The Woody Plants Architectural Models in the Songkhla Lake Basin, Peninsular Thailand.

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ชื่อวิทยานิพนธ์ แบบโครงร่างของพรรณพืชมีเนื้อไม้ในเขตทะเลสาบสงขลาในคาบสมุทรไทย

ผู้เขียน Mr. Leakkhaing Taing

สาขาวิชา พฤกษาศาสตร์

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บทคัดย่อ

วิเคราะห์แบบโครงร่างของพรรณพืชมีเนื้อไม้ในเขตทะเลสาบสงขลาและเก็บตัวอย่างเพื่อการระบุชนิดจากเดือนพฤษภาคม 2557 ถึง เดือน เมษายน 2558 สามารถระบุพรรณพืชได้ 84 ชนิด และสามารถจำแนกตามการจำแนกของ Hallé et al. (1978) ได้ 19 แบบ คือ Attim's model, Aubréville's model, Chamberlain's model, Champagnat's model, Cook's model, Corner's model, Holttum's model, Koriba's model, Leeuwenberg's model, Leeuwenberg/Rauh's model, Mangenot's model, Massart's model, Petit's model, Rauh's model, Rauh/Koriba's model, Roux's model, Schoute's model, Tomlinson's model และTroll's model. แบบที่พบมากที่สุดคือ Champagnat (21%) ถัดมาเป็น Roux (14%) และ Attim and Leeuwenberg (11%) ตามลำดับ แบบโครงร่างของพรรณพืชมีเนื้อไม้ของพันธุ์ไม้ในเขตทะเลสาบสงขลาสามารถใช้เป็นลักษณะในการระบุชนิดพันธุ์ไม้ได้ นอกจากนี้ยังสามารถใช้เป็นข้อมูลในการระบุโครงสร้างสังคมพืชดั้งเดิมจากป่าปลูกและพืชพันธุ์ที่ปลูกเพื่อการเกษตรกรรมอื่นๆด้วย

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ABSTRACT

The architectural model analysis of the woody plants in the Songkhla Lake Basin had been conducted from May 2014 to April 2015. 84 woody plant species were recognized with their models of architecture which were grouped into 19 models according to Hallé et al. (1978) i.e. Attim's model, Aubréville's model, Chamberlain's model, Champagnat's model, Cook's model, Corner's model, Holttum's model, Koriba's model, Leeuwenberg's model, Leeuwenberg/Rauh's model, Mangenot's model, Massart's model, Petit's model, Rauh's model, Rauh/Koriba's model, Roux's model, Schoute's model, Tomlinson's model and Troll's model. The most dominant architectural model was Champagnat (21%), followed by Roux (14%), Attim and Leeuwenberg (11%) respectively. The architectural models of woody plants found in the Songkhla Lake Basin could be considered as good characters in recognition of the woody plant species. It had, moreover, supported in recognition of the relic vegetation of the areas. This had provided opportunities in identifying relic vegetation out of the man-made plantations due to the agriculture and/or reforestation.

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Leakkhaing Taing

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Abbreviation		Symbols	
a.s.l.	above sea level	>	more than/larger than
ca.	about/ approximately	<	smaller than/ less than
cm	centimeter	±	more or less
diam.	diameter		
et al.	and others		
i.e.	that is		
m	meter		
mm	millimeter		
sp.	species		
subsp.	subspecies		
var.	variety		

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CHAPTER 1

INTRODUCTION

Tree architectural approaches distinguish the overall growth structures of the tree, i.e. trunk and branches (Navarro et al., 2009) and these trunk and branches form diverse distinctive structures due to the activities of one or more of apical meristems (Hallé et al., 1978; Niklas, 2000). Raunkiaer (1934) mentioned the type of the shoot apices or apical meristems projection to form the biological type in order to adapt in the diverse vegetation. The growth determinations of such apical and axillary meristems are under the control of genes (Sussex, 2001) and environmental factors (Barthélémy & Caraglio, 2007). Occasionally, diverse plant canopy structures occur and set up their own architecture to settle down to the place of its living. The tree architectural model done by Hallé et al., (1970; 1978) had focused on the tropical area of Africa and America, later, such concept was rapidly applied to the temperate areas (Stecconi et al., 2000), tropical forest areas (Hamilton, 1985; Tomlinson, 1987; León Enriquez et al., 2008; Navarro, 2009), subtropical humid forests (Shukla & Ramakrishan, 1986) and the lianas (Cremers, 1973-1974). In any case, there is no any record on the tree architectural models on the mainland SE Asia so far. The present study was trying to analyze the tree architecture of the natural vegetation in Songkhla Lake areas which situated on the East coast of the peninsular Thailand. According to Laongpol et al. (2005; 2009), there are diverse vegetation types along that coastal sandbars of peninsular Thailand, including the Songkhla Lake areas which is a part of the coastal sandbars/lagoon system in the peninsular Thailand. It is such a pity that most of the natural vegetation had been left as isolated patches due to the long anthropogenic disturbance in the area. The analyses of the woody plants architecture in such areas would provide a comprehensive understanding of the left-over isolated patches of this valuable natural coastal vegetation before such patches would, in the near future, disappear due to the high rate of disturbance and the “misunderstanding-reforestation” in the areas.

The Songkhla Lake areas in Peninsular Thailand.

The sediments deposited along this East coast-shoreline of peninsular Thailand had produced many sandbars and offshore bars. The largest one, built across the former Bay of Phatthalung was turning that bay into a large lagoon called "Thale Sap Songkhla" or the "Songkhla Lake" (Pongsaputra, 1991) (in fact, a lagoon) (see map, Fig. 1). This sandbar is around 100 km long and included the districts of Chian Yai in Nakhon Si Thammarat province and Ranot, Sathing Phra and Singhanakorn districts in Songkhla province. It is quite well-known under the name of "Sathing Phra Peninsula" and on the west coast of the lagoon included in Khuankhanun, Mueang Phatthalung and Pak Phayun districts of Phatthalung province with the southern part of the lagoon in Khuan Niang and Hat Yai districts of Songkhla province (Pongsaputra, 1991). The Songkhla Lake has only one connection to the open sea of the Thai Gulf at Mueang Songkhla district. The Songkhla Lake could be physically divided, from the north to the south, into four parts according to its geography as: "Thale Noi" (Northernmost part); "Thale Luang" (Middle-North part); "Thale sap Lampam" (Middle-South part) and "Thale sap Songkhla" (Southern part), respectively. This had created a large basin which bordered by a "Sathing Phra" Peninsula (sandbar) on the one site (East) and a range of the mountain called "Bantad" on the other (West).

The Vegetation of the Songkhla Lake area and the trees/shrubs architectural models.

Due to various topographic features as well as the different physical characteristics of the Songkhla Lake Basin, there are many microhabitats, both terrestrial and aquatic for plants, which belong to different plant communities all over the basin. This had characterized rather unique floristic composition as well as the vegetation structure in the areas around the Songkhla Lake. However, the Basin itself has been also an important area base of human settlement from the dawn of the civilization in the peninsular Thailand that could be documented by many prehistoric archeological artifacts as well as archeological sites of various ancient towns e.g.

ancient Sathing Phra town, ancient Phatthalung town etc; cemeteries (both Buddhist and Muslim) and many ancient Buddhist temples which date back to 9^{th} -15^{th} century, around this Songkhla Lake areas. Consequently, most natural habitats in this Songkhla Lake Basin have been continually disturbed. In spite of that, separated patches of natural vegetation could be detected from place to place in the areas. The present study was trying to locate the remnant patches of natural vegetation around the Songkhla Lake areas (Fig. 1) and identify its natural floristic composition and their architectural models, which would, the present study, focus on the woody plants i.e. tree and shrub species only.

OBJECTIVE

- To document the composition of woody plants in the Songkhla Lake Basin, Peninsular Thailand.
- To document the the woody plant architectural model which were found in the Songkhla Lake Basin.
- To document the profile diagram information in term of the architectural model of the woody plants along the particular habitat

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LITERATURE REVIEWS

The activities of the apical meristems (shoot and axillary) and the influences of the surrounded factors determined the successive structure of the present trees. The tree architectural growth models were studied, categorized and accounted but the proposed names of such architectural growth have not considered. For example: even though the account of information of the dynamic structural growth (vegetative axes growth) of the total 12 species of Apocynaceae family were studied, analyzed, categorized and described by Prévost (1966), the proposed names concerning the specific structural growth of the vegetative axes of those 12 species haven't suggested. By 1970 and 1978, Hallé with his group analysed the outline structural growth of the tree and reduced such diverse form of the tree into 23 architectural models.

The account of tree architectural model in global scale

Since the architectural growth structure of plant species is specific and consistent in a given plant species, the accounts of the tree architectural models could be considered as the good characters in recognition of the woody plant species. The account of information of the trees architectural structure were gathered, analyzed and proposed the names by Hallé et al. (1970, 1978). The total 23 tree architectural models were proposed and described with the illustrations. The elements of tree architecture like the shoot and lateral apical meristems were described and accounted. Further information of the extension growth of the tree (rhythmic/continuous growth), dynamic branching modes (syllepsis/prolepsis meristems), branches/relayed branches position and the reproductive organ position were accounted and used in categorizing the architectural growth of the tree.

Tomlinson (1983) gathered the account of tree architectural information and briefly explained (1) the reasons why the total 23 architectural models of Hallé et al. (1978) are restricted in the tropical forest rather than the temperate. (2) There is no precise relation between the architectural model with the higher taxa, e.g. Species of a

family or close related families might grew according to either the same or different architectural model. (3) The unrelated dynamic growth modes between the modes of branching and the mode of the main axe (commonly stand as trunk). There are two different modes of branching i.e. syllepsis (The bud immediately develop) and prolepsis (the bud delayed in development), which demonstrated the trunk and branches orientations in different way. Within the same individual species, in some case, the structural growth mode of the main axe (trunk) and the lateral axes (branches) emanated from these syllepsis and prolepsis growth mode i.e. the tree of Nozeran's model indicated two different branching modes such as (1) the plagiotropic branches/relayed branches grew in syllepsis manner and (2) the orthotropic main axe (trunk) grew in prolepsis manner. The different mode of apical (terminal and lateral) in the same indiviaul tree, in some case, is still unknown.

Cremers & Edelin (1995) studied the architectural growth of some tropical aerial plants which produced the basitonic branches. This study revised solely the aerial plant species of Tomlinson's model which included monocotyledonous and dicotyledonous species. The authors observed, classified and described the characteristics of the architectural growth of those species and according to their observation, they assumed this Tomlinson's model might not suitable to invent as a distinct model since except that repeated basitonic growth manner, this model likely imposed or appeared same or identical as the other known models i.e. Holttum or Corner's model etc.

Robinson (1996; 2000) created the roles and the shortcut symbols for describing/recognizing the total 23 tree architectural models of Hallé et al. (1978). Even though these roles and symbols have not indicated or proposed any new tree architectural model, these roles and symbols were useable to construct the limitation of the possibilities of tree architectures and in cases of the fast assumption on the woody plant architectural analysis, these symbols were applicable and also instantly interpretable the architecture which the woody plant fixed to.

Barthélémy & Caraglio (2007) combined and reviewed the related papers concerning the tree architectures and the dynamic approaches of the plants' structure and ontogeny. The authors focused on (1) the detailed of plant growth processes i.e. determinate/ indeterminate growth, rhythmic/continue growth of the shoot apical meristems were demonstrated. (2) Moreover, the chronological developments of the branches and the relayed branches i.e. terminal/lateral branching, prolepsis/syllepsis branching modes, monopodial/ sympodial branching, rhythmic/continue/diffused etc. were described and illustrated. (3) Last, the demonstration of the morphological differentiation of the vegetative axes i.e. orthotropic/plagiothropic/mixed axes, short/long axes, the position of the reproductive organs (terminal/lateral) etc. were reviewed and explained.

The account of tree architectural model in the specific place

Cremers (1973) investigated on the lianas architectural growth from the Ivory Coast, Tropical Africa. There were 13 architectural models were found and the details of the architectural growth of each species were described i.e. Corner, Tomlinson, Chamberlain, Leeuwenberg, Schoute, Petit, Nozeran, Massart, Roux, Cook, Champagnat, Mangenot and Troll's model.

Again, Cremers (1974) investigated and described the other 11 lianas species in the same place. In his second paper, he mentioned and described only about the architectural growths of the lianas which were totally difference from his former work and also no record from the tree architectural model of Hallé et al. (1978).

Hallé (1974) accounted the architectural growth model of the selected 11 plant species from the Rain Forest of Morobe District, New Guinea. Those species grew according to different 7 architectural models i.e. Leeuwenberg's model, Corner's model, Aubréville's model, Massart's model, Petit's model, Roux's model and Nozeran's model. The descriptions of each species with the details of its architectural growth were provided. He claimed that since tree architectural work hasn't broadly done in Asiatic and Melanesian trees and these 11 species were the preliminary

account which might be provided the chance for further investigation on the tree architectural account of this region.

Navarro et al. (2009) studied the plant architecture from the semi-arid shrub species in Cabo de Gata National park, Southeast Spain. The total 45 shrub species of 12 families were studied and classified into 6 different architectural models i.e. Scarrone, Rauh, Holttum, Leeuwenberg, Champagnat and Corner's model. The most common architectural model is Scarrone, followed by Rauh's model. The detailed of the functional traits like plant height, lateral spread and plant coverage were also accounted in line with the architectural model description.

Vester (2002) conducted also the tree architectural work from Yucantán Peninsula, Southern Mexico. The total 108 tree species (92 genera of 46 families) were studied and categorized into 15 different architectural models. All of the selected species and the architectural model were obtained from the field observations in line with the former literatures.

Lestari & Hapsari (2011) investigated on the total 16 selected tree species from the Purwodadi Botanical Garden, Indonesia. Those selected species were analyzed and classified into 9 architectural models i.e. Corner, Leeuwenberg, Aubréville, Massart, Rauh, Scarrone, Roux, Petit and Champagnat and the brief descriptions of those models were also provided and accounted.

The accounts of the Architectural model on the specific taxon

Hamilton (1985) examined the dynamic branching of the *Psychotria* L. (Rubiaceae) from Panama, Barro Colorado Island. The architectural growth of branches of the total 19 species were analyzed and categorized into three types of structural growth models i.e. Chamberlain, Leeuwenberg and Koriba's model. However, there are at least 3 species of this genus did not precisely fit to the proposed model of Hallé et al. (1978)

Vester (1999) also studied the architectural diversification of the specific genus, namely ***Vismia*** (Clusiaceae), from the Amazonian Rain Forest (Araracuara, Colombia). The architectural growth structure of the total 5 species were analyzed and classified into two architectural models i.e. **Roux's model** (***V. japurensis*** Reich., ***V. glaziovii*** Ruhl. and ***V. laxiflora*** Reich.) and **Troll's model** (***V. sandwithii*** Ewan and ***V. macrophylla*** Kunth). In term of the architectural criteria of each species, the assumption hypothetical diagrams concerning the relationship between those species were roughly concluded.

León Enriquez et al. (2008) studied about the architectural growth in line with the historical evolution of ***Phyllanthus acuminatus*** **Vahl.** (Phyllanthaceae). This species grew according to Roux's model and it was distinguishable by the continuous growth, monopodial orthotropic axe (commonly known as trunk) with the plagiothropic branches. However, the data did not completely conclude concerning the historical evolution.

Castellanos et al. (2011) analyzed the architectural growth of ***Buxus vahlii*** **Baill.** (Buxaceae) from two different environments i.e. (1) the coastal forest at about 10 m a.s.l. which is located in the municipality of Rincón and (2) the mountainous forest at about more than 300 a.s.l. which is located in the municipality of Isabela. Four development stages of this species were observed and recorded i.e. the seedling, the juvenile, the mature and the senescent (old) trees. The result revealed this species grew according to Champagnat's model and even though the crown shapes of this species were differences in these two different environments, but the stresses of the environments have no influence on the architectural growth of this species. The conclusion was assumed that the behavior of such variation or plasticity of crown shape imposed in order to adapted or adjusted to the stresses of the habitat.

CHAPTER 2

MATERIALS AND METHODS

STUDY AREA

1. Location:

The Songkhla Lake basin is situated in the Southern part of Thailand and surrounded by three provinces i.e. Songkhla, Phatthalung and Nakhon Si Thammarat province. The lake lies approximately between $7^{o}48'30"$ – $7^{o}8'10"$ N and $99^{o}58'50"$ – $100^{o}39'10"$ E (see map, Fig. 1).

2. Topography:

Two different areas in terms of flooding phenomena in the Songkhla Lake basin due to this topographic features have been recognized i.e. the sandbars/dunes where never ever being flooded; the plain behind the sandbars/dunes around the edge of the lake, performed as a large basin where regularly flooded in the rainy season. The present study had focused on the remnant patch of vegetation on this characteristic sandbar that bordered the lake to the open sea on the East and the basin around the lake.

3. Climate:

The area is under the tropical monsoon climate (Am) according to the Köppen's classification system of climatic region analysis (Kottek et al., 2006, Meteorological Department, 1994). While the northeast monsoon is active from October to March, the southwest monsoon is active from May to September. The northeast monsoon period is the heavy rainfall time with approximately 60 percent of the annual rainfall which reach the highest peak between October and December in general. As a result, the area would be flooded during this northeast monsoon period. The water could be in deficit during the dry period which occurs between February to March. The average precipitation over the Songkhla Lake Basin is approximately 1,880 mm, in any case, it could vary between 1,600 and 2,400 mm (Meteorological Department, 1994).

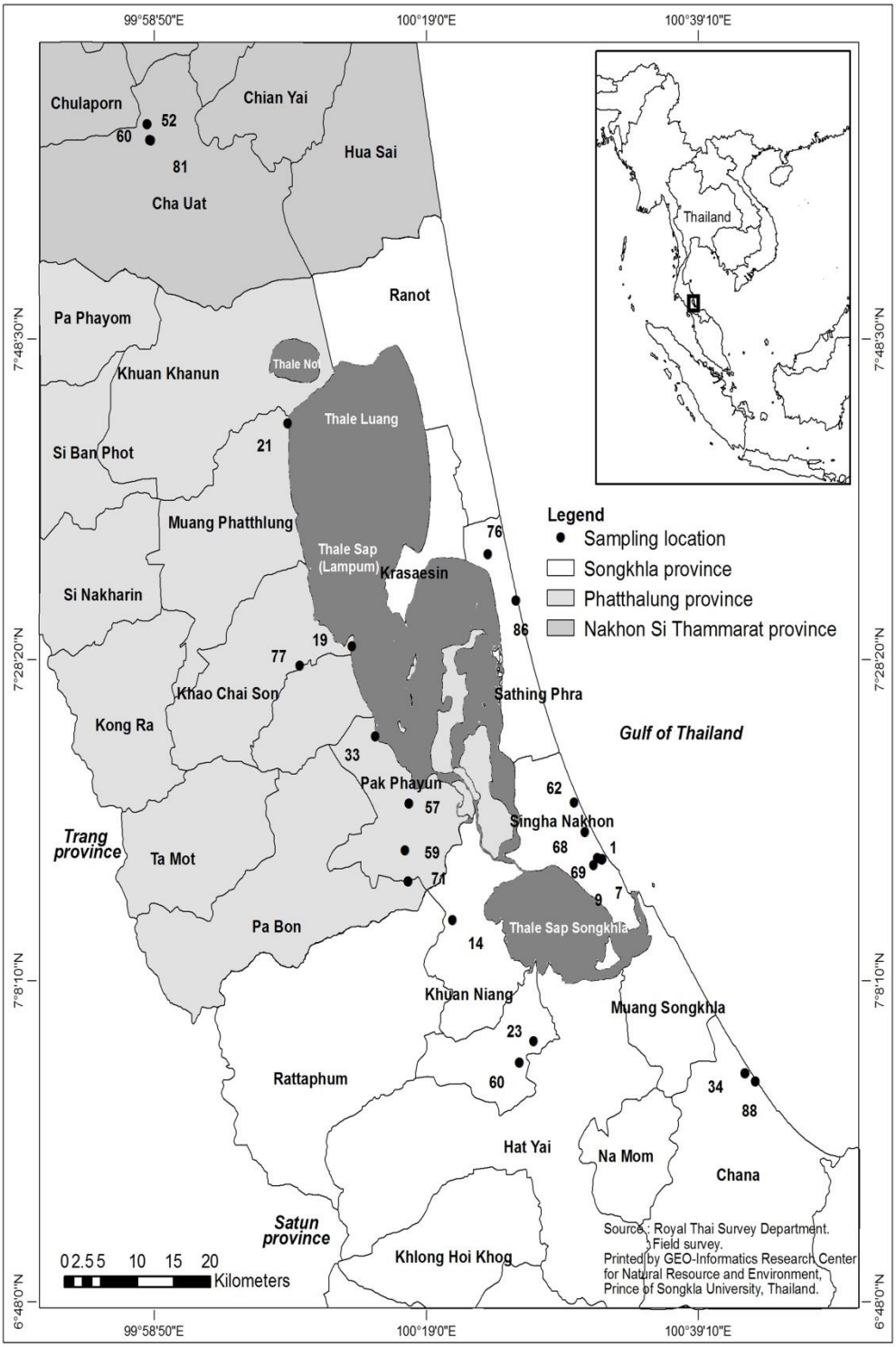

Figure 1: The Songkhla Lake Basin showing locations of the study areas**.**

DATA COLLECTION

1. Field Survey:

Due to the anthropogenic activities, most of the natural vegetation along the Songkhla Lake Basin has been fragmented into isolated patches. The relic vegetation, performing an important display of the tree structure, could be seen from site to site in the studied areas. Surveys on the remnant patches of such natural vegetation along the Songkhla Lake basin were carried out as to locate the trees/shrubs leftover in such patches and selected for the architectural analysis.

2. Plant collection:

Woody plant specimens i.e. tree, shrub and woody climber were collected from the selected sites, where remnant patches of natural vegetation occurred, once a month from May 2014 until April 2015 in order to cover all flowering seasons. Each of collected plants had been photographed and roughly illustrated in the field. Specimens processing followed Bridson & Foreman (1998).

3. Laboratory study:

The species identification had been carried out follows all of the available taxonomic literature. Plant family classification of angiosperms followed APGIII (Angiosperm Phylogeny Group, 2009). All voucher specimens were deposited at the Herbarium (PSU), Department of Biology, Prince of Songkla University. Hat Yai, Songkhla, Thailand.

Detail morphology of plants (e.g. size of leaf, flower, fruit, stamen, number of ovule, seed, etc.) was described with the help of Stereo microscope. Detailed scientific name with the author citation and other abbreviation followed the Authors of Plant Name (Brummitt & Powell, 1992) and online references included: The International Plant Name Index (IPNI), tropicos.org etc.

The basic units i.e. trunk, branches and the Inflorescence of each identified woody plant species were illustrated and analyzed followed Hallé et al. (1978); Robinson (1996); Robinson (2000); Barthélémy & Caraglio (2007). The architectural models of the woody plant species had been assigned according to the analyses of the basic units.

CHAPTER 3

RESULTS
PART I: TREE DIVERSITY IN THE SONGKHLA LAKE BASIN

A total 84 woody plant species in 37 families were recorded from the various vegetation types (Table 1) and the description of those species were provided below:

ACANTHACEAE

Avicennia marina (Forssk.) Vierh., Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl. 71: 435. 1907; Chen S. J. & Gilbert M. G. in Fl. China 17: 49. 1994.— ***Sceura marina*** Forssk., Fl. Aegypt.-Arab. 37. 1775. (Fig. 5, A)

Tree ca. 10 m tall; branchlets brownish grey, glabrous, slightly ridged when young; bark whitish grey, smooth. **Leaves** simple, opposite, succulent; lamina obovate to lanceolate, 4 – 8.5 cm long by 2.5 – 3.5 cm wide, glabrous, green above, pale grey underneath with finely hairs, apex obtuse to acute, base obtuse to attenuate, margin entire, midrib slightly raised above surface; petioles 0.5–1 cm, glabrous. **Inflorescence** axillary and terminal, compound cyme, many flowers; peduncle 1.5-2 cm long, hairy; rachis 1-2 cm long, hairy; bracts triangular, 2.5-3 mm long by 2-2.5 mm wide, apex acute to acuminate, margin entire, densely hairy on both side; bracteoles triangular, ca. 2 mm long by 1.5 mm wide, apex acute, margin entire with ciliate, sparsely hairy. **Flowers** spiral arranged on the stalk, actinomorphic, 4-5 mm long by 3 mm in diam.; pedicel subsessile, ca. 1 mm long, hairy. **Calyx** lobes 5, free, ovate, ca. 2 mm long by 1-1.5 mm wide, apex acute and glabrous or covered with scattered hairs, margin ciliate. **Corolla** yellow to brownish, lobes 4, gamopetalous, campanulate; tube 1-1.5 mm long, sparsely hairy to glabrous; lobes ca. 2 mm long by 2 mm wide, apex truncate-rounded, densely hairy outside and glabrous inside, margin entire. **Stamens** 4, ca. 2 mm long by 1 wide, epipetalous; filaments ca. 1 mm long, glabrous; anthers ca. 1 mm long, longitudinal dehiscence, dorsifixed. **Ovary** superior,

elliptic 1-1.5 mm long by 1 mm in diam., 2-loculed, ovule 2 per locule; style subsessile; stigma 2-lobed. **Fruit** not seen.

Thailand.—PENINSULAR: Songkhla.

Distribution: Coast of Southern Asia, Australia, western Indian Ocean, South China, Taiwan, the Philippines.

Ecology: mangrove swamp (salty water). Flowering Time: June- February.

Specimens examined. —L. Taing 75 (PSU)

ANNONACEAE

Uvaria rufa Blume, Fl. Javae Anon., 19. 1830; Li P.T. & Gilbert M. G. in Fl. China 19: 169.2011. (Plate 14, A; Fig. 10, E)

Woody climber; branchlets terete, yellowish brown, covered with densely brown stellate hairs; bark lenticellate, dark brown. **Leaves** simple, alternate; lamina oblong to elliptic or lanceolate, ca. 4-14.5 cm long by 2.5-6.5 cm wide, densely brown stellate hairs on both surface, apex acute or broadly acute to acuminate, base subcordate-rounded, midrib and secondary veins raised beneath surface, margin entire and covered with brown stellate hairs; petioles short, ca. 3-6 mm long, covered with densely brown stellate hairs. **Inflorescence** axillary, cymose; peduncle ca. up to 2.5 mm long and covered with brown stellate hairs; bracts ca. 4-8 mm long by 4-5 mm wide, green, covered with densely brown stellate hairs, apex rounded, margin entire. **Flower** actinomorphic ca. 1.5 to 2.5 cm in diam.; pedicel ca. 1 cm long, covered with densely brown stellate hairs. **Calyx** brownish green, lobes 3, campanulate, covered with densely brown stellate hairs on both surface; calyx lobes broadly triangular, ca. 2-3 mm long by 4-6 mm wide, apex rounded to sub-acute, margin entire and covered with densely brown stellate hairs; calyx tube ca. 1-1.5 mm long. **Corolla** red to dark red, lobes 6, free, ovate to elliptic, ca. 7-9 mm long by 5-6 mm wide, stellate hairs on both surface, apex obtuse to rounded, margin entire. **Stamens** numerous, free; filaments yellowish to brown, oblong, ca. 3 mm long by 1-1.5 mm wide, glabrous;

anthers along the filaments, 2-celled, ca. 2 mm long, longitudinal dehiscence. **Ovary** superior, numerous carpels free, oblong ca. 5 mm long (with style) by 1 mm in diam., covered with densely hairy; one locule per carpel and consisted of numerous ovules. **Fruit** not seen.

Thailand.—Throughout Thailand.

Distribution: Indochina to Malesia, Andaman Islands, Myanma and Southern China.

Ecology: Along the roadside, in the edge of secondary scrub forest, in tropical bog and the edge of secondary coastal woodland. Flowering Time: April to November.

Specimens examined. — L. Taing 65 (PSU)

Uvaria siamensis (Scheff.) L. L. Zhou, Y. C. F. Su & R. M. K. Saunders, Syst. Biodivers. 7(3): 255. 2009. − ***Rauwenhoffia siamensis*** Scheff., Ann. Jard. Bot. Buitenzorg 2:21. 1885. (Plate 12, A; Fig. 15, E).

