Park.

MUSA L.

Sp. Pl.: 1043. 1753; Andersson in Fam. Gen. Vasc. Pl. 4: 300. 1998. – *Musella* (Franch.) C.Y. Wu ex H.W. Li, Acta Phytotax. Sin. 16(3): 57. 1978.

Suckering herbs, often growing in dense clumps; lateral buds leaf-opposed. **Inflorescence** erect or pendent; spathaceous bracts caducous, shiny, waxy or glaucous, often brightly coloured; flowers and bracts separately inserted on axis. **Flowers** of proximal cymes usually functionally female. **Perianth** composed of outer 5-toothed lamina tepal and inner one free entire tepal.

Musa L. (Banana) is very important economic food plant and also for fibre, packaging, local medicines and garden ornamentals. About 15 species in Thailand.

ORCHIDACEAE

There are about 788 genera and 18,500 species worldwide (Mabberley, 1997), not included hybrids. About 178 genera and 1,133 species in Thailand (Thaithong, 1999). At least 32 genera and 51 species (2 unidentified to genera) recorded from Doi Phu Kha National Park.

Annotated Checklist of Orchids

The following checklist includes Orchids collected from this study between 1998 and 2003. The genera are arranged alphabetically as well as for the species within the genera. Identification uses Seidenfaden (1975a, 1975b, 1976, 1977, 1978a, 1978b, 1979, 1982, 1986, 1988, 1995, 1997), for Apostasioideae uses Larsen & de Vogel (1972). Voucher specimens were also compared with the materials deposited at QBG.

Annotations accompanying each taxon are arranged in the following sequence: Scientific names. Occurrence in Thailand. Distribution. Ecological information in Doi Phu Kha National Park. Phenology. Vernacular (if applicable). Voucher specimens. References.

Acanthephippium striatum Lindl.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan.

Distribution.— Nepal (type), India, Bhutan, Sikkim, Vietnam, Malaysia, Indonesia.

Ecology.— Terrestrial, Lower montane forest, alt. 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering: March-May.

Vernacular.— เข็ยอกน้ำคอย Yueak nam doi (Northern).

Voucher specimens.— *P. Srisanga* 1408.

References.— Seidenfaden (1986).

Anoectochilus siamensis Schltr.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Phitsanulok.

Distribution.— Endemic to Thailand.

Ecology.— Terrestrial, Lower montane forest, sometimes by streams, alt. 1,400-1,800 m (Doi Phu Kha).

Phenology.— Flowering: October-November.

Vernacular.— ว่านโพนนา Wan mai na (Chiang Rai).

Voucher specimens.— *P. Srisanga* 1148, 2292.

References.— Seidenfaden (1978a).

Anoectochilus sp.

Thailand.— Northern: Nan.

Ecology.— Terrestrial, Lower montane forest, alt. 1,700 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 1991.

Anthogonium gracile Wall. ex Lindl.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan; North-eastern: Loei; Eastern: Nakhon Ratchasima.

Distribution.— Nepal (type), India, Bhutan, Sikkim, Myanmar, China, Laos, Vietnam.

Ecology.— Terrestrial, Lower montane forest, open places among grasses, alt. 1,700-1,800 m (Doi Phu Kha).

Phenology.— Flowering: September-November.

Vernacular.— ว่านพร้าว Wan phroa (Chiang Mai).

Voucher specimens.— *P. Srisanga* 289, 1146.

References.— Seidenfaden (1986).

Apostasia odorata Bl.

Thailand.— Northern: Nan; Peninsular: Songkhla, Surat Thani.

Distribution.— India (Assam), S China (Yunnan), Vietnam, Malaysia, Indonesia (Java-type), Borneo.

Ecology.— Terrestrial, Dry evergreen forest, by streams, alt. 850 m (Sapan Waterfall).

Phenology.— Flowering: June-July.

Vernacular.— ตานโมย Tan moi (General).

Voucher specimens.— *P. Srisanga* 1952.

References.— Larsen & de Vogel (1972).

Aphyllorchis caudata Rolfe ex Downie

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— S China.

Ecology.— Saprophyte, Lower montane forest, alt. 1,300-1,400 m (Doi Phu Kha).

Phenology.— Flowering: October-November.

Voucher specimens.— *P. Srisanga* s.n.

References.— Seidenfaden (1978a).

Arundina graminifolia (D. Don) Hochr.

Thailand.— Almost throughout the country.

Distribution.— S China.

Ecology.— Terrestrial, Lower montane forest, open places by roadsides, alt. 1,300-1,600 m (Doi Phu Kha).

Phenology.— Flowering: August-November.

Vernacular.— เอื้องดินใบไผ่ Ueang din bai phai (Northern).

Voucher specimens.— *P. Srisanga* s.n.

References.— Seidenfaden (1986).

***Bulbophyllum bisetum* Lindl.**

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Phitsanulok; North-eastern: Loei.

Distribution.— India (Assam-type), Sikkim.

Ecology.— Epiphyte, Lower montane forest, alt. 1,800 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 1538.

References.— Seidenfaden (1979).

***Bulbophyllum* sp.**

Thailand.— Northern: Nan.

Ecology.— Epiphyte, Lower montane forest, alt. 1,300-1,400 m (Doi Phu Wae).

Phenology.— Flowering: February-March.

Voucher specimens.— *P. Srisanga et al.* 2440.

***Calanthe ceciliae* Rchb.f.**

Thailand.— Northern: Nan; Peninsular: Phangnga.

Distribution.— Malaysia, Indonesia (Sumatra, Java).

Ecology.— Terrestrial, Dry evergreen forest, moist places, alt. 800-900 m (Sapan Waterfall).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 1956.

References.— Seidenfaden (1975a).

***Calanthe* sp.**

Thailand.— Northern: Nan.

Ecology.— Terrestrial, Lower montane forest, by streams, alt. 1,200-1,300 m (Doi Phu Kha).

Phenology.— Flowering: September-October.

Voucher specimens.— *P. Srisanga* 1654.

Cheirostylis griffithii Lindl.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan (Fig 159).
 Distribution.— India (Assam-type), Bhutan, W Pakistan, Myanmar.
 Ecology.— Terrestrial, Lower montane forest, alt. 1,700-1,800 m (Doi Phu Kha).
 Phenology.— Flowering: January-March.
 Voucher specimens.— *P. Srisanga* 465.
 References.— Seidenfaden (1978a).

Cheirostylis pusilla Lindl.

Thailand.— Northern: Nan; North-eastern: Loei; South-eastern: Chanthaburi, Trat; Peninsular: Trang.
 Distribution.— India (type).
 Ecology.— Dry evergreen forest, creeping on rocks by streams, alt. 700-800 m (Doi Phu Kha).
 Phenology.— Flowering: August-September.
 Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2090.
 References.— Seidenfaden (1978a).

Coelogyne fimbriata Lindl.

Thailand.— Northern: Chiang Mai, Nan; Eastern: Nakhon Ratchasima.
 Distribution.— India, China, Laos, Cambodia, Vietnam, Malaysia.
 Ecology.— Epiphyte, Lower montane forest, alt. 1,100-1,200 m (Doi Phu Kha).
 Phenology.— Flowering: October-November.
 Vernacular.— เอื้องกางเขน Ueang kang khen (General).
 Voucher specimens.— *P. Srisanga* 2232.
 References.— Seidenfaden (1975b).

Coelogyne flavida Wall. ex Lindl.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Phitsanulok, Tak; Eastern: Chaiyaphum.
 Distribution.— Nepal, India, Sikkim, Myanmar.
 Ecology.— Epiphyte, Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).
 Phenology.— Flowering: June-July.
 Vernacular.— เอื้องเทียนหนู Ueang thian nu (General).
 Voucher specimens.— *P. Srisanga et al.* 821.
 References.— Seidenfaden (1975b).

***Coelogyne fuscescens* Lindl.**

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei.
 Distribution.— India, Nepal, Bhutan, Sikkim, Myanmar, Laos, Vietnam.
 Ecology.— Epiphyte, Lower montane forest, alt. 1,500-1,600 m (Doi Phu Kha).
 Phenology.— Flowering: October-November.
 Vernacular.— เอื้องเทียนสีส้ม Ueang thian si som (General).
 Voucher specimens.— *P. Srisanga* 355, 1791.
 References.— Seidenfaden (1975b).

***Coelogyne* sp.**

Thailand.— Northern: Nan.
 Ecology.— Epiphyte, Lower montane forest, alt. 1,500 m (Doi Phu Kha).
 Phenology.— Flowering: August-September.
 Voucher specimens.— *P. Srisanga* 355.

***Cyrtosia nana* (Rolfe ex Downie) Garay**

Thailand.— Northern: Chiang Mai (type), Nan; South-western: Kanchanaburi (Fig. 160).
 Distribution.— Endemic to Thailand.
 Ecology.— Saprophyte, Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).
 Phenology.— Flowering and fruiting: May-July.
 Voucher specimens.— *P. Srisanga* 744, 1426, 1792; *P. Srisanga et al.* 832.
 References.— Seidenfaden (1978a, 1995).

***Dienia ophrydis* (Koen.) Ormerod & Seidenf. [*Malaxis latifolia* J.E. Sm.]**

Thailand.— Almost throughout the country.
 Distribution.— E Himalayas, China, Japan, SE Asia, Australia.
 Ecology.— Terrestrial, Lower montane forest, sometimes on limestone rocks, alt. 1,000-1,400 m (Doi Phu Kha, Tham Pha Khaw).
 Phenology.— Flowering: June-August.
 Vernacular.— สิขุหลด Si khun khon (General).
 Voucher specimens.— *P. Srisanga* 940. 1925.
 References.— Seidenfaden (1978b, 1997).

***Eria muscicola* (Lindl.) Lindl.**

Thailand.— Almost throughout the country.
 Ecology.— Epiphyte, Lower montane forest, alt. 1,400-1,500 m (Doi Phu Wae).
 Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga et al.* 849.

References.— Seidenfaden (1982).

***Eria* sp.**

Thailand.— Northern: Nan.

Ecology.— Epiphyte, Lower montane forest, alt. 1,300 m (Doi Phu Wae).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga et al.* 853.

***Goodyera fumata* Thw.**

Thailand.— Northern: Chiang Mai, Nan, Tak.

Distribution.— Sri Lanka, Sikkim, S China (Yunnan), Vietnam (Tonkin), Taiwan, Japan (Ryukyu Is.), Indonesia (Java), Philippines.

Ecology.— Terrestrial, Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: March.

Voucher specimens.— *P. Srisanga* 543.

References.— Seidenfaden (1978a).

***Goodyera procera* (Ker-Gawl.) Hook.**

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Phetchabun; South-western: Kanchanaburi.

Distribution.— E Himalayas, Sri Lanka, China, Japan, SE Asia.

Ecology.— Terrestrial, Dry evergreen forest, moist places by falls, alt. 900-1,000 m (Thon Tong Waterfall).

Phenology.— Flowering: March-April.

Voucher specimens.— *P. Srisanga* 590.

References.— Seidenfaden (1978a).

