CHAPTER 5
DISCUSSION

5.1 **Plants used by the Hmong, Mien, Khamu, and Lua in Nan province**

5.1.1 **Diversity of used plants**

The large richness of species used by the Hmong, Mien, Khamu, and Lua in Nan province (818 plant species, 160 plant families) reflects these groups' great dependence on plant resources derived from their natural surroundings. Plant families with great number of used species, such as Asteraceae, Euphorbiaceae, Lamiaceae, and Zingiberaceae, provide large portions of the species of useful plants. This agrees with findings reported in a previous study by Inta (2008).

The use-category based Shannon-Wiener diversity index allows the evaluation and comparison of the diversity of plant uses in the 12 studied villages. In this study, the values for Shannon-Wiener index of each village ranged between 2.31 and 2.46. As Begossi (1996) pointed out, the Shannon-Wiener index reflects the homogeneity/heterogeneity aspect on the use of plant 'inside' a village, which means that a high diversity of plant uses signals less intra-homogeneity while a low diversity signals high intra-homogeneity of plant uses.

In this study, the lower values of Shannon-Wiener index calculated for some villages such as Nam Pan and Joon, may on one hand be interpreted as the lower diversity of plant uses which in turn shows higher intra-homogeneity of plant use knowledge. On the other hand, it could also be that the lower values of Shannon-Wiener index are due to lower richness of species used, compared to those villages that have higher Shannon-Wiener index values.

Among all the useful plants registered for each ethnic group, there were some commonly represented plant families of which species member are preferred for uses in one use-category. Also, knowledge related to particular uses of many species was shared between villages, either intra- or inter-culturally, especially those related to treatment of basic ailments, such as stomachache, cold, cough and fever. Hence, this discussion of the qualitative study is organized around the commonly represented

plant families and commonly used plant species shared within and between groups in each use-category. For the medicinal use-categories, the plants commonly used intra- and/or inter-culturally are presented along with their similar use(s) and/or the corroboration of their therapeutic efficacy as reported in previous studies in the form of tables. Additionally, the issues of medicinal plant knowledge variation, Informant Consensus Factor (ICF), and Fidelity Level (FL) are discussed.

5.1.2 **Food plants**

5.1.2.1 **Plant family**

Of the several dozens of plant species used as food by the four ethnic groups studied, the most important food plant families are those with many recorded species such as Asteraceae, Euphorbiaceae, Cucurbitaceae, Poaceae, Lamiaceae, Papilionaceae, and Zingiberaceae. Many of these, such as Asteraceae, Cucurbitaceae, Lamiaceae, Leguminosae (especially the Papilionaceae which mainly provide the beans and peas), Poaceae, and Solanaceae, were registered as the most important plant families that provide vegetables (Winch, 2006; Prohens-Tomás and Nuez, 2010)

5.1.2.2 **Commonly used plants**

Most of these major food plants are common among all the four ethnic groups. However, it is important to note that there were species, for instance, *Artemisia lactiflora*, *Gynura bicolor*, *Gynura nepalensis*, *Iresine herbstii*, *Talinum fruticosum*, and *Talinum paniculatum*, that were commonly used as culinary herbs among the Hmong and Mien for seasoning of chicken soup, indicating cultural preferences in respect to consumption of these plants. Both the Hmong and Mien prefer having chicken soup in combination with many kinds of culinary herbs, which is an old Chinese practice. The herbs are prepared as general tonic for restoring strength and for recovering women's health during the postpartum period. It is also interesting to note that several species of *Gynura* (Figure 99-100) are preferred ingredients for this kind of traditional food.

5.1.3 **Food additives**

5.1.3.1 **Plant family**

Based on the fact that the natural attributes of plants used for food additives, such as spices and condiments, are for their aromatic properties. It is not surprising that most plant species used for food additives are mostly those from the families Zingiberaceae, Lamiaceae, Rutaceae, and Apiaceae that are all aromatic and their species contain essential oils (Westover, 2010).

5.1.3.2 **Commonly used plants**

The commonly used food additives are those known nationwide and typically used in Thai food, and probably also in other Southeast Asian food and elsewhere in the world; for instance, *Capsicum frutescens*, *Alpinia galanga*, *Curcuma longa*, *Cymbopogon citratus*, *Piper interruptum*, and *Zingiber officinale*.

5.1.4 **Animal food**

5.1.4.1 **Plant family**

The plant families that are widely used as animal food are Amaranthaceae, Moraceae and Musaceae. This may be attributed to the fact that members of these families are leafy or have succulent stems that makes them edible to animals, particularly, pigs.

5.1.4.2 **Commonly used plants**

As mentioned, the plant family most frequently used as animal food is Amaranthaceae. Many animal food plants are from the cosmopolitan genus of herbs *Amaranthus*, *e.g.*, *Amaranthus cruentus, Amaranthus lividus* and *Amaranthus spinosus*. For this reason, they are common agricultural weeds present in cultivated field of the villages studied, and using these plants as animal food may probably be a way of controlling weeds. Additionally, plants such as *Broussonetia papyrifera* and *Ficus* spp., of which leaves were used for feeding pigs, were used in similar ways by the Akha living in both Thailand and China (Inta, 2008).

5.1.5 **Materials**

5.1.5.1 **Plant family**

Among the plant species used as materials, many were from the families Poaceae, Rubiaceae, Papilionaceae, and Euphorbiaceae. Because use for materials is mainly for constructions, many woody tree species, with good wood, from these plant families as well as many species of bamboo were frequently used (Figure 80). Bamboos are widely distributed in tropical Asia and also in northern Thailand where they are the preferred building material to many ethnic groups (Dransfield and Widjaja, 1995). For instance, 20 native species of bamboos are used by hill tribes in northern Thailand (Anderson, 1993).

5.1.5.2 **Commonly used plants**

The mature leaves of *Strobilanthes cusia* is used for dyeing by many ethnic groups. The Hmong use this plant to produce the blue color for their traditional batik (Figure 84). This plant has also been reported as a coloring agent among the Karen (Trisonthi and Trisonthi, 2002; Khamfachuea, 2008) and elsewhere in the world, *e.g.*, in India (Akimpou *et al*., 2005).

As in many other parts of the World, palm leaves are the most common form of thatch (Balick and Beck, 1990), and the leaves of one particular palm species, *Livistona speciosa*, was much used for roof thatching in my study area (Figure 81A-C).

Charcoal from burned stems of *Solanum erianthum* was commonly used as the starter for making gunpowder by all four ethnic groups (Figure 85).

The wood of *Gmelina arborea* was often used by the Khamu and the Lua for making the mortar or container used for steaming sticky rice and this prevalent use was said to be due to the long durability of its wood (Figure 82C; 99C).

Besides, large leaves of species of Marantaceae, including *Donax canniformis* and *Phrynium imbricatum* (Figure 106E), in addition to various other species of Marantaceae with large leaves, were used for wrapping (Figure 82H). Elsewhere these species are used for thatching, scooping and other household works as documented in the ethnobotanical study of the Mbuti and Efe in Congo (Terashima and Ichikawa, 2003).

Roots (and leaves) of *Plumbago indica* and *Plumbago zeylanica* were used as ingredients for fermentation of traditional alcoholic drinks by the Mien, Khamu and Lua. Similar uses were also reported in Prakash (2010).

5.1.6 **Fuels**

5.1.6.1 **Plant family**

Among various species of woody shrubs and trees species from many plant families were registered as used for fuel Euphorbiaceae was the largest family for this use. This may be attributed to the fact that it is a large family that includes a number of woody plant species. Elsewhere – in Chile – the Euphorbiaceae has also been reported as an important source of fuels (Gnecco *et al*., 1988).

5.1.6.2 **Commonly used plants**

Most uses of fuel plants were for the two species, *Cratoxylum formosum* subsp. *pruniflorum* and *Macaranga denticulata,* of which dried stems were considered 'good' fuel plants by many villagers. These two species are widely distributed across most of villages studied and they grow in their cultivated fields at forest edges. The natural attributes of the plants (Terashima and Ichikawa, 2003) as well as the salience and accessibility of the plants species are often considered to be factors that influence which plants are used (Thomas *et al*., 2009). In other words, more salient and accessible plants are often considered more useful than less abundant or less accessible species, and this seems to be the reason for the popularity of these two widely used species. *Cratoxylum formosum* is also used as fuel in other parts of northeastern Thailand (Cruz-Garcia and Price, 2011) and *Macaranga denticulata* is a useful fuel-wood in the Nagaland state of India (Bhan, 2009).

5.1.7 **Social uses**

5.1.7.1 **Plant family**

In this study, the plants most often selected for social uses were from the plant families Zingiberaceae, Euphorbiaceae, Araceae, and Asteraceae. Because the selection of plants to use socially by any culture, such as ritual plants, sacred plants, or symbolic plants, depends on a cultural perspective which is sometimes seen as

arbitrary when a plant's physical attributes are not taken into account (Terashima and Ichikawa, 2003), it is therefore difficult to determine certain attributes of plants used socially by a cultural group. The only possible explanation for this may be that these plant families are large and composed of a great number of species and therefore there is a high possibility for those plants to be chosen.

5.1.7.2 **Commonly used plants**

In this study, social uses were mostly recorded for plants used for spiritual or ritual ceremonies or used as masticatory. All four ethnic groups studied are animist, believing in spirits, ancestors and the supernatural. Plants are, therefore, used in many ways to show respect to the spirits. However, because it is most common to use chicken and pigs as offering among the Hmong and Mien, few plant species were recorded for Hmong and Mien ceremonies. Among the Lua and Khamu, *Celosia argentea* was commonly used in rice-related ritual ceremonies such as the *Sa-lode* of the Lua. Likewise, *Justicia gendarussa* was used as a symbolic plant to show respect in spiritual ceremonies. The rhizome of *Zingiber cassumunar* was thought to be sacred and it is widely used to ward off the evil spirit. The leaves of *Blumea balsamifera* are reputed to ward off evil spirits according to my observations as well as in Thai folklore. Here it is also interesting to note that even if each group used a number of different plant species for warding off the evil spirits, metaphorical associations were observed. For instance, many plant species with sharp spines such as *Acanthus montanus*, *Capparis zeylanica*, and *Mimosa pudica*, were used for this purpose.

As for the masticatory plants, *Areca catechu* or betel nut and *Piper betel* or betel leaves were common sources. The bark from *Artocarpus lakoocha* (Figure 90 D-E) was also widely used as supplement to the masticatory made of betel nut and betel leaves. These plants were widely used among the elders of the Lua and Khamu as observed in this study, and across many parts of Thailand as well as in India (Trivedi, 2006).

5.1.8 **Vertebrate poisons**

5.1.8.1 **Plant family**

In this category, most plants species were from the families Papilionaceae, Apiaceae, and Mimosaceae. However, unlike plants from aromatic plant families that were widely used as food additives, it appeared that the frequent mention of these plant families may be attributed to the natural poisonous features of the species themselves rather than to the characteristic of the plant family.

5.1.8.2 **Commonly used plants**

Uses registered in this category were mainly for fish poisons. The commonly used plants for this purpose were *Derris elliptica* (Figure 96C), *Buddleja asiatica* (Figure 90I), and *Hydrocotyle javanica* (Figure 101E). The informants in many villages reported that the most effective way of obtaining fish is by throwing poison composed of the extract from poisonous plants into a pool or stagnant water. The stupefied fish then rise to the surface, where they float and are easily collected. Similar ways of fishing has also been reported from other parts of Thailand (Khamfachuea, 2008) and many other countries such as India (Ayyanar and Ignacimuthu, 2010), Sri Lanka (Joshi and Joshi, 2006), and Taiwan (Hiroshi, 2000).

Derris elliptica is a climber widely distributed across Southeast Asia and it has been mentioned in the literature as an important source of compounds with pesticidal properties. These properties are due to the presence of rotenone. Extracts from its roots or stem have been used over centuries as fish poison and as insecticide (Sae-Yun *et al*., 2006). Similar uses of this plant were reported among the Monpa ethnic group from Arunachal Pradesh, India (Namsa *et al*., 2011) and the Karen in Chiang Mai province, Thailand (Khamfachuea, 2008; Kamwong, 2009).

Buddleja asiatica also has a wide distribution, stretching from northern India and Nepal to southern China and south to Malaysia, Indonesia and Papua New Guinea. This species has frequently been used as fish poison elsewhere such as in Taiwan (Hiroshi, 2000), Indonesia (Devendra, 1989), Sri Lanka (Joshi and Joshi, 2006), and Vietnam (Houghton, 1984).

Hydrocotyle javanica has also been used as fish poisons in Indonesia (Mabberley, 2008). In this study, in addition to *Hydrocotyle javanica*, another species

from the same genus, *H. sibthorpioides,* was used for the same purpose by the Mien from the Huai Labaoya and Huai Sanao villages. Elsewhere, *H. asiatica* (synonym of *Centella asiatica)* was reported as a fish poisons used by the Kattunayakka tribal people from Southern India (Ayyanar and Ignacimuthu, 2010). It would, therefore, be interesting to study the active compounds produced by other species from this genus.