Shrub, ca. 2-2.5 m tall, branchlets terete, dark greyish brown to dark brown, covered with stellate hairs. **Leaves** simple, alternate, glabrous on both surface; lamina oblong to lanceolate, ca. 11-19 cm long by 3.5 to 5.5 cm wide, apex acute to attenuate, base subcordate to rounded or obtuse, midrib impressed above and raised beneath surface, margin entire; petioles ca. 5 mm long, covered with stellate hairs. **Flowers** in pair or solitary**,** actinomorphic, ca. 2 -3 cm long (included pedicel); pedicel ca. 1-1.3 cm long, covered with brown stellate hairs, bracts not seen. **Calyx** yellowish to brownish, lobes 3, broadly triangular covered with densely brown stellate hairs, ca. 7-9 mm long by 4-6 mm wide, apex rounded, margin entire. **Corolla** yellowish to brownish, lobes 6, free, covered with densely brown stellate hairs; outer lobed 3 ovate, ca. 1.2 cm long by 1 cm, apex rounded, margin entire; inner lobed 3 obovate, ca. 11 mm by 7 mm wide, apex obtuse to acute, margin entire. **Stamens** numerous, free; filaments oblong and capitate, ca. up to 1.5 mm long by 0.5-1 mm wide, glabrous; anthers 2-celled placed along the filaments, longitudinal dehiscent.

Ovary superior, numerous carpels, free, oblong, ca. 5 mm long (with style) by 1 mm in diam., densely hairy; one locule per carpel and consisted of numerous ovules. **Fruits, Apocarpus** 10-12 mm long (with stipe) by 5-6 mm in diam., stipe 1-3 mm long, covered with stellate hairs.

Thailand.—PENINSULAR: Songkhla.

Distribution: Indochina to Malesia, Andaman Islands, Myanma and Southern China.

Ecology: Occur in the lowland area of tropical bog and floodplain. Flowering Time: June.

Specimens examined. —L. Taing 84 (PSU)

APOCYNACEAE

Alyxia reinwardtii Blume, Catalogus 43. 1823; Backer & Bakh.f., Fl. Java (Spermatoph.) 2:230. 1965; Li et at., Fl. China 16: 160. 1995; Middlton D.J. in Fl. Thailand 7(1): 55-57, fig. 18. 1999. (Plate 12, E; Fig. 14, F).

Woody climber; branchlets angular, grey to dark brown, glabrous; bark smooth, grey to dark brown. **Leaves** simple, opposite or in whorls of 3 to 4; lamina obovate or elliptic to lanceolate, ca. 4.5-8.5 cm long by 2.5-3.8 cm wide, glabrous on both surface, apex round to acuminate, base obtuse to cuneate, margin entire, midrib raised beneath and impressed above surface; petioles ca. 0.5–0.9 cm long, glabrous. **Inflorescence** axillary and terminal, raceme or compound dichasium, ca. 2-2.5 cm long; peduncles ca. 5-7 mm long, sparsely hair to glabrous; rachis ca. 5-6 mm long, covered with scattered hairs; bracts and bracteoles ca. 1-1.5 mm long by 1 mm wide, triangular, apex acute, margin entire, hairy. **Flowers** actinomorphic, ca. 8-10 mm long; pedicel ca. 2-2.5 mm long, covered with scattered hairs. **Calyx** lobes 5, triangular, ca. 1-1.5 mm long by 0.8-1 mm wide, hairy, apex acute, margin entire. **Corolla** brownish to white, lobes 5, slightly fused at base; tube commonly brownish, ca. 6 mm long by 1-1.5 mm in diam., glabrous outside but hairy at throat inside; lobes

white, suborbicular to broad ovate, ca. 2 mm long by 1-1.5 mm wide, apex rounded (rarely obtuse), margin entire, glabrous. **Stamens** 5, epipetalous, 1–1.5 mm long; filaments short, ca. 0.5 mm long, glabrous; anthers ca. 1 mm long, longitudinal dehiscence, dorsifixed. **Ovary** superior, <1 mm in diam., covered with soft hairs; 2-loculed, ovule 3-4 per locule; style long, 4-4.5 mm long, glabrous; stigma ca. 0.5 mm long. **Fruit** not seen.

Thailand. ─── NORTHERN: Chiang Mai, Phisanulok; NORTH-EASTERN: Loei, Sakhon Nakhon; EASTERN: Surin, Ubon Ratchathani; SOUTH-WESTERN: Kanchanaburi; CENTRAL: Bangkok; SOUTH-EASTERN: Chon Buri, Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Krabi, Nakhon Si Thammarat, Trang, Songkhla, Satun, Pattani.

Distribution: Indochina, China, Myanmar, Malaysia, Indonesia.

Ecology: Along the costal scrub communities and in understory of coastal heath forest, along the edge of coast woodland with regular canopy, Flowering Time: May - December.

Specimens examined. ─L. Taing 88 (PSU)

Cerbera manghas L., Sp. Pl. 1:208. 1753; Corn, Ways. Trees of Malaya 1:143. 1952; Li et al., in Fl. China 16:165. 1995; Middleton D.J. in Fl. Thailand 7(1): 67. 1999. (Plate 12, B; Fig. 7, D).

Shrubby tree, ca. 5 m tall; young twig (branchlets) terete, reddish brown to grey, glabrous; bark greyish brownish. **Leaves** simple, opposite; lamina oblong to elliptic or to ovate, ca. 6-16 cm long by 2.5-5 cm wide, apex acute to acuminate, base attenuate to cuneate, glabrous on both surface, margin entire, midrib raised underneath surface; petioles ca. 1-2.2 mm long, glabrous; stipules intrapetiolar. **Inflorescence** in terminal branchlets, racemose; peduncle terete, ca. 2-3 cm long, glabrous. **Flowers** actinomorphic, up to 7 cm long (included pedicel); pedicel terete, ca. 1-2 cm long, glabrous. **Calyx** greenish white, lobes 5, free, lanceolate, ca. 15 mm long by 2-3 mm wide, glabrous on both surface, apex acute, margin entire. **Corolla**

greenish white with pinkish or red at the mouth, lobes 5, united at base, salver-shaped; tube base greenish, ca. 2.5-3.5 cm long by 2-2.5 mm in diam., glabrous outside, densely hairy inside; lobes ovate, ca. 1.5-2 cm long by 7 mm wide, glabrous on both surface, apex acute or obtuse, margin entire. **Stamens** 5, inserted just beneath the mouth of corolla tube; filaments short, ca. 0.5-1 mm long; anthers ca. 1-1.5 mm long, longitudinal dehiscence, basifixed. **Ovary** superior, 2-loculed, ovule ca. 4 per locule; style long, ca. 3 cm long, glabrous; stigma head-liked, 2-lobed, ca. 2 mm long by 2 mm wide, glabrous. **Fruit** not seen.

Thailand:−SOUTH-WESTERN: Prachuap Khiri Khan; SOUTH-EASTERN: Chon Buri, Rayong, Chanthaburi, Trat; PENINSULAR: Surat Thani, Phangnga, Phuket, Songkhla, Satun, Narathiwat.

Distribution: Cambodia, Vietnam, Malaysia, Indonesia, Japan, Myanmar, Australia and Pacific Islands.

Ecology: In sandy soil of Costal heath forest. Flowering Time: June, July.

Specimens examined. ―L. Taing 78 (PSU).

Spirolobium cambodianum Baill., Bull. Linn. Soc. Paris 1:773. 1889; Pitard, Fl. Gén. I.-C. 3:1166.1933; Whitmore, Tree Fl. Mal. 2:4-5. 1973; Middleton D.J. in Fl. Thailand 7(1): 76. fig. 25. 1999. (Plate 12, C; Fig. 11, I).

Erect shrub, ca. 1 m tall; branchlets terete, dark brown, hairy. **Leaves** simple, opposite; lamina elliptic to linear (rarely lanceolate), ca. 5-6.5 cm long by 1.3-2.3 cm wide, glabrous on surface except along the midrib and secondary viens, apex acute to acuminate, base attenuate to cuneate, midrib raised beneath surface, margin entire; petioles ca. 2-2.5 mm long, bearing scattered hairs. **Flowers** terminal and axillary, in pairs or solitary, actinomorphic; pedicel red, ca. 8-10 mm long, glabrous or sparsely hairy; bracts triangular, ca. 1 mm long by 0.5 mm wide, sparsely hairy, apex acuminate, margin entire. **Calyx** red and greenish, lobes 5, subulate, ca. 4-5 mm long by 0.5 mm wide, margin entire, sparsely hairy. **Corolla** white, lobes 5, united at base; tube greenish white, ca. 1.5-2 cm long by 1-2 mm in diam., glabrous; lobes white,

ovate, ca. 1.8-2.1 cm long by 1-1.2 cm wide, apex acute, margin entire, glabrous. **Stamens** 5-lobed, free, epipetalous; filaments short, ca. 0.5 mm long; anthers long, ca. 4 mm long by 0.5 mm wide, longitudinal dehiscence, basifixed. **Ovary** superior, green, ca. 1-1.5 mm long, glabrous; style long, ca. 5 mm long, sparsely hairy; stigma ca. 1 mm long. **Fruits** in pairs, mericarp, ca. 10 cm long by 1.5-2 mm in diam., glabrous.

Thailand:−SOUTH-EASTERN: Chon Buri, Chanthaburi, Trat; PENINSULAR: Surat Thani, Phuket, Krabi, Trang, Satun, Nakhon Si Thammarat, Songkhla, Pattani, Narathiwat.

Distribution: Indochina, Malay Peninsula, Borneo.

Ecology: In sandy soil of open scrub communities and bog area. Flowering and Fruiting time: October - November.

Specimens examined. ―L. Taing 117 (PSU)

AQUIFOLIACEAE

Ilex umbellulata (Wall.) Lose., Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur. 78:99. 1901; Chen S. et al. in Fl. China 11:382. 2008. (Plate 13, A; Fig. 7, E).

Shrubby tree, ca. 5 m tall; branchlets terete, grey, smooth and glabrous; bark grey or greyish, lanticellate. **Leaves** simple, alternate; lamina lanceolate to elliptic (rarely suborbicular), ca. 4.8-10 cm long by 2.4-5 cm wide, glabrous on both surface, apex acuminate to emarginate, base obtuse to cuneate, midrib raised beneath surface, margin entire; petioles ca. 4-10 mm long, glabrous. **Inflorescence** axillary and terminal, a compound cyme, bearing numerous flowers; peduncle ca. 8-15 mm long, glabrous; rachis ca. 5-10 mm long, glabrous; bracts and bracteoles small, deltoid, ca. <0.5 long and wide, apex acute, margin entire, glabrous. **Flowers** actinomorphic, ca. 5 mm long (included pedicel) by 2-3 mm in diam.; pedicel ca. 2-2.5 mm long, sparsely hairy. **Calyx** lobes 5, campanulate; tube ca. 0.5 mm long, glabrous; lobes ovate or broad triangular, ca. 0.5 mm long by 1 mm wide, glabrous, apex acute, margin ciliate.

Corolla white, lobes 4-5, free, broadly ovate to suborbicular, ca. 1.5-2 mm long by 1 mm wide, glabrous, apex acute to subrounded, base truncate, margin entire. **Stamens** 4-5, free, alternate the corolla lobes; filaments ca. 1 mm long, glabrous; anthers ca. 0.7 mm long, longitudinal dehiscence, basifixed. **Ovary** superior, style ca. 0.5 mm long and glabrous. **Fruit** berry, globose, 4 mm long by 4-4.5 mm in diam.; **seed** ca. 12.

Thailand:–PENINSULAR: Nakhon Si Thammarat, Songkhla.

Distribution: – Bangladesh, India, Myanmar, Vietnam.

Ecology: In sandy soil of Costal heath forest and bog area. Flowering Time: August - September. Fruiting Period: October-December.

Specimens examined. —L. Taing 107; 110; 120. (PSU).

BIGNONIACEAE

Dolichandrone columnaris Santisuk, Bull. Mus. Natl. Hist. Nat., B. Adansonia Sér. 4, 7(1):100. 1985; Santisuk in Fl. Thailand. 5(1):54.1987. (Fig. 7, F)

Tree ca. 15 m tall; branchlets grey to pale grey, glabrous; bark brownish grey, scaly. **Leaves** odd-pinnate, alternate, glabrous, leaflets 7 (sometime 5); lamina ovate to elliptic or lanceolate, 3 - 14 cm long by 2.4-5 cm wide, apex attentuate to acuminate, base asymmetrical (obtuse to cuneate), mid rib and secondary veins raised beneath surface, margin entire, glabrous; petioles 2.5-4 cm, glabrous; rachis up to 13 cm long, glabrous; petiolule 1.5-3 cm long, glabrous. **Inflorescence** in terminal branchlets, solitary or simple cyme of 1 to 2(-3) flowers. **Flower** zygomorphic, up to 13 cm long by 2-2.5 cm in diam., glabrous; pedicel ca. 1 cm long, glabrous. **Calyx** connate (spathe-liked), reddish to green, 4-4.5 cm long by 1-1.6 cm wide, glabrous, apex broad acute, margin entire. **Corolla** white, lobes 5, united at base; basal tube cylindrical and upper tube campanulate, 8- 13 cm long by 4-15 mm wide, glabrous; corolla lobes 1-1.5 cm long, apex acute, margin undulate. **Stamen**s 4; filaments ca. 12 mm long, glabrous; anthers 5-7 mm long by 2 mm wide, 2 –celled, longitudinal

dehiscence, basifixed. **Ovary** superior, green, 2-loculed, glabrous, ovule numerous; stigma 2-lobed. **Fruit** siliqua, brown, glabrous, ca. 35 cm by 1.5 cm, glabrous; seed flatten and margin bearing wing-liked, 2-2.7 cm long by 5-7 mm wide, glabrous.

Thailand. − PENINSULAR: Songkhla, Patthalung, Surat Thai, Nakhon Si Thammarat, Pangnga, Trang, Satun.

Distribution: Cambodia, Southern Vietnam and Northern Malaysia.

Ecology: In floodplain area and commonly found at the edge of rice field. Flowering Time: April to July. Fruit period: June.

Specimens examined. ─L. Taing 69 (PSU)

COMBRETACEAE

Combretum trifoliatum Vent., Choix Pl. t. 58. 1808; Clarke C. B. in Hooker J. D., Fl. Brit. India 2: 454. 1878; Nanakorn, Thai Forest Bull. (Bot.) 16:167. 1986. (Fig. 9, A)

Woody climber, up to 5 m tall; young bud pubescent, dark brown; branchlets pale grey, glabrous; bark brownish-grey, fissured. **Leaves** simple, opposite or in whorls of 3 (sometimes 4), glabrous; lamina narrowly elliptic to broad lanceolate, 4-13 cm long by 1.5-4.5 cm wide, apex acute to obtuse (sometimes retuse), base cuneate, midrib impressed on the upper blade surface and slightly raised underneath surface, secondary veins 8 – 10, margin entire; petioles 2-5 mm long, glabrous. **Inflorescence** terminal and axillary, spike, 4-7.5 cm long, bearing numerous flowers; peduncle terete, 1-2 cm long and hairy; rachis terete, 3-5 cm long and hairy. **Flowers** ca. 2 mm in diam., actinomorphic, bell-shaped; pedicel which contain ovary ca. 2 mm long, green, hairy; bracts slender, 1-2 mm long by 0.3 mm wide, hairy. **Calyx** yellowish white, lobes 5, slightly fused at base, bell-liked; calyx tube ca. 1 mm long, hairy; calyx lobes ca. 1 mm long by 0.6 mm wide, sparsely hairy outside and densely inside, apex acute to attenuate, margin entire. **Corolla** not seen. **Stamens** 10, free, up to 3 mm long; filaments ca. 3 mm, base hairy and glabrous from the middle to the upper part; anthers longitudinal dehiscence, dorsifixed. **Ovary** inferior, 1-loculed and

bearing 2 ovules; style 2-4 mm long, glabrous. **Fruit** samara, green, ellipsoid, 5 winged, 2.8 by 1.3 cm, glabrous.

Thailand.— PENINSULAR: Songkhla

Distribution: India to Indonesia.

Ecology: Commonly found along the water channel and in the floodplain. Flowering Time May to July.

Specimens examined. — L. Taing 58 (PSU)

Lumnitzera racemosa Willd., Neue Schriften Ges. Naturf. Freunde Berlin 4: 187 1803; Corn., Ways. Trees of Malaya 1:191. 1952; Kochummen K. M., Tree Fl. Mal. 1:173. 1972; Chen J. & Turland N. J., in Fl. China 13:310. 2007. (Plate 14, B; Fig. 4, C).

Shrubby tree, ca. 5 m tall; branchlets dark brown to dark greyish brown, glabrous; bark dark greyish brown, scaly. **Leaves** simple, alternate; lamina obovate to oblanceolate, 5-7 cm long by 1.5-2.5 cm wide, apex emarginate, base attenuate, glabrous on both surface, midrib slightly raised underneath surface, margin entire; petioles 5-10 mm long, glabrous; stipules absent. **Inflorescence** axillary, ca. 3.5 cm long; peduncle 1.5-2 mm long, glabrous. **Flowers** actinomorphic, ca. 1.5 cm long; pedicel subsessile, ca. 2 mm long, glabrous; bracteoles in pair, triangular ca. 1.5 mm long by 1 m wide, apex acute, margin ciliate. **Calyx** lobes 5, triangular, ca. 1 mm long by 1 mm wide, apex acute, margin ciliate. **Corolla** white, lobes 5, free, elliptic to lanceolate, 4-4.5 mm long by 2-2.5 mm wide, glabrous on both surface, apex acute and sparsely ciliate, base truncate, margin entire or ciliate. **Stamens** 10, free, inserted to the calyx tube, alternate and opposite the corolla lobes; filaments white, ca. 5 mm long, glabrous; anthers ca. 1 mm long, longitudinal dehiscence, dorsifixed. **Ovary** 1-loculed, ovule 3; style and stigma ca. 5 mm long by 1 mm in diam., white, glabrous. **Fruit** not seen.

Thailand.—PENINSULAR: Songkhla.

Distribution: Hainan, Taiwan, Cambodia, Vietnam, India, Japan, Indonesia, South Korea, Malaysia, New Guinea, Philippine, Singapore, Sri Lanka, North Australia.

Ecology: Swampy area, mangrove forest. Flowering time: April.

Specimens examined. ―L. Taing 146 (PSU)

***Terminalia catappa* L.**, Syst. Nat. ed 12, 2:674. 1767; Clarke C. B. in Hooker J. D., Fl. Brit. India. 2: 444. 1878; Ridl., Fl. Mal Pen. 1: 705. 1922; Nanakorn, Thai Forest. Bull. (Bot.) 15: 64-67. 1985. (Fig. 3, C)

Tree up to 20 m tall; monopodial trunk with horizontal sympodial branches tiers; the crown is more flattened, spreading branch; branchlets terete, dark brown, pubescence; bark smooth, light brownish-yellow. **Leaves** simple, alternated; lamina obovate (sometimes elliptic), 20-25 cm long by 13-16 cm wide, glabrous on both surfaces, apex retuse to round, base cuneate to obtuse with two glands; midrib (midvein) and secondary veins highly raised on the beneath blade surface, secondary veins 7-10 and visible on both blade surfaces, margin entire, domatia in the axils of the secondary veins of beneath blade surface; petioles 1-2 cm long. **Inflorescence** axillary, spikes, 12-16 cm long, inflorescence axes terete, bearing densely pistillate and staminate flowers in the same axe; peduncle up to 2.5 cm long, hairy; rachis up to 14 cm long, hairy. **Staminate flowers** in the upper part of each inflorescence, ca. 4 mm long and 5 mm diam.; calyx green and turn to brownish-white, campanulate (bell-shaped), lobes 5, ca. 2 mm long by 1.5 mm wide, hairy; pedicel 2-3 mm, green, hairy; bract brown, triangular, ca. 1 mm long by 0.5 mm wide, hairy, apex acute; stamen 10, exserted, ca. 4 mm long, free; filaments ca. 3 mm long, white, hairy below (base) and glabrous above (from the middle to the top); anthers tiny (ca. 0.5 mm long), longitudinal dehiscence, dorsifixed. **Pistillate flowers** at the base of each inflorescence, ca. 3 mm long; calyx lobes 5, ca. 3 mm long by 2 mm wide, hairy; pedicel which contained ovary inside 6-7 mm, green, hairy; bract brown, triangular ca. 1 mm long by 0.5 mm wide, apex acute, hairy. **Ovary** inferior, 1-loculed and contained 2-ovuled; style ca. 2.5 mm long, glabrous.

Thailand.—Central: Bangkok; South-Eastern: Trat, Chon Buri, Chanthaburi; South-Western: Prachuap Khiri Khan, Kanchanaburi; PENINSULAR: Surat Thani, Trang, Songkhla.

Distribution: Indo-Malayan region, India, China and throughout the tropics.

Ecology: In coastal areas (sandy soil) starting from the coastal scrub next to the seashore (sea level) to coastal woodland, normally in the open area. Flowering Time May, June or July.

Specimens examined. — L. Taing 46 (PSU)

DILLENIACEAE

Dillenia suffruticosa (Griff.) Martelli in Becc., Malesia 3:163. 1886; Hoogl. in Fl. Mal. Seri. I. 4:162-163. fig. 10. 1951; Hoogl. In Fl. Thailand 2(2):101.1972. (Plate 11, A; Fig. 4, B)

Large shrub to appreciable height tree, ca. 4 m tall; branchlets terete, dark greyish brown, sparsely hairy to glabrous. **Leaves** simple, alternate; lamina ovate to elliptic, up to 37 cm long by 15-26 cm wide, apex rounded to obtuse, base obtuse to rounded, midrib highly raised underneath surface, margin serrate; petioles adnated with the basal blade, up to 6.5 cm long by 1.2 cm wide, persistent, pale green, glabrous, margin entire. **Inflorescence** terminal branchlets, simple or compound raceme, ca. 20 cm long; peduncle green, ca. 13.5 cm long, covered with scattered hairs to glabrous; rachis green, ca. 5 cm long, bearing scattered hairs or glabrous. **Flowers** 6-7 cm in diam.; pedicel green, 1-1.3 cm long, bearing scattered hairs to glabrous. **Calyx** green with marginal pink, lobes 5, free, oblanceolate to obovate, 2-3.5 cm long by 1-1.3 cm wide, glabrous, apex rounded base truncate, margin entire. **Corolla** yellow, lobes 5, free, obovate, apex rounded, 4-4.5 cm long by 2.3-2.7 cm wide, base truncate, margin entire, glabrous. **Stamens** numerous, 15-17 mm long by 1 mm wide, curved; filaments white, 2-3 mm long, glabrous; anthers long, 10-12 mm long, longitudinal dehiscence, basifixed. **Ovary** superior, 6-7 loculed, each locule

contained ovule ca. 10; style white, 6-7 (depending on the number of carpels), ca. 1 cm long, glabrous. **Fruit** not seen.

Thailand.—PENINSULAR: Songkhla.

Distribution: Malay Peninsula, Sumatra, Borneo, Indonesia.

Ecology: in tropical bog area, or at the edge between swampy and bog area. Flowering Time June, July

Specimens examined. —L. Taing 95 (PSU)

DIPTEROCARPACEAE

Dipterocarpus chartaceus Symington, Gard. Bull. Singapore 9(4):322.1938; Smitinand T. et al., Thai Forest Bull. (Bot.) 12:33. 1980; Pooma R. & Newman M., Thai Forest Bull. (Bot.) 29:124. 2001. (Plate 13, B; Fig. 14, B)

Tree, ca. 20 m; branchlets whitish grey, terete, stellate hairs on the young twig; bark grey, reticulately fissured. **Leaves** simple, alternate; lamina ovate to broadly elliptic, 7-12 cm long by 4-7 cm wide, light green to green above and pale grey beneath, glabrous on both surface, apex acute, base rounded to obtuse, midrib and lateral veins highly raised beneath surface, margin undulate (wavy like), domatia absent; petioles 2-2.5 cm long, glabrous or bearing scattered stellate hairs; stipule 5-9 mm long, caducous, covered with densely grey stellate hairy. **Inflorescence** axillary of the upper leaves (rarely terminal), paniculate; peduncle terete, 1.5- 3 mm long, glabrous or bearing scattered stellate hairs; rachis terete, 4-6 cm long, glabrous or bearing scattered stellate hairs. **Flowers** actinomorphic, 3-3.5 cm long; pedicel 2-5 mm long, covered with densely grey stellate hairs; bracts and bracteoles not seen. **Calyx** greyish to greenish, lobes 5, united at base; tubes narrowly funnel shaped, 8-10 mm long, covered with grey stellate hairs; lobes unequal, 3 triangular lobes ca. 1 mm long, 2 oblong lobes 8-9 mm long, apex acute to obtuse, covered with grey stellate hairs, margin entire and covered with stellate hairs. **Corolla** lobes 5, free, blade surface red with marginal white, oblong, 3-3.3 cm long by 6-8 mm wide, densely stellate hairs covered the outer part, apex obtuse, base truncate, margin entire. **Stamen**

numerous (ca. 30), free; filaments short, up to 1-1.5 mm long, glabrous; anthers long, 4-7 mm long, longitudinal dehiscence, dorsifixed. **Ovary** 1.5-2 mm long, 3-loculed, ovule 2 per locule; style long, 7.5-8.5 mm long by 0.5 mm in diam., base hairy. **Fruit** indehiscent, ovate, ca. 2.5 cm long by 2 cm in diam.; two conspisuously wings from the accrescent calyx, oblong, 6-10 cm long by 2 cm wide, glabrous, apex rounded.

Thailand:—NORTHERN: Chiang Mai, Lampang, Phrae, Sukhothai; NORTH-EASTERN: Phetchabun, Nong Khai, Nakhon Phanom; EASTERN: Nakhon Ratchasima, Ubon Ratchathani; SOUTH-WESTERN: Kanchanaburi; SOUTH-EASTERN: Sa Kaeo, Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Trang, Satun, Songkhla, Yala, Narathiwat.

Distribution:—Peninsular Malaysia.

Ecology: In sandy soil of the coastal woodland with regular canopy. Flowering time: March-May.

Specimens examined. —L. Taing 42; 43; 76; 153 (PSU)

Dipterocarpus obtusifolius Teijsm. ex Miq., Ann. Mus. Bot. Lugduno-Batavi 1:214. 1863-1864; Smitinand T. et al., Thai Forest Bull. (Bot.) 12:39. 1980; Pooma R. & Newman M., Thai Forest Bull. (Bot.) 29:133. 2001. (Fig. 14, C)

Tree, ca. 10 m tall; branchlets terete, grey to greyish brown, densely stellate hairs on the young twig; bark grey, deep reticulately fissured. **Leaves** simple, alternate; lamina ovate, 20-32 cm long by 16-22 cm wide, dark green above and pale grey beneath, apex obtuse, base rounded to subcordate, densely stellate hairs beneath surface and scattered stellate hairs to glabrous above surface, midrib and lateral veins highly raised beneath surface, margin slightly undulate to sinuate or repand with or without ciliate, domatia absent; petioles 3.5-4.5 cm long, densely stellate hairs; stipule oblong, 15-17 mm long by 3 cm wide, caducous, covered with densely stellate hairs. **Inflorescence** axillary of the upper leaves, paniculate; peduncle terete or subterete, 5-10 mm long, bearing densely grey stellate hairs, rachis terete, 5 cm long, bearing grey

stellate hairs; bracts and bracteoles caducous, not seen. **Flowers** actinomorphic, 5-5.5 cm long; pedicel very short ca. 3 mm long, covered with densely grey stellate hairs. **Calyx** lobes 5, campanulate; tubes ca. 10 mm long, covered with grey stellate hairs; lobes unequal, 3-triangular lobes ca. 5 mm long, 2-oblong lobes 1-14 mm long, apex acute to obtuse, covered with grey stellate hairs, margin entire and covered with stellate hairs. **Corolla** lobes 5, free, pink to pinkish white, oblong, ca. 5 cm long by 1.6 cm wide, densely stellate hairs covered the outer part, apex obtuse, base truncate, margin entire. **Stamen** numerous (ca. 30), free; filaments short, up to 1-1.5 mm long, glabrous; anthers long, up to 1.2 cm long, longitudinal dehiscence, basifixed. **Ovary** 5-7 mm long, covered with densely white hairs, 3-loculed, ovule 2 per locule; style long, 14-15 mm long by 0.7 mm in diam., base hairy. **Fruit** indehiscent, ovate, ca. 2 cm long by 2-2.4 cm in diam.; two conspisuously winged from the accrescent calyx, oblong, 10-12 cm long by 2-2.5 cm wide, apex rounded or broadly obtuse, glabrous.