***Habenaria corymbosa* Parish & Rchb.**

Thailand.— Northern: Chiang Mai, Lampang, Nan, Tak; North-eastern: Loei; South-western: Kanchanaburi.

Distribution.— Myanmar (type).

Ecology.— Terrestrial, Lower montane forest, alt. 1,300-1,500 m (Doi Phu Kha).

Phenology.— Flowering: December-February.

Vernacular — เอื้องดอกกุ่ม Ueang dok chum (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1299, 2334.

References.— Seidenfaden (1977).

***Habenaria dentata* (Sw.) Schltr.**

Thailand.— Almost throughout the country.

Distribution.— E Himalayas, Myanmar, China, Laos, Cambodia, Vietnam, Japan.

Ecology.— Terrestrial, Lower montane scrub, on limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering: October-November.

Vernacular.— เอื้องข้าวตอก Ueang khao tok (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1869.

References.— Seidenfaden (1977).

***Habenaria limprichtii* Schltr.**

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— S China (Yunnan-type).

Ecology.— Terrestrial, Lower montane scrub, on limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering: June-September.

Vernacular.— อ้าปากฝอยเชียงดาว Ua pak foi Chiang Dao (Northern).

Voucher specimens.— *P. Srisanga et al.* 871.

References.— Seidenfaden (1977).

***Habenaria rhodocheila* Hance**

Thailand.— Northern: Chiang Mai, Lampang, Nan, Tak; North-eastern: Loei; South-western: Kanchanaburi.

Distribution.— China (type), Laos, Vietnam, Malaysia, Philippines.

Ecology.— Terrestrial, Dry evergreen forest, by streams, alt. 800 m (Sapan Waterfall).

Phenology.— Flowering: July-September.

Vernacular.— ลินมังกร Lin mangkon (General).

Voucher specimens.— *P. Srisanga* 1585.

References.— Seidenfaden (1977).

***Habenaria* sp.**

Thailand.— Northern: Nan.

Ecology.— Terrestrial, Lower montane forest, alt. 1,400 m (Doi Phu Wae).

Phenology.— Flowering: July.

Voucher specimens.— *P. Srisanga et al.* 851.

Herminium lanceum (Thub. ex Sw.) Vuijk

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan.

Distribution.— E Himalayas, S China, Korea, Japan, Malaysia, Indonesia, Philippines.

Ecology.— Terrestrial, Lower montane scrub, open places among grasses on limestone rocks, alt. 1,700-1,800 m (Doi Phu Wae).

Phenology.— Flowering: June-August.

Vernacular — เอื้องม่วง Ueang muang (Chiang Mai).

Voucher specimens.— *P. Srisanga et al.* 881.

References.— Seidenfaden (1977).

Herpysma longicaulis Lindl.

Thailand.— Northern: Chiang Mai, Nan, Phitsanulok; North-eastern: Loei; South-western: Kanchanaburi (Fig. 161).

Distribution.— India (Assam), Nepal (type), Sikkim, S China (Yunnan), Vietnam, Indonesia (Sumatra).

Ecology.— Terrestrial, Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: December-February.

Voucher specimens.— *P. Srisanga* 2352.

References.— Seidenfaden (1978a).

Liparis viridiflora (Bl.) Lindl.

Thailand.— Almost throughout the country.

Distribution.— Sri Lanka, E Himalayas, S China, SE Asia.

Ecology.— Epiphyte, Dry evergreen and lower montane forest, alt. 900-1,100 m (Doi Phu Kha, Nan Watershed).

Phenology.— Flowering: October-December.

Vernacular.— เอื้องดอกหญ้า Ueang dok ya (General).

Voucher specimens.— *P. Srisanga* 308.

References.— Seidenfaden (1976).

Liparis wrayii Hook.f.

Thailand.— Northern: Chiang Mai, Nan; South-western: Prachuap Khiri Khan; Peninsular: Krabi.

Distribution.— Myanmar, Malaysia (type), Indonesia.

Ecology.— Terrestrial, Dry evergreen forest, in moist places, alt. 800 m (Doi Phu Kha, Tham Pha Kong).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 2542.

References.— Seidenfaden (1976).

***Malaxis acuminata* D. Don**

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan; South-western: Prachuap Khiri Khan; Peninsular: Krabi.

Distribution.— E Himalayas, S China, SE Asia.

Ecology.— Terrestrial, Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: May-July.

Voucher specimens.— *P. Srisanga* 1427.

References.— Seidenfaden (1978b).

***Panisea uniflora* (Lindl.) Lindl.**

Thailand.— Almost throughout the country.

Distribution.— India, Nepal (type), Bhutan, Sikkim, Myanmar, Laos, Vietnam, Cambodia.

Ecology.— Epiphyte, Dry evergreen forest, by streams, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering: February-April.

Vernacular — เอื้องรกรอง Ueang rung rong (General).

Voucher specimens.— *P. Srisanga* 1342.

References.— Seidenfaden (1986).

***Peristylus gracilis* Bl.**

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Malaysia, Indonesia (Java-type).

Ecology.— Terrestrial, Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: July-September.

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 1998.

References.— Seidenfaden (1977).

***Peristylus* sp.**

Thailand.— Northern: Nan.

Ecology.— Terrestrial, Lower montane forest, alt. 1,800 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 1494.

***Phaius flavus* (Bl.) Lindl.**

Thailand.— Northern: Chiang Mai, Nan, Phitsanulok; North-eastern: Loei.

Distribution.— India, Nepal, Bhutan, Sikkim, China, Japan, Laos, Vietnam, Malaysia, Indonesia (Java-type), Philippines.

Ecology.— Terrestrial, Lower montane forest, alt. 1,500-1,600 m (Doi Phu Kha).

Phenology.— Flowering: January-February.
 Vernacular.— เอื้องพร้าวดอกเหลือง Ueang phrao dok lueang (Northern).
 Voucher specimens.— *P. Srisanga* 2691.
 References.— Seidenfaden (1986).

***Phaius* sp.**

Thailand.— Northern: Nan.
 Ecology.— Terrestrial, Dry evergreen forest, by streams, alt. 700-800 m (Doi Phu Kha, Huay Pong).
 Phenology.— Flowering: August-September.
 Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2067.

***Pholidota articulata* Lindl.**

Thailand.— Almost throughout the country.
 Distribution.— E Himalayas, S China, SE Asia.
 Ecology.— Epiphyte, Lower montane forest, alt. 1,400-1,600 m (Doi Phu Kha).
 Phenology.— Flowering: April-June.
 Vernacular.— เอื้องลำต้อ Ueang lam to (General).
 Voucher specimens.— *P. Srisanga* 1414.
 References.— Seidenfaden (1986).

***Pholidota recurva* Lindl.**

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Tak, Phitsanulok;
 North-eastern: Loei; Eastern: Chaiyaphum, Nakhon Ratchasima.
 Distribution.— Nepal (type), Bhutan, Sikkim, Vietnam.
 Ecology.— Epiphyte, Lower montane forest, alt. 1,000-1,200 m (Doi Phu Kha, Tham Pha Khaw).
 Phenology.— Flowering: June-August.
 Vernacular.— เอื้องต่อคำเหลี่ยม Ueang to lam liam (General).
 Voucher specimens.— *P. Srisanga* 1930.
 References.— Seidenfaden (1986).

***Pleione praecox* (J.E. Sm.) D. Don**

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan; North-eastern: Loei (Fig. 162).
 Distribution.— E Himalayas, Myanmar, China.
 Ecology.— Epiphyte, Lower montane forest, alt. 1,500-1,800 m (Doi Phu Kha).
 Phenology.— Flowering: August-November.
 Vernacular.— เอื้องพลาชมพู Ueang plai chomphu (Loei).

Voucher specimens.— *P. Srisanga* 1160.

References.— Seidenfaden (1986).

***Plocoglottis bokorensis* (Gagnep.) Seidenf.**

Thailand.— Northern: Nan; Eastern: Nakhon Ratchasima; South-eastern: Trat.

Distribution.— Cambodia (type).

Ecology.— Terrestrial, Dry evergreen forest, moist places, alt. 800 m (Sapan Waterfall).

Phenology.— Flowering: June-July.

Vernacular.— เอื้องขาวค Ueang khuat (General).

Voucher specimens.— *P. Srisanga* 2584.

References.— Seidenfaden (1986).

***Polystachya concreta* (Jacq.) Garay & Sweet**

Thailand.— Almost throughout the country.

Distribution.— E Himalayas, Sri Lanka, SE Asia.

Ecology.— Epiphyte, Lower montane forest, alt. 1,300 m (Doi Phu Wae).

Phenology.— Flowering: June-July.

Vernacular.— เอื้องคางอ้ม Ueang khang om (General).

Voucher specimens.— *P. Srisanga et al.* 852.

References.— Seidenfaden (1988).

***Porpax ustulata* (Par. & Rchb.f.) Rolfe**

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan, Tak; South-eastern: Trat; Central: Nakhon Nayok; South-western: Kanchanaburi.

Distribution.— Myanmar (type), S China (Yunnan).

Ecology.— Epiphyte, Dry evergreen and lower montane forest, moist places, alt. 900-1,100 m (Doi Phu Kha, Tham Pha Khaw).

Phenology.— Flowering: June-July.

Vernacular.— เอื้องรังนก Ueang rang nok (General).

Voucher specimens.— *P. Srisanga* 2561.

References.— Seidenfaden (1986).

***Rhomboda moulmeinensis* (Par. & Rchb.) Ormerod**

Thailand.— Northern: Chiang Mai, Nan; Eastern: Nakhon Ratchasima.

Distribution.— Myanmar, S China (Yunnan).

Ecology.— Terrestrial, Lower montane forest, in shaded, alt. 1,600 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga & C. Maknoi* 2031.

***Tainia viridifusca* (Hook.) Benth. & Hook.f.**

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Phitsanulok; North-eastern: Loei.

Distribution.— India (Assam-type), Myanmar, S China (Yunnan), Vietnam.

Ecology.— Terrestrial, Lower montane forest, alt. 1,500 m (Doi Phu Kha).

Phenology.— Flowering: January-February.

Vernacular.— เอื้องสีลา Ueang sila (General).

Voucher specimens.— *P. Srisanga* 2691.

References.— Seidenfaden (1986).

***Tropidia angulosa* (Lindl.) Bl.**

Thailand.— Almost throughout the country.

Distribution.— India (Assam-type), Sikkim, Myanmar, Malaysia, Indonesia (Java, Sumatra).

Ecology.— Terrestrial, Lower montane forest, alt. 1,500-1,700 m (Doi Phu Kha).

Phenology.— Flowering: March-June.

Voucher specimens.— *P. Srisanga* 500, 1434.

References.— Seidenfaden (1978a).

***Thunia alba* (Lindl.) Rchb.f.**

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan, Tak, Phitsanulok; South-eastern: Chanthaburi; Peninsular: Satun (Fig. 163).

Distribution.— Nepal, India (type), Bhutan, Sikkim, Myanmar, S China (Yunnan), Malaysia.

Ecology.— Epiphyte and terrestrial, Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: June-August.

Vernacular.— เอื้องงาช้าง Ueang nga chang (Chiang Mai), ช้างงาเดียว Chang nga deao (General).