In addition to fish poisons, other vertebrate poisons were commonly reported for *Gelsemium elegans* (Figure 98H-I) and *Antiaris toxicaria*. *Gelsemium elegans* has been widely reported as an extremely poisonous plant in Southeast Asia (Fung *et al*., 2007; Lai and Chan, 2009; Dutt *et al*., 2010). The informants in this study reported that oral ingestion of "three young leaves" of *Gelsemium elegans* could cause the death. During the course of the survey conducted in Manee Pruek village, there was a heart-broken woman trying to commit suicide by eating the young shoot of this plant but fortunately someone noticed her and took her to the hospital in time. The use of *Antiaris toxicaria* was mostly for arrow poison derived from its milky latex in past time when the Hmong hunted in the forest but none of the informants mentioned its recent use. This plant has been reported as being used for similar purposes elsewhere and it is generally known for its poisonous properties that are attributed to the chemical compound called *antiarin* that is extracted from it (Jun, 1892).

5.1.9 **Non-vertebrate poisons**

5.1.9.1 **Plant family**

The plant species mentioned as non-vertebrate poisons frequently came from the families Asteraceae and Rutaceae. Many of the plants registered in this use-category were odorous and used as insect repellent. As reported elsewhere, the strong odor is a common attribute of plants used as insect repellent. The chemical components that produce the plants' odors are volatile oils. The dominance of these plant families may in this context be attributed to their content of essential oils and they may be promising plant families for the study of insecticidal activity (Yang and Ma, 2005; Barakat, 2011).

5.1.9.2 **Commonly used plants**

There was only one species in this use-category that was commonly used in more than one village. The Lua in Toei Klang and Manee Pruek 2 villages used *Toona sinensis*, which has very odorous leaves, to put in their chicken coops to repel parasites (*Dermanyssus* spp.). Leaf extracts from this species had significant repellent effects, especially on the greater grain weevil (*Sitophilus zeamais*) (Lin, 2010)

Medicinal plants

For the medicinal uses, there was large intra-cultural variation in the local knowledge reported by informants. Many uses were reported by only one informant. Cultural diversity in plant use reflects characteristics of the botanical environment (Kent, 2006), and the large variation in medicinal plant uses may reflect the large botanical diversity in the study region. This diversity of plants provides each community with a great number of plants to choose among when they identify medicinal plants. The anthropologists have defined knowledge as "*agreement between participants*"and culture as "*knowledge shared by a group*" (Reyes-García *et al*., 2003; Vandebroek, 2010). This suggests that the idiosyncratic uses reported by single informants cannot be counted as knowledge. However, single use-reports are considered in this study for following reasons:

1. The basis for intra-cultural variation in plant use lies in the different nature of knowledge transmission concerning plant use. People may not use plants as a communication medium and they may not communicate with each other about the plants; for this reason, they are not always required to agree about the way to use a given plant (Kent, 2006).

2. Use of medicinal plants may vary most with plants that can readily be replaced by other plant species (Kent, 2006). Such idiosyncrasy in medicinal plant knowledge may probably be attributed to the use of the scarce or non-preferred species.

3. Being reported by few or single informants, does not necessarily mean that the plant is unimportant. Because idiosyncratic knowledge is acquired individually through ongoing experimentation with plants and because the effectiveness of medicinal plants depends on biological efficacy of the medicinal plants as well as

each individual's response to the pharmacological components of the medicinal plants, this knowledge may be more or less restricted to an individual or a few individuals (Vandebroek, 2010).

4. Empirical experience is the basis for knowledge and knowledge of plant use is not consistent. Individual knowledge may therefore later be incorporated into a common knowledge of a community and then transmitted from generation to generation as shared knowledge (Kent, 2006).

The investigation found that some of the idiosyncratic knowledge mentioned by single informants in one village was also in accord with what was found from another village, either belonging to the same or a different ethnic group. Also, it was found that the idiosyncratic knowledge was mostly reported by the key informants who are medicinal plant specialists. This was likely due to medicinal plant knowledge often belongs to the specialty domain of a limited number of individuals in a community, and may be kept secret for that reason. Therefore, the key informants more likely have knowledge deviating from that of other informants. This finding was in line with a previous study that demonstrated that the traditional healer who holds more medicinal plant knowledge often agree less with others and hence possesses a higher degree of idiosyncratic knowledge (Vandebroek, 2010).

Informant Consensus Factor (ICF)

ICF is an ethnobotanical index used to test the homogeneity of plant knowledge among informants (Troter and Logan, 1986). Theoretically interpretation of ICF values revolve around two possibilities; high agreement (high homogeneity; ICF values approach to one (1)), and less agreement (high heterogeneity; ICF values are low near zero (0)). When ICF values are low, it implies that plants are chosen randomly for uses or there is no exchange of information (or no agreement) about plant uses among informants. In contrast, high ICF values imply that there is a well-defined selection criterion for a use-category in the community and/or plant knowledge is widely distributed among informants (Gazzaneo *et al*., 2005).

In this study, the low ICF values encountered in some medicinal use-categories from some villages may be attributed to the large idiosyncratic knowledge

reported by single or few informants and it is closely related to the use of many substitute plants for a specific use. In one village, the ICF value was definitely zero when the informants mentioned distinct uses for different species (no exchange of information). Besides, it was found for many use-categories that ICF value could not be calculated for some villages as there were only single use reports (N_{ur}=1) for single species (N_t=1) from only one informant, making the denominator for the calculation of ICF equal to zero.

Fidelity level (FL)

FL is an index used to determine the most preferred species used in the treatment of a particular ailment (Friedman *et al*., 1986). In this study, high FL values (approaching 100%) reflect two main situations. First, there is high degree of agreement among many informants about the use of a particular plant for the same purpose. Second, there is high degree of idiosyncratic knowledge, *e.g.*, single use of a species, either reported by single or a few informants. In that way some plants reported for a single use-category have 100% of fidelity level. Low FL values were found for plants that were used for many different purposes.

However, plants with low FL values, including those with high FLs resulting from the idiosyncrasy of plant uses, are not necessarily unimportant. For them, having low FLs indicates that traditional knowledge about them is at risk of not being transmitted and that it may be at risk of not being transmitted and may be gradually disappearing (Chaudhary *et al*., 2006).

5.1.10 **Medicines: Abnormalities**

5.1.10.1 **Plant family**

It may not be said that Papilionaceae and Urticaceae are the best represented plant families used for treating abnormalities because only two and three plant species, respectively, from these families were used in this category. Even if the specific characteristic of these plant families could not be determined to be associated with abnormalities, all use reports for member of these family was for treating oedemas. This could possibly be attributed to the natural bioactive compounds

commonly produced among members from these families, especially in the genus *Crotalaria* from which two plants species were reported for this use.

5.1.10.2 **Commonly used plants**

There was only one plant species for which knowledge about its use was shared between Hmong villages. The Hmong in Manee Pruek and Song Khwae commonly used *Boehmeria nivea* (Figure 92A) to treat oedemas. In part, this shared knowledge maybe related to traditional Chinese medicine, as in China, the root of this plant is an important traditional medicine that is also used for the treatment of many disorders including oedema (Xu *et al*., 2011)

5.1.11 **Medicines: Blood system disorders**

5.1.11.1 **Plant family**

The most frequently mentioned blood system disorders treated by medicinal plants were pale skin/anemia and blood tonic. Mostly, plants species from Araceae were used for treating pale skin/anemia whereas species from Amaranthaceae were used as a blood tonic. It was thought by many informants that pale skin is closely related to the spleen and the most commonly mentioned way to treat the disorder was to apply the heated poultice on the abdominal areas around the position of that organ. The preference of Araceae species for this purpose could be because their petioles are heat bearable so the warmness of poultice will last for long time when applied. Likewise, the preference of Amaranthaceae species for blood tonic may be attributed to the organoleptic property of the red pigment found in these plants (Leonti *et al*., 2002) such as betalains from *Celosia argentea* (Figure 76F-G; Schliemann *et al*., 2001), and betacyanins from *Amaranthus cruentus* (Figure 88C) and *Iresine herbstii* (Figure 102G). Both compounds have been reported to enhance the oxygen-carrying capacity of the blood (Cai *et al*., 2001). This is part of the doctrine of signature, the belief in "*curing like with like*" referring to the physical characteristics of plants that supposedly reveals their therapeutic value, which is found throughout the world (Bennett, 2007). In this case, their reddish color may refer to the plant's efficacy in treating blood ailments. In addition to these Amaranthaceae species, other plants with red pigment or red sap such as red variety of *Basella alba*, *Butea* cf. *superba* (Figure

91D), *Caesalpinia sappan* (Figure 92D), and *Stephania pierrei* (Figure 110E) are used as blood tonic. It therefore cannot be said that Amaranthaceae is the most used plant family for treating blood system disorders as the selection for plants for such uses is based largely on organoleptic property of the plants themselves, rather than the plant family.

5.1.11.2 **Commonly used plants**

As knowledge related to many plant species were shared between villages, either from identical or different ethnic groups, shared knowledge including its similar uses and/or therapeutic effects reported in the literature have been summarized in Table 81. Notably, four of five shared uses were related to the doctrine of signature (Bennett, 2007) based on their organoleptic property (Leonti *et al*., 2002), such as red pigments are thought to be efficient as blood tonic, and the yellow root of *Morinda angustifolia* (Figure 105A-B) is thought be effective for treating yellowing of skin.

Table 81. Medicinal plants commonly used to treat blood system disorders and similar uses/corroboration of their therapeutic effects reported in the literature

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Perilla frutescens	Treating pale skin/yellowing of skin (Hmong)	-	-
Butea cf. *superba*	Blood tonic (Hmong, Mien, Lua)	-	-
Ceasalpinia sappan	Blood tonic (Hmong, Mien, Lua)	Blood purifying (India)/ *blood vitalizing activity*	Badami *et al.*, 2004
Iresine herbstii	Blood tonic (Hmong, Mien, Lua)	Increasing of blood corpuscles (Mien)	Panyaphu *et al.*, 2011
Morinda angustifolia	Treating pale skin/yellowing of skin (Hmong, Mien)	Treating jaundice (Bangladesh)	Rahmatullah *et al.*, 2009; 2010
Stephania pierre	Blood tonic (Hmong, Mien)	-	-

5.1.12 **Medicines: Circulatory system disorders**

5.1.12.1 **Plant family**

There were no commonly represented plant families for this category as only one or two plant species were from each of them.

5.1.12.2 **Commonly used plants**

Knowledge related to six plant species used for particular ailments were shared between villages as well as their similar uses and/or therapeutic effects reported in the literature (Table 82). The use of *Gynostemma pentaphyllum* by the Hmong is in accordance with its use in Chinese traditional medicine. It is therefore implicitly assumed that the Hmong have had this knowledge since past time when they resided in their Chinese homeland and that the knowledge was past down from generation to generation. In contrast, the informants reported that shared knowledge of *Cissus quadrangularis* and *Gynura procumbens* were gained from outsiders (*e.g.*, the state officials who work in public health center within or nearby their villages) as part of the health knowledge dissemination project.

Table 82. Medicinal plants commonly used to treat blood system disorders and similar uses/corroboration of their therapeutic effects reported in the literature

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Gynostemma pentaphyllum	Hypertension (Hmong)	*Lowering high blood pressure*	Mishra and Joshi, 2011
Cissus quadrangularis	Hemorrhoids (Mien)	Hemorrhoids	Leelatheerakul, 2005
Gynura procumbens	Hypertension (Khamu, Lua)	*Antihypertensive activity* Hypertension	Kim *et al*., 2006 Keng *et al*., 2009
Mimosa pudica	Hypertension (Hmong, Mien, Khamu)	Hypertension (Philippine) Treating hypertension (Mien)	Hadjula, 2006 Panyaphu *et al*., 2011
Morinda angustifolia	Hypertension (Hmong, Khamu)	*Lowering high blood pressure* (China)	Xiang *et al*., 2008

Table 82. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Pseuderanthemum palatiferum	Hypertension (Mien, Khamu)	*Antihypertensive activity* Hypertension (Vietnam)	Khonsung *et al*., 2011 Huynh *et al.*, 2006; Mai *et al*., 2011

5.1.13 **Medicines: Digestive system disorders**

5.1.13.1 **Plant family**

The plant families commonly registered in this use-category were Zingiberaceae, Euphorbiaceae, Asteraceae, and Lamiaceae. The use of plant species from these plant families to treat digestive system disorders may be attributed to their essential oil compounds (Westover, 2010). Using of essential oils is a common phytotherapy of gastrointestinal disorders. Likewise, the use of astringent/bitter-tasting parts including barks of many species from Euphorbiaceae may be related to their tannin components (Leonti *et al*., 2002). Elsewhere, it appears that a large number of the plants used in the treatment of gastrointestinal pain contain essential oil or bitter principles, resulting from tannin (Heinrich *et al*., 1992).