Thailand: −−− NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Phrae, Tak, Phitsanulok; NORTH-EASTERN: Phetchabun, Loei, Udon Thani, Nong Khai, Sakon Nakhon, Mukdahan, Kalasin, Khon Kaen; EASTERN: Chaiyaphum, Nakhon Ratchasima, Buri Ram, Surin, Si Sa Ket, Ubon Ratchathani; SOUTH-WESTERN: Kanchanaburi, Ratchaburi, Phetchaburi, Prachuap Khiri Khan; SOUTH-EASTERN: Sa Kaeo, Prachin Buri, Chon Buri, Trat; PENINSULAR: Nakhon Si Thammarat, Satun, Songkhla.

Distribution:—Peninsular Malaysia, Indochina, Myanmar.

Ecology: In sandy soil of the coastal woodland with regular canopy. Flowering time: March-May.

Specimens examined. —L. Taing 152 (PSU)

Hopea odorata Roxb., Pl. Coromandel 3:7. 1811; Corn., Ways. Trees of Malaya 1:212. 1940; Smitinand T. et al., Thai Forest Bull. (Bot.) 12:50.1980; Pooma R. & Newman M., Thai Forest Bull. (Bot.) 29:146-148.2001. (Fig. 9, C)

Tree, ca. 25 m tall, blanchlets terete, dark brown, glabrous, fissured but not flaking; bark dark greyish brown, fissured. Leaves simple, alternate; lamina lanceolate to broadly ovate, 7-11 cm long by 3-5.5 cm wide, glabrous on both surface, apex acuminate (rarely acute), base obtuse to cuneate, midrib highly raised beneath surface, margin entire, domatia in the axils of the secondary vein of beneath blade surface; petioles 8-12 mm long, scattered stellate hairs to glabrous; stipule not seen. **Inflorescence** terminal and in axillary of upper leaves, paniculate; peduncle terete, up to 2 cm long, covered with numerous grey stellate hairs; rachis terete, up to 12 cm long, covered with densely grey stellate hairs; bracts deltoid, 1-1.5 mm long by 1 mm wide, apex acute, densely grey stellate hairs on the outside surface and scattered stellate hairs inside, margin entire; bracteoles small, triangular, 0.5-1 mm long by 0.5-1 mm wide, apex acute, densely grey stellate hairs outside, margin entire. **Flowers** actinomorphic, 5-6 mm long (with pedicel); pedicel short ca.1 mm long, densely grey stellate hairs. **Calyx** grey, lobes 5, ovate or triangular, 2-2.5 mm long by 1-1.5 mm wide, apex acute, covered with densely grey stellate hairs outside surface, margin entire and ciliate. **Corolla** grey outside and brown inside surface, lobes 5, gamopetalous; lobes oblanceolate 3.5-4.5 mm long by 2 mm wide, densely grey stellate hairs outside and glabrous inside surface, apex obtuse to truncate, base truncate, margin entire or repand. **Stamens** 15, free, insert into the corolla lobes; filaments short, ca. 0.5 mm long, glabrous; anthers ca. 0.5 mm long, longitudinal dehiscence, basifixed. **Ovary** 2-2.5 mm long (include style) by 1-1.5 mm in diam., 3-loculed, ovule 2 per locule; style and stigma 1-1.5 mm long, glabrous. **Fruit** not seen.

Thailand.—NORTHERN: Chiang Mai, Phayao, Lamphun, Lampang, Tak, Sukhothai, Phijit, Nakhon Sawan; NORTH-EASTERN: Phetchabun, Loei; EASTERN: Chaiyaphum, Nakhon Ratchasima, Buri Ram, Surin; SOUTH-WESTERN: Uthai Thani, Kanchanaburi, Ratchaburi, Phrachuap Khiri Khan; CENTRAL: Ang Thong, Bangkok; SOUTH-EASTERN: Phrachin Buri, Chon Buri, Rayong, Trat; PENINSULAR: Chumphon, Surat Thani, Phangnga, Nakhon Si Thammarat, Trang, Satun, Songkhla, Pattani, Narathiwat.

Distribution: − Singapore, Malay Peninsula, Indochina, Myanmar, Bangladesh..

Ecology: In sandy soil of the coastal heath forest communities and the coastal woodland. Flowering time: March-April.

Specimens examined. ―L. Taing 145 (PSU).

EUPHORBIACEAE

Shirakiopsis indica (Willd.) Esser, Blumea 44:185. 1999; Welzen & Chayam. In Fl. Thailand. 8(2):555. fig. 82. 2007; Li B. & Esser H. J. in Fl. China 11:285. 2008.―― Sapium indicum Wild., Sp. Pl. ed.4, 4(1): 572. 1805; Whitmore, Tree Fl. Mal. 2:128. 1973. (Fig. 13, G)

Shrub or small tree, ca. 5 m tall; branchlets grey to dark brown, glabrous; bark dark brown. **Leaves** simple, serrate, alternate; lamina elliptic to lanceolate, 8.5-11 cm long by 3-3.5 cm wide, glabrous on both surface, apex acuminate to attenuate, base cuneate with 2-4 basal glands, midrib raised underneath surface, margin crenate; petioles red, 1-1.8 cm long, glabrous. **Staminate Inflorescence** axillary and terminal, spike or thyrse liked 5-6 cm long by 6 mm wide, bearing numerous staminate flowers; peduncle 5-7 mm long, sparsely hairy; rachis 5.5 cm long, sparsely hairy; bracts deltoid, 1.5-2 mm long by 1-1.5 mm wide, apex acute, margin entire or ciliate, glabrous. **Staminate flowers** ca. 4 mm long by 3 mm in diam.; pedicel 1-1.5 mm long, sparsely hairy; perianth 3 lobes, deltoid, ca. 1 mm long by 1 mm wide, glabrous, margin ciliate. **Stamens** 3(-4), free; filaments 1-1.5 mm long, green or greenish, bearing sparsely hairy; anthers 2-celled, ca. 0.5 mm long, glabrous, longitudinal dehiscence, basifixed. **Pistillate Inflorescence** a solitary flower at the base of the staminate Inflorescence. **Pistillate flowers** ca. 14 mm long (included pedicel); pedicel ca. 7 mm long by 0.5-0.7 mm in diam., sparsely hairy; perianth lobes ca. 3, slightly united at base, campanulate; tube 0.8-1 mm long, sparsely hairy; lobes ca. 0.8-1 mm long by 1 mm wide, apex acute to attenuate, margin entire or ciliate. **Ovary** superior, 3-loculed, 1-1.5 mm long by 1 mm in diam., glabrous, ovule 1 per locule; style 1-1.5

mm long, glabrous, stigma 3 lobes, 2.5-4 mm long, sparsely hairy. **Fruit** a capsule, subglobose, 2.3-3 cm long by 2.8 cm in diam., glabrous.

Thailand.—CENTRAL: Bangkok; PENINSULAR: Surat Thani, Nakhon Si Thammarat, Phatthalung, Trang, Patthalung, Satun, Pattani, Songkhla, Narathiwat.

Distribution: India, Sri Lanka, throughout Malesia region, Caroline Islands and Soloman Islands.

Ecology: Along the riverine and floodplain areas, commonly found in the swampy area around the Songkhla Lake. Flowering and Fruiting time: whole year.

Specimens examined. —L. Taing 106 (PSU)

FLACOURTIACEAE

Flacourtia jangomas (Lour.) Raeusch., Nomencl. Bot., ed. 3. 290. 1797. (Fig. 13, I)

Tree up to 5 m; young bud hairy, purplish red to orange-red; branchlets dark red and turn to blue-grey when old, glabrous; bark flaky on the trunk and smooth on the young branch, light brown to grey. **Leaves** simple, alternated, glabrous; lamina ovate to elliptic or lanceolate, 3-10 cm long by 2-3.8 cm wide, shiny dark green above and pale green underneath but orange to brown when young, glabrous on the blade but sparsely hairy on the midrib and secondary veins, apex acute to acuminate or to narrow acuminate, base obtuse to cuneate, midrib slightly raised underneath blade surface, secondary veins 5-7, margin serrate to entire; petioles 0.6 to 0.8 cm long, young petioles hairy and turn to glabrous when the leave old. **Inflorescence** not seen. **Fruit** a berry, globose to subglobose, 1.5-2 cm long by 1.5 cm in diam., young fruit green, glabrous.

Thailand.—PENINSULAR: Songkhla

Distribution: In tropical regions of East Africa and Tropical Asia, India, Myanmar, Malay Peninsula, The Phillipines, Southern china.

Ecology: Found in lowland (along the water channel with sandy-soil deposition). Fruit period: June.

Specimens examined. ―L. Taing 59 (PSU)

GENTIANACEAE

Fagraea fragrans Roxb., Fl. Ind. 2: 32. 1824; Clarke C. B. in Hook, J. D., Fl. Brit. India 4: 85. 1883; Corn, Ways. Trees of Malaya 1:424.1952; Kochummen K. M., Tree Fl. Mal. 2:273.1972; Back. & Bakh.f., Fl. Java (Spermatop.) 2:211.1965; Griffin O. & Parnell J. in Fl. Thailand Vol. 6(3): 198-199. 1997. (Plate 14, C; Fig. 3, B)

Tree ca. 20 m tall; twig terete, glabrous, light green; bark brown, fissured. **Leaves** simple, alternate, glabrous; lamina lanceolate to elliptic, 8.5- 13 by 3 – 4.5 cm, apex acuminate, base obtuse to cuneate; midrib slightly raise adaxially and rounded abaxially, secondary veins 6-8, margin entire; petioles ca. 2 cm long, glabrous; stipules triangular, ca. 3 mm long by 2 mm wide, glabrous. **Inflorescence** axillary, paniculate, 6–8 cm long; peduncle terete, 3-4.5 cm long, glabrous; rachis terete, 1.5 – 2.5 cm long, glabrous; bracts in pair, small, triangular, ca. 1.5 long by 1 mm wide, glabrous; bracteoles in pair, small, triangular, ca. 0.5 mm long by 1 mm wide, glabrous. **Flower** with pedicel ca. 2.5 cm long, bisexual; pedicel up to 6 mm long, terete, glabrous. C**alyx** lobes 5 (rarely 4), bell-shaped, ca. 2 mm long by 2 mm wide, glabrous, apex rounded. **Corolla** yellowish-white, lobes 5, narrowly funnel-shape; corolla tube 1-1.2 cm long; corolla lobes ca. 1.2 cm long by 0.5 cm wide, apex acute, margin entire, glabrous. **Stamen** 5 (rarely 4), ca. 1.5 cm long, epipetalous; anthers ca. 1 mm long, longitudinal dehiscence, dorsifixed; filaments long, ca. 1.4 mm long and glabrous. **Ovary** superior, ca. 1.5 mm long, 2-loculed, ovule numerous; style long, up to 2.5 cm long, glabrous. **Fruit** drupe, ca. 5 mm in diam.

Thailand.―NORTHERN: Lampang, Nan, Tak; NORTH-EASTERN: Nakhon Phanom; EASTERN: Surin, Ubon Ratchathani; SOUTH-WESTERN: Trat; PENINSULAR: Chumphon, Surat Thani, Satun, Trang, Songkhla, Narathiwat.

Distribution: Indo-Malayan region, Andaman Islands, Southern India.

Ecology: In sandy soil of the tropical bog and/or in the edge between swamp and bog areas. Flowering Time: May to July.

Specimens examined. ―L. Taing 38 (PSU)

LAMIACEAE

Vitex pinnata L., Sp. Pl. 2:638. 1753; Kochummen K. M. in Tree Fl. Mal. 3:311. 1978;―***V. pubescens*** Vahl., Ridl., Fl. Malay Pennis. 2: 632-633. 1923; Clarke C. B. in Hook. J.D., Fl. Brit. India Vol.4:585. 1885. (Fig. 11, D)

Large shrub to tree with appreciable height ca. 8 m tall; young branchlets yellowish brown, quadrangular, tomentose; bark whitish grey, fissured. **Leaves** palmately compound, opposited, leaflets 3 (-5), unequal size (the lower leaflets are commonly smaller than the terminal leaflet); lamina elliptic to lanceolate (-oblong), 3-15 cm long by 1.5-7.5 cm wide, dark green to green above, brownish green underneath, densely hairy underneath, sparsely hairy above, apex acute to attenuate (-broad acuminate), base obtuse to cuneate, midrib highly raised beneath surface, margin covered with densely to sparsely hairy; petioles 2-7 cm long covered with densely brown hairs; petiolule short, up to 5 mm long, covered with densely brown hairs. **Inflorescence** terminal and in axil of the uppermost leaves, compound cyme, up to 15 cm long, bearing numerous flowers; peduncle 2-5 cm long, quadrangular and covered with densely brown hairs; rachis up to 7 cm long, quadrangular and covered with densely brown hairs; bracts leaf-liked, densely hairy, consistency; bracteoles leaf-liked, narrowly to broadly elliptic-lanceolate, 5-7 mm long by 3 mm wide, densely brown hairs, apex and base acute. **Flowers** zygomorphic, bisexual, ca. 2 cm long; pedicel short or subsessile. **Calyx** greenish to white, lobes 5, slightly fused at base, sparsely hairy in the outer surface; calyx tube ca. 3 mm long; calyx lobes deltoid, short, <1 mm long, apex acute and margin entire. **Corolla** pale violate to white, 5 uneaqule lobed, united at base, long soft white hairs on the throat and the medial lobes (lower lips); corolla tube up to 6 mm long, commonly white; lobes unequal, lower libs 2-lobed up to 8 mm long by 6 mm wide and commonly pale violate, upper lips 3-lobed up to 4 mm long by 2-3 mm wide and glabrous, apex

broadly acute, margin entire. **Stamens** white, 4, unequal in length, epipetalous; filaments 1–1.2 cm long, bearing soft white hairs at the base and glabrous from the middle to the upper part; anthers small, ca. 0.5 mm long, longitudinal dehiscence, dorxifixed. **Ovary** superior, green, glabrous, ca. 1.5 mm long and 1.5 mm in diam., 4-loculed, 1 ovule per locule; style ca. 1.5 cm long, glabrous; stigma 2-lobed, glabrous, each lobe ca. 0.5 mm long. **Fruits** not seen.

Thailand.−NORTHERN: Uttaradit; NORTH-EASTERN: Phetchabun, Udon Thani, Sakon Nakhon, Mukdahan; EASTERN: Amnat Charoen, Ubon Ratchathani; SOUTH-WESTERN; Kanchanaburi; SOUTH-EASTERN: Chon Buri, Trat; PENINSULAR: Ranong, Nakhon Si Thammarat, Satun, Songkhla, Patthalung.

Distribution: India, throughout Malaya, Southeast Asia, New Guinea.

Ecology: Along the roadside, coastal heath forest and along the water flow area (river, channel), peat swamp and tropical bog area. Flowering Time: June to November.

Specimens examined. ―L. Taing 61 (PSU)

Volkameria inermis L., Sp. Pl. 2:637. 1753.−***Clerodendrum inerme*** (L.) Gaertn., Fruct. Sem. Pl. 1: 271. 1788; Ridl., Fl. Malay. Penin. 2:624. 1923; Backer & Bakh. f., Fl. Java (Spermatoph) 2:608. 1965; Kochummen K. M., Tree Fl. Mal. 3:304. 1978; Chen S. & Gilbert M. G., in Fl. China 17:42. 1994. (Fig. 10, D)

Shrub up to 1.5 m tall, young branchlets quadrangular, dark brown and covered with scattered hairs. **Leaves** simple, opposite, glanduliferous; lamina elliptic to lanceolate, 2.5-6.5 cm long by 1.5-2.8 cm wide, glabrous, apex acute to acuminate, base cuneate, midrib raised beneath surface, margin entire; petioles 5-10 mm long and hairy. **Inflorescence** terminal and in axil of the uppermost leaves, simple cyme, ca. 5 cm long; peduncle 1.5-1.8 cm long, sparsely hairy; bracts slender, ca. 1 mm long, hairy, bracteoles very small, ca. 0.5 mm long, densely hairy. **Flowers** zygomorphic, ca. 3.5 cm long (included pedicel); pedicel ca. 3-6 mm long, sparsely hairy. **Calyx** lobes 5, covered with scattered hairs in the outer surface, campanulate; calyx tube ca.

4 mm long by 2-2.5 mm in diam.; calyx apex very short or almost truncate. **Corolla** white, united at base, ca. 2.8 cm long; corolla tube 2-2.2 cm long by 1-1.5 mm in diam., glabours outside and densely hairy inside; corolla lobes 5, unequal, upper lips 2-lobed elliptic, lower lip 3-lobed ovate, glabrous on both surface. **Stamen** 4, epipetalous; filaments long, 2-2.5 cm long, base hairy and glabrous from the middle to the upper part; anthers 2-2.5 mm long, longitudinal dehiscence, dorxifixed. **Ovary** superior, green, 1.5-2 mm long by 1 mm in diam., 2-loculed, ovule 2 per locule; style long, ca. 3 cm long, glabrous; stigma 2-lobed. **Fruits** not seen.

Thailand.—PENINSULAR: Songkhla.

Distribution: Throughout Malaya, India, China, Australia, and Pacific Islands.

Ecology: Occur in the sandy soil area of the coastal shore like the coastal scrub forest communities. Flowering Time: April.

Specimens examined. —L. Taing 149 (PSU)

LAURACEAE

Litsea glutinosa (Lour.) C. B. Rob., Philipp. J. Sci. C 6: 321. 1911; Kochummen K. M., Tree Fl. Mal. 4:157. 1989; Li S. et al., in Fl. China 7: 126.2008. (Fig. 6, C)

Tree, up to 15 m tall; branchlets yellowish brown, covered with greyish brown tomentose; bark greyish brown, scaly. **Leaves** simple, alternate, glanduliferous; lamina ovate to elliptic or broadly lanceolate, 8–15 cm long by 6–7.8 cm wide, apex round to obtuse or acute, base slightly obtuse to cuneate, midrib and secondary veins raised underneath surface and covered with whitish grey hairs, margin entire; petioles 1-2.5 cm long, tomentose. **Inflorescence** axillary, simple umbel, 2–3.5 cm long, 3 to 5 flowers; peduncle 2-2.3 cm long, tomentose. **Flowers** ca. 1 cm in diam., pedicel ca. 6 mm long and covered with dense hairs. **Perianth** greenish grey, lobes 4, free, obovate to orbicular, ca. 6 mm long by 6 mm wide, covered with tomentose, apex rounded, margin entire. **Stamens** numerous, ca. 2 mm long; filaments ca. 1 mm long, densely

hairy; anthers 4-celled, valvular dehiscence, basifixed. **Ovary** superior, ovoid, 0.5-0.8 mm long by 0.5 mm in diam., glabrous, 1-loculed, ovule 1 per locule; style almost absent (very short). **Fruit** not seen.

Thailand.—NORTHERN: Mae Hong Son, Chaing Mai, Chiang Rai, Phayao, Nan, Lamphun, Lampang, Phrae, Tak, Sukhothai, Phitsanulok, Kamphaeng Phet, Nakhon Sawan; NORTH-EASTERN: Phetchabun, Loei, Udon Thani, Nong Khai, Sakon Nakhon, Nakhon Phanom, Maha Sarakham, Khon Kaen; EASTERN: Chaiyaphum, Nakhon Ratchasima, Buri Ram, Surin, Roi Et, Si Sa Ket, Ubon Ratchathani; SOUTH-WESTERN: Uthai Thani, Kanchanaburi, Ratchaburi, Phetchaburi, Prachuap Khiri Khan, Suphanburi; CENTRAL: Chai Nat, Suphan Buri, Ang Thong, Saraburi, Bangkok, Nakhon Nayok; SOUTHEASTERN: Prachinburi, Chon Buri, Rayong, Chanthaburi; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Nakhon Si Thammarat, Trang, Songkhla, Pattani, Yala, Narathiwat.

Distribution: China, Bhutan, India, Myanmar, Nepal, Philippines and Vietnam.

Ecology: Along the edge of the coastal woodland with regular canopy and in the tropical bog area, along the riverine areas but water is unreachable. Flowering Time: May-July.

Specimens examined. —L. Taing 94 (PSU)

Litsea grandis (Nees) Hook. f., Fl. Brit. India 5: 162. 1886; Corn., Ways. Trees of Malaya 1:347. 1952; Ridl., Fl. Malay. Penin. 3:115. fig. 145. 1924; Kochummen K. M., Tree Fl. Mal. 4:158. 1989. (Plate 13, C; Fig. 6, E)

Tree, ca. 15 m tall; branchlets yellowish brown, covered with densely brown tomentose; bark grey-brown, lenticellate or slightly scaly. **Leaves** simple, alternate, tomentose on both surface; lamina elliptic, 18-21 cm long by 12-14 cm wide, apex rounded to obtuse (sometimes emarginated), base rounded to obtuse, midrib and secondary veins covered with densely brown tomentose and highly raised underneath surface, margin entire; petioles 2.5-3 cm long, densely tomentose. **Inflorescence** in

cluster or simple umbel, axillary (commonly on leafless branches), few flowers per cluster; peduncle subsessile, ca. 2 mm long, covered with densely brown tomentose. **Flowers** ca. 2 cm long (included pedicel); pedicel 1-1.3 mm long and covered with densely brown tomentose. **Perianth** greenish grey, 5 lobes, free, orbicular, ca. 6 mm long by 6 mm wide, covered with densely tomentose outer surface, apex round, base truncate, margin entire. **Stamens** numerous, free, 5-7 mm long; filaments 4-5.5 mm long and covered with white hairs; anthers 1-1.5 mm long, 4-celled, valvular dehiscence, basifixed. **Ovary (Pistillate flowers)** and **Fruits** not seen.

Thailand. ―― NORTH-EASTERN: Nong Khai, Nakhon Phanom; SOUTH-WESTERN: Kanchanaburi; SOUTHEASTERN: Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Pattani, Yala, Narathiwat.

Distribution: Throughout Malaya Peninsula, Myanmar.

Ecology: Occur in the sandy soil area of the coastal lowland forest like the coastal woodland with regular canopy. Flowering Time: March.

Specimens examined. ―L. Taing 128 (PSU)

Neolitsea zeylanica (Nees & T. Nees) Merr., Philipp. J. Sci. 1 (Suppl. 1): 57. 1906; Corn., Ways. Trees of Malaya 1:349. 1952; Ridl., Fl. Malay. Penin. 3:132. 1924; Kochummen K. M., Tree Fl. Mal. 4:169.1989; Li S. et al., in Fl. China 7:102. 2008. (Fig. 14, E)

Shrubby tree, ca. 5 m tall; branchlets terete or subterete, greyish brown, smooth (glabrous), shallowly fissured but not flaking; bark grey or greyish, lanticellate. **Leaves** simple with 2 lateral primary veins, alternate, shiny yellow pubescence when young turning to glabrous; lamina ovate to lanceolate, 6-9 cm long by 2-4.3 cm wide, dark green or dark green above, pale green underneath, glabrous on both surface, apex acute to acuminate, base rounded to cuneate or attenuate, midrib and the lateral primary veins raised beneath surface with yellow pubescence on the young leaves, margin entire; petioles ca. 5-15 mm long, glabrous. **Inflorescence**

axillary or terminal clusters (umbel-liked); peduncle subsessile, ca. 2 mm long, pubescence; bracts ovate, 1.5-2 mm long by 1.5 mm wide, apex acute, margin entire, shiny brown pubescence; bracteoles broadly ovate, 1.5-2 mm long and 2-2.5 mm wide, apex rounded, margin entire, shiny brown pubescence. **Staminate flowers** actinomorphic 3-4 mm long by 2-3 mm on diam., pedicel short. **Perianth** 6 lobes, 3-4 mm long by 2 mm wide, pubescence outside and glabrous inside surface. **Stamens** 4-6; filaments covered with hairs; anthers 4-celled, valvular dehiscence, basifixed. **Pistillate flowers** and **Fruits** not seen.

Thailand.—PENINSULAR: Nakhon Si Thammarat, Songkhla.

Distribution: India, Sri Lanka, Malaysia, Myanmar, Indochina.

Ecology: In sandy soil areas of the coastal scrub communities and in the tropical bog. Flowering time: September, October.

Specimens examined. —L. Taing 111 (PSU)

LECYTHIDACEAE

Barringtonia acutangula (L.) Gaertn., Fruct. Sem. Pl. 2:97. 1791; Clarke C. B. in Hooker J. D., Fl. Brit. Ind. 2:508. 1879. (Plate 14, D; Fig. 11, C)

Appreciable height tree ca. 10 m tall; branchlets terete, pale grey, glabrous; bark brownish grey, scaly. **Leaves** simple, alternate, glabrous, lamina oblanceolate to obovate, 7-22 cm long by 3-9 cm wide, glabrous, apex acute to obtuse, base acute to cuneate, midrib raised beneath surface, margin serrate; petioles up to 1.5 cm, glabrous. **Inflorescence** terminal, spike, bearing numerous flowers (ca. 100 flowers); peduncle 2-2.5 cm long, sparsely hairy to glabrous; rachis up to 30- 80 cm long, sparsely hairy to glabrous; bracts not seen. **Flowers** actinomorphic, 6-9 mm long by 5 mm in diam.; pedicels short ca. 1 mm long, bearing scattered hairs to glabrous; **hypanthial cup** 1-3 mm long by 2 mm wide, glabrous. **Calyx** lobes 5, slightly fused at base, funnel-shaped, sparsely hairy (-glabrous); calyx tube ca. 1 mm; calyx lobes obovate to lanceolate, 2-3 mm long by 2-3 mm wide, apex obtuse to round, base

cuneate to attenuate long, margin ciliolate. **Corolla** pale pink or pink to red or reddish white, lobes 5, free, elliptic to oblong, 6-10 mm long by 3-6 mm wide, sparsely hairy, apex obtuse (-rounded), base adnate to the staminate tube 1-1.5 mm long. **Stamens** numerous, free, up 10 1.2 mm long; filaments red to dark red, up to 1.2 mm long, glabrous, base connate each other to form staminate tube; anthers ca. 0.5 mm long, 2 celled, basifixed, glabrous. **Ovary** inferior, ca. 1 mm in diam., 2-loculed, ovule 3 per locule; style pink, 1.5 to 1.8 cm long, glabrous. **Fruits** not seen.

Thailand.—Throughout Thailand

Distribution: Indochina, Malesia, north Australia, Afghanistan, Pakistan, India and Sri Lanka.

Ecology: Along the stream or river, floodplain or seasonally inundated peat swamp.

Specimens examined. —L. Taing 68 (PSU)

LYTHRACEAE

Lagerstroemia floribunda Jack, Malayan Misc. 1(5):38. 1820; Furtado & Srisuko, Gard. Bull. Singapore 24:329. 1969; Everett & Whitmore, Tree Fl. Mal. 2:279. 1973; De Wilde et al., in Fl. Thailand 11(4): 563. 2014. (Fig. 13, D)

Tree, ca. 5 m tall; branchlets terete with shallowly ridged, brown to dark brown, glabrous; bark brownish or brown grey, flaking. **Leaves** simple, opposite or subopposite; lamina lanceolate to elliptic, variable in size, up to 17.5 cm long by 8 cm wide, glabrous, apex acute to obtuse, base obtuse, midrib and secondary veins highly raised beneath surface, margin entire; petioles short, ca. 5 mm long, glabrous. **Inflorescence** terminal, compound cyme, up to 27 cm long, bearing numerous flowers; peduncle terete, ca. up to 6 cm long, covered with brown stellate hairs; rachis terete, up to 21 cm long, covered with brown stellate hairs; bracts not seen. **Flowers** actinomorphic, 1.5-2 cm long (with pedicel); pedicel short, 2-4 mm long, covered with densely whitish brown hairs. **Calyx** covered with whitish brown stellate hairs,

fused at base; calyx tube with deep ridged, ca. 4.5 mm long, outer surface covered with densely whitish brown hairs, inside surface glabrous; lobes 5-6, ca. 4.5 mm long by 3 mm wide, outer surface covered with densely whitish brown hairs and inside surface sparsely hairy, apex acute, margin entire. **Corolla** purple to white, lobes 5-6, free, blade obovate, 1-1.4 cm long by 8 mm wide, sparsely hairy or sometimes glabrous, margin repand. **Stamens** numerous, free, up to 1.2 cm long; filaments up to 1.1 cm long, glabrous; anthers tiny, ca. 1 mm long, longitudinal dehiscence, dorsifixed. **Ovary** superior, covered with densely white hairs, ca. 6-loculed, each locule contained numerous ovules; style pinkish, ca. 5 mm long, glabrous. **Fruits** not seen.