Voucher specimens.— *P. Srisanga et al.* 778.

References.— Seidenfaden (1986).

***Vanilla siamensis* Rolfe ex Downie**

Thailand.— Northern: Chiang Mai (type), Nan; South-eastern: Chanthaburi.

Distribution.— Endemic to Thailand.

Ecology.— Climber, Dry evergreen forest, by streams and moist places, alt. 700-800 m (Doi Phu Kha, Tham Pha Kong).

Phenology.— Flowering: April-July.

Vernacular.— เขาทิวน Khao Thien (Nan).

Voucher specimens.— *P. Srisanga* 2512.

References.— Seidenfaden (1978a).

Unidentified 1

Thailand.— Northern: Nan.

Ecology.— Terrestrial, Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga et al.* 825.

Unidentified 2

Thailand.— Northern: Nan.

Ecology.— Terrestrial, Lower montane forest, in shaded, alt. 1,700 m (Doi Phu Kha).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga & C. Maknoi* 1996.

PANDANACEAE

Trees, shrubs or woody climbers, dioecious; stems usually sympodially branched, annulate with leaf scars; stilt roots usually present, sometimes branched and divaricate. **Leaves** simple, spirally arranged, 3-4-ranked, linear, ensiform, entire, but with armed along margin and on the midrib beneath. **Inflorescence** terminal, sometimes axillary, spikes or head-like, simple or compound. **Flowers** unisexual, small, numerous. **Perianth** absent. **Stamens** numerous; anthers dehiscing by longitudinal slits. **Carpels** numerous; ovules 1-several in each carpel. **Fruit** a drupe or berry.

Three genera and about 800-900 species in tropical Old World (Stone et al., 1998). Two genera and about 26 species in Thailand. One species recorded from Doi Phu Kha National Park.

PANDANUS Parkinson

J. Voy. South Seas: 46. 1773; Stone in Fl. C.L.V. 20: 13. 1983; Stone, Huynh and Poppendieck in Fam. Gen. Vasc. Pl. 3: 402. 1998.

Trees or shrubs; stilt roots usually present. **Leaves** in 3-ranked. **Ovule** 1 in each carpel. **Fruit** monodrupe or polydrupe (phalange).

About 700 species in tropical Old World (Stone et al., 1998). About 24 native or naturalized species in Thailand.

***Pandanus* sp.**

Tree, ca. 4 m high. **Leaves** up to 3 m long, 4-5 cm wide, armed along margin and on the midrib beneath, no additional lines of arms present on lower surface. **Flowers and fruits** not known.

Thailand.— Northern: Nan.

Ecology.— Dry evergreen forest, alt. 800-900 m (Doi Phu Kha).

Vernacular.— เตี้ย Toei (Lua-Nan).

Voucher specimens.— *P. Srisanga* 2727.

Notes.— This species belongs to section *Pandanus* of which closely to *P. tectorius* Sol. ex Parkinson. Due to insufficient materials, the affinity is uncertain.

POACEAE (GRAMINEAE)

There are about 668 genera and 9,500 species worldwide (Mabberley, 1997). About 100 genera and 600 species in Thailand. Twenty-one genera and 30 species recorded from Doi Phu Kha National Park (Table 12).

Annotated Checklist of Grasses

The following checklist includes Grasses collected from this study between 1998 and 2003. The genera are arranged alphabetically as well as for the species within the genera. Voucher specimens were also compared with the materials deposited at QBG.

Table 12. Checklist of Poaceae of Doi Phu Kha National Park.

Scientific names	Vernacular	Ecology	Elevation (m)	Voucher specimens
<i>Alloterpis cymicina</i> (L.) Stapf		DEF, LMF	600-1,600	PS 326, 2259; PS et al. 774
<i>Apluda mutica</i> L.	Ya phai	LMS, open places	1,600-1,800	PS 430
<i>Arthraxon lanceolatus</i> (Roxb.) Hochst.	Ya yung daeng	LMS, open places	1,600-1,800	PS 431, 1861, 1868
<i>Arthraxon lanceifolius</i> (Trin.) Hochst.	Ya yung daeng	LMS, open places	1,500-1,700	PS 1862, 2149
<i>Arthraxon</i> sp.		LMS, open places	1,700	PS 2655
<i>Arundinella nepalensis</i> Trin.		LMS, open places	1,600-1,800	PS 433
<i>Chrysopogon</i> sp.		LMS, open places	1,700-1,800	PS 432, 1874
<i>Cyrtococcum accrescens</i> (Trin.) Stapf		DEF, LMF	600-1,200	PS 325, 2313
<i>Eragrostis unioides</i> (Retz.) Nees ex Steud.	Ya khai pu	DEF, LMF	900-1,500	PS 314, 2619; W. Nanakorn 8289
<i>Eragrostis</i> sp.		DEF	900	PS 2620
<i>Eulalia</i> sp.		DDF	400-500	PS 2282
<i>Hyparrhenia rufa</i> (Nees) Stapf	Ya saeng kham	DEF	900	PS 2622
<i>Isachne albens</i> Trin.		LMF	1,500	PS 1903
<i>Microstegium</i> sp.		LMS, open places	1,600-1,800	PS 1866
<i>Oplismenus burmannii</i> (Retz.) P. Beauv.		DEF	600-700	PS 327
<i>Oplismenus compositus</i> (L.) P. Beauv.	Ya khai maeng da	LMF, by streams, Pine plantation	1,100-1,500	PS 1908, 2231, 2712
<i>Panicum notatum</i> Retz.	Ya khai hao luang	LMF	1,300-1,500	PS 2264
<i>Panicum sarmentosum</i> Roxb.	Ya khai hao	LMF	1,300-1,500	PS 536

(continued)

Scientific names	Vernacular	Ecology	Elevation (m)	Voucher specimens
<i>Panicum</i> sp.		LMF	1,300	PS 2713
<i>Paspalum conjugatum</i> Berg	Ya hep	Pine plantation	1,300-1,400	PS et al. 753
<i>Pogonatherum crinitum</i> (Thunb.) Kunth	Ya yung	DDF	400-500	PS 2289
<i>Pogonatherum</i> sp.		LMF	1,200-1,300	PS et al. 2448
<i>Saccharum arundinaceum</i> Retz.	Khaem, Pong	LMF, open places	1,500-1,800	PS 1783, 1907, 2693; PS et al. 749
<i>Saccharum spontaneum</i> L.	Khaem dok khao, Lao	DDF, by streams	400-500	PS 2283
<i>Sacciolepis indica</i> (L.) Chase		LMF, by streams	1,100-1,200	PS 2201
<i>Setaria pallide-fusca</i> (Schum.) Stapf & C.E. Hubb.	Ya hang ma khao	Pine plantation	1,300-1,400	PS et al. 751, 776
<i>Setaria palmifolia</i> (Koen.) Stapf	Ya kap phai	LMF, by streams	1,100-1,200	PS 2209
<i>Themeda villosa</i> (Poir.) A. Camus	Ya faek thuean	LMF	1,300-1,400	PS 397
<i>Thysanolaena latifolia</i> (Roxb.) Honda	Tong kong	LMF, roadsides	1,000-1,600	PS 2381
<i>Zoysia matrella</i> (L.) Merr.	Ya nuan noi	DEF	900-1,000	PS 318

SMILACACEAE

Climbers or rarely shrubs or perennial herbs, sometimes spiny; rhizomes with fibrous roots. **Leaves** mostly alternate, rarely opposite or verticillate, entire; main veins prominent, 3-7 from the base; venation distinctly reticulate, petiolate, mostly with paired tendrils from the petioles. **Inflorescence** axillary or terminal, simple or compound racemes, spikes or umbels. **Flowers** bisexual or unisexual, erect, actinomorphic; pedicels subtended by small scales; **Tepals** 6, in 2 whorls of 3, free or connate to form a tube. **Stamens** (3-)6(-18); filaments free or connate; anthers basifixed, latrorse to introrse, dehiscing by longitudinal slits. **Ovary** superior, 1- or 3-locular, with basal or axile placentation; styles 1 or 3, short, spreading, rarely rudimentary; ovules 1-2 in each loculus. **Fruit** a berry, black, purple or red. **Seeds** globose to ovoid-angular, pale yellow to dark brown.

Three genera and about 320 species, in tropical and temperate regions of both hemispheres. Two genera and 27 species in Thailand (Koyama, 1975). One genus and 5 species recorded from Doi Phu Kha National Park.

SMILAX L.

Sp. Pl.: 1028. 1753; Koyama in Fl. Thailand 2(3): 212. 1975; Conran in Fam. Gen. Vasc. Pl. 3: 420. 1998.

Climbers with woody or herbaceous annual stems, or becoming shrubby with suberect stems. Stems and branches often prickly, rarely bristly, occasionally verruculose; rhizomes or roots usually thickened. **Leaves** with 3-7 main veins from the base; petioles sheathing in lower part with a pair of wings, breaking off at apex or immediately above the sheathing portion, or between these points; tendrils, when developing, arising immediately above the apex of sheath. **Inflorescence** a single axillary umbel or 1-to many-umbellate raceme, rarely spike, of which the main axis bears a prophyll at very base; peduncles of pistillate umbels not or only weakly flattened. **Flowers** unisexual, clavate or ovoid-globose in bud. **Tepals** 6, free, recurved or patent, rarely incurved. **Staminate flowers** with 6(-18), free or more or less manadelphous stamens; anthers oblong, elliptic or globular, mostly unilocular; pistillode absent. **Pistillate flowers** with one pistil and 3-6 needle-like staminodes; ovary ovoid or globose, 3-locular; ovules 1-2 in each loculus; style very short; stigmas 3, elongate, recurved. **Berry** globose. **Seeds** 1-2.

Over 200 species in tropical and subtropical regions of both hemispheres with several herbaceous species extending their ranges into temperate regions in Eurasia and North America. Twenty-four species in Thailand (Koyama, 1975).

KEY TO THE SPECIES

- | | |
|--|-------------------------------|
| 1. Shrubs | 3. <i>S. myrtillos</i> |
| 1. Woody climbers | |
| 2. Leaves glaucous beneath. Inflorescence without prophyllate at base | 5. <i>S. sp.</i> |
| 2. Leaves not glaucous beneath. Inflorescence with prophyllate at base | |

3. Leaves ovate to suborbicular, about as long as wide **2. *S. ovalifolia***
 3.. Leaves lanceolate, elliptic to ovate, distinctly longer than wide
 4. Leaf base broadly cuneate to rounded. Inflorescence a single axillary umbel **1. *S. lanceifolia***
 4. Leaf base distinctly cuneate. Inflorescence a single or compound,
 1-4 axillary umbel **4. *S. perfoliata***

1. *Smilax lanceifolia* Roxb.

Fl. Ind. ed. 2, 3: 792. 1832 '*lanceaefolia*'; Koyama in Fl. Thailand 2(3): 225. 1975; Chen & Koyama in Fl. China 24: 109. 2000.