5.1.13.2 **Commonly used plants**

The large number of medicinal plants shared for treating common ailments such as stomachache, reflects the large body of knowledge related to medicinal plants used to treat digestive system disorder held by the four ethnic groups (Table 83).

Table 83. Medicinal plants commonly used to treat digestive system disorders and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Acorus calamus	Stomachache/ indigestion/gastric ulcers (Hmong)	Stomachache (Karen, Tai Lue, American Indian, Cree)	Motley, 1994; Tovaranonte, 1998; Sukkho, 2008; Kamwong, 2009
		Stomachache, indigestion (Hani/China)	Ghorbani *et al*., 2011
		Digestive disorders (Bai/China)	Weckerle *et al*., 2009
		Weak digestion	Balakumbahan *et al*., 2010
Agrimonia nepalensis	Indigestion (Hmong)	Indigestion (South Korea)	Kim and Song, 2011
Andrographis paniculata	Stomachache (Hmong, Khamu)	Stomachache	Patel, 2010
Artemisia verlotiorum	Stomachahe/flatulence (Hmong)	-	-
Bischofia javanica	Diarrhoea (Hmong, Mien)	Diarrhea (Hmong, Mien)	Tovaranonte,1998; Panyaphu *et al.*, 2011
		Diarrhea (India)	Pradhan and Badola, 2008
Blumea balsamifera	Stomachache/diarrhoea (Hmong, Mien)	Stomachache	Ahmad and Ismail, 2003; Sam *et al*., 2008; Bhuiyan *et al*., 2009
		Diarrhoea (Hani/China)	Ghorbani *et al.*, 2011
Butea cf. *superba*	Diarrhoea (Lua)	Diarrhea (India)	Bastin, 1895

Table 83. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
		Diarrhea (Saek, Kry/Lao PDR)	de Boer *et al.*, 2012
Camellia sinensis	Diarrhoea (Khamu,Lua)	Diarrhoea/gastrointestinal dysfunction	Sharangi, 2009
Canna indica	Stomachache (Hmong)	Stomachache (Hmong/USA)	Corlett *et al.*, 2002; 2003
Centella asiatica	Aphthous ulcer (Mien, Lua)	Aphthous ulcer (Thai, Chinese)	Krassanai, 1999
		Inner heat (Hani/China)	Ghorbani *et al*., 2011
Chlorophytum nepalense	Diarrhoea (Hmong, Lua)	-	-
Chromolaena odorata	Gastric ulcers (Mien)	Gastric ulcers (Mien)	Panyaphu *et al.*, 2011
		Stomachache, diarrhoea (Vietnam)	Sam *et al.*, 2008
		Stomachache, diarrhoea (Brou, Saek, Kry/Lao PDR)	de Boer *et al.*, 2012
Connarus semidecandrus	Diarrhoea (Mien, Khamu)	Diarrhoea (Lua, Khamu)	Tangtragoon, 1998
	Stomachache (Hmong, Lua)	Stomachache (H'tin)	Yaso, 2000
Cratoxylum formosum subsp. *pruniflorum*	Aphthous ulcer (Hmong, Lua)	Diarrhoea (Lahu, Karen)	Anderson, 1986b; Kamwong, 2009
	Diarrhoea (Hmong, Khamu)	Stomachache (Karen)	Sukkho, 2008
Curcuma aeruginosa	Gastric ulcers (Mien) Stomachache (Mien, Khamu, Lua)	-	-

Table 83. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Elephantopus scaber	Stomachache (Hmong, Mien)	Stomachache (Vietnam, India)	Sam *et al.*, 2008; Srivastava *et al*., 2012
Eleutherine americana	Stomachache (Hmong)	Stomachache (Akha, Lua)	Anderson, 1986a; Yaso, 2000
Fagopyrum cymosum	Stomachache (Hmong)	Stomachache (Hmong/USA)	Corlett *et al*., 2002; 2003
Fallopia forbesii	Diarrhoea/ stomachache (Hmong, Mien)	-	-
Garuga pinnata	Diarrhoea (Khamu, Mien)	Gastric ulcers (Mien)	Panyaphu *et al*., 2011
Gmelina arborea	Gastric ulcers (Mien)	Gastric ulcers (Karen, Mien)	Sukkho, 2008; Panyaphu *et al*., 2011
Hopea odorata	Toothache (Khamu)	Toothache (Mien)	Panyaphu *et al.*, 2011
Kaempferia galanga	Stomachache (Hmong)	Stomachache (H'tin) Stomachache	Yaso, 2000 Sirirugsa, 1999; Umar *et al*., 2011
Kaempferia parviflora	Gastric ulcers (Mien)	Gastric ulcers (Mien)	Panyaphu *et al.*, 2011
Kaempferia rotunda	Stomachache (Hmong,Mien) Stomachache (Hmong,Mien, Lua)	Stomachache Stomachache (Lahu, Karen)	Sirirugsa, 1999 Anderson, 1993
Kalanchoe laciniata	Stomachache (Hmong)	-	-
Kalanchoe pinnata	Stomachache (Hmong)	Stomachahce (Hmong/USA)	Spring, 1989
Kalimeris indica	Diarrhoea for newborn baby (Hmong)	-	-

Table 83. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Leea indica	Diarrhoea (Hmong, Mien)	Diarrhea	Chuakul *et al*., 2002; Wong *et al*.,2012
Lepidagathis incurva	Indigestion (Hmong)	-	-
Mahonia siammensis	Diarrhoea (Hmong, Lua)	-	-
Melastoma malabathricum	Diarrhoea/dysentery (Lua)	Diarrhea (red-headed Yao, Akha, Malaysian)	Long and Li, 2004; Inta 2008;Hossan *et al*., 2010; Kagyung *et al*., 2010
Morinda angustifolia	Gastric ulcers (Mien, Khamu)	Gastric ulcers (Mien)	Panyaphu *et al*., 2011
		Stomachache (Akha)	Anderson, 1993
Paederia pilifera	Flatulence (Khamu, Lua)	Stomachache (H'tin)	Yaso, 2000
Phyllanthus urinaria	Toothache (Khamu)	Toothache (Fiji)	Cambie and Ash, 1994
Plumbago zeylanica	Toothache (Hmong) Stomachache (Hmong, Mien)	Diarrhoea (India)	Shanmugam *et al*., 2011
Psidium guajava	Diarrhea (Four groups)	Diarrhea (Hmong, Mien, Khamu, Akha, Tai Lue, Hani, Brou, Saek, Kry, etc.)	Tangtragoon, 1998; Tovaranonte, 1998; Ahmad and Ismail, 2003; Anisuzzaman *et al*., 2007; Au *et al*., 2008; Inta *et al*., 2008; Sam *et al*., 2008; Ghimire and Bastakoti, 2009; Malla and Chhetri, 2009; Yang-ed *et al*., 2009; Kagyung

Table 83. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
			et al., 2010; Ghorbani *et al*., 2011; Husin, 2011; de Boer *et al*., 2012
Rumex crispus	Toothache (Hmong)	Toothache (USA)	Sackschewsky and Downs, 2001
Scoparia dulcis	Aphthous ulcer (Hmong, Mien)	Ulcer (Hmong, Karen)	Anderson, 1993
Sesbania grandiflora	Toothache (Khamu)	-	-
Sophora flevescense	Stomachache (Hmong)	Indigestion (South Korea)	Kim and Song, 2011
Stahlianthus campanulatus	Stomachache, flatulence (Hmong)	-	-
Stahlianthus involucratus	Stomachach, diarrhea (Hmong)	Stomachache (Hmong)	Pake, 1987
Tacca chantrieri	Gastric ulcer (Mien, Lua)	Stomachache (Hmong, Lahu) Stomachache (Lahu/China) Diarrhoea, gastric ulcers, stomachache (Hani/China)	Anderson, 1993 Huai and Pei, 2004 Ghorbani *et al.*, 2011
Tadehagi triquetrum	Stomachache (Khamu)	Diarrhoea (Akha)	Anderson, 1986a
Teucrium viscidum var. *viscidum*	Stomachache (Hmong)	Indigestion, stomachache (Hmong/USA)	Corlett *et al*., 2002; 2003
Thunbergia laurifolia	Gastric ulcer (Mien)	-	-
Verbena officinalis	Indigestion (Hmong)	Indigestion (Hmong/USA) Indigestion (Akha, Hmong)	Corlett *et al*., 2002; 2003 Anderson, 1993
Xiphidium caeruleum	Indigestion, stomachache (Hmong)	-	-

Table 83. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Zingiber cassumunar	Flatulence (Hmong,Khamu)	Stoamachache (H'tin) Indigestion (India)	Tangtragoon, 1998 Srivastava *et al.*,2012
Zingiber ottensii	Stomachache (Hmong, Lua, Khamu)	Flatulence (Karen)	Sukkho, 2008

5.1.14 **Medicines: Endocrine system disorders**

5.1.14.1 **Plant family**

There were no commonly used plant families for this use-category as only one or two plant species were allocated to each of them.

5.1.14.2 **Commonly used plants**

Of the shared knowledge of four plant species, as it was mentioned for some plants registered in the category of circulatory system disorders, the informants reported that the knowledge of using *Gynura procumbens* (Figure 100C), *Pseuderanthemum palatiferum* (Figure 107F) and *Tinospora crispa* was gained from the outsiders of their villages.

Table 84. Medicinal plants commonly used to treat digestive system disorders and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Clerodendrum colebrookianum	Goitre (Lua)	-	-
Gynura procumbens	Diabetes mellitus (Khamu, Lua)	Diabetes mellitus	Keng *et al.,* 2009
Pseuderanthemum palatiferum	Diabetes mellitus (Hmong, Mien, Khamu)	*Antidiabetic effects*	Chayarop *et al*., 2011

Table 84. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
		Diabetes mellitus (Vietnam)	Mai *et al*., 2011
Tinospora crispa	Diabetes mellitus (Hmong, Mien, Lua)	Diabetes mellitus (Karen)	Kamwong, 2009

5.1.15 **Medicines: Genitourinary system disorders**

5.1.15.1 **Plant family**

The plant families that provide large number of medicinal plants for treating genitourinary system disorders were Lamiaceae and Asteraceae. As these two plant families are reputed as important source of essential oil (Westover, 2010), such common natural attributes may contribute to their therapeutic effects. However, that assumption is is still ambiguous as, so far, there were only reports about using essential oils to treat disorders including genitourinary system disorder by using inhalation or aromatherapy (Lawless, 2002). Because these two families are large plant family, another possible explanation for their dominance may be their variation in growth form, general morphology as well as their availability in the natural surroundings since they can be found in many different localities and habitats.

In a previous study about medicinal plants used to treat genitourinary system disorders in Bangladesh, Asteraceae also provided the largest number of medicnal species (Hossan *et al*., 2010). I assume that this could be attributed to its great number of plant species that provide a pool for selection.

5.1.15.2 **Commonly used plants**

Knowledge related to uterine disorders and urinary disorders were mostly shared. Information in Table 85 refers to uterine and urinary disorders. It is noticeable that the uterine disorders were shared among villages of the Hmong. Because fertility is a dominant theme in Hmong culture (Weeks *et al.*, 1989; Lundh, 2007) and

infertility, low fertility, or inability to conceive are usually blamed on the woman, the Hmong often employ fertility-enhancing herbs (Lundh, 2007). To Hmong traditional attitude, the uterus is significant as the home for the unborn and the basis of "*true*" women for fulfilling her responsibility to her husband and family (Yang and Mielke, 2003). Hmong women fear the collapse of their uterus more than any other health condition because they believe that it is fatal and cannot be cured (Liamputtong, 2003). Women's ability to become pregnant and give birth to healthy children is the most important sign that the uterus is healthy. Absence of menstruation for a long time is considered bad for uterine health. Normal and regular menstrual cycles are important to clean the uterus. This may be the reason that plant uses recorded here mainly related to the uterine disorder, particulary amenorrhoea and dysmennorhoea. My findings therefore implicitly suggest that many Hmong woman still maintain these traditional attitudes. Furthermore, the lack of reports for similar uses related to gynecological disorders such as dysmennorhoea, amenorrhoea indicating that this use may be unique to the Hmong.