Thailand. − NORTHERN: Phrae; Tak, Phisanulok, Kamphaeng Phet; EASTERN: Nakhon Ratchasima, Si Sa Ket; SOUTH-WESTERN: Kanchanaburi, Ratchaburi; CENTRAL: Chai Nat, Saraburi, Nakhon Nayok, Bangkok; SOUTH-EASTERN: Prachin Buri, Chon Buri, Chanthaburi, Trat; PENINSULAR: Phuket, Krabi, Trang, Songkhla, Yala, Narathiwat.

Distribution: Indochina, Myanmar, Peninsular Malaysia.

Ecology: In the tropical bog, edge of swampy and tropical bog zone. Flowering Time: February-May.

Specimens examined. ―L. Taing 56 (PSU).

Lagerstroemia speciosa (L.) Pers., Syn. Pl. 2:72. 1806; Furtado & Srisuko, Gard. Bull. Singapore 24:264. 1969; Whitmore, Tree Fl. Mal. 2:280, fig. 2.1973; De Wilde et al., in Fl. Thailand 11(4): 574. 2014. (Plate 10, H; Fig. 13, E)

Tree, ca. 10 m tall; young twigs or branchlets terete, grey to dark greyish brown, glabrous; bark brownish, slightly flaking. **Leaves** simple, opposite; lamina lanceolate to elliptic, 15-19 cm long by 5-8 cm wide, glabrous, apex acute to attenuate, base obtuse to rounded, midrib highly raised beneath surface, margin entire; petioles ca. 1 cm long, glabrous. **Inflorescence** terminal, compound cyme, up to 25 cm long, bearing numerous flowers; peduncle terete, ca. 4 cm long, sparsely hairy to

glabrous; rachis terete, up to 20 cm long, sparsely hairy to glabrous; bracts triangular, 2-2.5 mm long by 1 mm wide, sparsely hairy, apex acute, margin entire. **Flowers** actinomorphic, ca. 6 cm in diam.; pedicel ca. 5 mm long, covered with densely white hairs. **Calyx** green and red, united at base; calyx tube with deep ridged, ca. 8 mm long, covered with densely white hairs; lobes 5-6, 4-6 mm long by 4 mm wide, apex acute, margin entire. **Corolla** purple, lobes 5-6, free, blade obovate or suborbicular, ca. 2.3 cm long by 1.2 cm wide, sparsely hairy or sometimes glabrous, margin repand. **Stamens** numerous, adnated to the calyx tube, up to 1.5 cm long; filaments up to 1.4 cm long, glabrous; anthers tiny, ca. 1 mm long, longitudinal dehiscence, dorsifixed. **Ovary** superior, glabrous, ca. 6-loculed, ovules numerous; style long, ca. 2 cm long, glabrous. **Fruits** not seen.

Thailand. − NORTHERN: Mae Hong Son, Kamphaeng Phet; EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Kanchanaburi, Ratchaburi, Phrachuap Khiri Khan; CENTRAL: Nakhon Nayok, Bangkok; SOUTH-EASTERN: Chanthaburi; PENINSULAR: Chumphon, Ranong, Pattani, Narathiwat, Songkhla.

Distribution: Indochina, Myanmar, Peninsular Malaysia, Indonesia, the Philippine, India, China.

Ecology: Along the riverine area, floodplain and commonly in the secondary forest. Flowering Time: February-May.

Specimens examined. ―L. Taing 50 (PSU).

Sonneratia caseolaris (L.) Engl., Nat. Pflanzenfam., Nachtr. 1: 261. 1897; Whitmore, Tree Fl. Mal. 1:445. 1972; Santisuk T. in Fl. Thailand 5(4):439. 1992; Qin H. et al., in Fl. China 13:287. 2007. (Fig. 5, B)

Tree, ca. 10 m tall; branchlets terete, dark greyish brown, glabrous; bark dark brown, shallowly fissured or flaking; pneumatophores long, up to 100 cm long. **Leaves** simple, opposite; lamina oblong to elliptic or lanceolate, 5-8.5 cm long by 1.5-3.3 cm wide, glabrous on both surface, apex acute to shortly acuminate, base attenuate to cuneate, midrib slightly raised beneath surface, margin entire; petioles red

to reddish, 5-10 mm long, glabrous; stipule not seen. **Flowers** in pairs or solitary, actinomorphic; pedicel quadrangular, 5-9 mm long, glabrous; bracts and bracteoles not seen. **Calyx** lobes 6, fused at base, campanulate; tubes 1-1.5 cm long, glabrous; lobes ovate or triangular, ca. 2 cm long, apex acute, glabrous, margin entire. **Corolla** purple, lobes 6, free, oblong, 2-2.2 cm long by 3 mm wide, glabrous on both surface, apex attenuate, base truncate, margin entire. **Stamens** inserted on the rim of the calyx tube, numerous, free; filaments slender ca. 4-6 cm long, white and glabrous; anthers ca. 1.5 mm long, longitudinal dehiscence, dorsifixed. **Ovary** superior, 1.5-2 mm long by 2 cm in diam., ca. 18-loculed, ovule numerous; style long, 7-8 cm long by 3 mm in diam., glabrous; stigma capitated, ca. 2 mm long by 4 mm wide. **Fruit** green, berry with persistent calyx, oblate, 4-4.5 cm long by 5.5-6 cm in diam.

Thailand:—CENTRAL: Bangkok, Samut Songkhram, Samut Sakhon, Samut Prakan; SOUTH-EASTERN: Chon Buri, Chanthaburi; PENINSULAR: Ranong, Phangnga, Krabi, Trang, Satun, Surat Thani, Nakhon Si Thammarat, Songkhla.

Distribution:—Sri Lanka, India to Southeast Asia, Australia, Solomon Island.

Ecology: In the muddy soil area along the fresh and less salty water shore. Flowering time: February, March.

Specimens examined. —L. Taing 151 (PSU)

MALVACEAE

Commersonia bartramia (L.) Merr., Interpr. Herb. Amboin. 362. 1917*;* Backer & Bakh.f., Fl. Java (Spermatoph.) 1: 406. 1963; Whitmore, Tree Fl. Mal. 2:357. 1973; Tang Y. et al. in Fl. China 12.323. 2007. (Plate 13, D; Fig. 15, C)

Large shrub to tree with appreciable height 5-7 m tall; branchlets terete, dark greyish brown, bearing densely stellate hairs; bark grey or dark greyish brown, scaly but not flaking. **Leaves** simple with 2-4 lateral primary veins, alternate; lamina elliptic or ovate to subcordate, 8-21 cm long by 4.5-12 cm wide, dark green above, pale grey or grey underneath, densely stellate hairs beneath and sparsely stellate hairs above

surface, apex acute to acuminate, base subcordate (rarely rounded), midrib and lateral primary veins bearing densely stellate hairs and highly raised beneath surface, margin serrate; petioles ca. 10 mm long, bearing stellate hairs. **Inflorescence** axillary, a compound cyme, bearing numerous flowers; peduncle 1-2.5 mm long, covered with densely stellate hairs; rachis 2-3 mm long, covered with densely stellate hairs; bracts linear, ca. 3 mm long by 0.3 mm wide, densely hairy. **Flowers** actinomorphic, up 10 mm long (with pedicel) by 7-8.5 mm on diam.; pedicel 5-8 mm long, covered with densely stellate hairs. **Calyx** white, lobes 5, ovate, ca. 4 mm long by 1.5-2.5 mm wide, covered with stellate hairs, apex acute, margin entire. **Corolla** white, lobes 5, narrowly triangular, 1.5-2 mm long by 0.5-0.8 in wide, densely hairy, apex acuminate, margin entire. **Stamenodia** 5, free, oblong, filaments 3-3.5 mm long by 0.5-1 mm wide, adaxial surface hairy, abaxial surface glabrous. **Stamens** 5, free; filaments ca. 0.5 mm long, hairy or glabrous; anther longitudinal dehiscence, dorsifixed. **Ovary** superior, hairy, ca. 1 mm (with style) long by 1 mm in diam., 5-loculed, ovule 4 per locule; style very short, ca. 0.5 mm long; stigma 5-lobed. **Fruit** bearing densely long hispid, globose, 1.5-2 cm in diam.

Thailand.—PENINSULAR: Songkhla**.**

Distribution: India, Malesia region, China, Philippines, Vietnam, Australia.

Ecology: Commonly occur in the open area along the riverine or water channel. Flowering and Fruiting time: August-November.

Specimens examined. —L. Taing 113 (PSU)

Helicteres hirsuta Lour., Fl. Cochinch. 2: 530. 1790; Ridl., Fl. Malay. Penin. 1: 281. 1922; Backer & Bakh.f., Fl. Java (Spermatoph.) 1:410. 1963; Phengklai in Fl. Thailand 7(3): 566. 2001; Tang Y., Gilbert M.G. & Dorr L. J. in Fl. China 12: 320. (Fig. 15, A)

Shrub, up to 3 m tall; branchlets terete, brownish to dark brown, covered with densely stellate hairs. **Leaves** simple with 3-5 basal veins, alternate; lamina oblong to lanceolate, 9 - 14 cm long by 3 - 4.8 cm wide, densely stallate hairs beneath surface,

sparsely stellate hairs above surface, apex acute to acuminate, base oblique (rounded to cuneate), midrib and secondary veins slightly raised above and highly raised beneath surface, margin doubly serrate; petioles 0.7-1.5 cm long, covered with densely stellate hairs. **Inflorescence** axillary, spike-liked, bearing many flowers (5-10 flowers); peduncle 5-6 mm long, covered with densely stellate hairs; rachis 1-1.5 cm long, covered with densely stellate hairy; bract subulate, ca. 5 mm long by ±1 mm wide, covered with densely stellate hairs; bracteoles up to 4 mm long by 1.5 mm wide, covered with densely stellate hairs on both surface. **Flowers** zygomorphic, 1.5-2 cm long; pedicel short, ca. 1 mm long, covered with densely stellate hairs. **Calyx** purplish to reddish brown, covered with densely stellate hairs, united at base; tube up to 15 mm long by 5-6 mm in diam.; lobes 5, unequal, up to 5 mm long, outer surface covered with stellate hairs, apex acute to acuminate. **Corolla** pink to purplish red, lobes 5, free, unequal, oblanceolate to spatulate, 20-23 mm long by 3-3.5 mm wide, apex rounded to truncate, margin entire. **Androgynophore** white, cylindrical ca. 18 mm long by 1 mm in diam., glabrous. **Stamens** 10, adnated to the androgynophore column; filaments linear, ca. 2 mm long by ±0.5 mm wide, glabrous; anthers along the filaments, ca. 0.5 mm long, longitudinal dehiscence. **Ovary** superior, 5-loculed, hairy, elliptic to oblong, ca. 1.5 mm long by 1 mm wide; style ca. 1.5 mm long, glabrous; stigma lobes 5. **Fruit** a capsule, oblong to cylindrical (-elliptic), 3.5- 4.5 cm long by 1- 1.3 cm wide, covered with densely stellate hairs.

Thailand. — NORTHERN: Kamphaeng Phet; NORTH-EASTERN: Sakhon Nakhon; EASTERN: Nakhon Ratchasima, Surin, Roi Et; SOUTH-WESTERN: Phachuap Khiri Khan, Kanchanaburi; CENTRAL: Nakhon Nayok, Lop Buri; SOUTH-EASTERN: Prachin Buri, Chon Buri, Chanthaburi, Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Songkhla.

Distribution: Widely distributed from India to Philippines.

Ecology: In the coastal heath and coastal woodland. Flowering Time: June. Fruiting period: June.

Specimens examined. ―L. Taing 74 (PSU)

Hibiscus tiliaceus L., Sp. Pl. 2:694. 1753; Tang Y. et al. in Fl. China 12:288. 2007. (Plate 11, B; Fig. 4, D)

Shrubby tree, ca. 5 m tall; young twigs or branchlets terete, dark brown, stellate hairs on the young twig and turn to glabrous when old; bark dark greyish brown to dark brown. **Leaves** simple, alternate; lamina cordate to broadly cordate, 9-13 cm long by 9-11 cm, stellate hairs on both surface, apex acute to attenuate or acuminate, base cordate, midrib and secondary veins highly raised beneath surface, margin slightly serrate or entire; petioles 5-7 cm long, covered with densely stellate hairs. **Inflorescence** axillary and terminal, racemose, 3-10 cm long, inflorescence axes covered with stellate hairs; peduncle terete, 1-3 cm long, bearing stellate hairs; rachis terete, 3-5 cm long, bearing stellate hairs; bracts in pairs, elliptic, 10-17 mm long by 5-7 mm wide, bearing stellate hairs on the outer surface and glabrous inside. **Flowers** actinomorphic, 5-6.5 cm long; pedicel 1-2.5 cm long, bearing densely stellate hairs. **Epicalyx** fused at base, lobes 8-11, ca. 1 cm long, bearing densely stellate hairs. **Calyx** lobes 5, free, blade elliptic to lanceolate, 1.5-1.8 cm long by 5-8 mm wide, bearing stellate hairs, apex acute. **Corolla** yellow and turn to red, lobes 5, free, blade obovate, bearing stellate hairs on both surface. **Stamens** numerous, united to the style. **Ovary** superior, hairy, 5-loculed, each locule contained numerous ovules; stigma 5-lobed. **Fruits** not seen.

Thailand.−PENINSULAR: Songkhla.

Distribution: Indochina to Malaysia, Indonesia, Myanmar, India.

Ecology: In secondary forest, along the river, channel or stream, edge of mangrove swamp. Flower and Fruit period: May-August.

Specimens examined. ― L. Taing 47 (PSU).

Microcos tomentosa Sm. in Rees, Cycl. 23 (2). 1813; Phengklai C. in Fl. Thailand 6(1):37. fig. 23. 1993. (Plate 14, E; Fig. 15, D)

Shrub to medium sized tree, ca. 5 m tall; branchlets angular, dark brown, hairy; bark brownish to grey. **Leaves** simple, alternate; lamina elliptic to obovate, 11-15 cm long by 4-7 cm wide, young leaves reddish brown, old leaves dark green above and greenish underneath, stellate hairs on both surface, apex acute to acuminate, base rounded to obtuse, midrib and secondary veins highly raised beneath surface, margin entire to slightly serrate; petioles 8-10 mm long, covered with brown stellate hairs; stipule intrapetiolar, bilobed, ca. 7 mm long by 2 mm wide, covered with brown stellate hairs. **Inflorescence** terminal and axillary, paniculate up to 10 cm long, bearing dense flowers, inflorescence axes covered with brown stellate hairs; peduncle terete, ca. 5 mm long; rachis terete, ca. 7 cm long; bracts in pairs, brownish, apex bilobed, ca. 7 mm long by 2 mm wide, covered with brown stellate hairs. **Flowers** actinomorphic, ca. <1 cm in diam.; pedicel short 2-3 mm long, covered by brown stellate hairs. **Calyx** greenish, covered with white and brown stellate hairs, lobes 5, free, obovate, ca. 6 mm long, apex obtuse to rounded. **Corolla** white, lobes 5, free, orbicular to suborbicular, ca. 2 mm long by 1-1.5 mm wide, covered with densely white hairs, apex acumnate, and margin entire. **Stamens** numerous, free, ca. up to 4.5 mm long; filaments up to 4.5 mm long, base hairy and upper part glabrous; anthers tiny, <0.5 mm long, longitudinal dehiscence, dorsifixed. **Ovary** ovoid and covered with densely white hairs, 3-loculed, each locule contained ovule 3; style ca. 3 mm long, base hairy and upper part glabrous. **Fruits** not seen.

Thailand.−Throughout the Country.

Distribution: India, China, Indochina, Malesian Region, the Philippine.

Ecology: In sandy soil of coastal woodland and bog area. Flowering and Fruiting Time: May-September.

Specimens examined. ― L.Taing 51 (PSU).

MELASTOMATACEAE

Melastoma malabathricum* subsp. *malabathricum, Sp. Pl. 1:390.1753; Clarke C. B. in Hook. J.D., Fl. Brit. India 2:523. 1879; Ridl., Fl. Malay Pennis. 1:764. 1922; Renner S. S. et al. in Fl. Thailand 7(3): 441. 2001. (Fig. 11, B)

Shrub ca. 3 m tall; young twig (branchlets) deep purple red (or dark red) to dark dull red, quadrangular, bearing white strigoses; old branch smooth, grey. **Leaves** simple with 2 or 4 lateral primary veins, opposite arranged; lamina elliptic to oblong, 1.5-6.5 cm long by 1-2.3 cm wide, strigose on both side, apex acute (rarely acuminate), base rounded to obtuse, all of the primary vein (midribs) impressed on the upper blade surface but raised underneath, margin entire; petioles 3-8 mm long, strigose. **Inflorescence** terminal, simple to compound cymes, bearing 3 to 6 (-7) flowers; peduncle short, <5 mm long, quadrangular, covered with numerous strigoses; bracts in pair, pale pink to white, broadly triangular, ca. 1.4 cm long by 1 cm wide, covered with stiff hairs (strigose) outside and glabrous inside, apex broadly acute, margin covered with stiff hairs (strigose). **Flowers** actinomorphic ca. 1.5 cm long; pedicel short, ca. 4 mm long, covered with stiff hairs (strigoses); **hypanthium** 6-8 mm long, bearing densely stiff hairs outside. **Calyx** red to dark red, lobes 5, campanulate, covered with stiff hairs on the dorsal and marginal part; calyx tube up to 1 cm long; calyx lobes ca. 3-5 mm long. **Corolla** purple to pink, lobes 5, free, obovate, 2–3 cm long, glabrous, margin ciliolate. **Stamens** 10, dimorphic; outer stamens 5, pinkish, filaments ca. 1 cm long, glabrous, pedoconnective ca. 1.2 cm long, anthers ca. 9 mm long and glabrous; inner stamens 5, shorter than the outer stamens, yellow, filaments ca. 0.8 cm, glabrous, anthers 8-9 mm long and glabrous. **Ovary** inferior, 5-loculed, densely hairy, numerous ovules in each locule; style ca. 2.3 cm long, glabrous. **Fruits** (**capsule**) ca. 1.2 cm long and covered with stiff hairs, campanulate, dark pink to dark purple, transversely dehiscent. **Seeds** numerous.

Thailand. − NORTHERN: Chiang Rai, Chiang Mai, Nan, Phisanulok; NORTH-EASTERN: Phetchabun; CENTRAL: Nakhon Nayok; SOUTH-WESTERN:

Trat, Chanthaburi; PENINSULAR: Ranong, Surat Thani, Phangnga, Phuket, Nakhon Si Thammarat, Patthalung, Trang, Songkhla, Narathiwat.

Distribution: Indochina to Malaysia, India, Northern Australia.

Ecology: In open area, tropical bog and coastal heath element. Flowering Time: whole year.

Specimens examined. ─ L. Taing 60 (PSU)

Memecylon edule Roxb. Pl. Coromandel I. 59. t. 82. 1795; Clarke C. B. in Hook. J.D., Fl. Brit. India 2: 563. 1879; Ridl., Malay. Penin. 1:819. 1922; Corn., Ways. Trees. 1:450. 1952; Maxwell J. F., Tree Fl. Mal. 4:186. 1989. (Fig. 12, H)

Shrubby tree, ca. 4 m tall; branchlets terete, dark brown, slightly fissured, glabrous; bark greyish brown, lanticellate or shallowly fissured. **Leaves** simple, opposite; lamina broadly lanceolate, 4.5-8 cm long by 2-3.5 cm wide, glabrous on both surface, apex acute to attenuate, base cuneate to attenuate, midrib raised beneath surface, margin entire; petioles ca. 4-5 mm long, glabrous. **Inflorescence** axillary, a compound umbel, bearing numerous flowers; peduncle 8-9 mm long, glabrous; rachis 3-4.5 mm long, glabrous; bracts and bracteoles small, triangular, 0.4-0.8 long by 0.4 mm wide, apex acute, and margin entire, glabrous. **Flowers** actinomorphic, 3-5 mm long (with pedicel); pedicel 1-1.5 mm long, glabrous. **Calyx** lobes 4, slightly fused at base, campanulate; tube 1-1.5 mm long by 1 mm in diam., glabrous; lobes very short, triangular, apex acute, glabrous. **Corolla** white, lobes 4, free, broadly ovate to suborbicular, 1.5-2.5 mm long by 1-1.5 mm wide, glabrous, apex acute, base truncate, margin entire. **Stamens** 8, free, filaments 2.5-3 mm long, glabrous; anthers ca. 1.5 mm long, longitudinal dehiscence, dorsifixed. **Ovary** inferior, 1-loculed, bearing 8-10 ovules; style 1, 1.5-3 mm long, glabrous. **Fruit** not seen.

Thailand. ─── NORTHERN: Chiang Mai, Phayao, Phitsanulok; NORTH-EASTERN: Phetchabun, Loei, Ubon Ratchathani, Nong Khai, Sakhon Nakhon, Maha Sarakham; EASTERN: Chaiyaphum, Nakhon Ratchasima, Surin, Yasothon; SOUTH-

WESTERN: Phachuap Khiri Khan; SOUTH-EASTERN: Sa Kaeo, Chachoengsao; PENINSULAR: Chumphon, Songkhla.

Distribution: Sri Lanka, Eastern Peninsular Malaysia

Ecology: In sandy soil of the coastal scrub communities. Flowering time: July, August.

Specimens examined. ―L. Taing 103; 116 (PSU)

Memecylon ovatum Sm, in Rees, Cyclop. xxiii. n. 3.; Corn., Ways. Trees Malaya 1:451. fig. 148. 1952. (Fig. 12, G)

Shrubby tree, ca. 5 m tall; branchlets terete, greyish or grey, slightly fissured and glabrous; bark greyish brown, shallowly fissured. **Leaves** simple, opposite; lamina broadly lanceolate, 8-15.5 cm long by 4-8 cm wide, glabrous on both surface, apex acute to narrowly attenuate, base cuneate (almost rounded), midrib raised beneath surface, margin entire; petioles ca. 1.5 cm long, glabrous. **Inflorescence** axillary, compound umbel, bearing numerous flowers; peduncle 2-3 cm long mm long, glabrous; rachis 1.5-2.5 cm long, glabrous; bract and bracteole not seen. **Flowers** actinomorphic, 6-8 mm long (with pedicel); pedicel ca. 6 mm long, glabrous. **Calyx** lobes 4, fused at base, campanulate; tube ca. 1.5 mm long; lobes 1-1.5 mm long by 1.5-2 mm wide, apex acute to rounded or truncate, glabrous. **Corolla** and **Stamens** not seen. **Ovary** inferior, unilocular; style (with stigma) 1, ca.5 mm long, glabrous. **Fruit** a capsule (immature).

Thailand.―PENINSULAR: Songkhla.

Distribution: From India to Malay Peninsula, Indochina.

Ecology: In sandy soil of the coastal scrub communities. Fruiting time: July, August.

Specimens examined. ―L. Taing 102 (PSU)

MELIACEAE

Aphanamixis polystachya (Wall.) R. Parker, Indian Forester 57: 486 1931; Peng H. et al., in Fl. China 11:125. 2008. (Fig. 13, F)

Tree ca. 20 m tall; branchlets green and turn to brownish grey when old, glabrous; bark grey, fissured. **Leaves** compound, imparipinnate and paripinnate, alternate, 30–50 cm long; petioles terete, up to 10 cm long, glabrous; rachis terete, up to 40 cm long, glabrous, petiolule ca. 0.3–1 cm long, hairy; **leaflets** opposite to subopposite, oblong or elliptic to lanceolate, 6–18 long by 3.5–8.5 cm wide, apex acute to acuminate, base oblique to obtuse or cuneate, midrib and secondary veins raised beneath surface, secondary veins 8-12, margin entire. **Inflorescence** not seen. **Fruit** capsule, 3-loculed spheroidal, ca. 3 cm in diam., glabrous, yellowish to reddish when mature. **Seeds** 3, greyish brown.

Thailand.−PENINSULAR: Songkhla.

Distribution: Indochina to Malay Peninsula, Taiwan, India.

Ecology: Along the river, water channel and the edge of costal woodland with regular canopy. Fruiting time: June.

Specimens examined. ―L. Taing 79 (PSU)

MORACEAE

Ficus hispida L. f., Suppl. Pl.: 442. 1782; Ridl., Fl. Malay Penin. 3:342.1924; Kochummen K. M., Tree Fl. Mal. 3:149.1978; Berg C.C. & Corner E.J.H., Fl. Males., Ser. 1, Spermat. 17(2):426. 2005; Berg C. C. et al. in Fl. Thailand 10(4):566.2011. (Fig. 6, D)

Shrubby tree, ca. 5 m tall; young twigs or branchlets terete, grey, densely tomentoses; bark brownish, lenticellate. **Leaves** simple, opposite; lamina lanceolate to elliptic-oblong, 15-25 cm long by 8-10.5 cm wide, densely strigose on both surface, apex acute to attenuate, base slightly oblique or obtuse to cuneate, midrib and

secondary veins raised beneath surface, margin serrate; petioles 2-3 cm long, densely strigoses; stipule interpetiolar, triangular, ca. 15 mm long by 5 mm wide, hairy outer surface. **Inflorescence** not seen. **Fruits** fleshy syconium, clusters on the leafless branches and trunk, globose to subglobose.

Thailand.−Throughout the country.

Distribution: Sri Lanka, Pakistan, India, Bhutan, Bangkladesh, Nepal, China, Southeast Asia, New Guinea, Australia.

Ecology: In secondary forest of coastal scrub, coastal heath and coastal woodland. Flower and Fruit period: May, June.

Specimens examined. ― L.Taing 49 (PSU).

Maclura cochinchinensis (Lour.) Corner, Gard. Bull. Singapore 19:239. 1962; Berg C. C. et al., Fl. Males., Ser. 1, Spermat. 17(1):36. 2006; Berg C. C. et al. in Fl. Thailand 10(4):655-656.2011.― ***Maclura cochinchinensis*** (Lour.) Corner var. ***pubescens*** (Trécul) Corner, Gard. Bull. Singapore 19:239. 1962. (Fig. 9, B)

Woody climber with thorn 0.6–3.1 cm long on branchlets and 5-6 cm on branches, white latex; branchlets terete, pale grey, covered with whitish puberlulous; bark grey or greyish. **Leaves** simple, alternate; lamina oblong to elliptic, 2.5–7 cm long by 1.5–3.5 cm wide, glabrous on both surfaces, apex acute to cuspidate, base obtuse or rounded to cuneate, midrib impressed above and raised beneath surface, margin entire; petioles 0.4–1.2 cm long, hairy; stipules triangular, 3–4 mm long by 2-2.5 mm wide, apex acute to acuminate, margin entire, hairy outside, glabrous inside. **Staminate Inflorescence** not seen. **Pistillate Inflorescence** axillary, head globose, ca. 8 mm diam., in pair (sometimes solitary); peduncle 4-10 mm long, densely hairy. **Pistillate flowers** numerous per head, connated at base; **perianth** 1-1.5 mm long, hairy. **Ovary** 1-1.5 mm long, glabrous; style and stigma up to 2-2.5 mm long, glabrous.

Thailand.―Throughout the country.

Distribution: From Indochina to Malaysian Region, Sri Lanka, India, Bhutan, China, Japan, and Australia.

Ecology: In dry evergreen of Coastal heath forest. Flowering Time: June.