Woody climber; stems terete, 4-7 mm in diam., smooth or sparsely prickly. **Leaves** variable in size and shape, lanceolate, elliptic to ovate, herbaceous to subcoriaceous, 5-17 cm long, 1.5-5(-8) cm wide, glabrous on both surfaces; base broadly cuneate to rounded; apex acute, acuminate to caudate; main veins 5, including weak marginal pair, raised on lower surface; petioles 1-2 cm long. **Inflorescence** a single axillary umbel, with prophyllate at base; prophyllus broadly ovate, boat-shaped. Staminate umbels 15-30-flowered; peduncles 7-10 mm long; pedicels 7-10 mm long. Pistillate umbels similar to staminate umbels. **Staminate flowers**: tepals green, oblong, 3-4 mm long, ca. 1 mm wide, obtuse at apex; stamens 6; filaments 2-3 mm long; anthers ellipsoid, ca. 0.5 mm long. **Pistillate flowers**: tepals elliptic, 1.5-2 mm long, subacute at apex; ovary ovoid, ca. 2 mm long; staminodes 3, ca. 1 mm long, needle-like. **Fruit** globose, 5-7 mm in diam., black. **Seeds** 1-2.

Thailand.— Northern: Chiang Mai, Chiang Rai, Nan; North-eastern: Udon Thai; Eastern: Chaiyaphum; South-eastern: Prachin Buri, Chanthaburi, Trat; South-western: Kanchanaburi; Peninsular: Surat Thani, Nakhon Si Thammarat.

Distribution.— E Himalayas, China, SE Asia.

Ecology.— Dry evergreen and lower montane forest, alt. 800-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: Almost throughout the year.

Vernacular.— เกร็ดเตา Khrueta dao (Northern).

Voucher specimens.— *P. Srisanga* 463, 472, 1680, 2324, 2724; *P. Srisanga et al.* 793.

2. *Smilax ovalifolia* Roxb.

Fl. Ind. ed. 2, 3: 794. 1832; Koyama in Fl. Thailand 2(3): 215. 1975; Chen & Koyama in Fl. China 24: 112. 2000.

Woody climber; stems terete, 5-10 mm in diam., smooth or sparsely prickly. **Leaves** variable in size, ovate to suborbicular, subcoriaceous, 10-20 cm long, 6-20 cm wide, glabrous on both surfaces; base broadly cuneate to rounded; apex rounded to mucronate; main veins 7 or 9, including weak marginal pair, raised on lower surface;

petioles 1.5-3 cm long. **Inflorescence** compound, 1-4 axillary umbel, with prophyllate at base; prophyllus broadly ovate, boat-shaped. Staminate umbels 10-30-flowered; peduncles 10-15 mm long; pedicels 7-15 mm long. Pistillate umbels similar to staminate umbels. **Staminate flowers:** tepals green, oblong, 5-7 mm long, ca. 1.5 mm wide, obtuse at apex; stamens 6; filaments 5-7 mm long; anthers oblong, ca. 1 mm long. **Pistillate flowers:** tepals oblong, 4-5 mm long, ca. 1 mm wide; ovary ovoid, ca. 2 mm long; staminodes 3, ca. 1 mm long, needle-like. **Fruit** globose, 8-12 mm in diam. **Seeds** 1-2.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Nan; Eastern: Nakhon Ratchasima; South-western: Kanchanaburi.

Distribution.— India (type), Nepal, Myanmar, China, Vietnam.

Ecology.— Dry evergreen and lower montane forest, alt. 1,000-1,500 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: January-February; fruiting: June-August.

Vernacular.— เครื่องเคา Khruea dao (Northern).

Voucher specimens.— *P. Srisanga* 2678; *P. Srisanga et al.* 887.

3. *Smilax myrtillus* A. DC.

Monogr. Phaner. 1: 106. 1878; Chen & Koyama in Fl. China 24: 108. 2000. – *S. rigida* Wall. ex Kunth var. *myrtillus* (A. DC.) T. Koyama, Adv. Front. Pl. Sci. 4: 74. 1963. – *S. rigida* Wall. ex Kunth subsp. *myrtillus* (A. DC.) T. Koyama in Fl. Thailand 2(3): 238. 1975.

Densely branched shrub; stems 80-150 cm high, 2-4 mm in diam., quadrangular with acute wing-like edges; prickles short, ca. 1 mm long. **Leaves** rhombic-ovate, herbaceous, (1-)2-4 cm long, (0.6-)1.3-3 cm wide, glabrous on both surfaces; base cuneate; apex acute; main veins 3, prominent on lower surface; petioles 1-4 mm long. **Inflorescence** a single axillary umbel, without prophyllate at base. Staminate umbels 5-10-flowered; peduncles capillary, 7-12 mm long; pedicels 5-8 mm long. Pistillate umbels few-flowered; peduncles up to 10 mm long; pedicels 5-8 mm long. **Staminate flowers:** tepals yellowish green, lanceolate, 1.5-2 mm long, ca. 0.5 mm wide, subacute at apex; stamens 6; filaments ca. 0.5 mm long; anthers subglobose, white. **Pistillate flowers:** tepals similar to staminate but slightly smaller; ovary globose, ca. 2 mm long; staminodes 3, 1-1.5 mm long, needle-like. **Fruit** 1-3 in each umbel, globose, 5-7 mm in diam., black. **Seeds** 1-2.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India (Assam-type), Bhutan, Myanmar, China.

Ecology.— Lower montane forest, alt. 1,700-1,800 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: August-February.

Voucher specimens.— *P. Srisanga* 279, 469; *P. Srisanga & C. Maknoi* 1997.

4. *Smilax perfoliata* Lour.

Fl. Cochinch.: 622. 1790; Koyama in Fl. Thailand 2(3): 229. 1975; Chen & Koyama in Fl. China 24: 115. 2000.

Woody climber; stems terete or obtusely angled, 4-7 mm in diam., with straight or slightly recurved prickles; prickles 2-4 mm long. **Leaves** variable in size and shape, broadly lanceolate, elliptic to ovate, herbaceous to subcoriaceous, 7-15 cm long, 2.5-8 cm wide, glabrous on both surfaces; base cuneate; apex acute, shortly acuminate to shortly caudate; main veins 5 or 7, including weak marginal pair, raised on lower surface; petioles 1-2 cm long. **Inflorescence** a single or compound, 1-4 axillary umbel, with prophyllate at base; prophyllus broadly ovate, boat-shaped, crest at the middle. Staminate umbels 20-50-flowered; peduncles 7-15 mm long; pedicels 7-15 mm long. Pistillate umbels similar to staminate umbels. **Staminate flowers**: tepals green, oblong, 5-6 mm long, ca. 1 mm wide, obtuse at apex; stamens 6; filaments 5-6 mm long; anthers ellipsoid, ca. 1 mm long, white. **Pistillate flowers**: tepals lanceolate, 4-5 mm long, subacute at apex; ovary ellipsoid, ca. 2 mm long; staminodes 3, ca. 2 mm long, needle-like. **Fruit** globose, 10-12 mm in diam., black. **Seeds** 1-2.

Thailand.— Northern: Chiang Mai, Nan; Eastern: Nakhon Ratchasima; South-western: Kanchanaburi; Peninsular: Nakhon Si Thammarat.

Distribution.— India, Bhutan, Myanmar, China, Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,600-1,800 m (Doi Phu Wae).

Phenology.— Flowering: March-April; fruiting: October-December.

Vernacular.— เครือเตา Khrua dao (Northern).

Voucher specimens.— *P. Srisanga* 2637.

5. *Smilax* sp.

Woody climber; stems terete, 2-4 mm in diam., smooth. **Leaves** variable in size, lanceolate to elliptic, chartaceous, 2.5-10 cm long, 1-5 cm wide, glabrous on both surfaces, glaucous beneath; base rounded to cordate; apex acute; main veins 5 or 7, including weak marginal pair, raised on lower surface; petioles 5-15 mm long. **Inflorescence** a single axillary umbel, without prophyllate at base. Staminate umbels 15-25-flowered; peduncles 5-10 mm long; pedicels 4-8 mm long. Pistillate umbels not known. **Staminate flowers**: tepals green or greenish white, lanceolate, ca. 2 mm long, ca. 0.5 mm wide, acute at apex; stamens 6; filaments ca. 0.5 mm long; anthers ovoid to subglobose, white. **Immature fruit** globose, ca. 5 mm in diam.

Thailand.— Northern: Nan.

Ecology.— Lower montane forest and lower montane scrub in open places on limestone rocks, alt. 1,500-1,800 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: Almost throughout the year.

Vernacular.— เครือเตา Khrua dao (Northern).

Voucher specimens.— *P. Srisanga* 443, 1980, 2131; *P. Srisanga et al.* 866, 2424.

Notes.— Possibly new record for Thailand.

TRILLIACEAE

Perennial herbs with rhizome; aerial stem simple, often glabrous, sometimes pubescent. **Leaves** 3-22 in a pseudowhorl at stem apex, sessile to petiolate, narrowly to broadly ovate to obovate, sometimes variegated, glabrous or pubescent along main veins on abaxial surface; base rounded, or sometimes cordate or cuneate. **Flowers** bisexual, 3(-5)-merous, actinomorphic, solitary, terminal, sessile to pedicellate. **Sepals** 3(-10) or sometimes absent, free, ovate to oblong, rarely clawed, green or sometimes maroon, yellow, yellowish green or white, sometimes adaxially streaked or mottled with purple, maroon, or silver-white, ascending to reflexed, imbricate or contorted, persistent. **Petals** 3(-8) or sometimes absent, free, imbricate or contorted, persistent, broadly ovate to filiform, rarely clawed, erect to spreading, maroon or sometimes pink, yellow, greenish yellow, green, or white. **Stamens** 6(-24), in 2-6 whorls, persistent; anthers linear, basifixed, often with prolonged connective, dehiscing by longitudinal slits, extrorse, latrorse or introrse. **Carpels** 3(-10), connate for more than 1/3 of their entire length; ovary superior; ovules several to numerous; styluli free or connate into a common style, linear to thickly subulate, erect, spreading or recurved, usually persistent, stigmatic on adaxial side, dry. **Fruit** a capsule or berry, usually green, maroon, dark purple or blackish, rarely white, yellow, or red. **Seeds** sometimes provided with an aril or a scarlet sarcotesta.

Four genera and about 70 species, distributed from subarctic to subtropical regions of the Northern Hemisphere (Tamura, 1998d). One genus with about 2 species in Thailand.

***DAISWA* Rafin.**

Fl. Tellur. IV: 18. 1836; Takhtajan, Brittonia 35: 255. 1983; Tamura in Fam. Gen. Vasc. Pl. 3: 450. 1998. – *Paris* sect. *Euthyra* (Salisb.) Franchet (1888); Hara, J. Fac. Sci. Univ. Tokyo III 10: 141. 1969. – *Paris* subgen. *Daiswa* (Rafin.) H. Li (1984); H. Li, Bull. Bot. Res. Kunming 6: 109. 1986.