Table 85. Medicinal plants commonly used to treat genitourinary system disorders and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Dioscorea bulbifera	Scrotal hernia (Hmong, Mien)	-	-
Uterine disorders:			
Achyranthes longifolia	Dymennorhoea (Hmong)	-	-
Celosia argentea	Amenorrhoea (Hmong, Lua)	-	-
Fallopia forbesii	Amenorrhoea (Hmong)	-	-
Impatien balsamina	Amenorrhoea (Hmong)	-	-
Kalanchoe laciniata	Amenorrhoea (Hmong)	-	-
Mirabilis jalapa	Amenorrhoea/dysmennorhoea (Hmong)	Treating genitourinary disorders (Bai/China)	Weckerle *et al.*, 2009
Verbena officinalis	Dysmenorrhoea (Hmong)	Dysmenorrhoea (China)	Jia *et al.*, 2006

Table 85. (Continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Urinary disorders:			
Averrhoa carambola	Dysuria (Mien, Khamu)	Diuretic/urinary problems (Hmong, Lahu, Mien)	Anderson, 1993
		Urethral stones (Karen)	Kamwong, 2009
Caesalpinia sappan	Dysuria/urethral stone (Hmong, Mien, Khamu)	*Diuretic and urinary antiseptic activity*	Badami *et al.*, 2004
Eleutherine americana	Dysuria (Hmong)	-	-
Coix lachryma-jobi	Dysuria (Hmong, Khamu)	Dysuria (Karen)	Sukkho, 2008
	Urethral stone (Mien, Khamu, Lua)	Uretral stone (Tai Lue, Karen)	Inta 2008; Sukkho, 2008; Kamwong, 2009
		Diuretic disorders	Rai, 2003
Costus speciosus	Dysuria (Hmong, Lua)	Dysuria (Hmong)	Tovaranonte, 1998
	Urethral stone (Mien, Khamu)	Clearing of urine	Hossan *et al.*, 2010
		Urinary tract infections (India)	Pradhan and Badola, 2008
Equisetum debile	Dysuria (Hmong, Mien,Khamu)	Kideney stones	Prachi *et al.*, 2009
		Painful,difficult urination/ kidney stones (Hmong)	Pake, 1987
	Urethral stones (Mien, Khamu, Lua)	Uretral stone (Lua, Karen Tai Lue)	Yaso, 2000; Inta, 2008; Sukkho, 2008; Kamwong, 2009
		Diuretic/urinary problems (Hmong, Lisu)	Anderson, 1993
Euonymus sp.	Urethral stone (Mien)	-	-
Fallopia forbesii	Dysuria (Hmong, Mien)	-	-
Millettia extensa	Dysuria (Lua)	-	-
Morinda angustifolia	Urethral stone (Hmong, Mien)	-	-

Table 85. (Continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Mussaenda sanderiana	Dysuria/urethral stones (Mien)	Cystitis (urinary tract infection)(Hmong) Urethral stones (Mien)	Tovaranonte, 1998 Panyaphu *et al.*, 2011
Orthosiphon aristatus	Kidney detoxicant (Hmong) Kidney disease (Mien, Khamu)	Diuretic/urinary problems (Hmong, Mien, Lisu)	Anderson, 1993

5.1.16 **Medicines: Ill-defined symptoms**

5.1.16.1 **Plant family**

In this use-category, only few species were allocated in each of the plant families but Asteraceae provided three species that was the largest number in one family. However, in a case like this, it is difficult to say which natural attributes of the plants are determinant factors. I therefore, assume that it is also likely attributed to the great number of plants species in this family that in turn provide a large pool for selection of medicinal plants.

5.1.16.2 **Commonly used plants**

As result of the highly idiosyncratic knowledge reported by informants in each village, I found knowledge related to only two species that was shared, *i.e.*, *Boehmeria nivea* (Figure 92A) used for treating fainting by the Hmong, and *Tacca chantrieri* (Figure110F-G) used for treating fatigue by the Mien. However, there was no literature reported for similar uses.

5.1.17 **Medicines: Infections/Infestations**

5.1.17.1 **Plant family**

Like in the category of genitourinary system disorders, the plant families that provide the largest number of medicinal plants used to treat infections and infestations

disorders are Asteraceae and Lamiaceae. It appeared that the frequently reported infectious disorders treated by medicinal plants from these two families were fever, cold, and tinea pedis (Table 37). Many species of Asteraceae were used to treat fever and cold (viral infections) whereas those from Lamiaceae were mostly reported for treating tinea pedis (fungal infections). In this regard, once again, the contributing natural attributes to their uses for this category may likely be the essential oil components produced by them as there are literature reports that essential oils are highly anti-infectious (e.g. Reichling *et al*., 2009, Schelz *et al*., 2010).

5.1.17.2 **Commonly used plants**

Knowledge related to fever and ringworm was shared most between villages. The Hmong shared knowledge intra-culturally more frequently than did other groups, reflecting the higher cultural consensus of plant use among them.

Table 86. Medicinal plants commonly used related to infections/infestations and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Acorus calamus	Fever (Khamu)	Fever (Karen, Tai Lue, Tibetan)	Motley, 1994; Inta, 2008; Sukkho, 2008; Kamwong, 2009; Ahmed *et al*., 2010; Balakumbahan *et al.*, 2010
		Fever (India)	Pradhan and Badola, 2008
		Infant high fever (Saek/Lao PDR)	de Boer *et al.*, 2012
Ageratum conyzoides	Cold (Hmong, Mien,Lua)	Cold (Lahu/China)	Huai and Pei, 2004

Table 86. (Continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Artemisia verlotiorum	Fever (Hmong)	-	-
Artemisia vulgaris	Fever (Hmong)	Fever (Hmong/USA)	Spring, 1989
Carica papaya	Fever (Hmong)	Dengue fever (Pakistan)	Ahmad *et al.*, 2011
Cissus discolor	Ringworm (Hmong, Lua)	Ichy feet and finger (Akha)	Anderson, 1986a
Drynaria quercifolia	Shingles (Herpes zoster) (Mien)	-	-
Elatostema repens	Ringworm, Tinea pedis (Mien)	-	-
Eleusine indica	Fever (Khamu, Lua)	Fever (Khamu, H'tin)	Tangtragoon, 1998; Yang-ed *et al*., 2009
Gmelina arborea	Tinea pedis (Four groups)	Tinea pedis (H'tin)	Yaso, 2000
		Skin disease (antifungal activity)	Kawamura *et al.*, 2004
Houttuynia cordata	Fever, cold (Hmong, Mien)	Fever, cold (Hmong)	Spring, 1989; Tovaranonte, 1998; Corlett *et al*., 2002; 2003
		Fever (Lahu)	Anderson, 1986b
		Fever (Brou, Kry/Lao PDR)	Lamxay *et al*., 2011; de Boer *et al.*, 2012
		Cold and flu (Hakka, Bai/China)	Au *et al*., 2008; Weckerle *et al*., 2009
Hydrocotyle sibthorpioides	Cold (Mien)	Cold (India)	Srivastava *et al*., 2012
Kalanchoe pinnata	Plague for chicken (Mien)	-	-
Lycopodium cernuum	Hepatitis (Hmong, Lua)	-	-
Lysimachia christinae	Hepatitis B (Hmong)	Hepatitis (red-headed Yao/China)	Long and Li, 2004
Mimosa pudica	Fever (Mien)	Fever (Hmong/USA)	Corlett *et al.*, 2003

Table 86. (Continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Paederia pilifera	Fever (four groups)	Fever (Hmong, Mien)	Anderson, 1993; Tovaranonte, 1998
Plectranthusamboinensis	Fever (Khamu)	Fever (Karen)	Sukkho, 2008
Plumbago zeylanica	Malaria (Hmong)	Malaria (Akha, Hmong, Mien)	Anderson, 1993
Pothos chinensis	Fever (Hmong, Mien)	-	-
Senna alata	Ringworm (Hmong, Khamu)	Ringworm, *Antifungal activity*	Wuthi-udomlert *et al.*, 2010
Solanum spirale	Fever (Khamu, Lua)	Fever (H'tin, Khamu, Akha, Mien)	Tangtragoon, 1998; Inta, 2008; Panyaphu *et al.*, 2011
Stephania sp.	Ringworm (Mien)	-	-
Strobilanthes cusia	Fever (four groups)	Fever (Tai Lue, Karen, Lahu)	Anderson, 1986b; Ho *et al.*, 2003; Inta, 2008; Sukkho, 2008
Teucrium viscidum var. *viscidum*	Fever (Hmong)	-	-
Toona sinensis	Chichen pox (Hmong)	-	-
Verbena officinalis	Tinea pedis (Hmong)	Skin disease Fungal infections (Akha, Hmong)	Tovaranonte, 1998 Anderson, 1993
Vernonia cinerea	Fever (Hmong, Lua)	*Antipyretic activity*	Gupta *et al*., 2003

5.1.18 **Medicines: Inflammation**

5.1.18.1 **Plant family**

As only one or two plant species were allocated to each plant family, commonly represented plant families for this use-category could not be determined.

5.1.18.2 **Commonly used plants**

Resulting from the idiosyncratic knowledge reported for five plants registered in this category, I found no knowledge related to those species was shared among villages.

5.1.19 **Medicines: Injuries**

5.1.19.1 **Plant family**

The plant families that provided large number of medicinal plants to this use-category were Euphorbiaceae and Lamiaceae. As discussed for other medicinal use-categories, I assume that the natural attributes that make Lamiaceae species preferred for treating injuries could be their essential oil components since essential oils have antiseptic properties and marked wound healing activity. Elsewhere, many plants that contain essential oil were reported for wound healing (*e.g.*, Sotheeswaran and Sotheeswaran, 1999; Ouoba *et al*., 2012; Tumen *et al*., 2012).

As for most Euphorbiaceae species used in this use-category, it appeared that the main parts used was the latex; the preference of plant species from this plant family may therefore be attributed to laticifrous characteristic of the family. Research indicated that latex of some plant species has the wound healing activity (Mahajan and Badgujar, 2008) and many laticiferous plants were reported for treating wound and injuries (*e.g.*, Ayyanar and Ignacimuthu, 2009; Sankaranarayanan *et al*., 2010; Tripathi and Srivastava, 2010).

5.1.19.2 **Commonly used plants**

Table 87. Medicinal plants commonly used to treat injuries and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Ageratum conyzoides	Wounds (anti-bleeding) (Hmong)	Stop bleeding (Lua, Akha)	Yaso, 2000; Inta *et al*., 2008

Table 87. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
		Stop bleeding (South Pacific Islands, Nepal)	Sotheeswaran and Sotheeswaran,1999; Rai, 2003
Aloe vera	Burns (four groups)	Burns (Hmong, Akha, Bai/China)	Pake, 1987; Inta *et al*., 2008; Weckerle *et al*., 2009
		Burns (Nepal)	Rai, 2003
Boehmeria nivea	Abscesses (Hmong, Mien, Khamu)	Abscess (Mien)	Panyaphu *et al*., 2011
Chromolaena odorata	Wounds (anti-bleeding) (four groups)	Stop bleeding (Lahu, Lua, H'tin, Khamu, Akha, Karen, Mien)	Anderson, 1986b; Tangtragoon, 1998; Inta *et al*., 2008; Kamwong, 2009; Panyaphu *et al.*, 2011
		Stop bleeding (Nigeria)	Green, 2007
Cissus discolor	Abscesses (Hmong, Lua)	-	-
Cissus repens	Abscesses (Mien, Khamu)	Abscess (Mien)	Panyaphu *et al*., 2011
Crinum amabile	Bruises (Hmong, Mien)	-	-
Croton roxburghii	Wounds (Mien, Khamu, Lua)	Wounds	Salatino *et al*., 2007
Eleutherine americana	Wounds (Four groups)	Wounds (Karen)	Sukkho, 2008
		Burns (Lua)	Tangtragoon, 1998
Fallopia forbesii	Bruises (Mien)	-	-
Jatropha curcas	Burns (Hmong)	Burns (Karen)	Sukkho, 2008
Jatropha multifida	Wounds (Four groups)	Acute wound	Panyaphu *et al*., 2011
Jatropha podagrica	Wounds (Hmong, Mien)	-	-
Kaempferia rotunda	Wounds (Hmong, Mien, Lua)	Wounds (India)	Sharma and Pegu, 2011

Table 87. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Kalanchoe pinnata	Bruise (Hmong, Mien, Khamu) Burns (Khamu, Lua)	Burns (H'tin, Lua, Akha, Karen) Burns (Vietnam)	Anderson, 1986a; Tangtragoon, 1998; Inta *et al*., 2008; Kamwong, 2009 Sam *et al*., 2008
Muehlenbeckia platyclada	Centipede bites (Hmong)	-	-
Sansevieria roxburghiana	Centipede/snake bites (Hmong, Mien)	-	-
Smilax ovalifolia	Scars (Hmong, Mien)	-	-
Tadehagi triquetrum	Rotten wounds (Khamu, Lua)	Rotten wounds (Khamu, H'tin)	Tangtragoon, 1998;Yaso, 2000

5.1.20 **Medicines: Mental disorders**

5.1.20.1 **Plant family**

Commonly represented plant families could not be determined as there were only single species allocated to each of the three families registered for this use-category.

