

CHAPTER 1

Introduction

1.1 Historical Background

The mosquito genus *Lutzia* occurring in Thailand consists of three species, *Lt. fusca* (Wiedemann, 1820), *Lt. halifaxii* (Theobald, 1903) and *Lt. vorax* Edwards, 1921 (Rattanaarithikul et al., 2005). They are widely distributed throughout the country. In 2012, during mosquito survey on Doi Inthanon, the highest mountain in Thailand, by Associate Professor Dr. Pradya Somboon, a number of *Lutzia* larvae were collected and brought back to the laboratory for rearing. It was preliminarily noticed that although the adults were morphologically identifiable as *Lt. vorax*, based on the abdominal banding pattern, their larval and pupal exuviae exhibited morphological differences from those collected in the plains of Chiang Mai Province. In addition, the wing venation, i.e. the mediocubital and radiomedial crossveins (mcu and rm), illustrated for *Lt. vorax* (as *Lt. halifaxii*) in Bram (1967) does not match with the identified *Lt. vorax* from Doi Inthanon. However, it appears similar to the holotypic description of *Lt. vorax* by Edward (1921) from Japan and the topotypic illustration of adult *Lt. vorax* by Tanaka et al. (1979). A question then arises whether such differences reflect interspecificity between the high altitude *Lt. vorax* from Doi Inthanon and *Lt. vorax* in the plains. More information on their taxonomy is needed to be investigated in detail.

1.2 Literature review

The genus *Lutzia* was established by Theobald in 1903 based on a unique type species, *Culex bigoti* Bellardi. *Lutzia* had been accepted as a genus by Edwards (1921, 1922) until 1932 when he reduced *Lutzia* to a subgenus of *Culex* that had been widely accepted by subsequent authors (Barraud and Christophers, 1931; Barraud, 1934; Bohart, 1956; Thurman, 1959; Belkin, 1962; Bram, 1967; Toma and Miyaki, 1986; Tanaka et al., 1979). In 2003, Tanaka restored *Lutzia* to its original generic status by

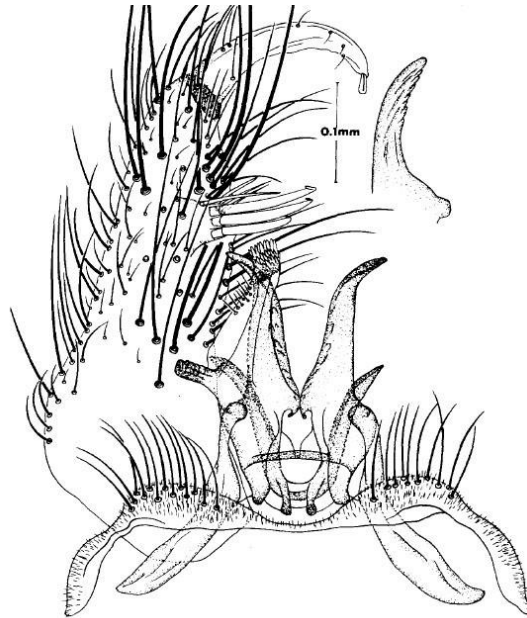
reason that it has more morphologically distinct than other subgenera of *Culex*. However, recent studies on molecular phylogeny of *Lutzia* and some *Culex* including ITS2 sequences (Vesgueiro et al., 2011) and COI gene (Demari-Silva et al., 2011) do not support the generic status of *Lutzia*, although analyses of morphological data do (Kitching et al., 2014). Therefore, more information is required to confirm the position of *Lutzia* in relation to *Culex*.

Following Tanaka (2003), *Lutzia* consists of eight species classified in three subgenera, i.e. *Insulalutzia*, *Lutzia* and *Metalutzia* (<http://mosquito-taxonomic-inventory.info/>). One species of subgenus *Insulalutzia*, *Lt. shinonagai* Tanaka, 2003, has been recorded on Ogasawara Island of Japan. Two species of subgenus *Lutzia* are found in the Neotropical Region, *Lt. allostigma* Howard, Dyar & Knab, 1915 and *Lt. bigoti* (Bellardi, 1862). Subgenus *Metalutzia* includes five species: *Lt. tigripes* (de Grandpre and de Charmoy, 1901), the only species found throughout the Afrotropical Region; *Lt. agranensis* Singh & Prakash 2008, found only in India; *Lt. fuscana* (Wiedemann, 1820) and *Lt. halifaxii* (Theobald, 1903), widely distributed in the Oriental, Australian and eastern Asia extending to Russia, and *Lt. vorax* Edward, 1921 found in the Oriental and Australian Regions.