Specimens examined. ―L. Taing 80 (PSU)

MYRTACEAE

Baeckea frutescens L., Sp. Pl. 1:358.1753; Gagnep. In Lec., Fl. Gén. I.-C. 2: 789.1920; Ridl., Fl. Mal. Pen. 1:712.1922; Corn. Ways. Trees Malaya 1:484. 1940; Kochummen K. M., Tree Fl. Mal. 3:170-171.1978; Turner, Gard. Bull. Singapore 47:370. 1995; Parnell J. & Chantaranothai P. in Fl. Thailand 7(4): 782. fig. 2. 2002. (Plate 10, A; Fig. 12, I)

Shrubby tree, up to 4 m tall, young twig terete, greyish-brown, glabrous; bark light greyish brown, fissured. **Leaves** simple or in clusters at the nodes, subopposite-opposite, needle-liked (acicular), flat and thick, 4- 10 mm long by 1 mm wide, apex narrowly to broadly acute, base continuously extended down and covered the stem (decurrent), glabrous, numerous gland dots on both surface, margin entire; petioles very short (almost absent). **Flowers** axillary, usually solitary, actinomorphic, ca. 3 mm long, 2.5 mm diam.; **hypanthial** cup bell-shaped with raised postulate glands, 1-1.5 mm long, glabrous; pedicel 1-1.5 mm long, glabrous; bracts ca. 1 mm long. **Calyx** lobes 5 (rarely 4), slightly fused at base, bell-shaped (campanulate) with pustulate glands; calyx tube 1-1.5 mm long, glabrous; calyx lobes greenish to white, ca. 0.5 mm long by 1 mm wide, apex rounded (rarely obtuse), glabrous. **Corolla** white (occasionally pink), bearing few gland dots, lobes 5 (rarely 4), free, ovate to obovate or orbicular, 1-3 mm long by 1.5-2 mm wide, glabrous, apex acute to rounded, margin entire. **Stamens** 8-10, free, 1-1.5 mm long, attached to calyx tube (episepalous); filaments ca. 0.5-0.8 mm long, glabrous; anthers very tiny (less than 0.5 mm long), longitudinal dehiscence, dorsifixed. **Ovary** 3-loculed, each locule bearing 10-12 ovules; style 1.5-2 mm, glabrous.

Thailand. −−− NORTH-EASTERN: Loei, Nong Khai, Ubon Ratchthani; SOUTH-EASTERN: Chanthaburi; PENINSULAR: Surat Thani, Krabi, Nakhon Si Thammarat, Songkhla, Pattani.

Distribution: Indo-Malayan region, Myanmar, China and New Guinea.

Ecology: Coastal woodland with low canopy (Coastal scrub forest). Flowering Time June-August.

Specimens examined. ─L. Taing 45 (PSU)

Melaleuca cajuputi Powell, *Pharm. Roy. Coll. Phys. Transl. 22. 1809*; Kochummen K. M., Tree Fl. Mal. 3:248. 1978; Parnell J. & Chantaranothai P., Fl. Thailand 7(4):801-803.fig.6. 2002. (Plate 10, B; Fig. 12, F)

Small tree, 7-10m tall; branchlets terete, brown or grey, densely grey sericeous on the young twig and turn to glabrous; outer bark grey and peeling, inner bark reddish brown or brownish. **Leaves** simple, opposite, ca. 6 main ribs (primary veins); lamina lanceolate, 5-8.5 cm long by 1.5-3 cm wide, young blade covered with grey sericeous and turn to glabrous on both surface when old, apex acute, base attenuate, margin entire; petioles 5-7 cm long, grey sericeous and turn to glabrous when old. **Inflorescence** axillary and terminal, spike-liked, bearing numerous flowers, 6-8 cm long; peduncle 3-6 mm long, densely hairy; bracts and bracteoles lanceolate, caduceus, covered with grey sericeous. **Flowers** actinomorphic, ca. 10 mm long, sessile (pedicel absent). **Calyx** greenish white, lobes 4, fused at base, campanulate; tube ca. 2 mm long by 3 mm in diam., hairy; lobes broadly ovate or triangular, ca. 1.5 mm long by 1.5-1.8 mm wide, apex rounded, margin ciliolate. **Corolla** white, lobes 5, free, ovate to suborbicular, ca. 3 mm long by 2.5-3 mm wide, glabrous on the surface, apex rounded, margin entire. **Stamens** numerous, grouping into 4-5 fascicles and usually 10 stamens per fascicle, inserted on the rim of calyx tube; filaments long, ca. 2 cm long, glabrous; anthers small, <0.5 mm long, longitudinal dehiscence, dorsifixed. **Ovary** inferior, densely hairy, 4-loculed, ovule numerous per locule; style 10-11 mm long, glabrous. **Fruit** not seen.

Thailand: −SOUTH-EASTERN: Chon Buri, Rayong, Chanthaburi, Trat; PENINSULAR: Ranong, Satun, Phangnga, Phuket, Nakhon Si Thammarat, Satun, Songkhla, Narathiwat.

Distribution: Malesia up to Myanmar, India, Cambodia, Vietnam, China.

Ecology: Swampy area (water log zone). Flowering time: April.

Specimens examined. ―L. Taing 05 (PSU)

Rhodomyrtus tomentosa (Aiton) Hassk., Flora 25:35. 1842; Ridl., Fl. Mal. Pen. 1:717. 1922; Backer & Bakh. f., Fl. Java (Spermatoph.) 1:335. 1963; Turner, Gard. Bull. Singapore 47:371. 1995; Parnell J. & Chantaranothai P., in Fl. Thailand 7(4):809-811. Fig.8. 2002; Chen J. & Craven L. A., Fl. China 13:331. 2007.―***Myrtus tomentose*** Aiton, Hort. Kew. 2:159. 1789. (Plate 10, G; Fig. 4, A)

Shrub ca. 3 m tall; branchlets grey to light brown, bearing densely tomentose; bark light brown to brown, longitudinal fissured. **Leaves** simple, opposite, densely tomentose underneath and glabrous above surface, glandular dots numerous; lamina ovate to elliptic, 1.7–7.5 cm long by 1–3.4 cm wide, apex refuse to rounded, base cuneate to attenuate, midrib and lateral veins highly raised underneath surface, margin revolute; petioles angular, 5-6 mm long, tomentose. **Flowers** actinomorphic, solitary, 2-4 cm long; pedicel 1.5–2.7 cm long, tomentose; **hypanthium** grey, campanulate, 4-6 mm long by 3-4.5 mm wide, tomentose; bracts elliptic, ca. 3 mm long by 1.5 mm wide, tomentose, apex obtuse to rounded, glandular dots present, margin entire. **Calyx** grey, lobes 5-6, suborbicular or orbicular, up to 4.5-5 mm long by 4.5 mm wide, glandular dots present, tomentose, apex rounded, margin entire. **Corolla** pink, lobes 5-6, free, ovate to suborbicular or orbicular, ca. 1.5 cm long, white tomentose outside and glabrous inside surface, apex rounded, margin entire. **Stamens** numerous, ca. 11 mm long; filaments ca. 10 mm long, base hairy; anthers ca. 1 mm long, longitudinal dehiscence, dorsifixed. **Ovary** inferior, 4-loculed, ovule numerous per locule; style pink, base hairy, ca. 15 mm long; sigma tiny, ca. 0.5 mm long. **Fruit** not seen.

Thailand.—EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Prachuap Khiri Khan; SOUTH-EASTERN: Chon Buri, Rayong, Chanthaburi, Trat; PENINSULAR: Chumphon, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Songkhla, Narathiwat.

Distribution: Indochina to Malaysian region, Myanmar, India, Sri lanka.

Ecology: In sandy soil of the coastal scrub, heath forest and woodland with regular canopy. Flowering time: June.

Specimens examined. — L. Taing 91 (PSU)

Syzygium antisepticum (Blume) Merr. & L. M. Perry, Mem. Amer. Acad. Arts 18:159. 1939.— ***S. gratum*** (Wight) S.N.Mitra, Indian Forester 99(2): 100. 1973.— ***S. gratum*** (Wight) S. N. Mitra var. ***confertum*** Chantar. & Parn., Kew Bull. 48(3): 599. 1993; Thai Forest Bull. (Bot.) 21:72. 1994; Parnell J. & Chantaranothai P., in Fl. Thailand 7(4): 861, 863. 2002. (Plate 10, D; Fig. 12, D)

Tree ca. 15 m tall; branchlets terete or quadrangular with shallowly fissured, glabrous; bark dark red to reddish brown with papery rolls. **Leaves** simple, opposite; lamina ovate to lanceolate or elliptic, 3.5–10 cm long by 1.2–4 cm wide, glabrous on both surfaces, apex acute to attenuate, base broadly obtuse to cunneate, midrib slightly raised beneath, margin entire; petioles 0.5-0.8 cm long, wrinkled, glabrous. **Inflorescence** terminal and axillary, paniculate, 4–9 cm long, bearing numerous flowers, inflorescence axe glabrous; peduncle quadrangular, up to 1.5 cm long, glabrous; rachis long, quadrangular, up to 10 cm long, glabrous; bracts ovate to lanceolate or triangular, 1-5 mm long by 1.5-2.5 mm wide, glabrous, apex acute to obtuse, base truncate, margin entire; bracteoles small, triangular, ca. 1 mm long by 1 mm wide, glabrous, apex acute, margin entire. **Flowers** actinomorphic, up to 7-8 mm long; pedicel short to sessile, 1-1.5 mm long, glabrous; **hypanthium** greenish white, narrowly funnel-shape or cylindrical, 3-4 mm long by 1-1.5 mm in diam., glabrous. **Calyx** greenish white, lobes 5, broadly triangular, 0.5- 1 mm long by 0.5-1 mm wide, glabrous, apex rounded to acute, margin entire. **Corolla** white, few to numerous gland

dots, lobes 5, suborbicular, 1-1.5 mm long by 1-1.5 mm wide, glabrous, apex rounded, margin entire. **Stamens** numerous, 5-7 mm long; filaments white, 5-7 mm long, glabrous; anthers tiny <0.5 mm long, longitudinal dehiscence, dorsifixed. **Ovary** inferior, 2-loculed and each locule contained ca. 8 ovules; style and stigma 7-8 mm long, glabrous. **Fruit** not seen.

Thailand. − NORTHERN: Chiang Mai, Lamphun, Nan, Phitsanulok, Kamphaeng Phet; NORTH-EASTERN: Loei, Udon Thani, Sakhon Nakhon, Nakhon Phanom; EASTERN: Chaiyaphum, Surin, Roi Et, Si Sa Ket, Ubon Ratchathani; SOUTH-EASTERN: Prachin Buri, Chon Buri, Rayong, Chanthaburi, Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Satun, Trang, Songkhla, Narathiwat, Yala.

Distribution: Throughout Malesian Region, Myanmar and India

Ecology: In sandy soil of the coastal woodland with regular canopy. Flowering time: January-June.

Specimens examined. ―L. Taing 89 (PSU).

Syzygium cf. craibii Chantar. & J. Parn., Kew Bull. 48(3):596. 1993; Thai Forest Bull. (Bot.) 21: 55. 1994; Fl. Thailand 7(4): 846. 2002. (Plate 10, C; Fig. 12, A)

Tree ca. 5 m tall; branchlets reddish brown, terete with shallowly fissured, glabrous; bark brownish. **Leaves** simple, opposite; lamina elliptic to oblong or lanceolate, 9-16 cm long by 2-6 cm wide, glabrous on both surface, apex acuminate (rarely acute), base obtuse to cuneate, midrib impressed above and raised beneath surface, margin entire; intramarginal vein 1, ca. 1 mm from the margin; petioles 5-8 mm long, glabrous. **Inflorescence** terminal and axillary, paniculate, bearing numerous flowers, up to 8 cm long, inflorescence axe glabrous; peduncle up to 2 cm long, subterete, glabrous; rachis up to 3 cm long, subterete, glabrous; bracts and bracteoles not seen. **Flowers** white, actinomorphic, sessile (pedicel absence); **hypanthial** cup green, funnel-shaped, pustuliferous, ca. 8 mm long by 5-5.5 mm in diam. **Calyx** lobes 5, 1-1.5 mm long by 3 mm wide, glabrous, apex rounded, margin entire. **Corolla**

white with many gland dots, lobes 5, orbicular or suborbicular, ca. 4 mm long by 3 mm wide, apex rounded, margin entire. **Stamens** numerous, ca. 18 mm long; filaments white, 14-16 mm long, glabrous; anthers tiny, ca. 0.5 mm long by 0.5 mm wide, longitudinal dehiscence, dosifixed. **Ovary** inferior, 2-loculed, each locule contained ovule 17-19; style and stigma ca. 17 mm long, glabrous. **Fruit** not seen.

Thailand.—PENINSULAR: Songkhla.

Distribution: Endemic.

Ecology: In the tropical bog area or in the edge between peat swamp and bog area. Flowering Time: June, July.

Specimens examined. —L. Taing 97 (PSU)

Syzygium cumini (L.) Skeels in U.S.D.A. Bur. Pl. Industr. Bull. 248:25. 1912; Backer & Bakh.f., Fl. Java (Spermatoph.) 1: 340. 1963; Long D. G. & Rae S. J. in Grierson A. J. C. & Long D.G., Fl. Bhutan 2(1):284.1991; Chantaranothai P. & Parn J., Thai Forest Bull. (Bot.) 21:56. 1994. (Fig. 12, E)

Tree, up to 10 m tall; young twigs angular, glabrous; bark whitish, smooth. **Leaves** simple, opposite; lamina lanceolate to elliptic, 7-11.5 cm long by 3.5-5 cm wide, glabrous, apex acute to attenuate, base obtuse to cuneate, midvein impressed on the upper blade surface, margin entire; petioles 5-8 mm long, glabrous. **Inflorescence** terminal and axillary, paniculate, ca. 6 cm long, bearing numerous flowers; peduncle angular, 0.5-2 cm long, glabrous; rachis angular, 1-4 cm long, glabrous; bracts in pairs, small, triangular, 1-1.5 mm long by 1 mm wide, glabrous; bracteoles small, triangular, ca. 0.6 mm by 0.5 mm. **Flowers** actinomorphic, 2-3 mm long, sessile; **hypanthium** 2-2.5 mm long, funnel shape, glabrous. **Calyx** lobes 4, ca. 0.5 mm long by 1 mm wide, glabrous, apex rounded to acute, margin entire. **Corolla** white, lobes 4, irregular shape (mostly rounded), 1-1.5 mm long by 1-1.5 mm wide, glabrous, apex rounded, margin slightly repand. **Stamens** white, numerous, 1-1.5 mm long, episepalous, glabrous; anthers ca. 0.5 mm long, longitudinal dehiscence, dorsifixed;

filaments ca. 1 mm long, glabrous. **Ovary** inferior, 2-loculed and each locule contained ca. 15 ovules; style 1-1.5 mm long, glabrous.

Thailand. ─── NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Phrae, Uttaradit, Nan, Tak, Phitsanulok; NORTH-EASTERN: Phetchbun, Loei, Sakhon Nakhon, Khon Kaen; EASTERN: Chaiyaphum, Nakhon Ratchasima, Si Sa Ket, Ubon Ratchathani; SOUTH-WESTERN: Uthai Thani, Kanchanaburi, Ratchaburi; CENTRAL: Saraburi, Bangkok; SOUTH-EASTERN: Chon Buri, Rayong, Chanthaburi; PENINSULAR: Surat Thani, Satun, Songkhla

Distribution: Indo-Malayan region, and introduced to other tropical regions.

Ecology: In the sandy soil of the peat swamp forest.

Specimens examined. ─L. Taing 25 (PSU).

Syzygium grande (Wight) Walp. var. ***grande***, Report. Bot. Syst. 2:180. 1843; Chantaranothai P. & Parn J., Thai Forest Bull. (Bot.) 21:68. 1994; Fl. Thailand 7(4):859. 2002. (Plate 10, E; Fig. 12, B)

Tree ca. 15 m tall; branchlets terete, dark brown, glabrous; bark dark greyish brown or dark brown, flaky. **Leaves** simple, opposite; lamina ovate to elliptic, 11-17 cm long by 7-10 cm wide, glabrous on both surfaces, apex acute to acuminate, base obtuse to cuneate, midrib raised beneath surface, margin entire, intramarginal veins 2; petioles 1-2 cm long, glabrous. **Inflorescence** terminal and in axillary of the upper leaves, paniculate, 8–10 cm long, bearing numerous flowers, inflorescence axe glabrous; peduncle terete, ca. 3.5 cm long, glabrous; rachis terete, up to 4 cm long, glabrous; bracts and bracteoles not seen (caducous). **Flowers** actinomorphic, up to 2 cm long, sessile; **hypanthium** greenish or green, broadly funnel-shaped, 6-8 mm long by 6 mm in diam., glabrous. **Calyx** lobes 4, broadly ovate to orbicular, ca. 4 mm long by 3-3.5 mm wide, glabrous, apex rounded or truncate, base rounded to broadly obtuse, margin entire. **Corolla** white, lobes 4, free, broadly ovate or suborbicular, 4-5 mm long, glabrous on surfaces, apex rounded, margin entire and membranaceous. **Stamens** numerous; filaments white 5-13 mm long, glabrous; anthers tiny (<0.5 mm

long), longitudinal dehiscence, dorsifixed. **Ovary** inferior, 2-loculed, ovules up to 20 per locule; style 1.3-1.5 mm long by 0.8 mm in diam., glabrous. **Fruit** not seen.

Thailand: − NORTHERN: Chiang Mai, Nan, Phitsanulok; NORTH-EASTERN: Loei, Sakhon Nakhon, Phetchabum; EASTERN: Chaiyaphum; SOUTH-WESTERN: Kanchanaburi; SOUTH-EASTERN: Chanthaburi, Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Phuket, Krabi, Satun, Trang, Songkhla, Narathiwat, Yala.

Distribution:—Singapore, Malaysia, Indochina, Myanmar, India, Sri Lanka.

Ecology: In sandy soil of the coastal scrub, coastal heath forest communities and woodland with regular canopy. Flowering time: January, February.

Specimens examined. —L. Taing 125 (PSU).

Syzygium cf. polyanthum (Wight) Walp., Report. 2:180. 1843, non Miq.; Backer & Bakh.f., Fl. Java (Spermatoph.) 1:399. 1963; Chantaranothai P. & Parn J., Thai Forest Bull. (Bot.) 21:95. 1994; Turner, Gard. Bull. Singapore 47: 380. 1995. (Plate 10, F; Fig. 12, C)

Tree, ca.7 m tall; branchlets angular, reddish brown, glabrous; bark brownish or reddish brown or whitish grey, flaky. **Leaves** simple, opposite; lamina elliptic to oblong or lanceolate, 6–10.5 cm long by 2.9–3.9 cm wide, glabrous on both surface, apex acute to attenuate, base obtuse to cuneate, midrib slightly raised beneath, margin entire; petioles 0.5 to 1.2 cm long, glabrous. **Inflorescence** axillary, paniculate, 1.5-2 cm long; peduncle quadrangular, up to 1.8 cm long, glabrous; rachis quadrangular ca. 1 cm long, glabrous; bracts and bracteoles in pair, triangular, ca. 0.5 mm long, glabrous. **Flowers** actinomorphic, ca. 4 mm long by 3.5 mm diam.; pedicel subsessile ca. 1 mm long, glabrous; **hypanthial cup** funnel-shaped, up to 2 mm long, glabrous. **Calyx** white to whitish pink, triangular, lobes 4, ca. 1 mm long by 1.5 mm wide, glabous, apex acute, margin entire. **Corolla** white and bearing pink gland dots, lobes 4, orbicular ca. 2 mm long by 1.5 mm wide, glabrous, apex rounded, margin entire. **Stamens** white, numerous, up to 3 mm long, episepalous, glabrous; filaments ca. 2.5

mm long, glabrous; anthers tiny, longitudinal dehiscence, dorsifixed. **Ovary** 2-loculed, each locule contained 16-26 ovules; style and stigma ca. 1.5 mm long, glabrous. **Fruit** capsule, subglobose, ca. 5 mm long by 5 mm in diam., glabrous.

Thailand. ── NORTHERN: Chiang Mai; EASTERN: Chaiyaphum, Ubon Ratchathani; SOUTH-WESTERN: Kanchanaburi; SOUTH-EASTERN: Chon Buri, Chanthaburi, Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Krabi, Nakhon Si Thammarat, Trang, Satun, Songkhla, Pattani, Yala, Narathiwat.

Distribution: Indochina, Myanmar, Malaysia.

Ecology: Along the roadside, tropical bog and paddy field.

Specimens examined. ─L. Taing 86 (PSU).

OLEACEAE

Olea brachiata (Lour.) Merr. Lingnan Agric. Rev. 2: 127. 1925; Chen C. M. et al., in Fl. China 15:298. 1996; Green P.S., in Fl. Thailand 7(2): 272-274. 2000.─ ***Olea maritima*** Wall. & G.Don, Gen. Hist. 4:49. 1837; Clarke C. B. in Hook. f. Fl. Brit. India 3:612. 1882; Ridl., Fl. Mal. Penin. 2:318. 1923; Gagnep. In Fl. Gén. I.-C. 3:1078.1933.─***Tetrapilus brachiatus*** Loureiro, Fl. Cochinch. 2: 611. 1790. (Plate 14, G; Fig. 7, A)

Shrub, ca. 5-7 m tall; young branchlets terete, sparsely hairy to glabrous; bark whitish grey or grey. **Leaves** simple, opposite; lamina narrowly lanceolate to oblong or elliptic, 4–8 cm long by 2–4 cm wide, glabrous on both surfaces, apex emarginate to acute or acuminate, base obtuse to cuneate, midrib raised beneath surface, margin entire or slightly serrate in the upper part; petioles up to 5 mm long, glabrous but sometime sparsely hairy. **Inflorescence** axillary and terminal, paniculate, 1.5–5 cm long, inflorescence axe glabrous or sparsely hairy; peduncle 1-1.3 cm long, sparsely hairy to glabrous; rachis 2-3.5 cm long, sparsely hairy to glabrous. **Flowers** actinomorphic, ca. 2 mm long by 1.5–2 mm in diam.; pedicel 1-2 mm long, glabrous. **Calyx** lobes 4, free, triangular, ca. 1 mm long by 0.7-1 mm wide, glabrous on both

surface, apex acute, margin entire. **Corolla** greenish, lobes 4, 1.5-2 mm long, glabrous, campanulate; corolla tube 1-1.5 mm long; corolla lobes ca. 0.5 mm long, apex acute, margin entire. **Stamens** 2, free; filament short, ca. 0.5 mm long, glabrous; anthers 0.5 mm long, longitudinal dehiscence, baxifixed. **Ovary** superior, ca. 1 mm long by 0.7 mm in diam., ovule 4; style very short. **Fruit** a drupe, globose to ovoid, ca. 4 mm in diam., glabrous.

Thailand. ─── NORTHERN: Sukhothai, Phitsanulok; NORTH-EASTERN: Loei, Khon Kaen; EASTERN: Chaiyaphum, Nakhon Ratchasima; SOUTH-WESTERN: Kanchanaburi; SOUTH-EASTERN: Prachin Buri, Chon Buri; PENINSULAR: Surat Thani, Phangnga, Phuket, Nakhon Si Thammarat, Songkhla, Narathiwat, Pattani.

Distribution: China, Indochina to Malay Paninsula, Brunei.

Ecology: In sandy soil of the coastal heath forest and coastal woodland with regular canopy. Flowering time: Whole year.

Specimens examined. ─L. Taing 90 (PSU).

PHYLANTHACEAE

Antidesma ghaesembilla Gaertn., Fruct. 1:189, t. 39.1788; Gagnep. & Beille in Lecomte, Fl. Indo-Chine 5:505, fig. 64. 1926; Hoffmann P., Thai Forest Bull. (Bot.) 28:147. 2000; Chayamarit K. & Welzen P. C. V., in Fl. Thailand 8(1):65. 2005. (Plate 12, H; Fig. 15, B)

Shrub to tree, ca. up to 5 m tall; young twig brownish to brown, pubescence; bark dark grey. **Leaves** simple, alternate; lamina broadly elliptic to obovate or rotund, 3.5-6.5 cm long by 2-4.5 cm wide, glabrous, apex rounded to obtuse, base subcordate to rounded, midrib and secondary veins slightly raised beneath surfface, margin entire; petioles 4-9 mm long, pubescence. **Staminate Inflorescence** terminal and axillary, up to 8 cm long, much branched spikes; peduncle angular, ca. 8 mm, pubescence; rachis angular, ca. 7 cm long, pubescence. **Staminate flowers** tiny, 1-1.5

mm diam., sessile; calyx white to greenish, lobes 4 to 6, free, triangular to broadly triangular, 0.5–1 mm long by 0.5-0.7 mm wide, pubescence, apex acute; corolla not seen; bract lanceolate to oblanceolate, 0.5 -1 mm long, pubescence, apex acute to attenuate. **Stamens** white, 4-6, free, 1-1.5 mm long; filaments 1-1.5 mm long, glabrous; anthers ca. 0.5 mm long, poricidal dehiscence, basifixed. **Pistillate flowers** and **Fruits** not seen.

Thailand:−NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Lamphun, Lampang, Tak, Phitsanulok, Nakhon Sawan; NORTH-EASTERN: Phetchabun, Loei, Khon Kaen; EASTERN: Nakhon Ratchasima, Buri Ram, Si Sa Ket; CENTRAL: Ang Thong, Bangkok; SOUTH-WESTERN: Chon Bori, Chanthaburi; PENINSULAR: Chumphon, Surat Thani, Phangnga, Nakhon Si Thammarat, Trang, Songkhla, Yala, Narathiwat.

Distribution: South China, Indo-Malayan region, Philippines, New Guinea, North Australia, India, Sri Langka, Bangladesh.

Ecology: Open scrubby forest along the coastal, riverine, and seconday forest.

Specimens examined. ―L. Taing 44 (PSU).

PRIMULACEAE

Ardisia crenata Sims, Bot. Mag. 45: t. 1950. 1817; Pipoly J. J. & Chen J. in Fl. China 15:19. 1996; Larsen K. & Hu C. M. in Fl. Thailand 6(2): 135. 1996. (Plate 13, E; Fig. 14, D)

Shrub ca. 1 m tall; branchlets terete to slightly angular, green; bark grey. **Leaves** simple with numerous glandular dots, alternate; lamina obovate to elliptic or lanceolate, 2.5 – 7 .5 cm long by 1.3 – 2.5 cm wide, glabrous on both surfaces, apex rounded to acute, base cuneate to attenuate, midrib slightly raised beneath surface, margin serrate with glands; petioles 4-7 mm long, glabrous. **Inflorescence** terminal, umbel-liked, glanduliferous, ca. 2 cm long, numerous flowers; peduncle 4-7 mm long, glabrous. **Flowers** actinomorphic, ca. 5 mm long; pedicel up to 1 cm long,

glanduliferous, sparsely hairy or glabrous. **Calyx** greenish to pinkish, glanduliferous, lobes 5, triangular, ca. 2 mm long by 1.5 mm wide, glabrous, apex acute to acuminate, margin entire. **Corolla** pinkish, glanduliferous, lobes 5, ovate, ca. 4 mm long by 2.5 mm wide, glabrous, apex acute, margin entire. **Stamens** 5, epipetalous; filaments subsessile, glabrous; anther narrowly triangular, 3-3.5 mm long by 1 mm wide, longitudinal dehiscence. **Ovary** superior, ca. 1 mm in diam., glabrous, 8-loculed, ovule 1 per locule; style and stigma ca. 2.5 mm long, glabrous. **Fruits** not seen.

Thailand.—NORTHERN: Chiang Mai, Chiang Rai, Phitsanulok; NORTH-EASTERN: Nakhon Phanom; EASTERN: Chaiyaphum, Nakhon Ratchasima; CENTRAL: Nakhon Nayok; SOUTH-EASTERN: Chanthaburi, Prachin Buri, Rayong, Trat; PENINSULAR: Ranong, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Narathiwat.

Distribution: India, Myanmar, South China, Vietnam, Japan, Philippines, Malay Peninsula.

Ecology: In sandy soil of the coastal woodland. Flowering time: June.