5.1.20.2 **Commonly used plants**

Only knowledge related to *Lysimachia christinae* (Figure 104F) was shared. Three Hmong informants in Khang Ho and Song Khwae village accordingly reported that its leaves are good for relief from panic and shock. However, I have not found any report for similar use of its therapeutic effect in the literature.

5.1.21 **Medicines: Muscular-skeletal system disorders**

5.1.21.1 **Plant family**

The commonly represented plant families were Acanthaceae, Asteraceae, Lamiaceae, and Zingiberaceae. I assume that the use of Acanthaceae species related to

muscular-skeletal system disorders may likely be attributed to doctrine of signature (Bennett, 2007) because they have swollen nodes that look like human's bones joints. Apart from the reasoning that Asteraceae, Lamiaceae and Zingiberaceae are large plant families containing large number of species, I assume that the use of these plant families may likely be attributed to their essential oils constituents. Many essential oils and their isolated components exhibit analgesic and muscular relaxant activity (de Martino *et al*., 2009).

5.1.21.2 **Commonly used plants**

As most of the villagers in all 12 villages are farmers, muscular-skeletal system disorders are common among them. As a consequence of working hard in the cultivated fields, many plant species were commonly used to treat basic disorders such as muscle pain, lumbago and fractures.

Table 88. Medicinal plants commonly used to treat muscular-skeletal system disorders and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Lygodium polystachyum	Muscle pain (Mien, Lua)	-	-
Ajuga sp.	Muscle pain (Hmong)	-	-
Betula alnoides	Muscle strengthening (Hmong, Lua)	Muscle strengthening (H'tin, Lua, Karen)	Tangtragoon, 1998; Yaso, 2000; Kamwong, 2009
Blumea balsamifera	Muscle pain (Hmong, Mien)	Bone and joint pain (Mien)	Panyaphu *et al.*, 2011
Costus speciosus	Muscle pain (Hmong, Mien)	-	-
Crinum amabile	Arthralgia, fractures, sprains (Strains)(Hmong, Mien, Lua)	Sprains (Karen)	Kamwong, 2009
Crinum asiaticum	Arthralgia, fractures, sprains (Strains) (Four groups)	Fractures, painful bone (Akha, Hmong)	Anderson, 1993

Table 88. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Croton roxburghii	Muscle pain (Khamu, Lua)	-	-
Cymbopogon citratus	Fractures (Mien)	Fractures (Hmong, Lisu, Lahu)	Anderson, 1993
		Bone and joint pain (Mien)	Panyaphu *et al.*, 2011
Gnetum montanum	Muscle pain (Mien)	-	-
Gonocaryum lobbianum	Muscle pain (Mien)	-	-
Justicia gendarussa	Fractures (Hmong, Mien)	Fracture (Garo)	Anisuzzaman *et al.*, 2007
		Pulled muscle	Corlett *et al.*, 2002; 2003
		Anti-arthritic activity	Paval *et al*., 2009
Kalanchoe pinnata	Fracture (Hmong)	Bone dislocation (Hmong)	Tovaranonte, 1998
	Sprains (Strains) (Khamu)	Fracture (Mien),	Tovaranonte, 1998
		Skeletal pain, sprains (Khamu)	Tangtragoon, 1998
Millettia extensa	Muscle strengthening, muscle pain	Muscle strengthening (H'tin)	Tangtragoon, 1998
Plantago major	Muscle pain (Khamu, Lua)	Muscle pain (Karen)	Kamwong, 2009
		Fracture (Hmong/USA)	Spring, 1989
Platycerium sp.	Fracture (Hmong, Mien)	-	-
Sambucus javanica	Fracture, muscle pain (Hmong, Mien, Lua)	Bruise (Karen),	Sukkho, 2008
		Fracture (Akha, Hmong, Lisu, Mien, Karen)	Anderson, 1993; Inta, 2008; Sukkho, 2008
Sambucus simpsonii	Fracture, muscle pain (Hmong)	Bone dislocation (Hmong)	Tovaranonte, 1998
		Bone, joint pain (Mien)	Panyaphu *et al.*, 2011
		Bruise, Fractures (Karen)	Sukkho, 2008

Table 88. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
		Muscle pain (Karen)	Kamwong, 2009
Sanchezia nobilis	Lumbago (Hmong)	-	-
Smilax lanceifolia	Muscle strengthening (Lua)	Muscle strengthening	Anderson, 1993
Strobilanthes cusia	Fracture (Hmong)	Muscular pain (Tai	Tovaranonte, 1998
	Muscle pain (Khamu)	Lue)	Ghorbani *et al.*,
		Fractures	2011
Tacca chantrieri	Muscle pain (Mien, Khamu)	Body pain (Hmong,	Anderson, 1993
	Lumbago (Mien, Lua)	Lahu)	
Torricellia angulata	Lumbago (Hmong)	-	-

5.1.22 **Medicines: Neoplasm**

5.1.22.1 **Plant family**

There were no commonly represent plant families as only single species was allocated to each of the nine plant families registered in this use-category.

5.1.22.2 **Commonly used plants**

The Hmong in Khang Ho village and the Mien in Huai Sanao village, which are located adjacently, shared the use of *Pseuderanthemum palatiferum* (Figure 107F). This plant is native to Vietnam and has been used in Vietnamese traditional medicine for treatment of many diseases. In Thailand, it is popular in plant markets and consumption of its leaves is said to be a good anti-cancer treatment. Researchs have been revealed the therapeutic effects of this plant for anti-cancer and antioxidant activity (Chayarop *et al*., 2011; Mai *et al*., 2011; Pamok *et al*., 2012). Resulting from its popularity, the informants from both villages reported that this plant was brought from outside communities by their relatives or members of the family who work elsewhere.

5.1.23 **Medicines: Nervous system disorders**

5.1.23.1 **Plant family**

As only a few species were allocated to each of the 12 plant families registered for treatment of nervous system disorders, there were no commonly represented plant families reported for this category.

5.1.23.2 **Commonly used plants**

In this use-category, only the knowledge related to *Thunbergia laurifolia* (Figure 111G) for treating convulsion was shared among the Khamu villages, Huai pook and Nam Pan. Similar uses have not been reported elsewhere, and this knowledge may therefore be unique to the Khamu in these two villages.

5.1.24 **Medicines: Nutritional disorders**

5.1.24.1 **Plant family**

The only common plant family registered in this use-category was Asteraceae. Most plants, especially those reported by the Hmong and Mien, were used as tonic food. It is not surprising that Asteraceae provides a number of plants for this use-category as it is one of the most important plant families that provide vegetables (Winch, 2006**;** Prohens-Tomás and Nuez, 2010).

5.1.24.2 **Commonly used plants**

The Lua and Khamu informants reported distinct knowledge for nutritional disorder; therefore, knowledge related to a single species, *Phylacium bracteosum*, was shared among them. I found that most of the commonly used plants were shared among the Hmong and the Mien, indicating cultural preferences in respect to consumption of these plants. Both the Hmong and Mien prefer having chicken soup in combination with many kinds of culinary herbs, which is an old Chinese practice, as a general tonic for restoring strength.

It was interesting that four species of the genus *Gynura* (Figure 100) were reported. The genus *Gynura* is native to Southeast Asia and their leaves are nutritious and regrow rapidly, making it an exemplary cut-and-come-again homegarden vegetable. The Hmong and the Mien prefer to use it as culinary tonic herbs to cook

with the chicken soup. The Hmong call this plants ‘tshuaj rog’ which means medicine that will make you fat.

Table 89. Medicinal plants commonly used to treat nutritional disorders and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Anredera cordifolia	Tonic (Hmong, Mien)	Postpartum tonic (Mien)	Panyaphu *et al.*, 2011
Artemisia lactiflora	Tonic (Hmong, Mien)	Tonic	Wong, 2007
Basella alba	Tonic (Mien)	Tonic (Hmong/USA)	Spring, 1989; Corlett *et al*., 2002; 2003
Dendranthema indica	Tonic (Hmong, Mien)	Tonic (Hmong/USA)	Corlett *et al*. 2002; 2003
Gynura bicolor	Tonic (Hmong, Mien)	-	-
Gynura longifolia	Tonic (Hmong, Mien)	-	-
Gynura nepalensis	Tonic (Hmong, Mien)	-	-
Gynura procumbens	Tonic (Hmong, Mien)	Tonic (Hmong/USA)	Corlett *et al*., 2003
Hemerocallis lilioasphodelus	Tonic (Hmong, Mien)	-	-
Iresine herbstii	Tonic (Hmong, Mien)	Tonic (Akha, Hmong)	Anderson, 1993
Kalanchoe laciniata	Tonic (Hmong, Mien)	Tonic (Hmong)	Anderson, 1993
Kalimeris indica	Tonic (Hmong, Mien)	Nutritional supplement (China)	Richard, 2011
Lysimachia christinae	Tonic (Hmong)	-	-
Paris polyphylla	Appetite stimulant (Hmong, Mien)	-	-
Phylacium bracteosum	Appetite stimulant (Lua, Khamu)	-	-
Talinum fruticosum	Tonic (Hmong, Mien)	Tonic (Hmong, Mien) Postpartum tonic (Mien)	Anderson, 1993 Panyaphu *et al*., 2011
Talinum paniculatum	Tonic (Hmong, Mien)	Tonic (Hmong/USA)	Spring, 1989
Tradescantia zebrina	Tonic (Hmong, Mien)	Appetite stimulant (Hmong/USA)	Spring, 1989
Valeriana jatamansi	Tonic (Hmong, Mien)	Nutritional supplement	Richard, 2011

5.1.25 **Medicines: Pain**

5.1.25.1 **Plant family**

The family Asteraceae provides the largest number of plant species used in this category. The frequently reported disorder for this use-category was headache and, in this study, the most commonly reported way to treat headache is to heat leaves of the medicinal plants over a fire and apply them over the forehead of the patient. It was thought that the sense from the leaves helps to provide headache relief. Even if the number of plant species is limited to four, it still makes sense to say that the preference to species of Asteraceae is likely attributed to its reputation as source of essential oils (Westover, 2010). Inhaling essential oils is a form of aromatherapy and it has been reported that almost all types of headaches can get relief from the use of essential oils (Keay, 2011).

5.1.25.2 **Commonly used plants**

Table 90. Medicinal plants commonly used to treat pain and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Artemisia verlotiorum	Headache (Hmong, Mien)	-	-
Artemisia vulgaris	Headache (Hmong)	Headache (Hmong/USA) Headache (Vietnam)	Spring, 1989 Sam *et al*., 2008
Blumea balsamifera	Headache (Hmong, Mien, Lua)	Headache (Hmong, Hani) Postpartum headache (Brou, Saek, Kry/Lao PDR)	Tovaranonte, 1998; Bletter, 2007; Lundh, 2007; Ghorbani *et al.*, 2011 de Boer *et al*., 2012
Juncus effusus	Analgesic (Mien)	-	-
Paederia pilifera	Headache (Lua)	-	-

5.1.26 **Medicines: Poisonings**

5.1.26.1 **Plant family**

Most plants used to treat poisonings were from the families Asteraceae and Acanthaceae. In spite of the lack of literature relevant to the natural attributes of these families to treat poisonings, I found that, elsewhere, a number of plant species from these family were used in the same way. The examples from Kenya indicated that a number of Asteraceae species such as *Bidens pilosa, Conyza sumatrensis, Laggera brevipes, Microglossa pyrifolia, Solanecio mannii, Tithonia diversifolia*, were reported as the antidote for snake bites. In addition, in Nigeria and India, many species of the Acanthaceae such as *Asystasia gangelica* (Odugbemi, 2008), *Andrographis paniculata* (Kulyal *et al.*, 2010; Radha *et al*., 2011), *Justicia calyculata* (Owuor and Kisangau, 2006), *Justicia betonica* (Nema *et al.*, 2012), and *Justicia tranquebariensis* (Neelima *et al.*, 2011), were also used as antidote, particulary for snake bites. It was suggested, that the antimicrobial activity of *Andrographis paniculata* could contribute to its claimed activity as an antidote for snake bite (Radha *et al.*, 2011).

5.1.26.2 **Commonly used plants**

Medicinal knowledge related to treating food poisoning was shared well among the Hmong. Likewise, informants in all three villages of the Mien also agreed highly that *Ipomoea muricata* (Figure 102E-F) is the efficacious antidote. This reflects that their cultural integrity related to healing practice for such disorders is still maintained.