In Thailand, the first records for *Lt. fuscana* and *Lt. halifaxii* appeared in the early 1900s (Barraud et al., 1931). Bram (1967) considered that *Lt. vorax* (as *Cx. (Lut.) vorax*) was a synonym of *Lt. halifaxii* because of similarity of the male genitalia (Figure. 1), and considered that this and differences of the abdominal banding patterns were due to intraspecific variation. Subsequent authors followed Bram's treatment (Tanaka et al., 1979; Apiwathnasorn, 1986; Toma and Miyaki, 1986; Harrison et al., 1990), which caused confusion about the two nominal species. However, Tanaka (2003) restored the specific status of *Lt. vorax* because he found only the abdominal banding typical of *Lt. vorax* and no specimens resembled the typical form of *Lt. halifaxii* or intermediate characteristics, although both species are difficult to separate in the adult (male genitalia), larval and pupal stages. Recently, Rattanarithikul et al. (2005) listed three species of *Lutzia* in Thailand, *Lt. fuscana*, *Lt. halifaxii* and *Lt. vorax*, with

illustrated keys for identifying females, but for larvae by reason that they were inseparable.

A



B



Figure 1.1 Illustrations of dorsal view of male genitalia with inserts of the lateral aspect of the phallosome. A, *Lt. fuscana*; B, *Lt. halifaxii* (Bram, 1967).

1.2.1 Morphological characteristics

The *Lutzia* adults are relatively large size (~4–5 mm wing length) with four (or more) lower mesepimeral setae, which arranged in a row parallel to the anterior margin of mesepimeron (Figure 2A), and the presence of the acrostichal bristles and ventral band of proboscis. The larvae have the modified mouth parts for predation. The siphon of fourth-instar larvae is as long as or shorter than saddle and pecten extending to apex of siphon (Figure 2B). Integument is covered with conspicuous spicules (Tanaka et al. 1979, Rattanarithikul et al. 2005).

The abdominal pattern of adult female of *Lt. fuscana* is shown in Figure 3A which is clearly different from the adults of *Lt. halifaxii* and *Lt. vorax* in having abdominal terga V–VIII entirely pale to yellowish-scaled, or with broad apical pale bands. Terga II–IV are entirely dark or with narrow apical bands. The abdominal pattern of *Lt. vorax* shows apical pale bands of approximately the same width (Figure 3B) whereas that of *Lt. halifaxii* is entirely dark, or with very narrow apical pale bands, or with lateral pale patches only on last few segments (Figure 3C). Edwards (1921) described that the wing venation of *Lt. vorax* is different from *Lt. fuscana* (as *Lt. concolor*) and *Lt. halifaxii* in having the mcu crossvein placed beyond the rm crossvein or in a straight line whereas the mcu crossvein of the two latter is placed at least slightly before the rm crossvein. Figures 4 and 5 show the illustrations of *Lt. halifaxii* in Bram (1967) and Tanaka et al. (1979), respectively. The cmu and rm crossveins in Tanaka et al. agree with the description of *Lt. vorax* by Edwards (1921). Later, Tanaka (2003) restored the specific status of *Lt. vorax* as mentioned above.

A



B

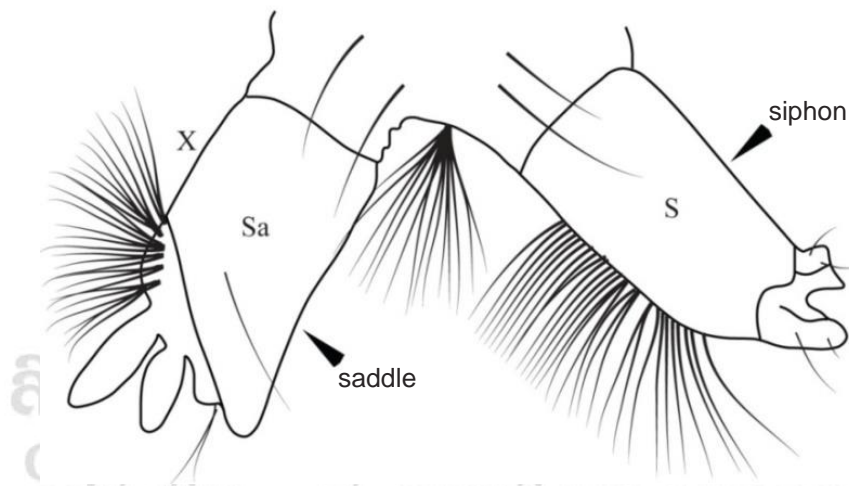


Figure 1.2 Illustrations of morphological characteristics of *Metalutzia*. A, Four (or more) lower mesepimeral setae of adult. B, siphon and saddle of fourth-instar larva (modified from Rattanaarithikul et al., 2005).