Specimens examined. —L. Taing 92 (PSU)

RHAMNACEAE

Colubrina asiatica var. ***asiatica*** (L.) Brongn., Brittonia 23. 1971. (Plate 13, F; Fig. 9, F)

Shrub, ca. 3 m tall; branchlets terete, green, glabrous; bark greyish brown, fissured. **Leaves** simple with 2 lateral primary veins, alternate; lamina broadly ovate, 4-7.3 cm long by 3-5 cm wide, glabrous on both surface, apex acute, base rounded to subcordate, midrib raised beneath surface and hairy, margin crenate; petioles 7-10 mm long, sparsely hairy or glabrous. **Inflorescence** axillary, paniculate, bearing numerous flowers; peduncle 2-3 mm long, sparsely hairy; rachis ca. 5 mm long, sparsely hairy; bracts and bracteoles small, deltoid, <0.5 long, apex acute, margin ciliate. **Flowers** actinomorphic, 3-5 mm long (with pedicel) by 3-4 mm in diam.;

pedicel 3-4 mm long, bearing sparsely hairy. **Disc** yellow, fleshy, rounded, 1.5-2 mm in diam. **Calyx** greenish white, lobes 5, slightly fused at base, campanulate; tube hemispherical, ca. 0.5 mm long by 2 mm in diam., glabrous or sparsely hairy; lobes broadly triangular, ca. 1 mm long by 1.5 mm wide, glabrous, apex acute, margin entire. **Corolla** greenish, lobes 5, free, obovate, ca. 1 mm long, apex rounded to obtuse, base attenuate to cuneate, glabrous. **Stamens** 5, free; filaments ca. 1 mm long, glabrous; anthers ±0.5 mm long, longitudinal dehiscence, dorsifixed. **Ovary** inferior, 3-loculed, ovule 1 per locule, style very short, stigma 3 lobes. **Fruit** berry, 5-6 mm long by 6 mm in diam., glabrous.

Thailand.—PENINSULAR: Songkhla**.**

Distribution: India, Sri Lanka, throughout Malesia region, Myanmar, Australia, Australia, Taiwan, China.

Ecology: In the sandy soil areas of the coastal scrub communities. Flowering and Fruiting time: July, August.

Specimens examined. —L. Taing 105 (PSU)

RHIZOPHORACEAE

Bruguiera cylindrica (L.) Blume, Enum. Pl. Javae. 1: 93. 1827; Back. & Bakh. f., Fl. Java (Spermatoph.) 1:381.1963; Hou D. in Fl. Thailand 2(1): 9-10. 1970; Kochummen K. M., Tree Fl. Mal. 4:310. 1989. (Fig. 5, D)

Tree, ca. 10 m tall; branchlets terete, dark greyish brown, glabrous; bark dark brown or dark greyish brown. **Leaves** simple, opposite; lamina elliptic to lanceolate, 6-8 cm long by 3-3.5 cm wide, glabrous on both surface, apex acute, base cuneate, midrib slightly raised beneath surface, margin entire; petioles 2-2.5 mm long, glabrous; stipule caducous, ca. 3 cm long, glabrous. **Inflorescence** axillary, a simple cyme, ca. 2 cm long, peduncle 8-9 mm long and glabrous; bracts and bracteoles not seen. **Flowers** actinomorphic, 1.3-1.5 cm long (included pedicel); pedicel ca. 5 mm long, glabrous. **Calyx** lobes 8, fused at base, funnel-shaped; tubes 5-6 mm long by 4

mm in diam., glabrous; lobes ensiform, ca. 6 mm long by 1.5 mm wide, apex acute, glabrous, margin entire. **Corolla** lobes 8, free, ca. 3 mm long, glabrous on surface, each lobe apex shortly bilobed, obtuse with 2-3 bristles, base truncate, margin ciliate. **Stamens** 2-celled, ca. 16, free, inserted to the calyx lobes; filaments white, 1.5-2 mm long, glabrous; anthers ca. 1.5 mm long, longitudinal dehiscence, basifixed. **Ovary** inferior, ca. 2-loculed, each locules contained ovule 2; style ca. 4 mm long, glabrous; stigma bilobes. **Fruits** not seen.

Thailand: − SOUTH-EASTERN: Chanthaburi; SOUTH-WESTERN: Ratchaburi, Phetchaburi; PENINSULAR: Surat Thani, Trang, Songkhla, Satun.

Distribution: Southeast Asia, throughout Malesia.

Ecology: In muddy soil of mangrove forests. Flowering Time: June, July.

Specimens examined. ―L. Taing 150 (PSU)

Carallia brachiata (Louz.) Merr., Philipp. J. Sci. 15: 249 1919; Back. & Bakh. f., Fl. Java (Spermatoph.) 1:380. 1963; Hou D. in Fl. Thailand 2(1): 13. 1970; Kochummen K. M., Tree Fl. Mal. 4:313. fig. 4. 1989. (Plate 12, G; Fig. 10, C)

Tree, ca. 10 m tall; branchlets terete, dark brown, glabrous; bark yellowish brown to dark greyish brown, slightly ridged but not flaking. **Leaves** simple, opposite; lamina elliptic to lanceolate, 6-9 cm long by 3.5-4.3 cm wide, glabrous on both surface, apex acute with mucronate (sometimes absent), base cuneate, midrib slightly raised beneath surface, margin entire; petioles ca. 5 mm long, glabrous; stipule not seen. **Inflorescence** axillary, compound cyme, 3-4 cm long; peduncle 10-13 mm long, glabrous; bracts in pair, broadly triangular, ca. 1 mm long by 2 mm wide, glabrous on both surface, apex acute, margin entire. **Flowers** actinomorphic, ca. 5 mm long, sessile. **Calyx** lobes 6, fused at base, campanulate; tubes 2-2.5 mm long by 2 mm in diam., glabrous; lobes ovate, ca. 1.5 mm long by 0.5-1 mm wide, glabrous, apex acute, margin entire. **Corolla** lobes 6, free, ca. 1.5 mm long, glabrous on surface, each lobe apex bilobed, margin entire. **Stamens** 2-celled, ca. 12, free, inserted to the calyx lobes; filaments ca. 1.5 mm long, sparsely hairy to glabrous; anthers <0.5 mm long,

longitudinal dehiscence, dorsifixed. **Ovary** inferior, ca. 4-loculed, each locule contained ovule 2; style 2.5-2.8 mm long, glabrous; stigma 4-lobed. **Fruit** not seen.

Thailand: − NORTH-EASTERN: Loei; SOUTH-EASTERN: Chanthaburi, Trat; PENINSULAR: Surat Thani, Nakhon Si Thammarat, Songkhla.

Distribution: Bhutan, Nepal, Myanmar, Southeast Asia, Malaysia, Indonesia, Philippines, North Australia, New Guinea, China

Ecology: In sandy soil of the coastal woodland. Flowering Time: March-April.

Specimens examined. ―L. Taing 131 (PSU)

Rhizophora apiculata Blume, En.. Pl. Jav. 1: 91. 1827; Back. & Bakh. f., Fl. Java (Spermatoph.) 1:379. 1963; Hou D. in Fl. Thailand 2(1):6. 1970; Kochummen K. M., Tree Fl. Mal. 4:322. 1989. (Fig. 5, E)

Tree, ca. 10 m tall; branchlets terete, dark greyish brown, glabrous; bark greyish or dark greyish brown, slightly ridged but not flaking. **Leaves** simple, opposite; lamina oblong to lanceolate, 10-13 cm long by 4-5.5 cm wide, glabrous on both surface, apex acute with mucronate (sometimes absent), base obtuse to cuneate, midrib raised beneath surface, margin entire; petioles up to 2 cm long, glabrous; stipule not seen. **Inflorescence** simple cyme, bearing 2-4 flowers in axillary of leafless branchlets; peduncle 5-7 mm long, glabrous; bracts not seen. **Flowers** actinomorphic, ca. 15 mm long; pedicel 4-5 mm long, glabrous. **Calyx** lobes 4, basal part green and upper part brown, lobes lanceolate ca. 18 mm long by 9 mm in diam., glabrous on both surface, apex acute, margin entire. **Corolla** white, lobes 4, free, oblong, 10-11 mm long by 2-2.5 mm wide, glabrous on both surface, apex acute, margin entire. **Stamens** 10, free, sessile; anthers ca. 10 mm long by 3 mm wide, dehiscencing inwards (introrse) by an adaxial valve. **Ovary** semi-inferior and consisted 2-loculed; ovule ca. 1 mm long and wide, 2 ovules per locule; stigma conspicuously bilobed, ca. 0.5 mm long and glabrous. **Fruits** not seen.

Thailand.—CENTRAL: Chon Buri; SOUTH-EASTERN: Chanthaburi, Trat; SOUTH-WESTERN: Prachuap Khiri Khan; PENINSULAR: Satun, Trang, Surat Thani, Chumphon, Songkhla.

Distribution: India and widely distribution from the Southeast Asia to the Northern Australia.

Ecology: Swampy area, muddy soil of mangrove forest. Flowering time: whole year.

Specimens examined. —L. Taing 147 (PSU)

RUBIACEAE

***Canthium* sp. (Fig. 6, A)**

Shrub, ca. 2.5 m tall; branchlets and branches grey, lenticellate, glabrous. **Leaves** simple, opposite; lamina lanceolate, 6-10.5 cm long by 2.5-4.8 cm wide, glabrous on both surfaces, apex acuminate to acute, base obtuse to cuneate, midrib slightly raised beneath surface, margin entire, few domatia in the axils of the secondary veins; petioles 5-7 mm long, glabrous; stipule in pairs, interpetiolar, linear ovate to triangular, 3-6 mm long by 2.5-3 mm wide, glabrous, apex acuminate, margin entire. **Inflorescence** axillary, simple umbel or compound umbel; peduncle 2-2.5 cm long, covered with puberulent. **Flowers** 7-9 mm long (with pedicel); pedicel 6-8 mm long by 0.5 mm wide, sparsely hairy (puberulent); bracts and bracteoles not seen. **Calyx** lobes 5, slightly fused at base; calyx tube 1-1.5 mm long; calyx lobes triangular 0.5-0.7 mm long by 0.5-0.6 mm wide, apex acute, puberlulent on both surface, margin ciliate. **Corolla** and **stamens** not seen (fell off). **Ovary** inferior, 2-loculed, ovule one per locule; style and stigma not seen (fell off). **Fruit** berry, globose, 6-7 mm in diam., glabrous.

Thailand.—PENINSULAR: Nakhorn Si Thammarat.

Distribution: ___

Ecology: In sandy soil areas of the edge of tropical bog. Fruiting time: November, December.

Specimens examined. ―L. Taing 121 (PSU)

Catunaregam tomentosa (Blume ex DC.) Tirveng., Taxon 27: 515. 1978. publ. 1979. (Plate 11, C; Fig. 15, F)

Shrub ca. 3 m tall; young twig (branchlets) terete, reddish brown to grey, hairy; bark brownish to grey with terete thorn, thorn 3-4 cm long. **Leaves** simple, opposite; lamina obovate to broadly oblanceolate (rarely elliptic), 4-10 cm long by 2.2-5.5 cm wide, densely tomentose beneath and sparsely hairy above surface, apex rounded to obtuse with mucronate, base obtuse to cuneate, midrib and secondary veins raised underneath surface with densely tomentose, margin entire; petioles 8-20 mm long, tomentose; stipules in pair, interpetiolar, broadly triangular, 3-4 mm long by 3-4 mm wide, densely tomentose, apex acuminate to attenuate, base truncate. **Inflorescence** axillary and terminal, simple cyme or solitary flower, bearing 1-3 (-4) flowers; peduncle short, terete, 1-1.5 mm long, bearing tomentose. **Flowers** actinomorphic, ca. 2.5 cm long; pedicel short (ca. 1-4 mm long), terete, tomentose; bracts triangular, ca. 3 mm long by 2 mm wide, densely tomentose, apex acuminate, margin entire. **Calyx** lobes 6-7, united at base; basal tube 10-11 mm long by 5 mm in diam., outside surface hairy; lobes subulate, ca. 6 mm long by 0.5-1 mm wide, densely tomentose on both surfaces, apex attenuate, margin entire. **Corolla** yellow to white, lobes 6-7, united at base, salver-shaped; basal tube ca. 12 mm long by 3.5 mm in diam., outside surface tomoentose except the lower part of the basal tube which is glabrous; lobes ca. 13 mm long by .6 mm wide, hairy, apex broadly acute, margin entire. **Stamens** 6-7 (depended on the number of corolla lobes), alternate the corolla lobes, epipetalous, sessile (filaments absent); anthers ca. 2-3 mm long by 0.5-0.7 mm wide, longitudinal dehiscence. **Ovary** inferior, 2-loculed, bearing numerous ovules (18-20) in each locule; style white, ca. 1.4 cm long by 1-1.5 mm in diam., glabrous; stigma 2-lobed, ca. 2.5 mm long. **Fruit** drupe, subglobose or globose 3-3.5 cm long by 3-3.5 cm in diam., wrinkled, hairy outside.

Thailand:−PENINSULAR: Songkhla.

Distribution: From Indochina to West Malaysia

Ecology: In sandy soil of costal scrub and coastal heath forest. Flowering Time: June, July, August. Fruiting Period: July, August.

Specimens examined. ―L. Taing 100 (PSU)

Chassalia curviflora (Wall.) Thwaites, Enum. Pl. Zeyl. 150. 1859; Chen T. & Taylor C. M., Fl. China 19:87. 2011. (Plate 11, H; Fig. 11, E)

Small **s**hrub ca. 1 m tall; branchlets green, glabrous. **Leaves** simple, opposite; lamina oblong to broadly lanceolate, 3.5-10 cm long by 1.3-4.3 cm wide, apex acute to acuminate, base attenuate to cuneate (rarely obtuse), midrib raised beneath surface, margin entire; petioles 0.3-1 cm long, glabrous; stipule interpetiolar, triangular, ca. 2 mm long by 1 mm wide, glabrous on both surface, apex acuminate (-acute). **Inflorescence** terminal, compound cyme, bearing numerous flowers; inflorescence axes reddish, purplish or white, succulent; peduncle ca. 1 cm long, glabrous; rachis up to 2.2 cm long, sparsely hairy. **Flowers** actinomorphic, ca. 1.5 cm long; pedicel red to purplish, 1-1.5 mm long, glabrous. **Calyx** purplish to dark red (sometimes white), lobes 5, slightly fused at base, campanulate, glabrous on the surface; tube ca. 1 mm long by 0.5-0.8 mm wide; lobes white, triangular, ca. 0.5 mm long by 1 mm wide, apex acute and purplish (-red). **Corolla** white to red (sometimes purplish), lobes 5, united at base; tube cylindrical, up to 12 mm long by 1-1.5 mm wide, glabrous; lobes 2-3 mm long by 1-1.5 mm wide, glabrous, apex acute, margin entire. **Stamens** 5, 4-5 mm long, inserted to the corolla tube (epipetalous); filaments 2.5-3 mm long, white, glabrous; anthers ca. 2 mm long by 0.5 mm wide, longitudinal dehiscence, dorsifixed. **Disc** annular (ring-liked) glabrous, ca. 1 mm in diam. **Ovary** inferior, 2-loculed, ovule 2 per locule; style white, slender, 10-12 mm long, glabrous; stigma purplish to white, 2-lobed, free, 1.5 -2 mm long. **Fruit** fleshy drupe, globose, ca. 5 mm long by 5 mm in diam.

Thailand.―PENINSULAR: Phatthalung, Songkhla.

Distribution: India, Bangladesh, Bhutan, China, Peninsular Malaysia, Philippines, Singapore, Borneo, Indochina.

Ecology: In sandy soil of the coastal heath and coastal woodland. Flowering Time: April to June. Fruiting Time: April to January.

Specimens examined. ―L. Taing 72 (PSU)

Ixora javanica (Blume) DC., Prodr. (DC.) 4:487. 1830; Bakh. f., Fl. Java (Spermatoph.) 2: 325. 1965; Wong K. M., Tree Fl. Mal. 4: 360. 1989. (Plate 11, F; Fig. 11, F)

Shrub, up to 3 m tall, branchlets green when young and dark red to dark brown when old. **Leaves** simple, opposite; lamina oblong to lanceolate or elliptic, 7-13 long by 2.8-4.2 cm wide, glabrous on both surface, apex acute to acuminate, base obtuse to cuneate (-attenuate), midrib raised underneath surface, margin entire; petioles 3-6 mm long, glabrous; stipule interpetiolar, triangular, ca. 3.5 mm long by 2.5 mm wide, apex acuminate to long caudate, sparsely hairy inside and glabrous outside. **Inflorescence** terminal, compound cyme, bearing numerous flowers; peduncle up to 2.5 cm long, sparsely hairy to glabrous; rachis 5- 10 mm long, hairy; bracts in pair, triangular, 2-3 mm long by 1 mm wide, apex acuminate to caudate, margin entire; bracteoles in pair, triangular, <0.5 mm long by <0.5 mm wide, apex acute, margin entire. **Flowers** actinomorphic, ca. 4 cm long; pedicel 1.5-3 mm long, hairy. **Calyx** reddish pink, slightly fused at base, campanulate, sparsely hairy or glabrous, tube ca. 1 mm long by 1 mm in diam.; lobe apex truncate or slightly 4-denticulated, ca. 0.5 mm long. **Corolla** reddish to light yellow, lobes 4, united at base; tube narrow cylintrical, ca. 3 cm long by 0.5-1 mm wide, glabrous but throat hairy inside; lobes 6.5-7.5 mm long by 2-2.5 mm wide, glabrous, apex acute, margin entire. **Stamens** 4, epipetalous, alternate the corolla lobes; filaments 1-1.5 mm long; anthers 3-4 mm long by 1 mm wide. **Disc** annular (ring-liked), glabrous, 1-1.5 mm long by 1 mm in diam. **Ovary** inferior, 2-loculed, ovule 1 per locule; style pale pink, ca. 3 cm long, glabrous; stigma pinkish, 2-lobed, free, ca. 2 mm long. **Fruits** fleshy drupe, green turning black when ripe, globose ca. 7 mm long by 8-9 in diam.

Thailand.— NORTHERN: Lampang, Tak; NORTH-EASTERN: Ubon Thani, Nong Khai, Sakhon Nakhon, Nakhon Phanom, Maha Sarakham; EASTERN: Nakhon Ratchasima, Surin, Yasothon, Si Sa Ket, Ubon Ratchathani; SOUTH-WESTERN: Phachuap Khiri Khan; CENTRAL: Nakhon Nayok; SOUTH-EASTERN: Sa Keo, Prachin Buri, Chon Buri, Rayong, Chanthaburi, Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Narathiwat.

Distribution: India, China, Peninsular Malaysia, Indonesia.

Ecology: In sandy soil of the coastal heath and coastal woodland. Flowering Time: May to September, June. Fruiting Time: June.

Specimens examined. — L. Taing 73 (PSU)

Kailarsenia campanula (Ridl.) Tirveng., Nordic J. Bot. 3(4): 464. 1983.—***Gardenia campanula*** Ridl., Trans. Linn. Soc. London, Bot. 3(9):310. 1893.; Fl. Malay. Penin. 2:81-82.1923. (Plate 11, G; Fig. 11, G)

Shrub, ca. 3 m tall; young branchlets terete, green to dark green, hairy; bark light to dark brown. **Leaves** simple, opposite or in whorls of 3; lamina oblong to lanceolate or oblanceolate, 6-12 cm long by 1.8-4.5 cm wide, glabrous on both surface, apex acute to acuminate, base obtuse to cuneate, midrib and secondary veins raised beneath and hairy, margin ciliate, domatia in the axils of the secondary vein; petioles 5-10 mm long, hairy; stipule ocreate, triangular, ca. 8 mm long by 6 mm wide, hairy outside and glabrous inside surface, margin ciliate. **Flowers** actinomorphic, solitary, 5-6 mm long; pedicel up to 1 cm long, glabrous. **Calyx** lobes 5, slightly fused at base; calyx tube 1-1.2 mm long by 3-4 mm in diam.; calyx lobes narrowly triangular, 4-5 mm long by 1 mm wide, apex acute to acuminate, margin entire. **Corolla** white, lobes 5, united at base, campanulate; corolla tube, 3-3.5 cm long, basal hairy; corolla lobes elliptic, ca. 20 mm long by 14 mm wide, apex obtuse (-broadly acute), margin entire. **Stamens** 5, ca. 15 mm long by 1-1.5 mm wide, epipetalous; filaments subsessile or sessile; anthers longitudinal dehiscence,

dorsifixed. **Ovary** inferior, 6-6.2 mm long by 2-2.5 mm in diam., glabrous, 1-loculed, ovule numerous; style long, 1-1.5 cm long, glabrous; stigma 2-lobed, 1.5-1.7 cm long by 2-3 mm in diam., glabrous. **Fruits** berry, subglobose or ellipsoid, ca. 2 cm long by 1.5-1.7 cm in diam., glabrous.

Thailand. ─PENINSULAR: Surat Thani, Nakhon Si Thammarat, Trang, Songkhla, Patthalung.

Distribution: Malay Peninsula.

Ecology: Along flooded area and the riverine, stream or water channel. Flowering Time: August- October. Fruiting Time: June, July.

Specimens examined. ─L. Taing 57 (PSU).

Morinda citrifolia L. Sp. Pl. 1:176.1753; Ridl., Fl. Malay Penin. 2: 117.1923; Corn, Ways. Trees of Malaya 1:550.1952; Backer & Bakh. f., Fl. Java (Spermatoph) 2:350-351. 1965; Wong K. M., Tree Fl. Mal. 4:376.1989. −***M. elliptica*** (Hook. f.) Ridl., J. Straits Branch Roy. Asiat. Soc. 79:86.1918; Ridl., Fl. Malay Penin. 2:118.1923; Corn, Ways. Trees of Malaya 1:550.1952; Corn, Ways. Trees of Malaya 1:550.1950; Wong K. M., Tree Fl. Mal. 4:376. 1989. (Fig. 15, G)

Shrub to medium sized tree, ca. 7 m tall; young twigs or branchlets angular, grey; bark grey, scaly. **Leaves** simple, opposite; lamina lanceolate to narrowly elliptic, 10-15 cm long by 3-5 cm wide, glabrous, apex acute to attenuate, base acute to attenuate, midrib and secondary veins raised beneath surface, margin entire; stipule in pairs, interpetiolar, free, broadly traingular; petioles 8-12 mm long, glabrous. **Inflorescence** axillary, opposite to the leave, solitary capitate 1-2 cm long, bearing numerous flowers; peduncle angular, 2-5 cm long, glabrous. **Flowers** 4-6 merous, 1-1.5 cm long, sessile. **Calyx** campanulate, 1-2 mm long, calys lobes truncate. **Corolla** white, lobes 5-6, united at base; corolla tube green to white, 6-8 mm long, glabrous; corolla lobes ca. 5 mm long, glabrous, margin entire. **Stamens** 5, epipetalous, alternate the corolla lobe; filament ca. 3 mm long, glabrous; anthers slender, ca. 5 mm long, longitudinal dehiscence, medifixed. **Ovary** inferior, glabrous, 4-loculed, ovule 2

per locule; style ca. 12 mm long, glabrous; stigma 2-lobed, each lobe ca. 3 mm long. **Fruit** fleshy syncarp, ovoid to subglobose.

Thailand.−PENINSULAR: Songkhla, Patthalung.

Distribution: Southeast Asia, New Guinea, Australia.

Ecology: In sandy soil of coastal scrub, coastal heath and coastal woodland. Flowering and Fruiting Time: May, June.

Specimens examined. ― L.Taing 48 (PSU).

Neolamarckia cadamba (Roxb.) Bosser, Bull. Mus. Natl. Hist. Nat., B, Adansonia Sér. 4, 6(3): 247. 1985**.―*Anthocephalus cadamba*** (Roxb.) Miq. Fl. Ned. Ind. 2:135. 1856. (Plate 11, D; Fig. 10, A)

Tree, more than 10 m tall; young branchlets terete, grey, glabrous; bark grey, longitudinally fissured. **Leaves** simple, opposite; lamina elliptic to oblong or lanceolate, 8–19.5 cm long by 4–17 cm wide, glabrous on both surface, apex acute or obtuse to rounded, base rounded, obtuse to subcordate, midrib and secondary veins raised underneath surface, margin entire; petioles up to 2.5 cm long, glabrous; stipule rounded to obovate, ca. 3 cm long by 1.8 cm wide, apex rounded, glabrous. **Inflorescence** terminal, globose head 1.5 to 4.5 cm diam., bearing numerous flowers, bracteoles absent; peduncle terete, 1.5 to 3.5 cm long, sparsely hairy to glabrous. **Flowers** bisexual, actinomorphic, ca. 6-7 mm long, pedicel absent (sessile). **Calyx** lobes elliptic, ca. 3 mm long. **Corolla** yellowish or yellow, lobes 5, slightly fused at base, salverform, hairy; tube ca. 4 mm long by 0.5-1 mm in diam.; lobes elliptic-oblong, 1.5-2 mm long by 1-1.5 mm wide, hairy, apex acute, margin entire. **Stamens** 5, epipetalous, 1.5-2 mm long by 0.5-1 mm wide, filaments short, anthers longitudinal dehiscence. **Ovary** inferior, 2-loculed, ovule more than 10 per locule; style long, exserted, ca. 7 mm long, hairy; stigma ca. 1 mm long by 0.5 mm wide. **Fruits** not seen.

Thailand.―PENINSULAR: Songkhla, Pattani.

Distribution: Indochina, Malaysia, Indonesia, Philippines, Singapore, China, India, Australia.

Ecology: Along the riverbank, stream or water channel of the secondary forest.

Specimens examined. ―L. Taing 81 (PSU).

Prismatomeris tetrandra (Roxb.) K. Schum. subsp. ***malayana*** (Ridl.) J. T. Johanss., Opera Bot. 94:29 (1987); Wong K. M., Tree Fl. Mal. 4:395. 1989;―***Prismatomeris malayana*** Ridl., J. Fed. Malay States Mus. 10: 142. 1920.; Ridl., Fl. Malay. Penin. 2: 116.1923. (Fig. 10, B)

Shrub, ca. 2 m tall, branchlets pale brown to grey, peeled on the outer layer of branchlets. **Leaves** simple, opposite; lamina elliptic to broadly lanceolate, 4.5-9 cm long by 1.2-4 cm wide, glabrous on both surfaces, apex acute or broadly acute to acuminate, base obtuse to cuneate, midrib slightly raised on the upper surface, margin entire; petioles 5-10 mm long, glabrous; stipules interpetiolar, small, triangular, ±1 mm long. **Inflorescence** fasciculate or umbellate in terminal branchlets, bearing 2-5 flowers; peduncle 3-7 mm long, glabrous. **Flowers** actinomorphic, ca. 2.5 cm long; pedicel ca. 6 mm long, glabrous. **Calyx** greenish white, slightly fused at base, campanulate, glabrous; tube 2-2.5 mm long by 2.5 mm in diam.; lobes apex truncate or 4 (-5)-denticulated, <0.3 mm. **Corolla** white, lobes 5-6, united at base; tube cylindrical, up to 1.6 cm long, glabrous; lobes elliptic, 1-1.2 cm long by 3-4 mm wide, glabrous, apex acute, margin entire. **Stamens** 5-6, epipetalous, alternate the corolla lobes; filaments short, 1-1.5 mm long; anthers 2.5-3.5 mm long by 1 mm wide. **Disc** annular (ring-liked), glabrous, ca. 0.5 mm long by 1-1.2 mm in diam. **Ovary** inferior, 2-loculed, ovule 1 per locule; style white, ca. 3.5 mm long, glabrous; stigma white, 2-lobed, free, ca. 3 mm long. **Fruit** not seen.

Thailand. − NORTH-EASTERN: Loei; EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Phachuap Khiri Khan; CENTRAL: Saraburi; PENINSULAR: Satun, Songkhla.

Distribution: ―Cambodia, Peninsular Malaysia, China, Lankawi, Sumatra and Borneo.

Ecology: In sandy soil of coastal heath forest and coastal woodland, edge of the peat swamp. Flowering Time: March, August.

Specimens examined. ―L. Taing 71 (PSU).

