



CHAPTER V

CONCLUSION AND DISCUSSION

Most species of Convolvulaceae are herbaceous or woody climbers, rarely erect herbs, usually with milky juice. For the species studied, they are more or less with watery juice. According to habits, they can be divided into 3 groups :

1. Leafless parasitic vine : Cuscuta.
2. Leafy herbaceous or woody twiners : Aniseia, Donamia, Hewittia, Jacquemontia, mostly Merremia, Neuropeltis, Operculina and Xenostegia.
3. Leafy erect or prostrate plants: Evolvulus and M. emarginata.

Leaf of species studied are simple entire or undulate, however, palmately compound leaves with 5-leaflets found in only one species, M. quinata (Fig. 27).

Inflorescences are axillary, mostly in cymose type, some with 1-2-flowers which are reduced form or in cluster as in Cuscuta. Only two species, M. peltata and N. racemosa are of racemose type. The flowers are either yellow, pale yellow, cream, or white, except Jacquemontia is blue or pale blue. The sizes of the flowers vary from 0.3-0.5 cm to 6-7 cm in diameter.

Bracts of every species are deciduous, except of N. racemosa is persistent and enlarged when fruiting.

Sepals usually free, except in Cuscuta, often persistent, sometimes enlarged when fruiting. Corolla are gamopetalous in various forms.

The numbers of styles can be used as distinguished character of genera and species. One style is found in Aniseia, Hewittia, Jacquemontia, Merremia, Operculina, Xenostegia and C. reflexa. Two styles is found in Donamia, Evolvulus, Neuropeltis and C. chinensis.

Generally, anthers are straight, but twisted after opening in Merremia and Operculina.

The characters of the pollen aperture can be classified into 3 types.

1. Colpate type i.e. Donamia, Cuscuta, Merremia, Neuropeltis and Operculina.
2. Polyrugate type i.e. Aniseia, Evolvulus, Hewittia, Jacquemontia.
3. Pantoporate type i.e. Xenostegia.

Fruits are capsule, dehiscing longitudinally except of Cuscuta and Operculina dehiscing transversely. The capsule of Neuropeltis is with enlarged persistent bract. This character has never been found in the other genera.

Aniseia, a small genus of about 5 species confined to tropical and subtropical America. The species A. martinicensis of the tropics of the Old World (Van Ooststroom, 1953) is also found in Thailand. Aniseia and Hewittia are closely related by having the flat-unconcaved and distinctly unequal sepals, midpetaline bands being hairy outside, (Fig. 1, 9) and also the polyrugate type (Plate 23, 29). They differ in the colour of corolla; entirely white in Aniseia but pale yellow with dark purple center in Hewittia (Plate 1, 6); glabrous ovary and capsule in Aniseia but hairy in Hewittia (Fig. 9).

The genus Cuscuta is easily separated from other genera by its parasitic habit. Only two species found in Thailand. C. chinensis seem to be widely distributed while C. reflexa seem to be endemic in the northern part of Thailand at high altitude, however it is reported that this species found in Malay peninsular. It is suggested that the other parts of Thailand especially in the South should be explored. The differences between these 2 species are in : pistil with 2 styles with capitate stigmas in C. chinensis but one style with elongate stigmas in C. reflexa; stamens with long filaments in C. chinensis but sessile in C. reflexa (Fig. 5, 6); rugulate pollen in C. chinensis while reticulate with pila on the muri in C. reflexa (Plate 25, 26). These 2 species are quite different from each other. C. reflexa is classified in subgenus Monogyna which have one style (Van Ooststroom, 1953). According to available references, C. chinensis has never been grouped in any subgenus, therefore it is suggested that it should be added to the subgenus Grammica.

Donamia semidigyna was previously collected from Central, South Eastern and Peninsular floristic regions, but during 3 years surveying in the same region, this species is not found. The distinguishing characters of this species are : pistil with 2 styles and united below, peltate stigmas (Fig.3). The colpate pollen type of this study confirmed Austin 's work (Austin, 1980). However other species are polyrugate pollen type such as D. repens and D. thunbergiana (Austin & Staples, 1985), indicated that the pollen character of this genus is variable.

Neuropeltis racemosa can be separated from the others by having enlarged persistent bract and very small flowers in raceme. This genus is related to Donamia in having 2 styles but styles free from each other; peltate stigma and colpate pollen type. (Fig. 32; Plate 60).

Two species of Evolvulus studied, E. alsinoides and E. nummularius are small herbaceous plants and never twining. Pistil composed of two styles, resembling Donamia and Neuropeltis but each style forked with 4 filiform or clavate stigmas (Fig. 7). Pollen is polyrugate which is differ from Donamia and Neuropeltis. (Plate 30, 31).