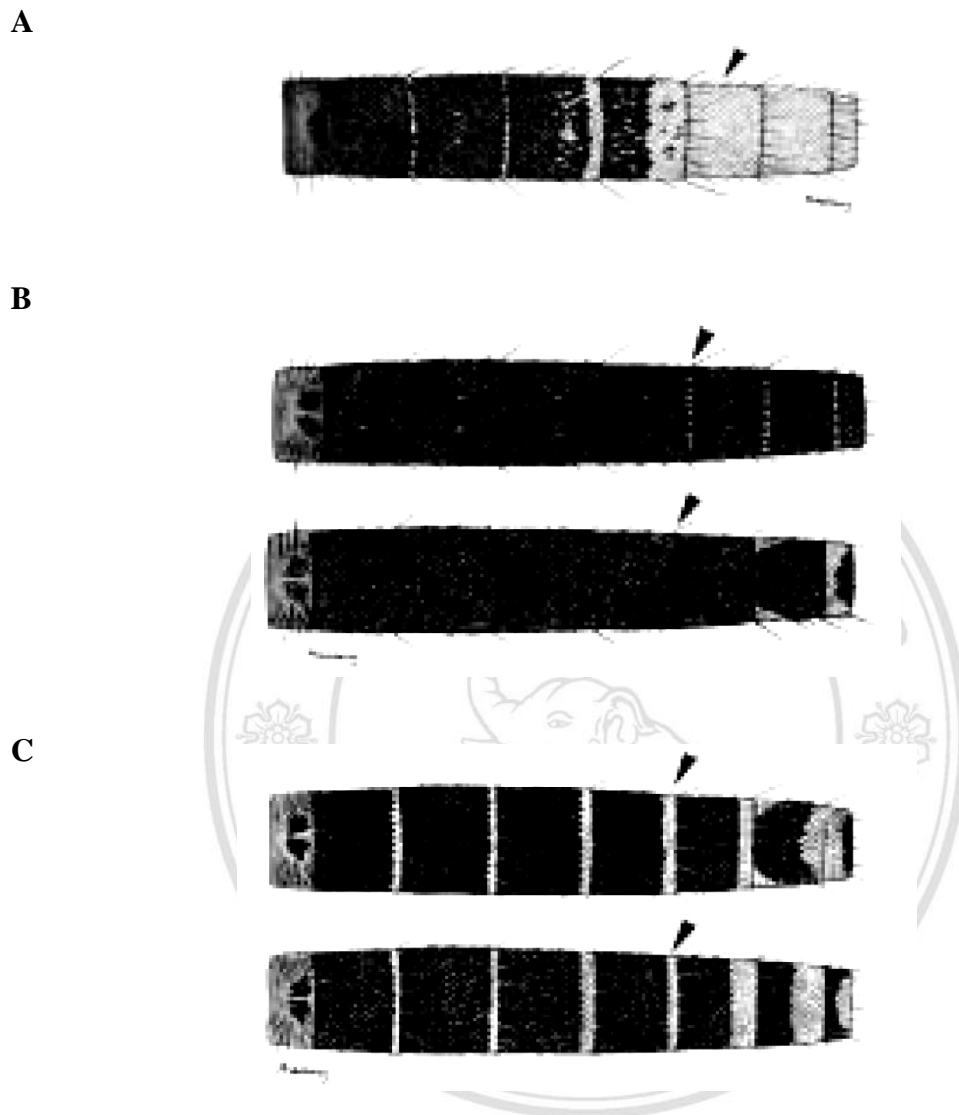


Figure 1.3 Illustrations showing the abdominal banding patterns of *Lutzia* females.

A, *Lt. halifaxii*. B, *Lt. fuscana*. C, *Lt. vorax* (Rattanaarithikul et al., 2005).