Table 91. Medicinal plants commonly used to treat poisionings and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Acorus calamus	Food poisoning (Hmong)	-	-
Agrimonia nepalensis	Food poisoning (Hmong)	-	-
Apiaceaesp.1	Food poisoning (Hmong)	-	-

Table 91. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Ipomoea muricata	Antidote (Mien)	-	-
Maranta arundinacea var. *arundinacea*	Intoxication due to alcohol (Hmong)	-	-
Tacca chantrieri	Food poisoning (Khamu, Lua)	Food poison antidote (Hmong, Lahu, Tai Lue)	Anderson, 1993; Inta, 2008
*Teucriumviscidum*var. *viscidum*	Food poisoning (Hmong)	-	-
Thunbergia lauriflolia	Antidote (Hmong, Mien, Khamu) Poisonings due to snake bites (Mien, Khamu)	Antidote (Tai Lue)	Salguero, 2003; Oonsivilai, 2006; Inta, 2008; Posridee *et al.*, 2011
		Poisonings due to snake bites (Karen, Akha)	Anderson, 1993; Inta *et al.*, 2008
Vernonia parishii	Antidote (Hmong, Lua)	Antidote for food posions (Lua, H'tin)	Yaso, 2000
Xiphidiumcaeruleum	Food poisoning (Hmong)	-	-

5.1.27 **Medicines: Pregnancy/Birth/Puerperium disorders**

5.1.27.1 **Plant family**

Most plant species used to treat pregnancy/birth/puerperium disorders were from the families Asteraceae, Euphorbiaceae, and Zingiberaceae. Species from Euphorbiaceae, particularly those that produce latex, are salient as lactation stimulant. This is in accord with the doctrine of signature (Bennett, 2007) that milky sap is like the breast milk, thus it was thought as efficacious lactagogue.

As for the Asteraceae and Zingiberaceae, the preference for them and/or their efficacy could be attributed to their essential oil components. In Lao PDR, many plant species that contain essential oil constituents have been documented as useful for

postpartum recovery and it was demonstrated that their therapeutic effect were related to the essential oils components, especially the terpenes which have documented antimicrobial, analgesic properties, and anti-inflammatory properties (de Boer *et al.*, 2011)

5.1.27.2 **Commonly used plants**

Most of the commonly used medicinal plants were reported for postpartum recovery. Knowledge of medicinal plants used for this purpose was shared well among the Mien, particularly knowledge about plants used for herbal bathing. In the Yao (Mien) communities in China, herbal bathing is an important traditional way to prevent and cure common diseases including postpartum disorders (Li *et al*., 2006). With the baths, the herbal liquid can boost blood circulation, enhance metabolism, improve immunity and help restrengthing the new mothers. The practice of postpartum herbal bathing of the Mien in this study may reflect that the Mien in Thailand still maintain their integrity of cultural traditional practice. The lack of reports for similar use for postpartum herbal bathing may likely reflect that despite the traditional practice is still maintained but the distinct variety of used plants is the result of adaptation to plant resources available in their surroundings.

Table 92. Medicinal plants commonly used to treat pregnancy/birth/puerperium disorders and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Acorus calamus	Postpartum recovery (Mien)	-	-
Aganosma marginata	Postpartum recovery (Mien)	-	-
Angiopteris evecta	Labour induction (Khamu, Lua)	-	-
Apiaceae sp.1	Fetal stabilization/morning sickness (Hmong)	-	-

Table 92. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Blumea balsamifera	Postpartum recovery (Mien, Khamu, Lua)	Postpartum recovery (Brou, Saek, Kry/Lao PDR) Weakness after childbirth (Vietnam)	Lamxay *et al.*, 2011; de Boer *et al*. 2012 Sam *et al*., 2008
Butea cf. *superba*	Postpartum recovery (Mien)	-	-
Carica papaya	Lactation stimulant (Hmong)	Galactagogues	Adebiyi and Adaikan, 2004
Celosia argentea	Postpartum recovery (Mien)	-	-
Chromolaena odorata	Postpartum recovery (Mien)	Postpartum recovery (Kry/Lao PDR)	Lamxay *et al*., 2011; de Boer *et al*., 2012
Commelina benghalensis	Postpartum recovery (Mien, Khamu)	-	-
Connarus semidecandrus	Postpartum recovery (Mien)	-	-
Croton roxburghii	Postpartum recovery (Mien, Khamu, Lua)	-	-
Curcuma comosa	Postpartum recovery (inducing uterus shrinking) (Hmong, Khamu)	*Estrogenic activity*	Su *et al*., 2010
Eleusine indica	Anti-abortion (Mien)	Anti-abortion (Mien)	Anderson, 1993
Eleutherine americana	Postpartum recovery (Mien, Lua)	-	-
Euphorbia neriifolia	Lactation stimulant (Hmong)	*Lactation stimulant* (for other *Euphorbia* spp.)	Rosengarten, 1982; Rahmatullah *et al*., 2010
Ficus squamosa	Postpartum recovery (Mien)	-	-
Flemingia stricta	Postpartum recovery (Mien)	-	-

Table 92. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Gonocaryum lobbianum	Postpartum recovery (Mien)	Postpartum disorders: *e.g.*, dizziness, fever, headache (Brou, Saek, Kry)	de Boer *et al.*, 2012
Gouania leptostachya	Postpartum recovery (Mien)	Postpartum disorders (Mien)	Panyaphu *et al*., 2011
Impatien balsamina/ Impatiens violaeflora	Labour induction (Hmong)	Labour induction (Hmong/USA)	Spring,1989; Corlett *et al*., 2003
		Labour induction (Yunnanese, Akha, Hmong)	Anderson, 1993; Liulan *et al*., 2003; Inta *et al*., 2008
Leea indica	Postpartum recovery (Mien)	-	-
Platycerium sp.	Postpartum recovery (Mien)	-	-
Pleocnemia submembranacea	Labour induction (Lua)	-	-
Plumbago zeylanica	Postpartum recovery (Mien)	Postpartum recovery (Malaysia)	Singh *et al*., 2011
Poikilospermum suaveolens	Postpartum recovery (Mien, Khamu)	Postpartum recovery (Mien)	Panyaphu *et al*., 2011
Ricinus communis	Postpartum recovery (Mien)	Postpartum recovery	Anderson, 1993
	Labour induction (Hmong, Mien)	Uterine prolapsed, postpartum pain (Hmong/USA)	Spring, 1989
Sansevieria roxburghiana	Postpartum recovery (Mien)	-	-
Sedum cf. *sarmentosum*	Fetal stabilization/morning sickness (Hmong)	-	-
Sida rhombifolia	Anti-abortion (Mien)	-	-
Teucrium viscidum var. *viscidum*	Fetal stabilization/morning sickness (Hmong)	-	-

Table 92. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Urena lobata	Anti-abortion (Mien)	Anti-abortion (Mien)	Anderson, 1993; Panyaphu *et al*., 2011
Xiphidium caeruleum	Abortion (Hmong, Mien)	-	-

5.1.28 **Medicines: Respiratory system disorders**

5.1.28.1 **Plant family**

Most plants in this use-category were from the families Asteraceae and Lamiaceae. As mentioned for other use-categories, these two plant families are reputed as source of essential oils (Westover, 2010). Such features may therefore contribute to their therapeutic effect on the respiratory system as essential oils have antibacterial and antiviral activity (Reichling *et al*., 2009; Schelz *et al*., 2010).

5.1.28.2 **Commonly used plants**

There was a set of plants used to treat cough and their knowledge were mostly shared intra-culturally, particulary among the Hmong and the Mien.

Table 93. Medicinal plants commonly used to treat respiratory system disorders and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/ country)/ *corroboration of therapeutic effects*	References
Andrographis paniculata	Cough (Hmong, Mien)	Chronic cough	Jiang *et al*., 2009
Artemisia verlotiorum	Cough (Hmong)	-	-

Table 93. (continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/ country)/ *corroboration of therapeutic effects*	References
Blumea balsamifera	Epistaxis (nose bleed) (Mien, Khamu, Lua)	Epistaxis (Khamu, Mien)	Tangtragoon, 1998; Panyaphu *et al.*, 2011
Centella asiatica	Cough (Mien)	Cough (Brou, Saek/Lao PDR)	de Boer *et al*., 2012
Dracaena elliptica	Cough (Mien)	Cough (Mien)	Panyaphu *et al*., 2011
Elephantopus scaber	Cough (Hmong, Mien, Khamu)	Cough (Akha, Karen, Saek)	Anderson, 1986a; Inta *et al*., 2008; Sukkho, 2008; de Boer *et al*., 2012
Eleutherine americana	Cough (Mien)	-	-
Hemerocallis lilioasphodelus	Cough (Mien)	-	-
Houttuynia cordata	Cough (Hmong)	Cough (Hmong/USA)	Corlett *et al*.,2002; 2003
		Cough (Hani/China)	Ghorbani *et al*., 2011
		Cough (Brou, Saek)	de Boer *et al*., 2012
Hydrocotyle sibthorpioides	Cough (Mien)	Cough (Hmong/USA)	Spring, 1989
		Cough (India)	Srivastava *et al*., 2012
Inula cappa	Cough (Hmong, Lua)	Cough (Karen)	Sukkho, 2008
Kalimeris indica	Cough (Mien)	Cough (Red-headed Yao/China)	Long and Li, 2004
Lindernia ruellioides	Cough (Hmong)	-	-
Lygodium flexuosum	Cough (Hmong)	-	-
Mentha arvensis	Nasal congestion (Hmong, Lua)	*Decongestion effect of Menthol*	Ahijevych and Garrett, 2004
Orthosiphon aristatus	Cough (Mien)	-	-

Table 93. (Continued)

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/ country)/ *corroboration of therapeutic effects*	References
Oxalis corniculata	Cough (Hmong)	Cough (India)	Kathiriya *et al*., 2010; Mallick and Mallick, 2012
Phyllanthus niruri	Cough (Hmong, Mien)	Cough	Taylor, 2003
Plantago major	Cough (Hmong)	Cough (Tai Lue, Hmong)	Tovaranonte, 1998; Inta, 2008
Pothos chinensis	Cough (Hmong, Mien)	Common cold (Mien)	Panyaphu *et al*., 2011
Pothos scandens	Cough (Mien)	Common cold (Mien)	Panyaphu *et al*., 2011
Psilopeganum sinense	Cough (Hmong)	-	-
Scoparia dulcis	Cough (Hmong)	Cough (Nepal, India)	Rai, 2003; Sharma and Pegu, 2011; Srivastava *et al*., 2012
Selaginella willdenowii	Voice loss (Mien)	Voic loss (Mien)	Anderson, 1993
Tadehagi triquetrum	Cough (Mien, Lua)	Cough and sorethroat (Vietnam)	Heider *et al*., 2005
Teucrium viscidum var. *viscidum*	Cough (Hmong)	-	-
Torenia asiatica	Cough (Mien, Hmong)	Cough (Mien)	Panyaphu *et al*., 2011
Viola curvistylis	Cough (Hmong, Lua)	-	-
Zingiber officinale	Cough (Hmong, Khamu, Mien)	Cough (Tai Lue, Karen)	Tovaranonte, 1998; Inta, 2008; Sukkho, 2008
		Cough (Nepal, China, Nigeria, India)	Rai, 2003; Chaudhary *et al*., 2006; Green, 2007; Pradhan and Badola, 2008

5.1.29 **Medicines: Sensory system disorders**

5.1.29.1 **Plant family**

As only one or two species were allocated in each of the 14 plant families, commonly represent plant families used in this category could not be determined.

5.1.29.2 **Commonly used plants**

Among the four groups, the Lua had most shared knowledge related to sensory system disorders.

Table 94. Medicinal plants commonly used to treat sensory system disorders and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/ country)/ *corroboration of therapeutic effects*	References
Albizia lebbeck	Conjunctivitis (Pink eyes) (Hmong, Lua)	Pink eye (East Timor) Eye diseases (India)	Collins *et al*., 2007 Yadav *et al*., 2011
Costus speciosus	Otosclerosis (Mien, Khamu, Lua)	Earache (Lahu)	Anderson, 1986b
Ricinus communis	Tinnitus (Khamu, Lua)	Tinnitus (Karen) Earache	Sukkho, 2008 Anderson, 1993
Thunbergia laurifolia	Tinnitus (Lua)	Tinnitus (Khamu, H'tin)	Tangtragoon, 1998; Yaso, 2000
Viola inconspicua	Conjunctivitis (Pink eyes) (Hmong)	-	-

5.1.30 **Medicines: Skin/Subcutaneous cellular tissue disorders**

5.1.30.1 **Plant family**

Despite the large number (37) of plant families registered treating skin/subcutaneous cellular tissue disorders the plant families were represented by only a few species; therefore, the commonly represent plant families could not be

determined for this use-category. Each plant may be randomly selected for specific use based on their therapeutic efficacy.

5.1.30.2 **Commonly used plants**

Plant knowledge reported by the Khamu and Lua were distinct. For this reason, inter-culturally shared knowedge has only been reported for *Zingiber cassumunar* (Figure 113F-G).