88. *Psychotria* sp. (Fig. 7, C)

Shrub, ca. 2.5 m tall; branchlets terete, dark green to dark brown, glabrous; bark grey or greyish brown. **Leaves** simple, opposite; lamina lanceolate, 8-16 cm long by 4-5.5 cm wide, glabrous on both surface, apex acuminate to acute, base attenuate to cuneate, midrib raised beneath surface, margin entire, domatia in the axils of the secondary veins; petioles 1.5-2 cm long, glabrous; stipule interpetiolar, ca. 10 mm long by 4-6 mm wide, sparsely hairy to glabrous, apex acuminate, margin entire. **Inflorescence** terminal, compound cyme, bearing numerous flowers; peduncle 1-1.5 cm long and glabrous; rachis 1-1.5 cm long and hairy; bracts up to 10 mm long by 5 mm wide, sparsely hairy to glabrous, apex ciliate, margin entire; bracteole small, <0.5 mm long and wide, apex and margin ciliate. **Flowers** actinomorphic, 4-5 mm long (with pedicel); pedicel ca. 2 mm long, bearing sparsely hairy. **Calyx** lobes 7, slightly fuseed at base, campanulate; calyx tube ca. 1 mm long by 1 mm in diam., glabrous; calyx lobes triangular, <1 mm long by 0.5 mm wide, apex acute, margin ciliate. **Corolla** greenish white, lobes 7, slightly fused at base; tube ca. 1 mm long by 1-1.2 mm in diam.; lobes ovate, ca. 1.5 mm long by 1 mm wide, glabrous outside but densely tomentose at the mouth of the inner lobes, apex acute, margin entire. **Stamens** 7, free, inserted to the corolla lobes; filaments ca. 0.5 mm long, glabrous; anthers 0.5-0.7 mm long, longitudinal dehiscence, dorsifixed. **Disc** whitish, annular, glabrous, ca. 1 mm in diam. **Ovary** inferior, 2-loculed, ovule one per locule; style 2-3 mm long (included stigma), glabrous; stigma 2-lobed. **Fruit** not seen.

Thailand.―PENINSULAR: Songkhla**,** Patthalung

Distribution: ___

Ecology: In sandy soil areas of the coastal heath forest and coastal woodland. Flowering time: December, January.

Specimens examined. ―L. Taing 124 (PSU).

Tarenna wallichii (Hook.f.) Ridl., Fl. Mal. Pen. 2:106. 1923; Wong K. M., Tree Fl. Mal. 4:415. 1989. (Plate 11, E; Fig. 11, H)

Shrub, ca. 1 m tall; branchlets terete, dark greyish brown or dark brown, glabrous; bark grey or greyish brown, lanticellate. **Leaves** simple, opposite; lamina lanceolate to elliptic, 6-13 cm long by 2.5-5.5 cm wide, glabrous on both surface, apex acuminate to emarginate, base obtuse to cuneate, midrib raised beneath surface, margin entire, domatia in the axils of the secondary veins; petioles 4-10 mm long, glabrous; stipule interpetiolar, triangular, 3.5-5 mm long by 3-3.5 mm wide, sparsely hairy on the outer surface, apex acute, margin entire. **Inflorescence** terminal, compound cyme, bearing numerous flowers; peduncle 2-3 cm long, glabrous; rachis 1-1.3 cm long, sparsely hairy; bracts triangular, 1.5-2 mm long by 1-1.5 mm wide, sparsely hairy, apex acute, margin ciliate; bracteoles 1-1.5 mm long by 0.5-1 mm wide, sparsely hairy, apex acute, margin ciliate. **Flowers** actinomorphic, 6-8 mm long (with pedicel); pedicel ca. 2 mm long, covered with scattered hairs. **Calyx** 5-lobed, campanulate; calyx tube 1-1.5 mm long by 1.5 mm in diam., sparsely hairy; calyx lobes triangular, 1 mm long by 0.7 mm wide, sparsely hairy, apex acute, margin ciliate. **Corolla** white or yellowish, 5-lobed, fused at base; tube ca. 2.5 mm long by 1-1.5 mm in diam., glabrous or sparsely hairy outside; lobes oblong, 4-5.5 mm long by 1-1.5 mm wide, glabrous outside but densely tomentose at the mouth of the inner lobes, apex obtuse to broadly acute, margin entire. **Stamens** 5, free, inserted into the corolla lobes; filaments ca. 1 mm long and covered with scattered tomentose; anthers ca. 3 mm long, longitudinal dehiscence, basifixed. **Disc** greenish or yellowish, annular and glabrous. **Ovary** inferior, style 6-7 mm long (included stigma), base hairy, upper part glabrous; stigma reddish, 2-lobed. **Fruit** not seen.

Thailand.―PENINSULAR: Songkhla**.**

Distribution:—Malaysia, Borneo.

Ecology: In sandy soil areas of the thick coastal scrub communities, coastal heath forest and coastal woodland. Flowering time: November-January.

Specimens examined. —L. Taing 123 (PSU).

RUTACEAE

Melicope lunu-ankenda (Gaertn.) T. G. Hartley, Sandakania. 4:61. 1994; Zhang D. et al. in Fl. China 11:71. 2008.—***Euodia roxburghiana*** (Cham.) Benth. ex Hook. f., Fl. Hongk. 59.1861; Hooker J. D., Fl. Brit. India 1:487-488. 1875; Corn., Ways. Trees of Malaya 1:572. 1952; Stone B.C., Tree Fl. Mal. 1:379. 1972. (Plate 13, G; Fig. 15, C)

Shrub, ca. 5 m tall; branchlets subterete to quadrangular, dark greyish brown, hairy; bark grey. Leaves compound, trifoliolate, glanduliferous; lamina elliptic, 6-12.5 cm long by 3.5-4 cm wide, apex acute to acuminate, base attenuate to cuneate (rarely rounded), midrib highly raised beneath surface and sparsely hairy, margin entire; petioles 3-6.5 cm long, sparsely hairy; petiolules 5–10 mm long, sparsely hairy. Inflorescence axillary, paniculate, 5-10 cm long, numerous flowers; peducle 2-5.5 cm long, hairy; rachis 2-3 cm long, hairy; bracts and bracteoles triangular, 1-1.5 mm long by 1 mm wide, hairy, apex acute, margin entire. **Flowers** actinomorphic, ca. 1.5 mm in diam.; pedicel ca. 2.5 mm long, hairy. **Calyx** lobes 4, broadly triangular, ca. 1 mm long by 0.5 mm wide, hairy, apex acute, margin entire. **Corolla** white, glanduliferous, lobes 4, ovate to elliptic, ca. 2.5 mm long by 1.5 mm wide, glabrous, apex acute, base cuneate to obtuse, margin entire. **Stamens** 4, free, exserted, alternate the corolla lobes; filaments white, ca. 2.5 mm long, glabrous; anthers ca. 1 mm long by 0.5-0.8 mm wide, longitudinal dehiscence, dorsifixed. **Ovary** superior, 1.5-2 mm in diam., hairy, 4-loculed, ovule 1 per locule; style white, ca. 1 mm long, glabrous; stigma ca. 0.5 mm long, 4-lobed. **Fruits** a mericarp, 4-valved; seed 1 per coccus.

Thailand: —PENINSULAR: Nakhon Si Thammarat, Patthalung, Songkhla.

Distribution: − Bhutan, India, Nepal, Philippine, Sri Lanka, Indochina to Malay Peninsula.

Ecology: In the tropical bog area or in the edge between peat swamp and bog area. Flowering Time: June, July.

Specimens examined. ―L. Taing 96 (PSU).

SAPINDACEAE

Mischocarpus sundaicus Blume, Bijdr. Fl. Ned. Ind. 5: 238. 1825; in Engl., Pflanzenr. 98: 1299. 1933; Ham R.W. in Fl. Mal. Ser.I. 11:667, fig. 58g. 1994; Welzen P. C. V. in Fl. Thailand 7(1): 223. 1999; Xia N. & Gadek P. A., in Fl. China 12: 19. 2007. (Fig. 13, B)

Shrubby tree, ca. 5 m tall; branchlets brownish to grey, sparsely hairy; bark commonly brownish to grey or greyish brown, scaly but not flaking. **Leaves** compound, alternate, paripinnate; leaflets 2-4, subopposite arranged on the rachis; lamina lanceolate to elliptic, 4.5-13.5 cm long by 1.7-5.5 cm wide, glabrous on both surfaces, apex acute, base cuneate, midrib raised beneath surface, margin entire, domatia in the axils of the secondary veins; petioles 1-2 cm long, sparsely hairy; rachis 1-2 cm long, sparsely hairy; petiolule 3-4 mm long, glabrous. **Inflorescence** not seen. **Fruit** capsule, red, ca. 10 mm long (including stalk) by 5-5.5 mm in diam., 3-4 angled, sparsely hairy to glabrous; stalk ca. 5 mm long by 1 mm wide, sparsely hairy; seed one per fruit.

Thailand: − EASTERN: Chaiyaphum; CENTRAL: Saraburi; SOUTH-EASTERN: Prachin Buri, Chon Buri, Chanthaburi, Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat,Satun, Songkhla, Narathiwat, Pattani, Yala.

Distribution: Widely distribution from India to South China, throughout Southeast Asia to Australia.

Ecology: In sandy soil of costal heath forest and costal woodland. Flowering Time: June, July, August. Fruiting Time: July, August.

Specimens examined. ―L. Taing 101 (PSU).

SAPOTACEAE

Planchonella obovata (R. Br) Pierre, Not. Bot. 1: 36. 1890; Back. & Bakh.f., Fl. Java (Spermatop.) 2:190.1965; Lee S. & Pennington T. D., in Fl. China 15: 211. 1996;―***P. obovata*** H. J. Lam, Bull. Jard. Bot. Buitenz., 3(8):473; Corn., Ways. Trees of Malaya 1:602. 1965;―***Pouteria obovata*** (R. Br.) Baehni, in Candollea 9:324. 1942. (Fig. 6, F)

Large shrub to tree, ca. 10 m tall; branchlets dark brown, densely hairy; bark brown to grey. **Leaves** simple, alternate; lamina obovate to elliptic (-lanceolate), 2-14 cm long by 1-5.5 cm wide, young leaves hairy and old leaves glabrous, apex obtuse to acute or broadly acute, base cuneate to attenuate, midrib raised on the beneath surface, margin entire; petioles 1-1.5 cm long, densely hairy to glabrous when old; stipule absent. **Inflorescence** axillary (also in the leafless branchlets), fasciculate. **Flowers** actinomorphic, bearing 3-8 flowers in cluster, axillary; pedicel 3-5 mm long, bearing scattered hairs. **Calyx** lobes 5, free, rounded to obovate, 1-2 mm in diam., apex rounded, outer surface covered with brown hairs and inside surface glabrous, margin entire. **Corolla** whitish to light green, lobes 4 (-5), rounded to obovate, 2-3 mm long by 1-0.5 mm in diam., glabrous, apex rounded, margin entire. **Stamens** 5, free; filaments short, ca. 1 mm long, glabrous; anthers ca. 0.5 mm long, longitudinal dehiscence, dorsifixed. **Ovary** 5-loculed, ca. 1 mm in diam., greenish white; ovule 1 per locule; style greenish white, ca. 1.5 mm long; stigmas 5-lobed, fused. **Fruits** not seen

Thailand.―CENTRAL: Samut Prakan, Bangkok; SOUTH-EASTERN: Chon Buri, Rayong, Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Phuket, Trang, Satun, Songkhla, Pattani, Narathiwat.

Distribution: Malaysia, China, India, Australia, Cambodia, Japan, Indonesia.

Ecology: In sandy soil of the coastal woodland. Flowering Time: June.

Specimens examined. ― L. Taing 70 (PSU)

SYMPLOCACEAE

Symplocos sumuntia Buch.-Ham. Ex D. Don, Prod. Fl. Nepal. 145. 1825; Nooteboom H. P., in Fl. Thailand. 2(4): 463-464. 1981. Wu. R. F. & Nooteboom H. P. in Fl. China 15:243. 1996. (Plate 14, H; Fig. 13, C)

Shrub to medium sized tree, ca. 7 m tall; young twigs or branchlets angular, dark brown, hairy; bark brownish to grey. **Leaves** simple, alternate; lamina lanceolate to narrowly elliptic, 5.5-15 by 2.5-4.5 cm, glabrous, apex acute to attenuate or acuminate, base attenuate, midrib impressed above and raised beneath surface, secondary veins 5-10, margin serrate with gland dots; petioles 0.5-1 cm long, glabrous to sparesly hairy. **Inflorescence** axillary, paniculate, 2.5- 4.5 cm long, bearing dense flowers, inflorescence axes pubescence; peduncle angular, ca. 0.5 cm long, pubescence; rachis angular, ca. 3.5 cm long, pubescence; bracts in pairs, brownish, broadly ovate or triangular, ca. 1.5 mm long by 1 mm wide, hairy; bracteoles brownish, broadly ovate or triangular ca. 1.5 mm long by 1 mm wide, hairy. **Flowers** actinomorphic, ca. 3 mm long, subsessile; pedicel very short, < 2 mm long. **Calyx** campanulate; lobes 5, ca. 2.5 mm long by 1 mm wide, glabrous, apex acute. **Corolla** white to yellowish, lobes 5, oblong to narrowly elliptic, 3-3.5 mm long by 1.5 mm wide, glabrous, margin entire. **Stamens** numerous, epipetalous, up to 3.5 mm long; filaments ca. 3.4 mm long, glabrous; anthers tiny, <0.5 mm long, longitudinal dehiscence, dorsifixed. **Ovary** superior, glabrous, 3-loculed, each locule contained ovule 4; disk glabrous; style ca. 3 mm long, glabrous; stigma 3-lobed. **Fruits** fleshy and indehiscent, ovoid, ca. 1 cm long by 0.5 cm wide.

Thailand. − NORTHERN: Chiang Rai (Doi Duan), Chiang Mai (Doi Inthanon); NORTH-EASTERN: Loei (Phu Kradueng); EASTERN: Ubon Ratchathani (Warin Chamrap), Nakhon Ratchasima (Khao Leam), Chaiyaphum (Thung Kamang);

SOUTH-WESTERN: Trat (Khao Kuap), Chanthaburi (Khao Sabap); PENINSULAR: Ranong (Khao Phota Luang Kaeo), Songkhla.

Distribution: Indo-Malayan region, India, China, Korea and Japan.

Ecology: In coastal woodland with regular canopy. Flowering Time: May.

Specimens examined. ─L. Taing 40 (PSU)

VITACEAE

Leea indica (Burm. f.) Merr., Philipp. J. Sc. 14(2): 245. 1919; Ridsdale in Fl. Males.; Ser. 1, Spermat. 7(4): 779. 1975; Chen Z. & Wen J., in Fl. China 12:169. 2007; Welzen P.C.V., in Fl. Thailand. 10(2): 221. 2010. (Fig. 10, H)

Shrub, ca. 3 m tall; branchlets angular, covered with scattered hairs or glabrous; bark greyish green. **Leaves** compound, bipinnate to tripinnate, imparipinnate, alternate, 3-7 leaflets; lamina serrate, elliptic to oblong (rarely lanceolate), 7–16 cm long by 3–5.5 cm wide, glabrous, apex acute to acuminate, base rounded to obtuse, midrib raised beneath surface, margin serrate; petioles 4–10.5 cm long, sparsely hairy or glabrous; rachis long, ca. 15 cm long, glabrous; petiolules up to 1-1.5 cm long, glabrous; stipules obovate, ca. 2 cm long, falling off soon (caducous). **Inflorescence** terminal, opposite to leaves, compound dichasium, bearing numerous flowers; peduncle ca. 5 cm long, sparsely hairy to glabrous; rachis 3-4 cm long, hairy; bracts and bracteoles not seen. **Flowers** actinomorphic, 4-5 mm long by 3–4 mm in diam.; pedicel up to 2 mm long, sparsely hairy. **Calyx** lobes 5, slightly fused at base, campanulate; tubes ca. 1 mm long, glabrous; lobes triangular, ca. 1 mm long by 1 mm wide, glabrous, apex acute, margin entire. **Corolla** greenish white, lobes 5, slightly fused at base; tube 0.5 mm long; lobes ovate to oblong, ca. 2 mm long by 1.5 mm wide, glabrous, apex acute, margin entire. **Stamens** 5, connate to staminodal tube; **staminode** yellowish white, 5-lobed, glabrous, staminodal tube ca. 1 mm long, staminodal lobes ca, 1 mm long; **fertile anthers** 5, ca. 1 mm long, longitudinal dehiscence, dorsifixed; filaments ca. 1 mm long, white, glabrous. **Ovary** superior, ca.

1 mm in diam., glabrous, 6-loculed, ovule 1 per locule; style and stigma greenish white, 1–1.5 mm long, glabrous. **Fruits** not seen.

Thailand.−Throughout the country.

Distribution: Indochina to Malay Peninsula, Myanmar, South China, India, Nepal, Bangladesh, Philippine, Borneo, Northern Austarlia..

Ecology: Understory of coastal woodland, edge of the peat swamp (between peat swamp and coastal woodland). Flower: whole year.

Specimens examined. ―L. Taing 82 (PSU)

Leea rubra Blume ex Spreng., Syst. Veg. 1. 670. 1824; Ridl., Fl. Malay. Penin. 1:485. 1922; Corn., Ways. Trees of Malaya 1:98. 1940; Backer & Bakh. f., Fl. Java (Spermatoph) 2:94. 1965; Welzen. in Fl. Thailand. 10 (2):225. 2010. (Plate 13, H; Fig. 10, G)

Shrub, ca. 2 m tall; branchlets furrowed (grooved), dark red to green, covered with scattered hairs and turn to glabrous when old; bark green to brownish brown. **Leaves** 2-pinnate to 3-pinnate (4-pinnate), alternate, numerous leaflets; **lamina** serrate, lanceolate to linear-lanceolate, 1-9 cm long by 1.5-2.5 cm wide, glabrous, apex acuminate to caudate (rarely acute), base obtuse to cuneate, midrib raised on both surface covered with scattered hairs, secondary veins raised underneath surface and glabrous, margin serrate; petioles long, 4-7.5 cm long, glabrous; rachis long, 5-18 cm long, glabrous; petiolules angular, 2-6 mm long, sparsely hairy to glabrous. **Inflorescence** opposite the leaves, compound dichasium, bearing numerous flowers; peduncle 1-3 cm long, covered with scattered hairs; rachis 2-2.5 cm long, covered with scattered hairs; bracteoles small, triangular, ca. 1 mm long by 1 mm wide, red or dark red, covered with scattered hairs, apex acute, margin entire. **Flowers** actinomorphic, 2-2.5 mm long by 2.5-3 mm in diam.; pedicel short, 1-1.5 mm long, covered with scattered hairs. **Calyx** red to reddish, lobes 5, fused at base, bell-shaped (campanulate) covered with scattered hairs; calyx tube ca. 1 mm long; calyx lobes 0.5 -0.7 mm long by 1 mm wide, apex acute, margin entire. **Corolla** red, lobes 5, slightly

fused at base; corolla tube up to 1 mm long; corolla lobes elliptic-oblanceolate, ca. 1.5 mm long by 1-1.3 mm wide, apex acute (-broadly acute), base adnate to the staminodal tube <1 mm long. **Stamens** 5, connate to the staminodal tube; **staminode** white, 5-lobed, glabrous, staminodal tube ca, 1 mm long, staminodal lobes ca. 0.5 mm long with apex acute; **fertile anthers** 5, longitudinal dehiscence, dorsifixed; filaments ca. 1 mm long, white, glabrous. **Ovary** superior, <1 mm in diam., glabrous, 6–loculars, ovule 1 per locule; style yellowish white, ca. 1.5 mm long by <0.3 mm wide, glabrous. **Fruits** not seen.

Thailand.−NORTHERN: Tak; NORTH-EASTERN: Nong Khai; EASTERN: Buri Ram, Surin; SOUTH-WESTERN: Kanchanaburi; CENTRAL: Nakhon Pathom; SOUTH-EASTERN: Trat; PENINSULAR: Surat Thani, Trang, Songkhla, Narathiwat.

Distribution: India, Banglades, Indochina to Malaysia and Northern Austarlia.

Ecology: In secondary forest, along the roadside, river, channel or stream, rice field, peat swamp edges. Flowering and Fruiting Time: whole year.

Specimens examined. ―L. Taing 66 (PSU).

CHAPTER 3

RESULTS

PART II: WOODY PLANT ARCHITECTURAL DESCRIPTIONS

A total 84 woody plant species in 37 families which grow according to 19 tree architectural models were recorded from various vegetation types (Table 1) (Fig. 3-15). The most dominant architectural model of woody plants in the Songkhla Lake Basin is Champagnat's model (21%), followed by Roux (14%), Attim and Leeuwenberg (11%), respectively (Fig. 2).

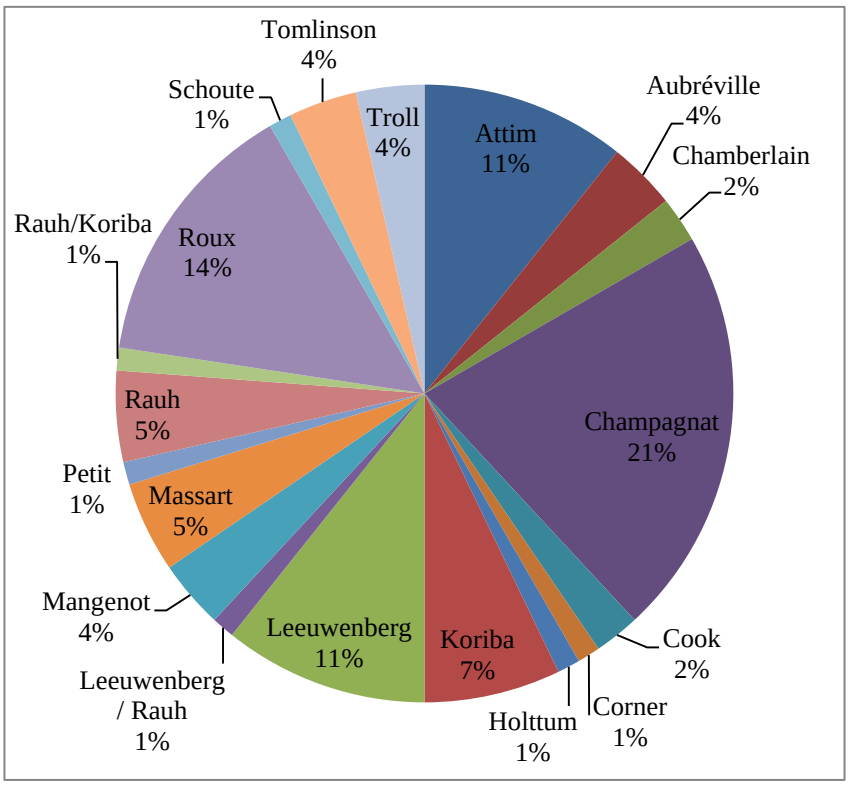

Figure 2: The Percentage of the Woody Plant Architectural Models found in the Songkhla Lake Basin.

Table 1: The list of woody plants with their architectural model types in different vegetation types in the Songkhla Lake Basin.

Family	Scientific name	Architectural Model	Habit	Coastal Scrub	Coastal Heath forest	Coastal woodland	Melaleuca/ Peat vegetation	Tropical Bog	Floodplain	Riparian	Mangrove
Acanthaceae	*Avicennia marina* (Forssk.) Vierh.	Attim	Tree								X
Annonaceae	*Uvaria siamensis* (Scheff.) L. L. Zhou, Y. C. F. Su & R. M. K. Saunders	Mangenot	Shrubby tree					X	X		
	Uvaria rufa Blume	Roux	Woody climber			X					
Apocynaceae	*Cerbera manghas* L.	Koriba	Tree		X						
	Spirolobium cambodianum Baill.	Leeuwenberg	Shrub					X			
	Alyxia reinwardtii Blume	Leeuwenberg/ Rauh	Woody climber	X	X						
Aquifoliaceae	*Ilex umbellulata* (Wall.) Lose.	Koriba	Tree		X			X			
Arecaceae	*Corypha utan* Lam.	Holttum	Palm						X	X	
	Metroxylon sagu Rottb.	Tomlinson	Palm							X	
	Livistona saribus (Lour.) Merr. ex Chev.	Corner	Palm					X			
	Nypa fruticans Wurmb	Schoute	Palm							X	
	Oncosperma horridum (Griff.) Scheff.	Tomlinson	Palm				X				
	O. tigillarium (Jack) Ridl.	Tomlinson	Palm				X	X			
Bignoniaceae	*Dolichandrone columnaris* Santisuk	Koriba	Tree						X		
Combretaceae	*Combretum trifoliatum* Vent.	Roux	Woody climber						X		
	Lumnitzera racemosa Willd.	Attim	Shrub								X

Table 1: Continued.

Family	Scientific name	Architectural Model	Habit	Coastal Scrub	Coastal Heath forest	Coastal woodland	Melaleuca/ Peat vegetation	Tropical Bog	Floodplain	Riparian	Mangrove
Combretaceae	*Terminalia catappa* L.	Aubréville	Tree		X	X					
Dilleniaceae	*Dillenia suffruticosa* (Griff.) Martelli	Attim	Tree					X			
Dipterocarpaceae	*Dipterocarpus chartaceus* Symington	Massart	Tree		X	X					
	D. alatus Roxb. ex G. Don	Massart	Tree			X					
	D. obtusifolius Teijsm. ex Miq.	Massart	Tree			X					
	Hopea odorata Roxb.	Roux	Tree			X					
	Shorea roxburghii G. Don	Roux	Tree		X	X					
	Vatica harmandiana Pierre	Roux	Tree			X					
Euphobiaceae	*Shirakiopsis indica* (Willd.) Esser	Champagnat	Tree						X	X	
Flacourtiaceae	*Flacourtia jangomas* (Lour.) Raeusch.	Champagnat	Tree							X	
Gentianaceae	*Fagraea fragrans* Roxb.	Aubréville	Tree				X	X			
Lamiaceae	*Vitex pinnata* L.	Leeuwenberg	Tree				X	X			
	Volkameria inermis L.	Roux	shrub	X							
Lauraceae	*Litsea glutinosa* (Lour.) C. B. Rob.	Rauh	Tree			X		X			
	Litsea grandis (Nees) Hook. f.	Rauh	Tree			X					
	Neolitsea zeylanica (Nees & T. Nees) Merr.	Rauh/Koriba	Tree		X			X			
Lecythidaceae	*Barringtonia acutangula* (L.) Gaertn.	Leeuwenberg	Tree						X		
Lythraceae	*Lagerstroemia speciosa* (L.) Pers.	Champagnat	Tree						X	X	

Table 1: Continued.

Family	Scientific name	Architectural Model	Habit	Coastal Scrub	Coastal Heath forest	Coastal woodland	Melaleuca/ Peat vegetation	Tropical Bog	Floodplain	Riparian	Mangrove
Lythraceae	*L. floribunda* Jack	Champagnat	Tree					X			
	Sonneratia caseolaris (L) Engl.	Attim	Tree						X	X	X
Malvaceae	*Hibiscus tiliaceus* L.	Attim	Shrubby tree							X	X
	Helicteres hirsuta Lour.	Troll	Shrub			X		X			
	Sterculia foetida L	Aubréville	Tree						X		
	Commersonia bartramia (L.) Merr.	Troll	Tree							X	
	Microcos tomentosa Sm.	Mangenot	Tree			X		X			
Melastomataceae	*Memecylon ovatum* Sm.	Champagnat	Shrub	X							
	M. edule Roxb.	Champagnat	Shrub	X							
	Melastoma malabathricum L. subsp. *malabathricum*	Leeuwenberg	Shrub					X			
Meliaceae	*Aphanamixis polystachya* (Wall.) R. Parker	Champagnat	Tree			X				X	
Moraceae	*Ficus hispida* L. f.	Rauh	Tree			X		X		X	
	Maclura cochinchinensis (Lour.) Corner	Roux	Woody climber			X					
Myrtaceae	*Baeckea frutescens* L.	Champagnat	Shrubby tree		X			X			
	Melaleuca cajuputi Powell	Champagnat	Shrubby tree				X				
	Syzygium antisepticum (Blume) Merr. & L. M. Perry	Champagnat	Tree			X					

Table 1: Continued.

Family	Scientific name	Architectural Model	Habit	Coastal Scrub	Coastal Heath forest	Coastal woodland	Melaleuca/ Peat vegetation	Tropical Bog	Floodplain	Riparian	Mangrove
Myrtaceae	*S. cumini* (L.) Skeels	Champagnat	Tree				X				
	S. cf. craibii Chantar. & J. Parn.	Champagnat	Shrubby tree					X			
	S. grande (Wight) Walp. var. *grande*	Champagnat	Tree	X	X	X					
	S. cf. polyanthum (Wight) Walp.	Champagnat	Tree					X			
	Rhodomyrtus tomentosa (Aiton) Hassk.	Attim	Shrub		X	X		X			
Oleaceae	*Olea brachiata* (Lour.) Merr.	Koriba	Shrubby Tree		X	X					
Pandanaceae	*Pandanus odorifer* (Forssk.) Kuntze	Leeuwenberg	Shrubby Tree	X							
Papilionoideae	*Derris indica* (Lam.) Bennet	Koriba	Tree							X	
Phyllanthaceae	*Aporosa octandra* (Buch.-Ham ex D. Don) Vickery var. *malesiana* Schot	Champagnat	Tree		X	X					
	Antidesma ghaesembilla Gaertn.	Troll	Shrub		X	X		X			
	A. montanum Blume var. *salicinum* (Ridl.) P. Hoffm.	Champagnat	Shrub			X					
	Glochidion rubrum Blume	Cook	Shrub					X		X	
	Hymenocardia punctata Wall. ex Lindl.	Roux	Shrub					X		X	
Primulaceae	*Ardisia crenata* Sims	Massart	Shrub			X					
Rhamnaceae	*Colubrina asiatica* (L.) Brongn. var. *asiatica*	Roux	Shrub	X							

Table 1: Continued.