Rhizome stout; aerial stem erect. **Leaves** (3-)5-14(-22), lanceolate to broadly ovate, acuminate to aristate at apex, usually petiolate, rarely sessile. **Flowers** pedicellate. **Sepals** 3(-10), linear to lanceolate-oblong or oblanceolate, green, rarely with whitish stripes. **Petals** 3(-8), long, filiform to linear. **Stamens** 8-24. **Ovary** subglobose to ovate pyraminal, angular, with a disk at apex; ovules numerous; style thick, cleft to dissected; branches 3-10, linear. **Fruit** a capsule or berry.

About 15 species, distributed from E Himalayas, China, Japan to SE Asia.

KEY TO THE SPECIES

1. Leaves (18-)23-26 cm long, (11-)14-16 cm wide
 1. *D. hainanensis* subsp. *vietnamensis*
 2. *D. polyphylla*
1. Leaves 6-15 cm long, 3-6 cm wide

1. *Daiswa hainanensis* (Merr.) Takhtajan subsp. *vietnamensis* Takhtajan

Brittonia 35: 259. 1983. – *Paris vietnamensis* (Takhtajan) H. Li, Acta Bot. Yunnan. 6: 357. 1984; Liang & Soukup in Fl. China 24: 90. 2000.

Perennial herb, 1-1.5 m high. **Leaves** (4-)7, obovate, (18-)23-26 cm long, (11-)14-16 cm wide; base shallowly cordate to rounded; petioles 4-11 cm long. Peduncle 30-90 cm long. **Sepals** (4-)7, green, lanceolate-oblong, 6-8 cm long, 2-3 cm wide. **Petals** (4-)7, green, linear, 5-12 mm long, ca. 1 mm wide. **Filaments** 2-5 mm long, anthers 5-15 mm long. **Style** branches 7, recurved. **Fruit** subglobose, 3-4 cm in diam., irregularly dehiscent.

Thailand.— Northern: Nan.

Distribution.— China, Vietnam.

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Sapan Waterfall).

Phenology.— Flowering and fruiting: July-October.

Voucher specimens.— *P. Srisanga* 1600.

2. *Daiswa polyphylla* (Smith) Rafin.

Fl. Tellur. IV: 18. 1836. – *Paris polyphylla* Smith in Rees, Cycl. 26: *Paris* no. 2. 1813; Noltie in Fl. Bhutan 3(1): 22. 1994; Liang & Soukup in Fl. China 24: 90. 2000.

Perennial herb, up to 1 m high. **Leaves** 6-10, lanceolate to oblanceolate, 6-11 cm long, 3-6 cm wide; base cuneate; petioles (0.5-)1-2.5 cm long. Peduncle 5-35 cm long. **Sepals** (3-)6, green, lanceolate, 4-10 cm long, 1-3 cm wide. **Petals** (3-)6, green, linear, 4-10 cm long, ca. 1 mm wide. **Filaments** 4-7 mm long, anthers 5-8 mm long. **Style** branches 6, recurved. **Fruit** subglobose, 1-3 cm in diam., irregularly dehiscent. **Seeds** enveloped by orange aril.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, China, Vietnam.

Ecology.— Lower montane forest, alt. 1,200-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering and fruiting: June-December.

Vernacular.— ตีนฮุ้งคอย Tin hung doi (Northern).

Voucher specimens.— *P. Srisanga* 2657; *P. Srisanga et al.* 837.

XYRIDACEAE

Annual or perennial herbs, rosulate to caulescent. **Leaves** simple, alternate, distichous to spirally arranged, linear or filiform, sheathing. **Inflorescence** in a pedunculate dense spikes or heads. **Flowers** bisexual, subtended by imbricate persistent bracts. **Sepals** (2-)3; the inner 1 reduced to scale, subequal to the rest, or membranous; the outer 2 subopposite, boat-shaped, chaffy, persistent. **Petals** 3, equal

to subequal, clawed or basally connate, mostly yellow. **Stamens** 3(-6), oppositipetalous; anthers basifixed, dehiscent by longitudinal slits. **Staminodes** (1-)3, alternipetalous, usually filamentous and penicillate hairy. **Ovary** superior, composed of 3 carpels, 1- or 3-locular, axile, parietal, basal, free central or marginal placentation; style terminal, simple or 3-branched. **Fruit** mostly loculicidal capsule. **Seeds** usually numerous.

An almost pantropical family with 5 genera and over 300 species especially in S America, rarely in N temperate region (Kral, 1998). Only 1 genus with 11 species in Thailand (Hansen, 1987). One species recorded from Doi Phu Kha National Park.

***XYRIS* L.**

Sp. Pl.: 42. 1753; Hansen in Fl. C.L.V. 20: 151. 1983; in Fl. Thailand 5(1): 130. 1987; Kral in Fam. Gen. Vasc. Pl. 4: 468. 1998.

Annual or perennial herbs, grass-like, mostly rosulate, solitary or caespitose. **Leaves** mostly equitant and distichous. **Inflorescence** in a dense spike on an elongated scape. Bracts usually with a triangular to oblong, greyish-greenish or brownish field below apex; median bracts each subtending one flower. **Flowers** subsessile. **Sepals** 3; the inner 1 hood-like, fugacious at anthesis; the outer 2, lateral, keeled, persistent. **Petals** 3, mostly clawed, yellow, usually withering before noon. **Stamens** 3, inserted on the petals. **Staminodes** 3, filiform, 2-armed, each arm brush-like by numerous hairs. **Ovary** 1-locular, 3 parietal placentas; style erect, unappendaged, 3-branched. **Fruit** a capsule. **Seeds** numerous, ellipsoid-fusiform, with dark-coloured longitudinal ribs.

Nearly 300 described species, mostly in S America, several in Africa, Australia and Asia, in America extending N to Canada and in Asia north to China and Taiwan (Kral, 1998).

***Xyris lobbii* Rendle**

J. Bot. 37: 506. 1899; Hansen in Fl. C.L.V. 20: 153, Pl. 31: 1. 1983; in Fl. Thailand 5(1): 131, fig. 41: C1, D1. 1987.

Perennial, rosulate herb. **Leaves** linear to subfalcate, equitant, distichous, (10-)15-30 cm long, 2-5 cm wide, glabrous; apex acute. Scape terete, without ribs, 20-45 cm long, glabrous. **Spike** subspherical, ovoid to ellipsoid, 8-13 mm long, 5-9 mm wide; median bracts elliptic to ovate, 5-7 mm long, 4-5 mm wide, emarginate at apex, with entire margin, brown, with a triangular brownish field below apex. **Lateral sepals** 5-6 mm long, crest entire or finely dentate to serrate, obtuse, emarginated at apex, tapering towards the base. **Petals** 10-12 mm long, crenulate at margin. **Stamens** ca. 4 mm long. **Staminodes** 9-10 mm long, penicillate. **Ovary** obovoid, ca. 2 mm long; style 5-6 mm long; branches ca. 3 mm long.

Thailand.— Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Nan.
Distribution.— Myanmar (type), Vietnam.

Ecology.— Lower montane forest, open places among grasses, alt. 1,700-1,800 m (Doi Phu Kha).

Phenology.— Flowering: September-October.

Voucher specimens.— *P. Srisanga* 288.

ZINGIBERACEAE

Rhizomatous perennial, aromatic herbs; stems short, poorly developed, mostly lengthened by erect pseudostem formed by the leaf sheaths. **Leaves** simple, distichous, sometimes appearing tufted; leaf sheath usually open; ligule present or absent; blade entire, when young rolled up from one side to the other; midrib prominent; lateral veins pinnate-parallel; petioles present or absent. **Inflorescence** terminal on the leafy shoot, or terminal on a short, separate, sheath-covered, leafless shoot arising directly from the rhizome, with (1-)few-many-flowered; bracteole present or absent. **Flowers** bisexual, zygomorphic, solitary or in cymes in axils of bracts. **Calyx** tubular, usually 3-lobed or 3-dentate, sometimes split down 1 side. **Corolla** tubular at base; lobes 3, varying in size and shape, the median posterior one often larger than the other ones and cucullate. **Stamen**: the median posterior stamen of the inner whorl functional; the other 2 stamens of the inner whorl sterile and connate to form the petaloid labellum; lateral staminodes of the outer whorl 2, petaloid or inconspicuous or absent; the median anterior member of outer whorl always reduced; filament of functional stamen long or short, sometimes absent; anthers 2-thecate, 4-sporangiate opening by longitudinal slits, occasionally dehiscent by pores, the connective often apically prolonged in a crest and sometimes also basally into spurs. **Gynoecium** composed of 3 carpels; ovary inferior, 3-locular with axile placentation or 1-locular with parietal or basal placentation; style terminal, very thin, nearly always placed in a furrow of the filament and held between the thecae; ovules many to numerous. **Fruit** a loculicidal capsule, 3-valved or irregularly dehiscent, or flesh or dry indehiscent, smooth, ridged or verrucose. **Seeds** few to many, usually arillate.

A pantropical family of about 50 genera and 1,300 species with the centre of diversity in S and SE Asia (Larsen et al., 1998). About 21 genera and 200 species in Thailand (Larsen, 1996). Eight genera and 35 species recorded from Doi Phu Kha National Park.

KEY TO THE GENERA

1. Style not exerted beyond the anther. Anther crest, if present, never wrapped around the style
2. Filament usually long exerted from the flower, arched as a bow; style forming the string of the bow. Ovary 1-locular, parietal placentation **6. *Globba***
2. Filament not as above. Ovary 3-locular, axile placentation or rarely incompletely 3-locular with basal placentation
3. Lateral staminodes of the outer whorl petaloid
4. Corolla tube equal to or shorter than bracts

- | | |
|--|-------------------------------|
| 5. Bracts densely imbricated | 3. <i>Boesenbergia</i> |
| 5. Bracts red, well spaced | 4. <i>Cautleya</i> |
| 4. Corolla tube much longer than bracts | 7. <i>Hedychium</i> |
| 3. Lateral staminodes of the outer whorl small teeth or absent | |
| 6. Inflorescence terminal on the leafy shoot | 1. <i>Alpinia</i> |
| 6. Inflorescence terminal on the separate leafless shoot | |
| 7. Labellum and filament connate into a distinct tube above the insertion of the petals. Anther crest absent | 5. <i>Etingera</i> |
| 7. Labellum and filament not connate. Anther usually crested | 2. <i>Amomum</i> |
| 1. Style exerted well beyond the anther tip. Anther crest elongate, wrapped around the style | 8. <i>Zingiber</i> |

1. *ALPINIA* Roxb.

Asiat. Res. 11: 350. 1810, nom. cons.; R.M. Sm., Edinb. J. Bot. 47: 1. 1990; Larsen, Lock, Maas & Maas in Fam. Gen. Vasc. Pl. 4: 489. 1998.

Herbs, often large, from well-developed rhizome. **Leaves** many or rarely few on the shoot. **Inflorescence** usually terminal on the leafy shoot, lax or congested, sometimes surrounded by sterile bracts, sometimes branched; bracts when present open to the base, cincinni 1-many-flowered; bracteole tubular or open to the base, sometimes completely enclosing a cincinnus, sometimes caducous, or absent. **Calyx** tubular, 3-lobed, often split down one side. **Corolla** tube usually equal in length to the calyx. Lateral staminodes small or absent. Labellum erect or concave, sometimes spreading or pendulous, varying in shape, variously lobed or entire. **Filament** absent or present, sometimes appendaged; anther crest present or absent. **Ovary** 3-locular, rarely 1-locular. **Fruit** indehiscent, globose or ellipsoid. **Seeds** arillate.