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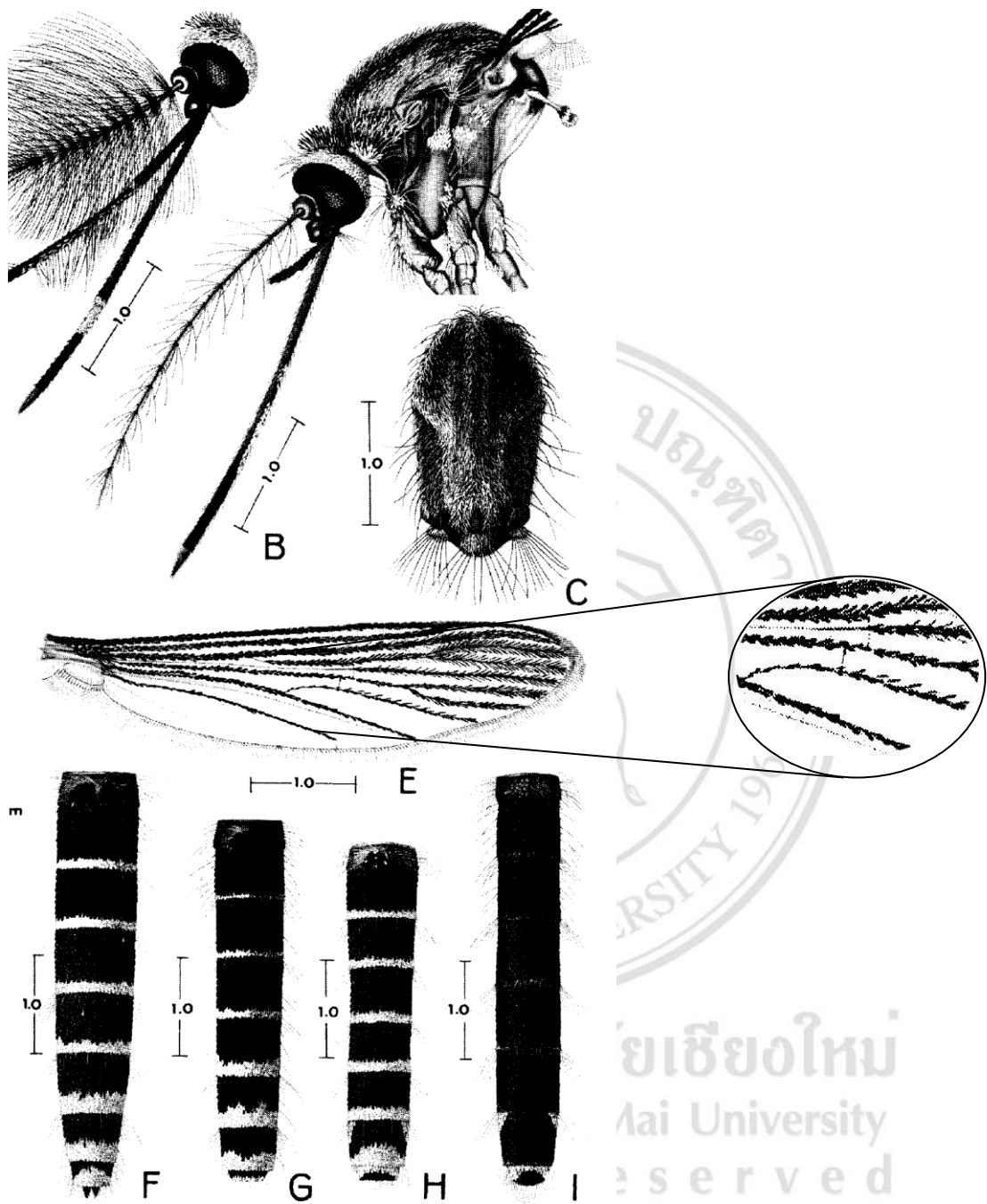


Figure 1.4 Illustrations of adult *Lt. halifaxii* modified from Bram (1967). The area of crossveins is magnified showing that the mcu is placed slightly before the rm.