Table 95. Medicinal plants commonly used to treat skin/subcutaneous cellular tissue disorders and similar uses/corroboration of their therapeutic effects reported in the literature.

Plant name	Common uses in this study (Ethnic groups in which knowledge was shared)	Similar use in literature (Ethnic group/country)/ *corroboration of therapeutic effects*	References
Microglossa pyrifolia	Rahes (Hmong)	-	-
Nicotiana tabacum	Itching (Pruritus) (Hmong)	Itching (India)	Sharma and Mishra, 2009
Zingiber cassumunar	Irritation (due to hairy caterpillar) (Hmong, Mien)	-	-

The information concerning intra-culturally shared knowledge of plant uses implicitly indicate cultural consensus about plant use of a group and imply that each ethnic group still, more or less, maintain their cultural integrity related to plant use or traditional healing practice. Likewise, despite knowledge related to some medicinal plants such as *Gynura procumbens* and *Pseuderanthemum palatiferum*, were gained via communitcation with outsiders, the inter-culturally shared knowledge together with the reports of similar uses/therapeutic effect for medicinal plants indicate that the similar use of plants by the four ethnic group is based on three factors: 1) the empirical observation of curative efficacy, 2) the natural attributes of the plants (whether the plant is edible or good for specific purposes), and 3) the organoleptic properties of the plants (Leonti *et al*., 2002) or the doctrine of signature (Bennett, 2007). For commonly used plants for which similar uses have not been reported

elsewhere, it may likely imply that their uses are unique to the ethnic groups in this study. I propose that scientific investigation and evaluation for these commonly used medicinal plants may be interesting candidates for intensive research.

5.2 **Culturally important plant species**

Anthropologists have defined knowledge as "*agreement between participants*" and culture is "*knowledge shared by a group*" (Reyes-García *et al*., 2003; Vandebroek, 2010). Here, I have determined 12, nine, and five plant species, with identical use knowledge shared within a group of the Hmong, Mien, and Khamu, respectively, as culturally important species. These culturally important species and their exclusiveness of uses reflect the cultural identity related to plant uses of a group. The greater number of culturally important species of the Hmong and the Mien comes from greater degree of agreement among informants from different villages. The exclusiveness of knowledge related to culturally important medicinal plants for treating particular disorder reflect the unity of cultural belief and healing practices of a group related to such disorder.

For example, the female Hmong informants in all three villages reported the similar use of Apiaceae sp.1 to treat morning sickness and promoting fetal stabilization. For that purpose, its leaves are finely chopped and mixed with eggs and then steamed and served to the pregnant woman suffering morning sickness. The Hmong woman believed that morning sickness is a sign of weakness of the fetus and may cause miscarriage. This plant helps regaining strength and stabilizes the life of the unborn. Apart from its name in Hmong language, they usually call this plant the 'herb that prolongs the unborn's life'. Child bearing is not only a biological event but also relates to the social and cultural environments where it occurs (Rice, 1999). To the Hmong, miscarriage is not only the physiological failure of a pregnant woman to bear a child, but also considered a failure to extend the clan and lineage and it has profound meanings related to the spirit and the soul of the unborn (Rice, 2000). Thus, every attempt must be made by a Hmong pregnant woman to avoid miscarriage. Even if there are many plants that are used to treat morning sickness and to promote fetal stabilization, most informants suggested that this Apiaceae sp.1 is the most effective of them all. It may be used together with other herbs such as *Lysimachia christinae*

(Figure 104F), *Kalanchoe pinnata* (Figure 103G), and *Sedum* cf. *sarmentosum*. Still, complete identification of this Apiaceae species is pending. Likewise, the Mien informants in all three villages reported the similar use of *Eleusine indica* (Figure 97K) in combination with *Sida rhombifolia* (Figure 109F) or *Urena lobata* (Figure 112E) for the purpose of anti-abortion. They believed that if a woman feels pain in the uterus at the early months of her pregnancy, it is a sign of weakness of the uterine wall and may cause miscarriage. The perception of this knowledge is attributed to the nature of this plant that has many rootlets that adheres it to the ground. To the Mien perspective, taking this plant out from the ground is difficult and therefore they use this plant metaphorically to help strengthening the uterine wall and protect the fetus from the undesirable miscarriage.

It is also interesting that I found higher degree of exclusiveness of knowledge related to the culturally important species of the Hmong and the Mien than to those of the Khamu and the Lua. This is to say, despite the overlapping of some plants between groups (*i.e., Acorus calamus*; Figure 87A-B), the knowledge related to all 12 and nine culturally important species of the Hmong and the Mien are exclusively reported from Hmong and Mien communities, respectively.

As for the Khamu, despite that five culturally important species of the Khamu reflect homogeneity of knowledge, four of them were not exclusive to the Khamu. This is to say, knowledge about those four species was also reported by Lua informants in some villages. More specifically the Lua use a cold infusion from roots of *Eleusine indica* (Figure 97K) in combination with leaves of *Solanum spirale* (Figure 109I) to treat fever and high temperature; the Lua from Joon and Toei Klang village also use *Paederia pilifera* or *Zingiber cassumunar* (Figure 113F-G) to treat flatulence. So, although there were high CI value for these four species in some Lua villages (Table73-75) it was combined with lack of intra-cultural agreement of knowledge of them among the three Lua villages which makes it impossible to consider them as culturally important species of the Lua.

5.3 **Shared culture of plant use between groups**

In spite of such lack of intra-cultural agreement among the Lua, I have found that they shared knowledge of some plants with the other groups. I defined that shared knowledge of plant use as "the shared culture of plant use among them." The possible explanations for two or more different cultures using plants in similar ways could be attributed to the independent discovery of each group that such plants are good for a particular type of use or it could be due to communication about plant uses through the media moving from one culture to another (Bletter, 2007). For the less related cultures with decreasing distance between cultures, the probability of the later case increases with high possibility of communication (Johnson, 2006). Such assumptions may, however, in part fit with this study because some villages of different cultural groups are located not far from each other (*e.g.*, Khang Ho, Huai Sanao, and Joon). Nevertheless, I found that some medicinal plant knowledge shared among these closely located villages were also in accord with knowledge reported from distant villages. The case of the knowledge related to use of *Boehmeria nivea* (Figure 92A) to treat abscess exemplify this. This is to say, despite this knowledge being shared between the adjacent village, Khang Ho and Huai Sanao, such accordance may probably be attributed to the communication about plants uses between these village; however, this knowledge is also widely shared in other distant village beyond these two villages (*i.e.*, in the other two Hmong villages including Huai Satang village of the Khamu).

Information about uses of particular plants is considered more dependable when the same or similar uses are reported 1) by more than one informant, 2) reported from different location, 3) reported among different ethnic groups, or 4) corroborated from the published literatures on that area or elsewhere (Idu, 2009). The case of *Boehmeria nivea* (discussed above) may suggest that different ethnic groups in this study independently developed knowledge about this plant, and that the plant may produce satisfactory effects on certain human systems and that it was therefore selected and repeatedly employed in a consistent manner because of its culturally perceived effectiveness (Bletter, 2007; Bye, 1986; Heinrich *et al*., 1998). Scientific investigation and evaluation of such plants may be an interesting topic for further intensive research.

5.4 **Medicinal plant knowledge and its trends of erosion**

Two significant findings stand out from the study of knowledge erosion as follows.

5.4.1 **Knowledge and actual use**

Informants knew many more useful plants than they actually used, and this difference was statistically significant. Of all the 8,567 answers (39%) given for plants that they knew as medicinal, only 6,431 (29%) were for actually used plants known by personal experience. The remaining reports were based on hearing about a use. The answers regarding use of medicinal plants were mainly given as "rarely" in most of the villages. Furthermore, of those actually used, in most of villages the informants referred to their past use and said that they had not used them during the past five years. Only two villages, Manee Pruek and Huai Satang, had higher proportions of recent use. During the questionnaire interviews, most informants mentioned that when a herbal remedy was needed, the plants could not be found and prepared immediately. They therefore had to rely on the modern healthcare system. The accessibility of new or easier method of living is always accompanied with the changes in lifestyle related to the loss of once well-known traditions unless attempts are made to strengthen and apply them (Zumsteg and Weckerle, 2007). A similar situation was reported in Brazil by Albuquerque (2006). There it was suggested that such discrepancies could occur because some species were "non-preferred" species, but that erosion of knowledge could occur if the processes of knowledge transfer were disrupted. Prolonged lapses between times when a plant is used may lead to disruption of knowledge transmission because medicinal knowledge is passed down orally and via lifestyle to the young generation. Some of the older informants mentioned medicinal knowledge of a plant that they had used to treat illness when they still lived in their old homes high in the mountains. Such historical uses may be mentioned because they were very important and had great practical significance in their previous situation, which was characterized by a lack of access to external health services. Similar situations have been described for other areas (Byg and Balslev, 2001). Discrepancies between what informants say they previously did and what they currently do may reflect changes in medicinal plant use within their communities,

changes that may generate long-term changes in local knowledge (Reyes-García*et al*., 2005).

5.4.2 **Prevalence of knowledge and use**

In all villages, knowledge of medicinal plant use among the young was less well developed and negatively correlated with the level of informants'education, indicating the non-prevalence of knowledge and use of medicinal plants of such village. I organize the discussion around these two main findings; age and educational level against medicinal plant knowledge.

5.4.2.1 **Age and plant knowledge**

As knowledge of medicinal plants develops over a lifetime and also increases with frequent application of that knowledge (Phillips and Gentry, 1993b), older people are more knowledgeable about illness because of their greater experience in both dealing with and communicating about illness (Garro, 1986**)**. This is to say, when factors that interrupt knowledge transmission are absent, knowledge of medicinal plants can develop over a lifetime as the young informants get older.

I, however, find some factors that could interrupt transmission of knowledge and that may have lead to the erosion of knowledge. My observation suggests that the educated, usually younger people tend to migrate to more lucrative jobs away from the villages. In this context, it may be important that personal contacts with natural areas not only provide learning opportunities but also motivate people to protect their environment; thus, the natural setting seems to be central to the acquisition of traditional plant knowledge (Lozada *et al*., 2006). The disappearance of environments related to the traditional lifestyle threatens the existence of traditional medicinal knowledge (Huai and Pei, 2004). Also, the rare use of some plant species could be related to their scarcity (Benz *et al*., 1994). This may, however, not be very significant in the 12 villages studied here in which most medicinal plants raised as the questionnaire domain were mainly said to have been seen by informants in each village (Figure 37). Some knew plant local name but said they did not pay attention to its medicinal uses. This may suggest that medicinal plant knowledge is more vulnerable to extinction than the plant themselves (Anyinam, 1995). I take the case of

culturally important species of the Hmong, *Impatiens balsamina* (Figure 102A) and *Miralibis jalapa* (Figure 104J) that were reported for treating many genitourinary system disorders, as evidence. These two species are still grown in Hmong communities but their traditionally medicinal uses were seldom practiced; young informants, instead, merely see them as ornamental plants. Furthermore, with access to modern medical care, knowledge of using *Impatiens balsamina/violaeflora* to induce childbirth is vulnerable to extinction. Additionally, young informants who had practiced herbal remedies reported that they rely on knowledge held by the elders. They informed the elder in their family about their health problem and asked them to gather and prepare the medicinal plant used to treat such disorders, without themselves paying attention to learning how to gather and prepare the herbal remedy. For this reason, when the younger informants were interviewed regarding medicinal plant use, they could not recall and determine which plants were used.

5.4.4.2 **Educational level and plant knowledge**

Schooling, on one hand, has been considered one of the main causes of loss of traditional knowledge as it opens pathways to the non-indigenous world and world views (Reyes-García *et al*., 2010). It was also suggested that schooling and the academic skills learned in school causes the devolution of local environmental knowledge. For instance medicinal plant knowledge reported in this study may be lost, because time and resources are spent developing academic skills that detract from learning local environmental knowledge (Sternberg *et al*., 2001). It is possible that, because the younger generations is acculturated by institutions run by the government (*i.e.*, schools), the increased exposure to global capitalist culture (including modern healthcare system) may accelerate a decline in the use of traditional remedies (Giovannini *et al*., 2011)

One of the main results, that educational level of the informants has highly negative association with their medicinal plant knowledge and use (most $r < -0.5$; Table 80), dovetails with results from studies among different indigenous societies where schooling bear a negative association with local environmental knowledge (Sternberg *et al*., 2001; Voeks and Leony, 2004; Quinlan and Quinlan, 2007; Reyes-García *et al*., 2010; Giovannini *et al*., 2011). For example, in a study among Luo

children in western Kenya, Sternberg *et al*. (2001) found that the scores on a test of tacit knowledge for natural herbal medicines, used to fight illnesses— viewed by the villagers as important in adaptation of children to their environment — correlated negatively with measures of academic intelligence. Similarly, in Brazil, Voeks and Leony (2004) found that knowledge of the names and uses of medicinal plants decreased with the increase of individuals' schooling and literacy. In the least developed villages on Dominica's remote eastern (Atlantic) side, years of formal education are inversely associated to the number a person could list of plants used as bush medicine. Less educated residents tend to be less acculturated and in turn know more traditional medicine whereas the educated and acculturated people may seek western medical treatment more readily than do their less educated neighbors (Quinlan and Quinlan, 2007). In Bolivian Amazon, practical environmental knowledge of the Tsimane'was negatively correlated with schooling and school related abilities (Reyes-García *et al*., 2010). Likewise, in rural Mexico, increasing years of schooling bore a significant negative association with the use of medicinal plants in all the models tested (Giovannini *et al*., 2011).