Two species of Jacquemontia, J. paniculata and J. pentantha, found in Thailand. The former one is wild species but the latter one is cultivated for ornamental purpose. J. paniculata is easily seperated from J. pentantha in small and hairy bracts while large and glabrous in the latter (Fig. 11, 12). Their pollen with polyrugate type is the same as Aniseia, Hewittia, and Evolvulus (Plate 34-37).

The genus Merremia occurs in Thailand as a large group of 12 species. It is interesting that leaves of this genus are mostly simple, but palmately compound in M. quinata. This type of leaf is also found in M. quinquefolia and M. aegyptia (Van Ooststroom, 1953). No compound leaves found in 21 known genera of Convolvulaceae except of these 3 species mentioned. In general, simple leaves are more primitive in Angiosperms according to the fossil evidences and the ranalean families (Eames, 1961), therefore the leaves of these 3 species showed advanced character. The palmatifid divided leaf type is also found in M. vitifolia (Fig. 30-31; Plate 18), M. tuberosa and M. dissecta (Van Ooststroom, 1953). This type of leaf may be the intermediate type between the primitive, simple leaves, and the advanced, palmately compound leaves. It is interesting that only one species, M. collina, found dimorphism of leaves, it is also a good taxonomic charater.

Other distinct characters to be pointed out are : anthers twisted after opening; pollen colpate type which are also found in Operculina. However, the apertures vary from 3-9 furrows; 3-colpate with operculum (M. collina, M. gemella, M. hirta and M. peltata); 3-colpate without operculum (M. emarginata and M. hederacea); 5-colpate

(M. vitifolia); 6-colpate (M. bambusetorum, M. kingii, M. umbellata); 6-9-colpate (M. quinata). The pollen type, 6-9-colpate, of M. quinata, observed in this study differ from the pollen type, 12-rugate, reported by Ferguson et al (1977). This is probably possible that this species has pollen dimorphism which can be found in many dicotyledonous plants (Huynh, 1976). The pollen dimorphism of 3-4-colpate and 6-rugate in Cuscuta epilinum was also reported. (Erdtman, 1971).

Among these 12 species, the identity of M. bambusetorum, M. kingii, and M. umbellata, is debatable because of their closely related characters. M. bambusetorum was firstly published by A.F.G. Kerr in Kew Dulletin, 1941, and he mentioned that this species differs from M. umbellata, in having long peduncles, flowers larged and few in each inflorescence (Kerr, 1954). M. umbellata used to be named as Ipomoea cymosa. M. kingii used to be identified as I. cymosa var. macra which differs from I. cymosa in having larger size of all parts, longer peduncles, upto 10-16 cm, sepals 1.5-1.7 cm long, and corolla 5 cm long (Clarke, 1885). From these 2 reports, it might be concluded that these 3 species only are different in size and length of some parts. From this study of these 3 species, it is found that

1. M. umbellata : inflorescence usually umbelliform cymes with more or less dense flowers rarely 1-2 flowers; peduncles short and pubescent; sepals 0.6-1 cm long, corolla 2.5-3.8 cm long and 2-3 cm in diameter.

2. M. bambusetorum : from isotype (Kerr 17704); inflorescence 1-2 flowers; peduncles 5-7 cm long, glabrous; sepals 1.3-1.4 cm long; corolla 5 cm long. From other specimens; sepals 1-1.5 cm long; corolla 4-5 cm long and 3.5-4 cm in diameter.

3. M. kingii is conspecific with M. bambusetorum in the inflorescence, sepal and corolla but the size of sepals and corolla are larger. Sepals are in 1.5-2.3 cm long, corolla 6-7 cm long and 6.5-7 cm in diameter.

4. All these 3 species showed the similar variation of leaves shape.

5. The pollen structure of these 3 species belongs to the same type, colpate with 6 apertures, but differ in sizes. However the pollen polarity is different, heteropolar in M. bambusetorum and isopolar in the other 2 species.

According to Kerr (1951), M. bambusetorum differed from M. umbellata by having 1-2-flowered inflorescence and longer peduncles. It is not true in this study since the inflorescence of M. umbellata vary from 1-to many-flowered, and peduncles show much variation as well as indumentum.

In comparing M. kingii to M. umbellata, the most outstanding character separating these 2 species is the inflorescence type, 1-2-flowered in M. kingii and umbelliformed cyme in M. umbellata

M. kingii is hardly separated from M. bambusetorum by using the inflorescence.

According to the pollen character (Plate 38, 50, 56), they seem to be slightly different, therefore it is not recommended to use as distinguish character.