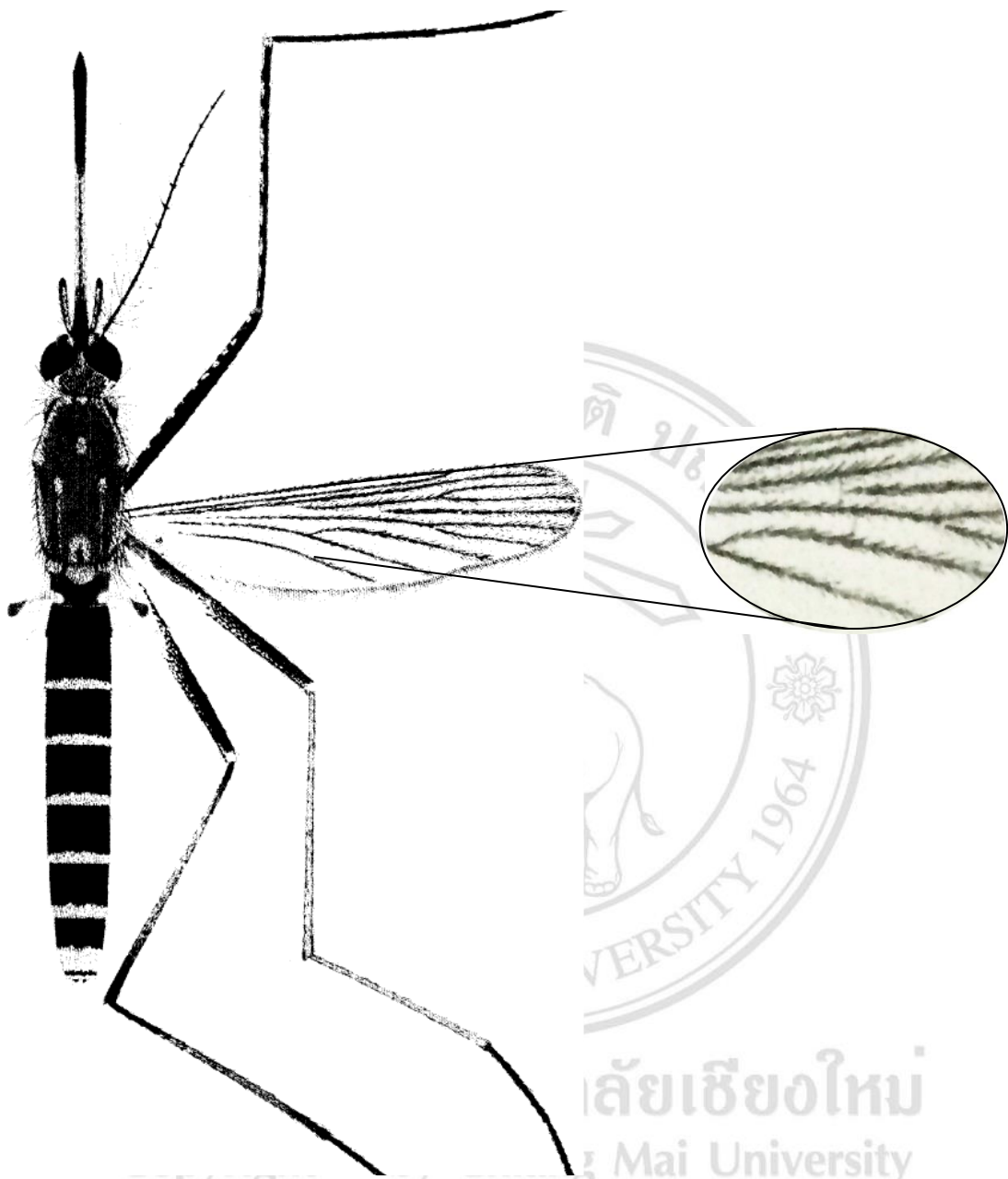


Figure 1.5 Illustration of adult *Lt. vorax* (as *Cx. halifaxii*) modified from Tanaka et al. (1979). The magnified area shows the position of the mcv placed beyond rm crossvein.

1.2.2 General biology

Larvae of *Lutzia* are found in high organic content ground water habitats. They are predaceous, feed on mosquitoes larvae of other species. *Lt. fuscana* is reported to feed upon vector species larvae i.e. *Anopheles*, *Aedes* and *Culex* species in several parts of India. The first instar larva immediately attacks another larva of similar size. *Lt. fuscana* larvae are potent destroyers of *Cx. pipiens* and *Cx. quinquefasciatus* larvae under field conditions. Laboratory experiments on predatory habit of *Lt. fuscana* showed that the average consumption of daily larvae is 18.89 larvae/day (Singh et al., 2014). However, the role in controlling mosquito larvae in wild population is not well documented. The females are nocturnally active but rarely attack human. They have been collected in light traps and animal baited nets (Bram, 1967, Rattanaarithikul et al., 2005, Singh et al., 2013). However, little is known about the bionomics of the adults and medical importance. Nono (1966) used *Lt. fuscana* for study on malaria infecting birds. He found the alive sporozoites along the stomach wall and concluded that *Lt. fuscana* was a vector of avian malaria *Plasmodium cathemerium* and *P. capistrani*.

1.3 PURPOSE OF THE STUDY

- 1) To describe the morphological characteristics of *Lutzia* species found on Doi Inthanon.
- 2) To compare the morphology of larvae, pupae, and adults of *Lutzia* species from Doi Inthanon with *Lt. fuscana*, *Lt. halifaxii* and *Lt. vorax* from the plains of Chiang Mai Province.

1.4 USEFULNESS

This study will extend taxonomic knowledge of *Lutzia* species found on Doi Inthanon and will be useful for developing keys for identification of *Lutzia*.