More than 200 species, throughout tropical Asia to New Guinea, Australia, the Solomon Islands, New Hebrides, New Caledonia, Fiji and Samoa (Larsen et al., 1998). About 12 species in Thailand (Larsen, 1996). Two species recorded from Doi Phu Kha National Park.

1. *Alpinia blepharocalyx* K. Schum.

Thailand.— Northern: Chiang Mai, Lampang, Nan; North-eastern: Loei.

Distribution.— India, Bangladesh, Myanmar, S China (Yunnan), Laos, Vietnam.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: November-March.

Vernacular.— กากู๋น Ka kuk (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1753, 2368; *P. Srisanga et al.* 2431.

References.— Larsen (1996); Wu & Larsen (2000); Saensouk et al. (2003).

2. *Alpinia conchigera* Griff.

Thailand.— Northern: Chiang Mai, Nan; North-eastern: Loei; South-western: Phetchaburi; Peninsular: Nakhon Si Thammarat.

Distribution.— India, Bangladesh, S China (Yunnan), SE Asia.

Ecology.— Dry evergreen forest, alt. 800 m (Sapan Waterfall).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 2578.

References.— Larsen (1996); Wu & Larsen (2000).

2. *AMOMUM* Roxb.

Pl. Corom. 3: 75. 1820, nom. cons.; Larsen, Lock, Maas & Maas in Fam. Gen. Vasc. Pl. 4: 492. 1998.

Tall herbs, sometimes with stilt roots; rhizome usually thin. **Leaves** usually many. **Inflorescence** congested, terminal on a separate leafless shoot, 1-several-flowered; peduncle sometimes short, then inflorescence subterranean and only the apical part visible; bracts closely imbricate, rather large; bracteole tubular or open to the base. **Calyx** tubular, 3-lobed. **Corolla** tube about as long as calyx or longer, sometimes lateral petals centrally adnate to each other and to the labellum in their lower part. Lateral staminodes small or absent. Labellum longer than the petals, spathulate, variously lobed. **Stamen** shorter than labellum; anther with well-developed, variously lobed, entire or absent crest, sometimes basally spurred. **Ovary** 3-locular. **Fruit** a capsule, subglobose to flask-shaped, dry or flesh, smooth, ribbed, winged or echinate, sometimes united in a syncarp. **Seeds** arillate.

About 150 species, widely distributed in tropical Asia to tropical Australia, the majority in the Malesian region (Larsen et al., 1998). About 15 species in Thailand (Larsen, 1996). Five species recorded from Doi Phu kha National Park.

1. *Amomum biflorum* Jack

Thailand.— Northern: Nan; Peninsular: Yala.

Distribution.— Malaysia.

Ecology.— Dry evergreen and lower montane forest, alt. 1,000 m (Tham Pha Khaw).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 1919.

References.— Holttum (1950); Larsen (1996).

2. *Amomum mengtzense* H.T. Tsai & P.S. Chen

Thailand.— Northern: Nan.

Distribution.— S China (Yunnan).

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).

Phenology.— Flowering and fruiting: April-July.

Uses.— Seeds edible, sweet taste.
 Vernacular.— ฝัก Kuk (Lua-Nan).
 Voucher specimens.— *P. Srisanga* 1451.
 References.— Wu & Larsen (2000).

3. *Amomum villosum* Lour.

Thailand.— Northern: Nan.
 Distribution.— China.
 Ecology.— Dry evergreen forest, alt. 800 m (Doi Phu Kha).
 Phenology.— Flowering and fruiting: July-September.
 Vernacular.— เร่วดง Reo dong (Trat).
 Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2106.
 References.— Wu & Larsen (2000).

4. *Amomum* sp. 1

Ecology.— Dry evergreen forest, by streams, alt. 800-900 m (Doi Phu Kha).
 Phenology.— Flowering and fruiting: May-June.
 Uses.— Seeds edible.
 Vernacular.— กระจี่ง Kra Jang (Lua-Nan).
 Voucher specimens.— *P. Srisanga* 1449.

5. *Amomum* sp. 2

Ecology.— Lower montane forest, alt. 1,100 m (Doi Phu Kha).
 Phenology.— Fruiting: August-September.
 Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2057.

3. *BOESENBERGIA* Kuntze

Rev. Gen. 2: 685. 1891; Sirirugsa, Nat. Hist. Bull. Siam Soc. 40(1): 67. 1992; Larsen, Lock, Maas & Maas in Fam. Gen. Vasc. Pl. 4: 486. 1998.

Small herbs from short, fleshy rhizome. **Leaves** few arranged in tufts. **Inflorescence** terminal on the leafy shoot, sometimes terminal on a separate leafless shoot, uppermost flowers opening first; bracts distichous or spiral, densely imbricate, each subtending 1-flowered; bracteole open to the base and entire, boat-shaped. **Calyx** tubular. **Corolla** tube slender, usually shorter than the bracts. Lateral staminodes oblong, petaloid. Labellum conspicuous and usually concave, entire to emarginated. Lateral staminodes and filament adnate to the base of labellum. **Anther crest** absent or very small. **Ovary** 3-locular or incompletely 3-locular. **Fruit** a capsule, fleshy, subglobose. **Seeds** with white, lacerate aril, often longer than the seed.

About 60 species from southern Himalayas throughout SE Asia (Larsen et al., 1998). About 15 species in Thailand (Larsen, 1996). Two species recorded from Doi Phu Kha National Park.

1. *Boesenbergia parvula* (Wall. ex Baker) Kuntze

Thailand.— Northern: Chiang Mai, Nan; South-eastern: Chanthaburi; South-western: Kanchanaburi.

Distribution.— India, Myanmar (type).

Ecology.— Dry evergreen forest, alt. 900-1,000 m (Thon Thong Waterfall).

Phenology.— Flowering: August-September.

Vernacular.— เอื้องดิน Ueang din (Northern).

Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2099.

References.— Sirirugsa (1992); Larsen (1996).

2. *Boesenbergia pulcherrima* (Wall.) Kuntze

Thailand.— Almost throughout the country.

Distribution.— Myanmar (type), Malaysia.

Ecology.— Dry evergreen forest, alt. 800-900 m (Tham Pha Kong).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 2530.

References.— Sirirugsa (1992); Larsen (1996).

4. *CAUTLEYA* Hook.f.

Bot. Mag.: ad t. 6991. 1888; Larsen, Lock, Maas & Maas in Fam. Gen. Vasc. Pl. 4: 484. 1998.

Small herbs with short rhizome. **Leaves** with distinct, 2-lobed ligule. **Inflorescence** terminal on the leafy shoot; bracts often deep red, well spaced, each subtending 1-flowered; bracteole absent. **Flowers** yellow. **Calyx** tubular. **Corolla** funnel-shaped; tube short. Lateral petals basally connate with labellum. Lateral staminodes narrowly obovate, erect, connate to base of labellum for about half of their length. Labellum broadly spatulate, emarginate or 2-lobed. **Filament** short; anther versatile; crest absent, basally with 2 long spurs at right angles to the thecae. **Ovary** 3-locular. **Fruit** a capsule, globose, dehiscent. **Seeds** with short, white aril.

Two species in Himalayan region from N India and Nepal to S China and N Thailand (Larsen et al., 1998). One species in Thailand (Larsen, 1996).

Cautleya gracilis (Smith) Dandy

Thailand.— Northern: Chiang Mai, Nan (Fig. 164).

Distribution.— India, Nepal, Bhutan, Sikkim, Myanmar, China, Vietnam.
 Ecology.— Epiphyte, Lower montane forest, alt. 1,600-1,900 m (Doi Phu Kha).
 Phenology.— Flowering and fruiting: July-September.
 Voucher specimens.— *P. Srisanga* 932, 933; *P. Srisanga & C. Maknoi* 1999, 2036.
 References.— Larsen (1996); Wu & Larsen (2000).

5. *ETLINGERA* Giseke

Prael. Ord. Nat.: ad 202, 209. 1792; Larsen, Lock, Maas & Maas in Fam. Gen. Vasc. Pl. 4: 492. 1998.

Tall herbs up to 8 m high with stout rhizome. Leafy shoots usually with many leaves. **Inflorescence** terminal on a separate leafless shoot, subglobose, very often broader than long, often surrounded by an involucre of sterile bracts; peduncle long or very short, then inflorescence subterranean with only the apical part visible; bracts densely imbricate, subtending 1-flowered; bracteole tubular. **Flowers** red to yellow, rarely white. **Calyx** tubular, 3-lobed to 3-dentate, often split down 1 side. **Corolla** tube long; lobes shorter than the tube. Lateral staminodes absent or rudimentary. Labellum conspicuous, variously lobed to entire, central lobe expanded to orbicular, labellum and filament connate into a tube above the insertion of petals. Free part of filament short or absent; anther crest absent. **Ovary** 3-locular. **Fruit** indehiscent, globose to obovoid, longitudinally ribbed, sometimes united in a fleshy, globose or elongated syncarp. **Seeds** arillate.

About 70 species, from Himalayan region through SE Asia to N Queensland, with main distribution in Indonesia (Larsen et al., 1998). About 10 species in Thailand (Larsen, 1996; Maknoi & Sirirugsa, 2002). One species recorded from Doi Phu Kha National Park.

Etilingera littoralis (Koenig) Giseke

Thailand.— Northern: Chiang Mai, Nan; Peninsular: Almost throughout (Phuket-type).

Distribution.— China (Hainan), Malaysia, Indonesia.

Ecology.— Dry evergreen forest, by streams, alt. 1,000-1,100 m (Doi Phu Kha, Tham Pha Kaow).

Phenology.— Flowering: June-July; fruiting: August-September.

Uses.— Aril edible, sour taste.

Vernacular.— ฝัก Kuk (Lua-Nan).

Voucher specimens.— *P. Srisanga* 2562; *P. Srisanga & C. Maknoi* 2056.

References.— Holttum (1950); Larsen (1996); Wu & Larsen (2000).

6. *GLOBBAL* L.

Mantissa 2: 170. 1771; Larsen, Lock, Maas & Maas in Fam. Gen. Vasc. Pl. 4: 487. 1998.

Small herbs with short, creeping rhizome; roots tuberous. **Inflorescence** terminal on the leafy shoot, lax or congested; bracts green or variously coloured, each subtending a few- to many-flowered cincinnus, lower ones often bulbiferous; bracteole open to the base. **Flowers** white, yellow, pink, orange or purple. **Calyx** turbinate to campanulate, 3-lobed to 3-dentate. **Corolla** tube slender, long. Labellum 2-lobed to entire, connate to the filament above the staminodes. Lateral staminodes petaloid, free from labellum, elliptic, inserted at about the same level as the petals. **Anther** with or without lateral appendages, apical crest absent. **Fruit** a capsule, usually globose, smooth, verrucose or ribbed, dehiscent. **Seeds** with lacerate aril.