Among these 3 species, it may be concluded that they are closely related species and might be group into one species or they are possibly the natural intraspecific hybrids.

Further biosystematic studies on these 3 species are suggested as follow :

1. Carefully study the type specimen of these 3 species and other specimens as many as possible in order to see the variations of all characters occur in the nature.

2. Studies the numerical taxonomy of the taxonomic character.
3. Studies chromosome numbers and karyotype.
4. Experimental study of intraspecific hybridization is needed.

The genus Operculina : a related taxon to Merremia, without fruit is hardly separated these 2 genera. In this study, O. riedeliana is a new recorded for Thailand. Among 3 species, O. petaloidea, O. riedeliana and O. turpethum, are quite clearly distinct in taxonomic character except the pollen character is rather similar.

The genus Xenostegia : this genus was separated from Merremia by the differences of stigma, anther, and pollen type (Austin & Staples, 1980). X. tridentata was firstly found in Thailand under the name M. hastata (Desr.) Hall.f. (Kerr, 1954). The characters of stigma (Plate 69), anther (Fig. 38) and pollen type (Plate 67, 68) of X. tridentata from this study are agreeable to the study of Austin & Staples. In addition, the sepals in mature fruit are not persistent, not as in the Merremia.

According to the pollen morphology, they all are smooth-surfaced pollen grains, these ten genera of Convolvulaceae studied can be divided into 3 main types.

1. The colpate pollen type occurs in 5 genera, Donamia, Cuscuta, Merremia, Operculina and Neuropeltis. pollen character of these 5 genera can be divided into 4 types, according to the number of apertures as follows :

1.1 3-colpate type can subdivided into two groups.

1.1.1 3-colpate type with operculum : D. semidigyna, M. collina, M. gemella, M. hirta, M. peltata, O. petaloidea, O. riedeliana, and O. turpethum.

1.1.2 3-colpate without operculum : C. chinensis,

M. emarginata, M. hederacea, N. racemosa.

1.2. 5-colpate type : C. reflexa, M. vitifolia.

1.3. 6-colpate type : M. bambusetorum, M. kingii, M. umbellata.

1.4. 6-9-colpate type : M. quinata.

Among these species, operculum is not found in pollen of every taxon. It occurs in all species of Bonamia and Operculina, and in almost all of species of Merremia except in M. bambusetorum, M. emarginata, M. hederacea, M. kingii and M. umbellata. No operculum found in Cuscuta and Neuropeltis.

Pollen sculpturing of Cuscuta differs from the others. C. chinensis is rugulate while C. reflexa is reticulate with pila on muri. In the other genera, the variation of sculpturing is mainly on the perforation. Some species have clear and dense perforation such as M. kingii, M. bambusetorum, M. gemella, M. vitifolia. (Plate 38, 44, 50, 58) Some species with scatter perforation such as M. hirta, B. semidigyna and O. riedeliana. (Plate 25, 48, 63) In M. quinata, there is the remarkable character of fossulate sculpturing. (Plate 54)

2. The polyrugate pollen type, found in 4 genera, Aniseia, Hewittia, Evolvulus, and Jacquemontia. According to their apertures, Hewittia and Jacquemontia (Plate 32, 34, 36) have the distinct operculums but in the Evolvulus, the operculum is found only in E. alsinoides var. alsinoides (Plate 30) while it is indistinct in E. nummularius (Plate 31). No operculum found in Aniseia (Plate 23).

The supra tectal granules of Jacquemontia are rather large and the perforation is hardly visible while the others, the supra tectal granules are quite small and the perforation is clearly visible.

3. The pantoporate pollen type found in only one genus, Xenostegia. This character easily separated this genus from Merremia and the others.

From the fossil evidences, the first appearance of the angiosperm was found in Cretaceous. A monosulcate form was observed in the early period of Cretaceous and then tricolpate form (Chaloners, 1976). The study on stratigraphic setting of early angiosperm pollen in Southern England and Northern France gave the same results. The probable angiosperm pollen, a monosulcate form was found in the soils in Barremian stage (upper Cretaceous) and the 3-colpate form was found in the soils in the lower Albian stage (middle Cretaceous) which lay above the Barremian soils (Liang, 1976). So the 3-colpate type is probably the most primitive pollen type in this study. Pantoporate and polyrugate type are more advanced than the 5-9-colpate and 3-colpate respectively. (Fig. 40)

From the present study it is suggested that the important taxonomic characters to distinguish the genera of the family Convolvulaceae are flowers, mature fruits and pollen. The pollen studies as well as the cytotaxonomic studies of this family are also needed. This may help to solve the taxonomic problems of this family.