Nevertheless, Reyes-García *et al*. (2010) suggested that schooling, on the other hand, can also be a potential remedy to the demise of local traditional knowledge if school curricula were contexualized and designed to complement, rather than substitute, local environmental knowledge. Educational curricula could be aligned with local context by giving instruction in local languages and incorporating local traditional knowledge, or any type of cultural knowledge, in school content. I hereby suggest that the erosion of the traditional knowledge and use of plants, particularly medicinal plants should be of particular concern of the Thai Ministry of Education.

All mentioned situations, the prolonged lapses between times when a plant was recently used together with interaction of education, could erode traditional medicinal knowledge. Prolonged lapses between times when a plant was used by each informant may contribute to the gap between local knowledge and local use which can be taken as the first sign of traditional knowledge erosion in context of "time-scale"; *i.e.,* a medicinal plant that once was intensively used in the past but its use(s) became non-prevalent during the change of time course. Schooling and increased

educational level may contribute to inter-generational knowledge erosion as time and resources spent in school may be perceived as taking away from time that needs to be spent developing practical skills (Sternberg *et al*., 2001). In this study, despite the fact that most of the informants from the two villages Manee Pruek and Huai Satang reported more "recent uses" than "past uses" [implying that the villages are probably not undergoing 'time-scale' (horizontal) erosion], the trend of inter-generational (vertical) knowledge erosion can never the less still be observed in these two villages as well as in the other 10 villages.

5.5 **Plant use patterns of the four ethnic groups: cultural or ecological constraints?**

As it is generally accepted and known, plant use patterns of people groups may be attributed to two main constraints, cultural and ecological (Inta *et al*., 2008; Terashima and Ichikawa, 2003; Kent, 2006). Let me then examine the constraints affecting plants used by the four ethnic groups in this study.

5.5.1 **Comparison of overall useful plant composition, wild plants and domesticated plants**

In the comparative part of this study; when classifying used plant compositions of the 12 studied villages based on matrices of all used plants, including both wild and domesticated plants, significant results stand out from dendrogram topologies of cluster analysis that showed both ecological, in particular altitudinal, and cultural clusters comprised of villages sharing the same altitudinal conditions or culture.

In the classification of all used plants (Figure 38), the cultural clusters explicitly stand out from the dendrogram topology, *i.e.*, villages that belonged to the same cultural group were clustered together on the same main branch with the categorical distinctness of the Hmong and Mien whereas overlap was still found among the Lua and Khamu. However, within each cluster of a particular culture group, altitudinal influences on composition of all plants used still play a role as villages with different altitudinal range stand out from the others. For example the highland Hmong village, Manee Pruek, is isolated from the two low land Hmong

villages and the lowland Lua village, Joon, is isolated from the two highland Lua villages (Figure 38).

In the classification of wild used plants, the altitudinal clusters explicitly stand out from dendrogram topology. This is evident in that all three villages from the highlands were distinctly clustered on the same main branch as an out-group. Nonetheless, among the nine lower-altitude villages, culture still exerted its effects on plant uses of a group, *i.e.*, the remaining villages from the identical group were clustered together (Figure 39).

Likewise, in the classification of domesticated plants, the dendrogram topology similar to one from the classification of wild used plants but offer a nuance; for the domesticated plants, despite the fact that all three highland villages were distinct and isolated from the other nine lower altitudinal villages, they themselves were also distinct and not clustered together like in the dendrogram based on the wild plants used (Figure 40).

In this study, in all villages, homegardens are the central sites for plant domestication. Because homegardens involve management of many useful plant species over prolonged periods of time, they can be sites that reflect the cultural history of ethnic groups (Blanckaert *et al*., 2004) and also in turn reflect the cultural identity related to plant uses of a group (Corlett *et al*., 2003). Domesticated plants are therefore potential cultural markers of ethnic groups. In the USA, plant grown in Hmong homegardens include mostly Southeast Asian food or medicinal plants and contribute importantly to maintain Hmong cultural identity and practices (Corlett *et al*., 2003). These may coincide with the case for cultural clusters found among the nine lowland villages. The altitudinal location of homegardens was reported to affect the characteristic of its floristic composition (Shrestha *et al*., 2002; Soemarwoto and Conway, 1991; Huai *et al*., 2011). This reason, in combination with the cultural constraints, may contribute to the distinctness and isolation of species composition for domesticated plant in the three highland villages.

5.5.2 **Comparison of plant uses based on use-category**

Composition of species used by all groups varies from one use-category to another. When comparing species composition of used plants based on use-category,

both ecological and cultural clusters were detected and demonstrated diversity in plant use patterns.

One signification result that stand out from most use-category based dendrograms (Figure 41-69), was that species composition used by the Hmong were mostly distinct among all plant species used by all four ethnic groups studied and species selected for each specific category by the Khamu and Lua were more similar. In this context, similarity in plant use pattern of the Khamu and Lua could be attributed to the fact that the Khamu and Lua are indigenous and originally lived in the area around the Thai-Laos border in Nan province since ancestral time. The rich diversity of their surroundings may provide a similar set of plants to choose among and they may independently discover the utility of the plants.

Clustering patterns found in the dendogram topology for each use-category are summarized in Table 96. In this table, cultural clusters were counted when at least two villages from the same ethnic group were branched together. Likewise, ecological clusters were counted when at least two villages, either from highland or lowland, from different ethnic groups sharing the similar environmental conditions, were grouped on the same branch such as Manee Pruek (Hmong) and Manee Pruek 2 (Lua), Huai Labaoya (Mien) and Huai Pook (Khamu), as well as Khang Ho (Hmong), Huai Sanao (Mien) and Joon (Lua).

As shown in Table 96, a total of 68 clusters were detected. Six clusters were ecological of which two clusters were found between adjacent Khang Ho and Huai Sanao villages in the medicinal category of neoplasm and endocrine system disorders. This can definitely be attributed to the common use of *Pseuderanthemum palatiferum* (Figure 107F) that was reported as used for treating cancer (Table 47) and diabetes mellitus (Table 31) in these villages. Two other ecological clusters were found that included the two lowland neighboring villages, Huai Labaoya and Huai Pook, for the category of food additives and non-vertebrate poisons whereas the other two clusters included the two neighboring highland village, Manee Pruek and Manee Pruek 2, for the category of food and fuels. Possible explanation for this is primarily the natural attributes of the plants (Terashima and Ichikawa, 2003; Kent, 2006), *i.e.*, edible, aromatic, good for fuels, poisonous, along with the availability of plant resources in

their gathering environments. This could likely be in line with the findings from the study in Mapuche community from northwestern Patagonia where the knowledge and consumption of wild edible plants follows a pattern according to ecological conditions of their gathering environment (Ladio and Lozada, 2004).

For the sixty-two cultural clusters detected, 23 and 19 were detected among the Hmong and Mien villages whereas only 10 clusters were detected among each of the Khamu and Lua villages. The greater number of cultural clusters among the Hmong and the Mien reflects higher degree of cultural integrity compared to the Khamu and Lua. The similarity of plant uses between the Khamu and Lua may in this context lower the degree of cultural integrity of each group. Nevertheless, as mentioned above, species composition of food plants follows ecological pattern of gathering environment but on the other side uses of plants for food is also culturally bound, as evidenced by the presence of cultural clusters among the lower-altitudinal villages.

Overall, the presence of cultural clusters in the dendrogram topologies of most use-categories indicate the different interest in plant utilization of each group and reflected that plant use patterns of the four ethnic groups in this study were related to the cultural boundaries such as food culture, cultural beliefs and healing practices for different disorders. However, the presence of ecological clusters in dendrogram topologies of plant use pattern for general purpose which was based primarily on the natural attributes or the availability of the plants, such as food, food additive, and fuels, reflect the adaptability of a population to ecological constraints in its surroundings. I take this as the evidence that plant use patterns of the four ethnic groups in this study is related to the cultural boundaries but that ecological constraints (*e.g.,* elevation, vegetation type of gathering environment) impose additional influence on which plants they chose or adapt to use for specific purposes.

Table 96. Summary of clustering patterns found in the dendogram topology for each use-category resulting from Cluster Analysis based on presence/absence matrix and Jaccard's similarity index

No.	Use-category	Dendrogram topology (Figure#)	Cultural clusters				Ecological clusters	
			Hmong	Mien	Khamu	Lua	Highland	Lowlands
1	Food	41	√ (KH,SK)	√ (All)	√ (HP,HST)	-	√ (MNP,MNP2)	-
2	Food additive	42	√ (MNP,SK)	√ (HSN,STP)	-	√ (MNP2,TK)	-	√ (HBY,HP)
3	Animal food	43	√ (MNP,SK)	√ (HBY,HSN)	-	-	-	-
4	Materials	44	√ (MNP,SK)	√ (HSN,STP)	√ (All)	√ (MNP2,TK)	-	-
5	Fuels	45	√ (KH,SK)	-	-	-	√ (MNP,MNP2)	-
6	Social uses	46	√ (All)	√ (All)	√ (All)	√ (JN,MNP2)	-	-
7	Vertebrate poisons	47	√ (All)	√ (HBY,STP)	√ (HST,NP)	-	-	-
8	Non-vertebrate poisons	48	-	-	-	√ (MNP2,TK)	-	√ (HBY,HP)

Table 96. (continued)

No.	Use-category	Dendrogram topology (Figure#)	Cultural clusters				Ecological clusters	
			Hmong	Mien	Khamu	Lua	Highland	Lowlands
9	Environmental uses	49	√ (MNP,SK)	√ (All)	√ (HST,NP)	√ (JN,TK)	-	-
10	**Medicines:**							
10.1	Abnormalities	50	√ (All)	-	-	-	-	-
10.2	Blood system disorders	51	√ (MNP,SK)	√ (All)	-	-	-	-
10.3	Circulatory system disorders	52	-	√ (HBY,HSN)	-	-	-	-
10.4	Digestive system disorders	53	√ (All)	√ (All)	-	√ (MNP2,TK)	-	-
10.5	Endocrine system disorders	54	-	-	-	-	-	√ (HSN,KH)
10.6	Genitourinary system disorders	55	√ (All)	√ (HBY,STP)	√ (All)	-	-	-
10.7	Ill-defined symptoms	56	√ (All)	√ (HBY,STP)	-	-	-	-

Table 96. (continued)

No.	Use-category	Dendrogram topology (Figure#)	Cultural clusters				Ecological clusters	
			Hmong	Mien	Khamu	Lua	Highland	Lowlands
10.8	Infections/Infestations	57	√ (All)	√ (All)	-	-	-	-
10.9	Inflammation	-	-	-	-	-	-	-
10.10	Injuries	58	-	-	-	-	-	-
10.11	Mental disorders	59	√ (KH,SK)	-	-	-	-	-
10.12	Muscular-skeletal system disorders	60	√ (All)	√ (HBY,STP)	√ (HST,NP)	√ (MNP2,TK)	-	-
10.13	Neoplasm	61	-	-	-	-	-	√ (HSN,KH)
10.14	Nervous system disorders	62	√ (MNP,SK)	-	-	-	-	-
10.15	Nutritional disorders	63	√ (KH,SK)	√ (HBY,HSN)	-	-	-	-
10.16	Pain	64	√ (KH,MNP)	√ (All)	-	-	-	-
10.17	Poisonings	65	√ (KH,MNP)	√ (All)	√ (HST,NP)	√ (JN,TK)	-	-

Table 96. (continued)

No.	Use-category	Dendrogram topology (Figure#)	Cultural clusters				Ecological clusters	
			Hmong	Mien	Khamu	Lua	Highland	Lowlands
10.18	Pregnancy/Birth/Puerperium disorders	66	√ (All)	√ (All)	-	√ (MNP2,TK)	-	-
10.19	Respiratory system disorders	67	√ (All)	√ (All)	√ (HP,NP)	√ (JN,TK)	-	-
10.20	Sensory system disorders	68	-	-	-	-	-	-
11.21	Skin/Subcutaneous cellular tissue disorders	69	√ (MNP,SK)	-	√ (HST,NP)	-	-	-