About 100 species from E Himalayas to S China and throughout India and Indo-china to Malesia, most species in the Indo-Chinese monsoon region (Larsen et al., 1998). About 34 species in Thailand (Larsen, 1996). Seven species recorded from Doi Phu Kha National Park.

1. *Globba clarkei* Baker

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Bhutan, Sikkim.

Ecology.— Dry evergreen and lower montane forest, alt. 780-1,550 m (Doi Phu Kha, Sapan Waterfall).

Phenology.— Flowering and fruiting: June-September.

Vernacular.— ขมิ้นมะไฟ Khamin ma phi (Chiang Mai).

Voucher specimens.— *P. Srisanga* 962, 1576; *P. Srisanga* & *C. Puff* 1088; *P. Srisanga et al.* 768.

2. *Globba* sp. 1

Ecology.— Dry evergreen forest, by streams, alt. 780-950 m (Sapan Waterfall, Thon Thong Waterfall).

Phenology.— Flowering and fruiting: June-September.

Voucher specimens.— *P. Srisanga* 1586, 1949; *P. Srisanga* & *C. Maknoi* 2100.

3. *Globba* sp. 2

Ecology.— Dry evergreen forest, by streams, alt. 850 m (Sapan Waterfall).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 1944.

4. *Globba* sp. 3

Ecology.— Dry evergreen forest, alt. 800 m (Tham Pha Kong).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 2540.

5. *Globba* sp. 4

Ecology.— Dry evergreen forest, alt. 800 m (Tham Pha Kong).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga* 2543.

6. *Globba* sp. 5

Ecology.— Dry evergreen forest, open places, alt. 850 m (Doi Phu Wae).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga et al.* 892.

7. *Globba* sp. 6

Ecology.— Lower montane forest, alt. 1,400 m (Doi Phu Wae).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga et al.* 897.

7. *HEDYCHIUM* Koenig

In Retz., Obs. Bot. 3: 73. 1783; Larsen, Lock, Maas & Maas in Fam. Gen. Vasc. Pl. 4: 482. 1998.

Terrestrial or epiphytic herbs with long, robust rhizome. **Inflorescence** terminal on the leafy shoot; bracts broad and densely imbricate, or narrow and leaving the inflorescence axis visible; cincinni several-flowered, rarely flowers single; bracteole tubular. **Flowers** white, yellow or red. **Calyx** tubular, unequally dentate. **Corolla** tube usually much longer than calyx and bracts; lobes narrow, reflexed. Lateral staminodes about as long as petals, but broader and spreading. Labellum usually conspicuous and pendulous, emarginate to 2-lobed. **Filament** usually much longer than the anther, linear; thecae elongated; crest absent. **Ovary** 3-locular. **Fruit** a capsule, trigonous, globose or ellipsoid, dehiscent. **Seeds** with red, lacerate aril.

About 50 species, widely distributed in S and SE Asia (Larsen et al., 1998). About 25 species in Thailand (Larsen, 1996). Ten species recorded from Doi Phu Kha National Park.

1. *Hedychium aureum* C.B. Clarke & Mann ex Baker

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India.

Ecology.— Lithophyte on limestone rocks, Lower montane scrub, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 2136.

References.— Larsen (1996).

2. *Hedychium biflorum* Sirirugsa & Larsen

Thailand.— Northern: Nan, Tak (type).

Distribution.— Endemic to Thailand.

Ecology.— Lithophyte on limestone rocks, Lower montane scrub, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga* 2125.

References.— Sirirugsa & Larsen (1995); Larsen (1996).

3. *Hedychium coccineum* Buch.-Ham. ex Smith

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, Sikkim, Sri Lanka, Myanmar, China, Laos.

Ecology.— Terrestrial, Lower montane scrub, alt. 1,600-1,700 m (Doi Phu Wae).

Phenology.— Flowering: June-July.

Vernacular.— ขาดัง Kha dong (Northern).

Voucher specimens.— *P. Srisanga et al.* 857.

References.— Larsen (1996), Wu & Larsen (2000).

4. *Hedychium ellipticum* Buch.-Ham. ex Smith

Thailand.— Northern: Chiang Mai, Nan, Phitsanulok (Fig. 165).

Distribution.— India, Bhutan, Sikkim.

Ecology.— Terrestrial, Lower montane scrub, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering: June-July; fruiting: August-September.

Vernacular.— ตาเหินไหว Ta hoen wai (Chiang Mai).

Voucher specimens.— *P. Srisanga* 2122.

References.— Larsen (1996).

5. *Hedychium forrestii* Diels

Thailand.— Northern: Mae Hong Son, Nan (Fig. 166).

Distribution.— Myanmar, China, Laos.

Ecology.— Terrestrial, Lower montane forest, alt. 1,400-1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: August-October; fruiting: October-November.

Voucher specimens.— *P. Srisanga* 1660, 1752, 2152; *P. Srisanga & C. Maknoi* 2003; *P. Srisanga & C. Puff* 1090.

References.— Larsen (1996), Wu & Larsen (2000).

6. *Hedychium speciosum* Wall.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India (type).

Ecology.— Lithophyte on limestone rocks, Lower montane forest, alt. 1,750 m (Doi Phu Wae).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga et al.* 870.

References.— Larsen (1996).

7. *Hedychium spicatum* Smith var. *acuminatum* (Roscoe) Wall.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Nepal, Bhutan, Sikkim, China.

Ecology.— Lithophyte on limestone rocks or epiphyte, Lower montane forest and lower montane scrub, alt. 1,700 m (Doi Phu Kha, Doi Phu Wae).

Phenology.— Flowering: August-September.

Voucher specimens.— *P. Srisanga et al.* 2117; *P. Srisanga & C. Maknoi* 2000.

References.— Larsen (1996); Wu & Larsen (2000).

8. *Hedychium stenopetalum* Lodd.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Bhutan, Myanmar.

Ecology.— Terrestrial, Lower montane forest, alt. 1,000-1,400 m (Doi Phu Kha, Doi Phu Wae, Nan Watershed).

Phenology.— Flowering: August-September.

Vernacular.— ตาเห็นหลวง Ta hoen luang (Northern).

Voucher specimens.— *P. Srisanga* 2165; *P. Srisanga & C. Maknoi* 2088.

References.— Larsen (1996).

9. *Hedychium thyrsoforme* Buch.-Ham. ex Smith

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Bhutan, Sikkim.

Ecology.— Lithophyte on limestone rocks, Lower montane scrub, alt. 1,700 m (Doi Phu Wae).

Phenology.— Flowering: August-September; fruiting: October-November.

Voucher specimens.— *P. Srisanga* 1830.

10. *Hedychium villosum* Wall.

Thailand.— Northern: Chiang Mai, Nan.

Distribution.— India, Myanmar, China, Vietnam.

Ecology.— Lithophyte on limestone rocks or epiphyte, Lower montane forest and lower montane scrub, alt. 1,600-1,800 m (Doi Phu Wae).

Phenology.— Flowering: August-March.

Vernacular.— ตาเหิน Ta hoen (Chiang Mai).

Voucher specimens.— *P. Srisanga* 1803, 2118; *P. Srisanga et al.* 2432, 2433; *P. Suksathan* 1797.

References.— Larsen (1996); Wu & Larsen (2000).

8. *ZINGIBER* Boehm.

In Ludwig, Def. Gen. Pl. ed. 3: 89. 1760, nom. cons.; Larsen, Lock, Maas & Maas in Fam. Gen. Vasc. Pl. 4: 488. 1998.

Herbs with creeping, fleshy rhizome. **Inflorescence** cylindrical to ovoid, long pedunculate or sessile; bracts often bright red or yellow, closely imbricate or with the apices free, forming pouches filled with mucilage, each enclosing 1(-4)-flowered cincinnus, margin patent or inflexed; bracteole open to the base. **Flowers** white to yellow, with red to purple markings. **Calyx** tubular, split down 1 side. **Corolla** tube about as long as the bracts. Lateral lobes connate to each other and to the centre of the labellum in the lower 1/3. Labellum 3-lobed. **Filament** short. **Fruit** a capsule, first fleshy, later leathery, subglobose, dehiscent. **Seeds** with white, lacerate aril.

About 100 species, widespread in tropical Asia with centres of diversity in Indo-China and Borneo (Larsen et al., 1998). About 26 species in Thailand (Theilade, 1999). Seven species recorded from Doi Phu Kha National Park.

1. *Zingiber fragile* S.Q. Tong

Thailand.— Northern: Nan.

Distribution.— S China (Yunnan).

Ecology.— Lower montane forest, alt. 1,300-1,400 m (Doi Phu Wae).

Phenology.— Flowering: June-July.

Voucher specimens.— *P. Srisanga et al.* 848.

References.— Wu & Larsen (2000).

2. *Zingiber larsenii* I. Theilade

Thailand.— Northern: Nan (Doi Wao-type).

Distribution.— Endemic to Thailand.

Ecology.— Lower montane forest, alt. 1,600-1,700 m (Doi Phu Kha).

Phenology.— Flowering: November.

Voucher specimens.— *P. Srisanga* 1749.

References.— Theilade (1999).

3. *Zingiber neotruncatum* T.L. Wu, K. Larsen & N.J. Turland

Thailand.— Northern: Nan (Fig. 167).
 Distribution.— S China (Yunnan).
 Ecology.— Lower montane forest, alt. 1,500-1,600 m (Doi Phu Kha).
 Phenology.— Flowering: July-September.
 Voucher specimens.— *P. Srisanga* 942; *P. Srisanga* & *C. Maknoi* 2004.
 References.— Wu & Larsen (2000).

4. *Zingiber smilesianum* Craib

Thailand.— Northern: Chiang Mai (type), Nan (Fig. 168).
 Distribution.— Endemic to Thailand.
 Ecology.— Lower montane forest, alt. 1,700-1,800 m (Doi Phu Kha).
 Phenology.— Flowering: July-August.
 Voucher specimens.— *P. Srisanga* 924.
 References.— Larsen (1996); Theilade (1999).

5. *Zingiber teres* S.Q. Tong & Y.M. Xia

Thailand.— Northern: Nan.
 Distribution.— S China (Yunnan).
 Ecology.— Dry evergreen and lower montane forest, alt. 750-1,500 m (Doi Phu Kha).
 Phenology.— Flowering: August-September.
 Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2001, 2071.
 References.— Wu & Larsen (2000).

6. *Zingiber xishuangbannaense* S.Q. Tong

Thailand.— Northern: Nan.
 Distribution.— S China (Yunnan).
 Ecology.— Dry evergreen forest, alt. 700-1,000 m (Thon Thong Waterfall).
 Phenology.— Flowering: August-September.
 Voucher specimens.— *P. Srisanga* & *C. Maknoi* 2073, 2098.
 References.— Wu & Larsen (2000).

7. *Zingiber* sp.

Ecology.— Lower montane forest, alt. 1,330 m (Doi Phu Kha).
 Phenology.— Flowering: September-October.
 Voucher specimens.— *P. Srisanga* 1686.



Figure 84. *Asystasiella neesiana* (Wall.) Lindau



Figure 85. *Barleria cristata* L.