In addition, as the flowers are very delicate, preserving them in 70 % ethyl alcohol together with few drops of glycerine is also recommended. Further more, an extensive collection activities should be urgently conducted, according to a rich flora may not be present as a result of the unlimited expansion of the cultivating area of the lowland over long time together with the subsequent destruction of the natural forest.



A



B

Plate 69 Comparison of stigmas

A. Undulate stigma of *Merremia* (*M. peltata*).

B. Not undulate stigma of *Xenostegia*.

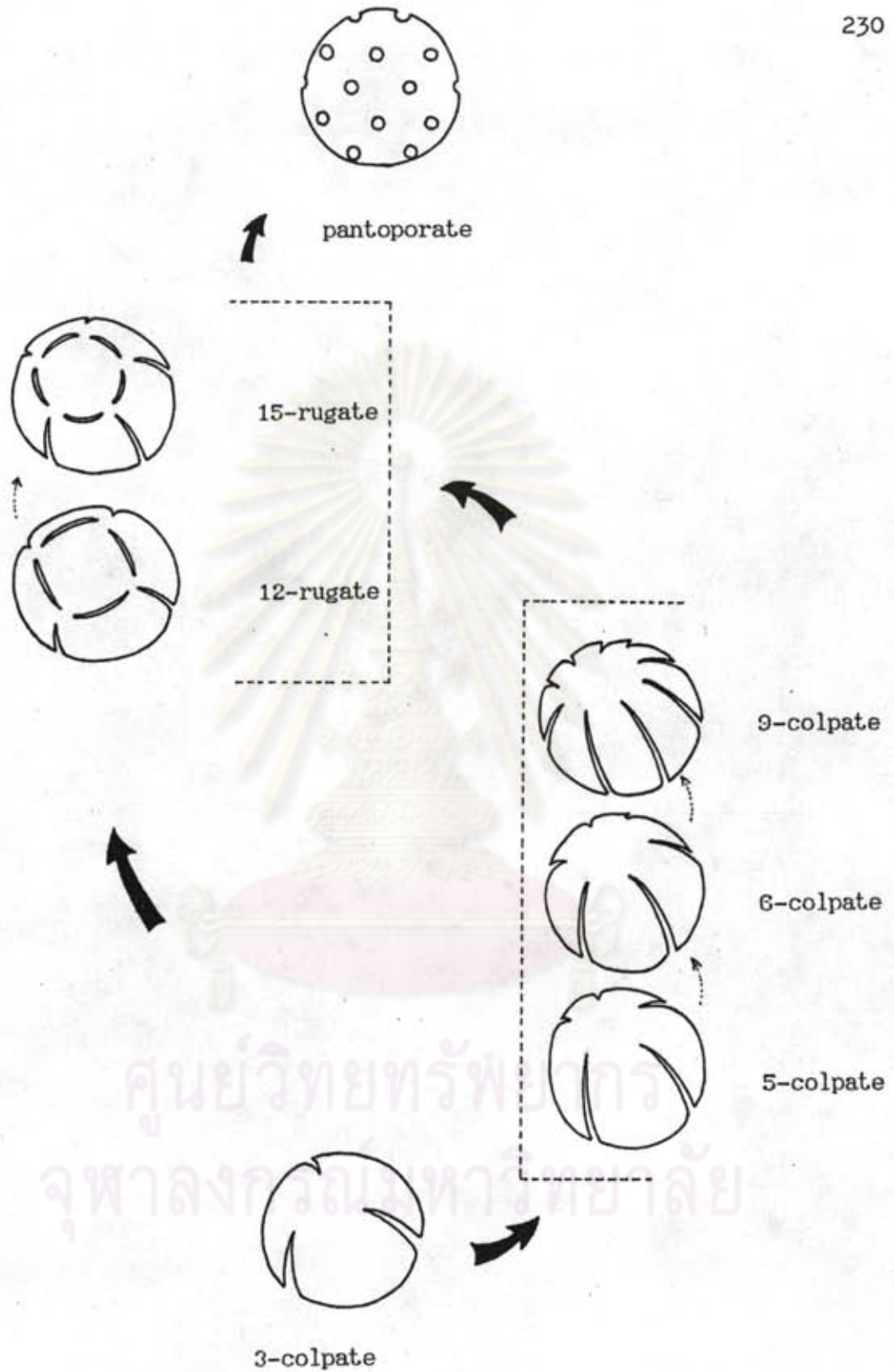


Figure 40. Probable successive patterns of the apertures types of pollens in 10 genera of Convolvulaceae studied.