Figure 86. *Thunbergia colpifera* B. Hansen



Figure 87. *Acer laurinum* Hassk.

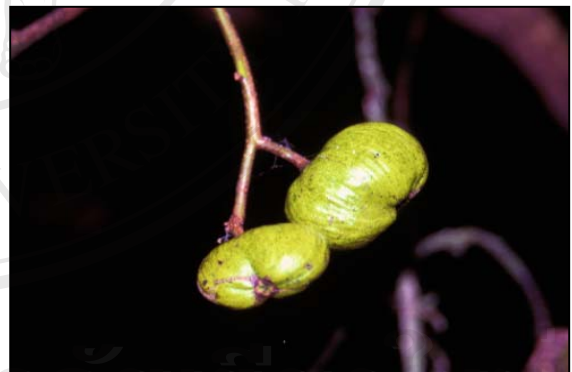


Figure 88. *Drimycarpus racemosus* (Roxb.) Hook.f.



Figure 89. *Alphonsea tonkinensis* A. DC.



Figure 90. *Miliusa cuneata* Craib



Figure 91. *Goniothalamus chiliensis* Hu



Figure 92. *Bupleurum tenue* Buch.-Ham. ex D. Don



Figure 93. *Aristolochia kerrii* Craib



Figure 94. *Raphistemma pulchellum* (Roxb.) Wall.



Figure 96. *Ligularia hodgsonii* Hook.f.



Figure 95. *Hoya thailandica* O. Thaithong



Figure 97. *Impatiens jurpia* Ham. ex Hook.f. & Thoms.



Figure 98. *Impatiens* sp. 2



Figure 99. *Begonia puttii* Craib



Figure 100. *Radermachera eberhardtii* Dop



Figure 101. *Bretchneidera sinensis* Hemsl.

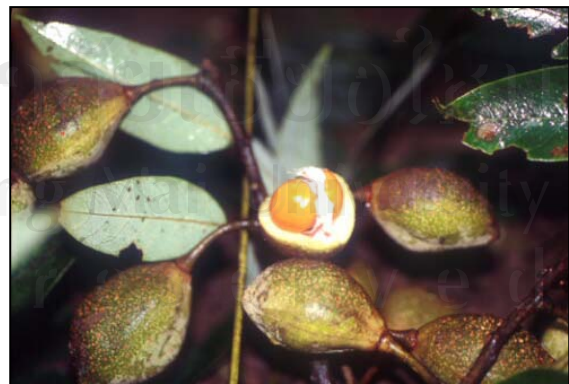


Figure 102. *Bretchneidera sinensis* Hemsl.



Figure 103. *Campanula cana* Wall.



Figure 104. *Lobelia angulata* Forst.



Figure 106. *Capparis trisonthiae* Srisanga & Chayamarit



Figure 105. *Capparis sikkimensis* Kurz subsp. *yunnanensis*(Craib & W.W. Sm.) Jacobs



Figure 107. *Capparis trisonthiae* Srisanga & Chayamarit



Figure 108. *Capparis viburnifolia* Gagnep.



Figure 109. *Carlemannia tetragona* Hook.f.



Figure 110. *Lonicera siamensis* Gamble



Figure 111. *Silene burmanica* Coll. & Hemsl.



Figure 112. *Argyreia osyrensis* (Roth) Choisy



Figure 113. *Argyreia wallichii* Choisy

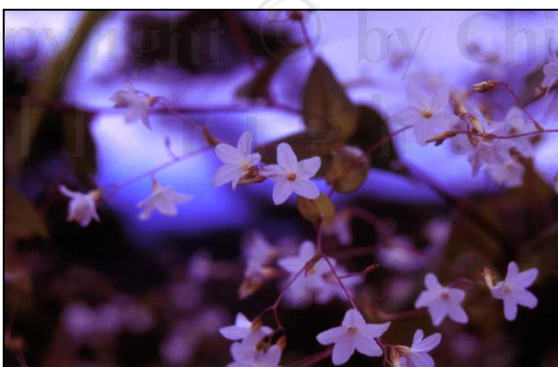


Figure 114. *Dinetus racemosus* (Roxb.) Sweet



Figure 115. *Ipomoea soluta* Kerr

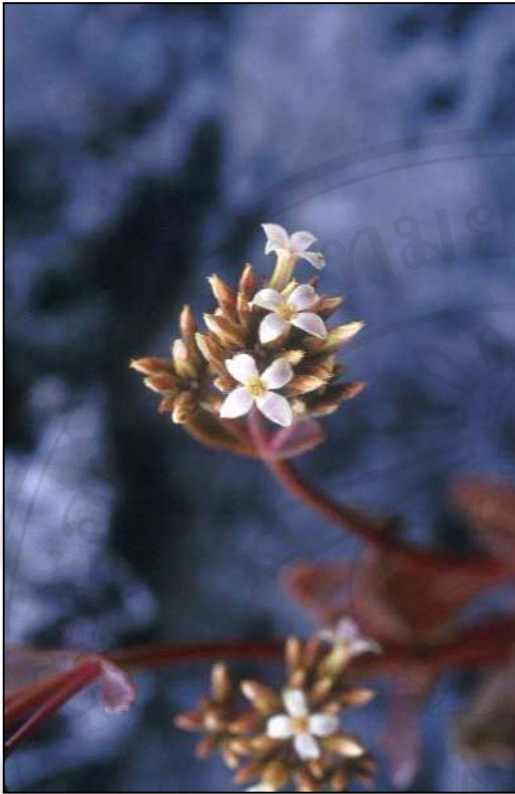


Figure 116. *Kalanchoe dixoniana* Hamet



Figure 117. *Sedum sarmentosum* Bunge



Figure 118. *Dillenia parviflora* Griff.



Figure 120. *Sloanea sigun* (Bl.) K. Schum.



Figure 119. *Sloanea sigun* (Bl.) K. Schum.



Figure 121. *Agapetes lobbii* C.B. Clarke



Figure 122. *Agapetes megacarpa* W.W. Sm.



Figure 123. *Rhododendron aff. lyi* Lév.



Figure 124. *Vaccinium sprengelii* (G. Don) Sleum.



Figure 125. *Trigonostemon thyrsoides* Stapf



Figure 126. *Bauhinia ornata* Kurz var. *subumbellata* (Pierre ex Gagnep.) K. & S.S. Larsen



Figure 127. *Bauhinia variegata* L.



Figure 128. *Archidendron alternifoliolatum* (T.L. Wu) Nielsen



Figure 129. *Erythrina stricta* Roxb.



Figure 130. *Quercus lineata* Bl. var. *hildebrandii* King



Figure 131. *Aeschynanthus superbus* C.B. Clarke



Figure 132. *Sycopsis griffithiana* Oliv.



Figure 133. *Iodes cirrhosa* Turcz.



Figure 134. *Michelia* sp.



Figure 135. *Kydia calycina* Roxb.



Figure 136. *Osbeckia stellata* Buch.-Ham. ex Ker-Gawl.



Figure 137. *Fraxinus floribunda* Wall. ex Roxb.



Figure 138. *Jasminum rufohirtum* Gagnep.



Figure 139. *Sapria himalayana* Griff.



Figure 140. *Clematis fulvicoma* Rehd. & Wils.



Figure 141. *Duperrea pavettaefolia* (Kurz) Pitard



Figure 142. *Forsbergia thailandica* Tirveng. & Sastre



Figure 143. *Luculia gratissima* Sweet



Figure 144. *Mycetia chasalioides* (Craib) Craib



Figure 145. *Neohymenopogon parasiticus* (Wall.) Bennet



Figure 146. *Pavetta indica* L.



Figure 147. *Cyrtandromoea grandiflora* C.B. Clarke



Figure 148. *Byttneria aspera* Colebr.



Figure 149. *Pterospermum diversifolium* Bl.

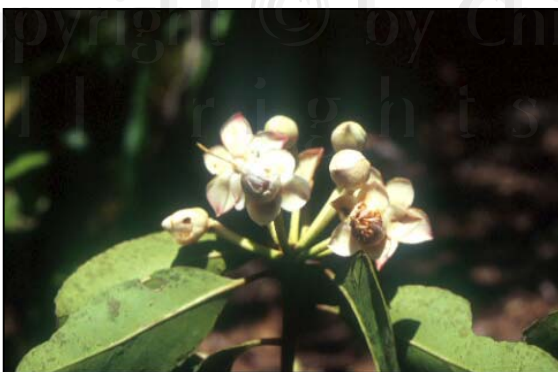


Figure 150. *Anneslea fragrans* Wall.

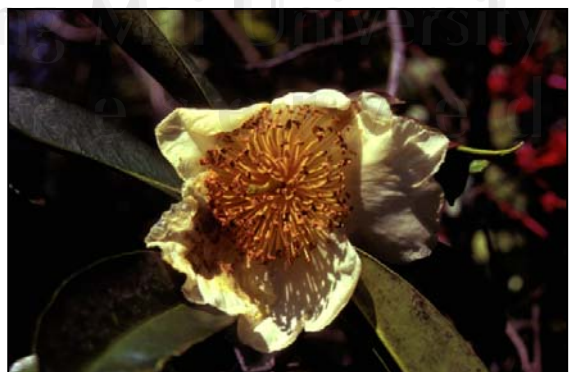


Figure 151. *Gordonia axillaris* (Roxb. ex Ker-Gawl.) Dietr.



Figure 152. *Caryota gigas* Hahn ex Hodel



Figure 153. *Trachycarpus oreophilus* Gibbons & Spanner



Figure 154. *Allium wallichii* Kunth



Figure 155. *Floscopa scandens* Lour.

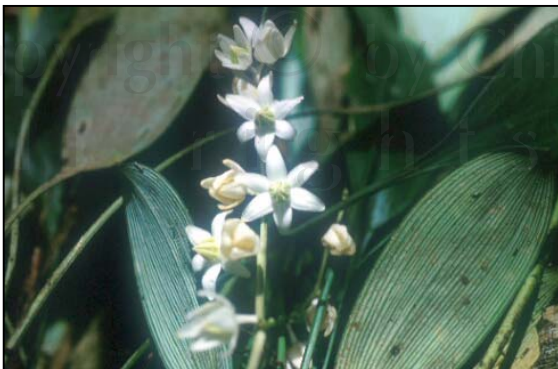


Figure 156. *Ophiopogon* sp.



Figure 157. *Polygonatum kingianum* Coll. & Hemsl.



Figure 158. *Veratrum mengtzeanum* Loes.f.



Figure 159. *Cheirostylis griffithii* Lindl.



Figure 160. *Cyrtosia nana* (Rolfe ex Downie) Garay



Figure 162. *Pleione praecox* (Sm.) D. Don



Figure 161. *Herpysma longicaulis* Lindl.



Figure 163. *Thunia alba* (Lindl.) Rchb.f.



Figure 164. *Cautleya gracilis* (Smith) Dandy



Figure 165. *Hedychium ellipticum* Buch.-Ham. ex Sm.



Figure 166. *Hedychium forrestii* Diels



Figure 167. *Zingiber neotruncatum* T.L. Wu, K. Larsen & N.J. Turland



Figure 168. *Zingiber smilesianum* Craib