Family	Scientific name	Architectural Model	Habit	Coastal Scrub	Coastal Heath forest	Coastal woodland	Melaleuca/ Peat vegetation	Tropical Bog	Floodplain	Riparian	Mangrove
Rhizophoraceae	*Bruguiera cylindrica* (L.) Blume	Attim	Tree								X
	Rhizophora apiculata Blume	Attim	Tree								X
	Carallia brachiata (Louz.) Merr.	Roux	Tree			X					
Rubiaceae	*Canthium sp.*	Cook	Tree					X			
	Psychotria sp.	Koriba	Shrubby tree		X	X					
	Prismatomeris tetrandra (Roxb.) K. Schum. subsp. *malayana (*Ridl.) J. T. Johanss.	Roux	Shrub		X	X					
	Chassalia curviflora (Wall.) Thwaites	Leeuwenberg	Shrub		X	X					
	Ixora javanica (Blume) DC.	Leeuwenberg	Shrub		X	X					
	Kailarsenia campanula (Ridl.) Tirveng.	Leeuwenberg	Shrub						X	X	
	Tarenna wallichii (Hook. f.) Ridl.	Leeuwenberg	Shrub	X	X	X					
	Catunaregam tomentosa (Blume ex DC.) Tirveng.	Mangenot	Shrubby tree		X						
	Morinda citrifolia L.	Petit	Tree	X	X			X			
	Neolamarckia cadamba (Roxb.) Bosser	Roux	Tree							X	
Rutaceae	*Melicope lunu-ankenda* (Gaertn.) T. G. Hartley	Attim	Shrubby tree					X			
Sapindaceae	*Mischocarpus sundaicus* Blume	Champagnat	Shrubby tree		X	X					

Table 1: Continued.

Family	Scientific name	Architectural Model	Habit	Coastal Scrub	Coastal Heath forest	Coastal woodland	Melaleuca/ Peat vegetation	Tropical Bog	Floodplain	Riparian	Mangrove
Sapotaceae	*Planchonella obovata* (R. Br.) Pierre	Rauh	Shrub to tree			X					
Symplocaceae	*Symplocos sumuntia* Buch.-Ham. ex D. Don	Champagnat	Tree			X		X			
Vitaceae	*Leea rubra* Blume ex Spreng.	Chamberlain	Shrub							X	
	Leea indica (Burm. f.) Merr.	Chamberlain	Climbing shrublets to treelets			X					

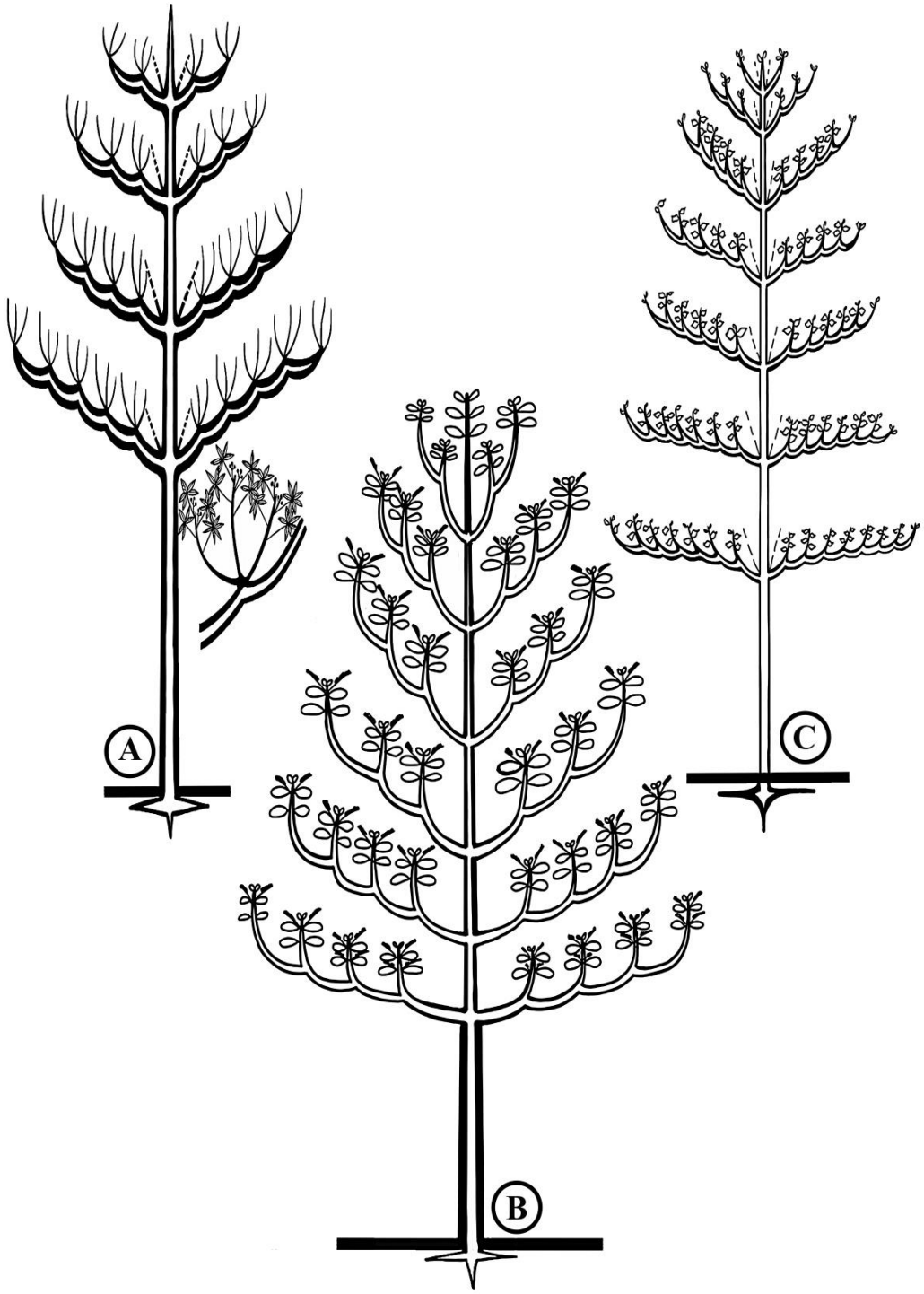

Figure 3: Architectural models of Woody Plants in Songkhla Lake Basin. **A-C. Aubreville's model: A.** ***Sterculia foetida*** L.; **B.** ***Fagraea fragrans*** Roxb.; **C.** ***Terminalia catappa*** L.

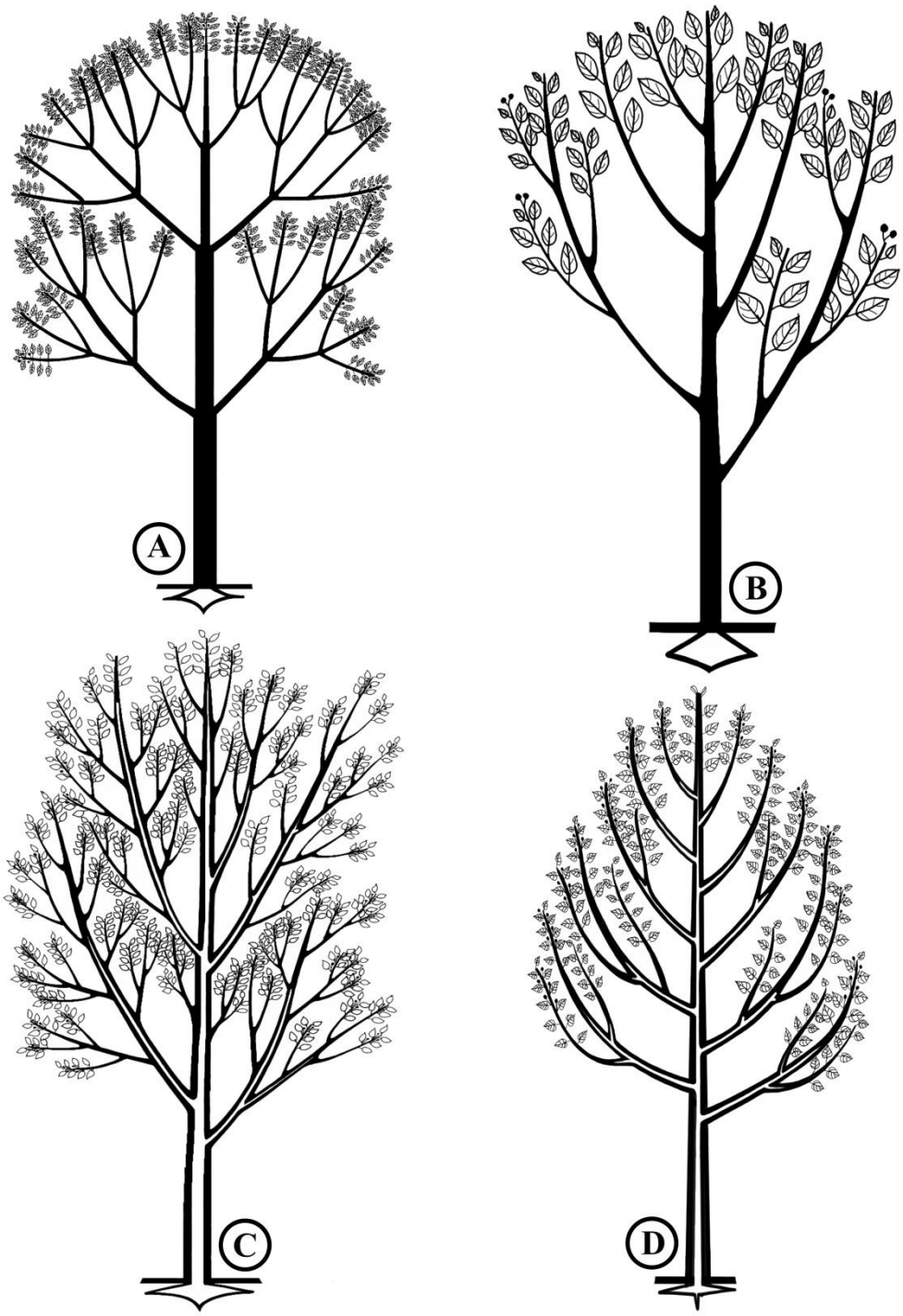

Figure 4: Architectural models of Woody Plants in Songkhla Lake Basin**. A-D. Attim's model: A.** ***Rhodomyrtus tomentosa*** (Aiton) Hassk.; **B.** ***Dillenia suffruticosa*** (Griff.) Martelli**; C.** ***Lumnitzera racemosa*** Willd.; **D.** ***Hibiscus tiliaceus*** L.

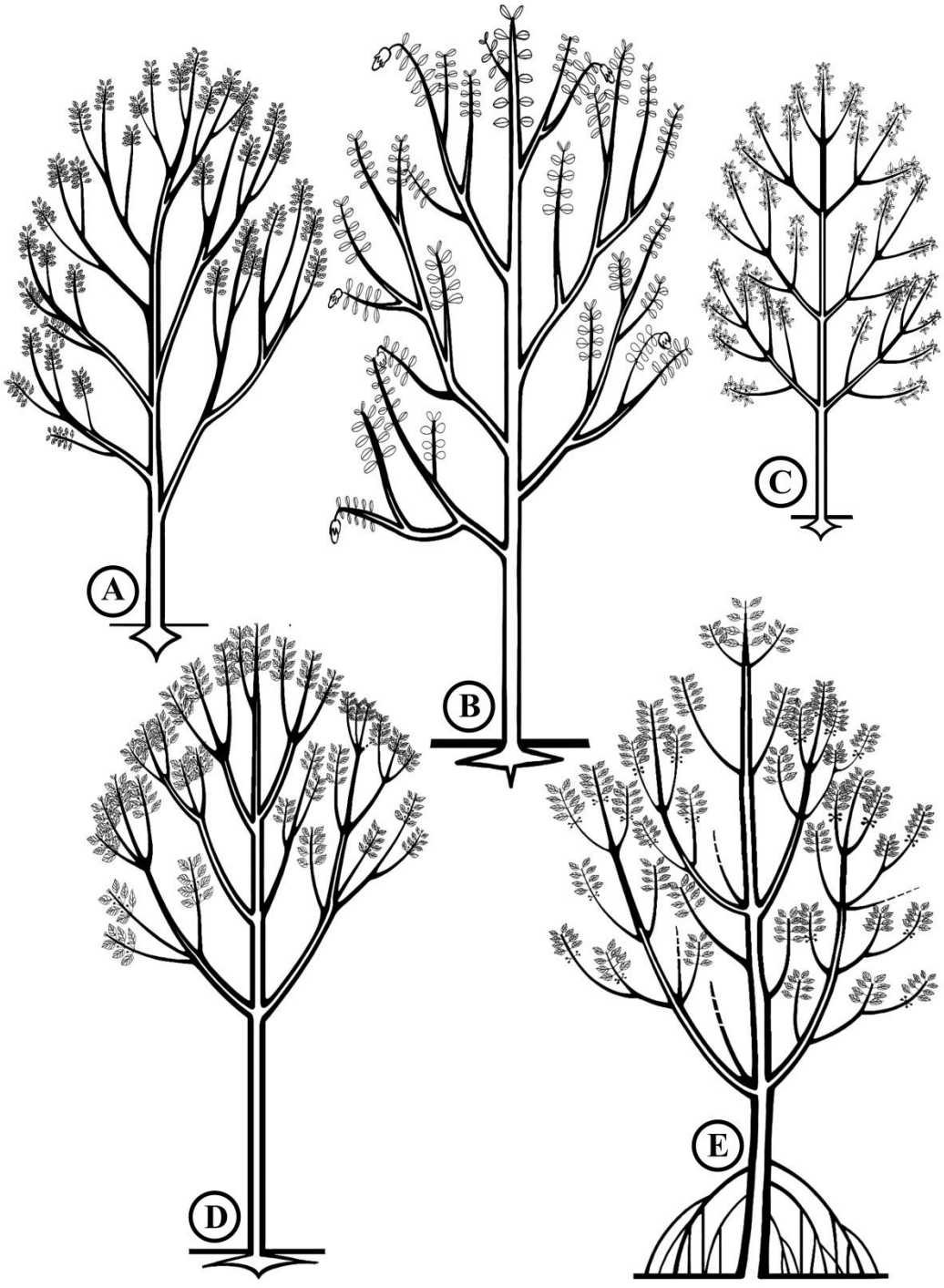

Figure 5: Architectural models of Woody Plants in Songkhla Lake Basin**. A-E. Attim's model: A.** ***Avicennia marina*** (Forssk.) Vierh.; **B.** ***Sonneratia caseolaris*** (L) Engl.; **C.** ***Melicope lunu-ankenda*** (Gaertn.) T. G. Hartley; **D.** ***Bruguiera cylindrica*** (L.) Blume; **E.** ***Rhizophora apiculata*** Blume.

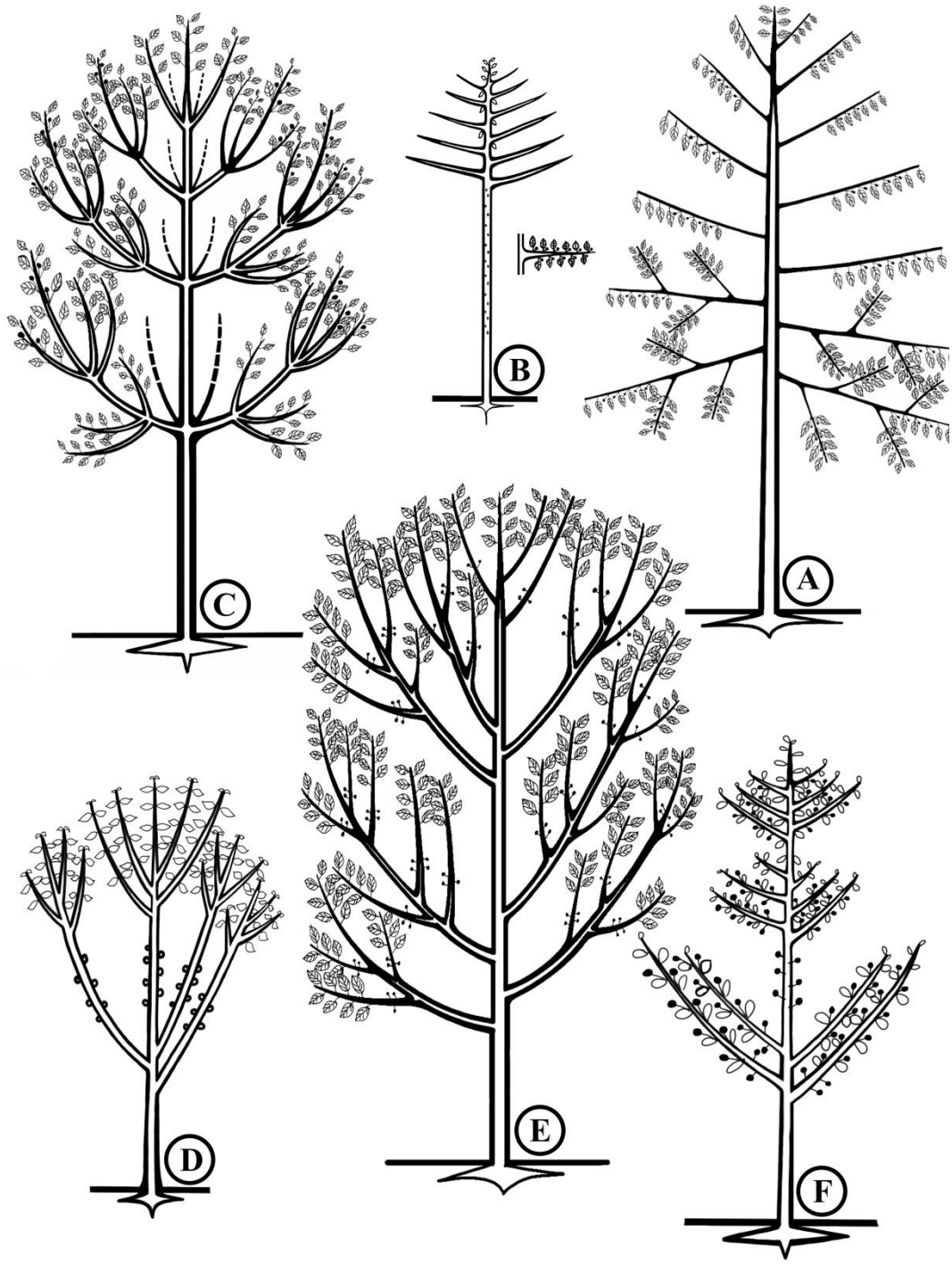

Figure 6: Architectural models of Woody Plants in Songkhla Lake Basin. **A-B. Cook's model**: **A.** ***Canthium sp.***; **B.** ***Glochidion rubrum*** Blume −**C-F. Rauh's model: C.** ***Litsea glutinosa*** (Lour.) C. B. Rob.; **D.** ***Ficus hispida*** L. f.; **E.** ***Litsea grandis*** (Nees) Hook. f.; **F.** ***Planchonella obovata*** (R. Br.) Pierre Spreng.

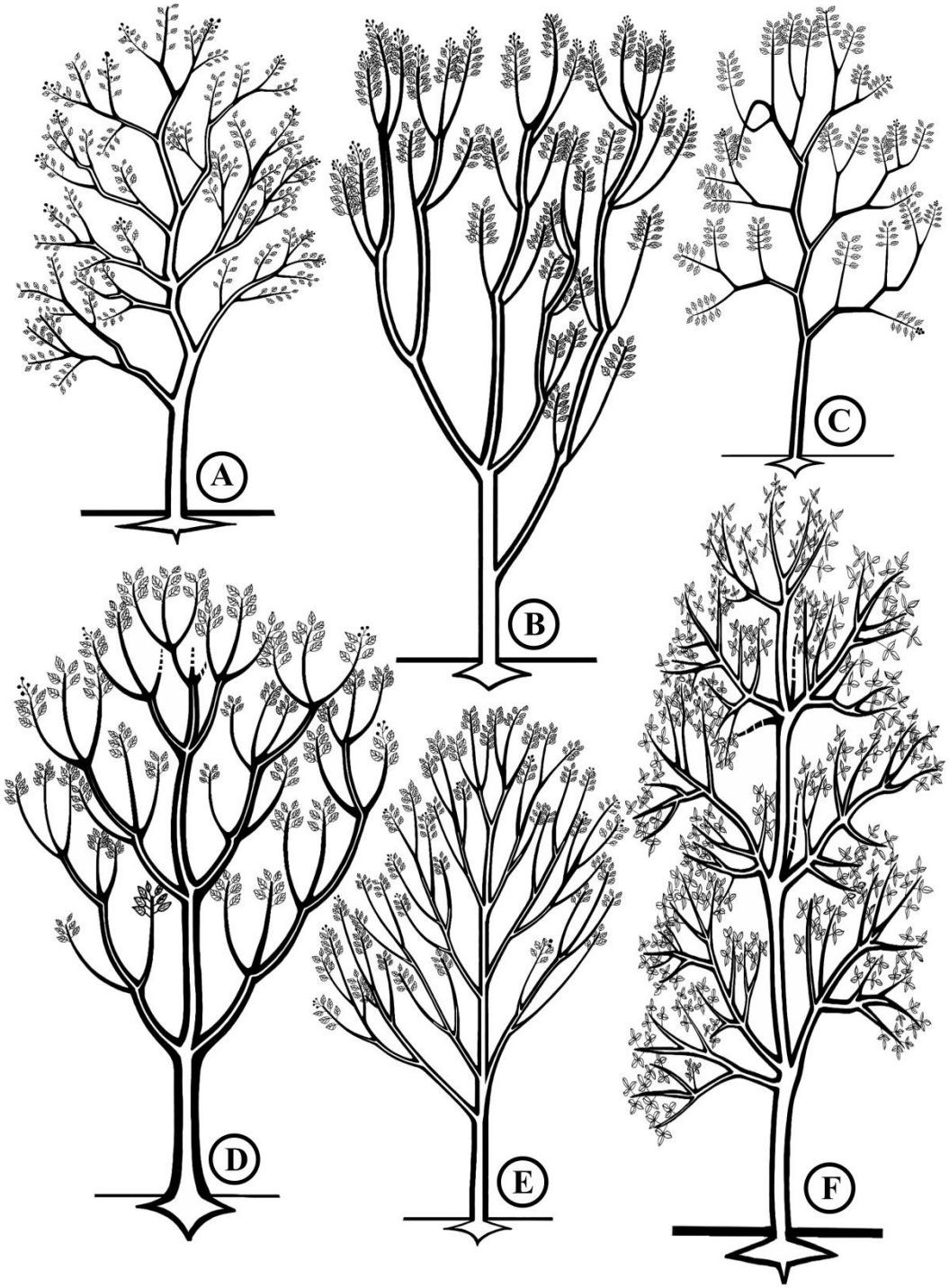

Figure 7: Architectural models of Woody Plants in Songkhla Lake Basin. **A-F. Koriba's model: A.** ***Olea brachiata*** (Lour.) Merr.; **B.** ***Derris indica*** (Lam.) Bennet; **C.** ***Psychotria sp.***; **D.** ***Cerbera manghas*** L.; **E.** ***Ilex umbellulata*** (Wall.) Lose.; **F.** ***Dolichandrone columnaris*** Santisuk

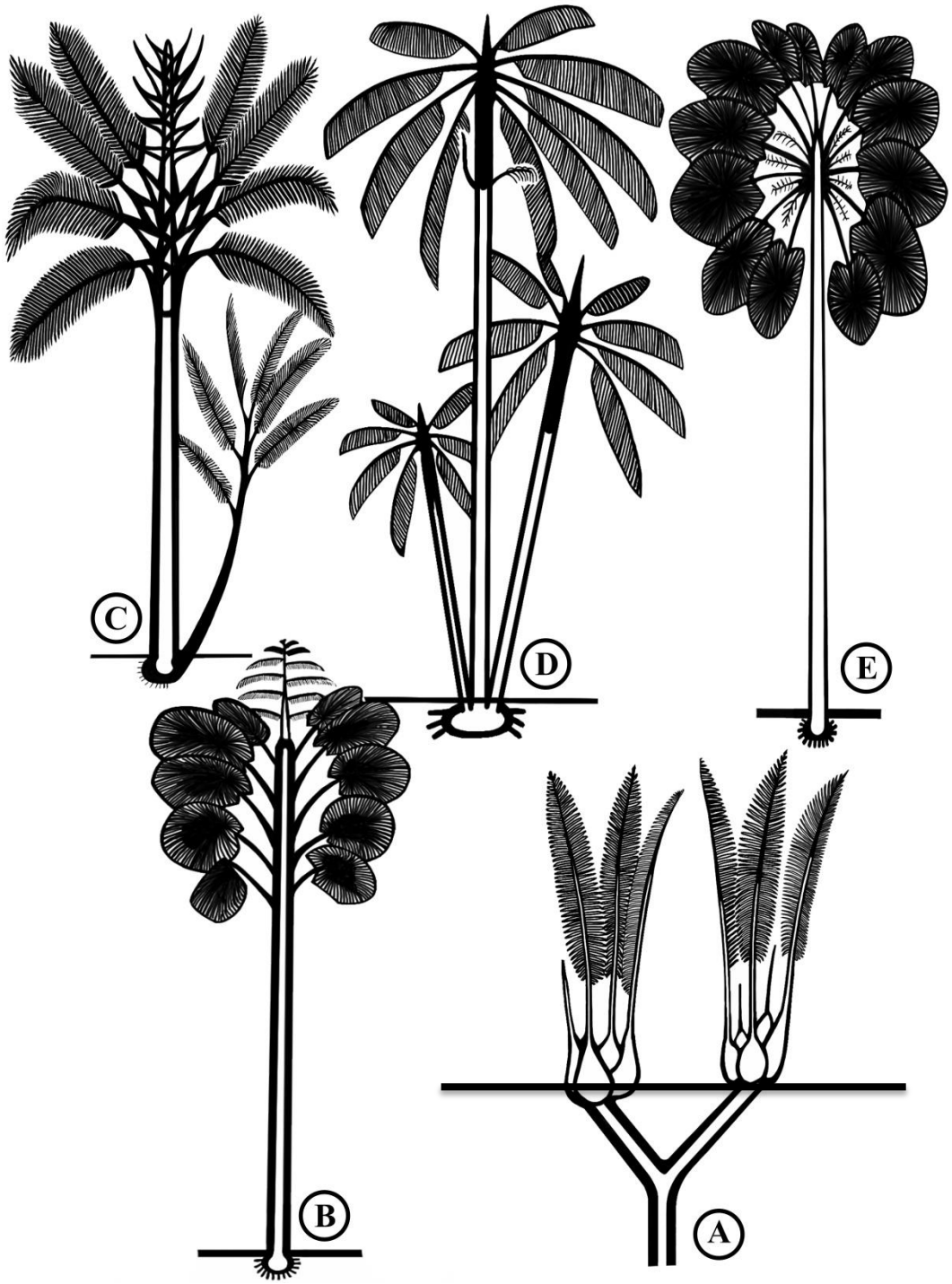

Figure 8: Architectural models of Woody Plants in Songkhla Lake Basin**. A. Schoute's model:** ***Nypa fruticans*** Wurmb –**B. Holttum's model:** ***Corypha uta****n* Lam. –**C-D. Tomlinson's model: C.** ***Metroxylon sagu*** Rottb.; **D.** ***Oncosperma horridum*** (Griff.) Scheff. −**E. Corner's model:** ***Livistona saribus*** (Lour.) Merr. ex Chev.

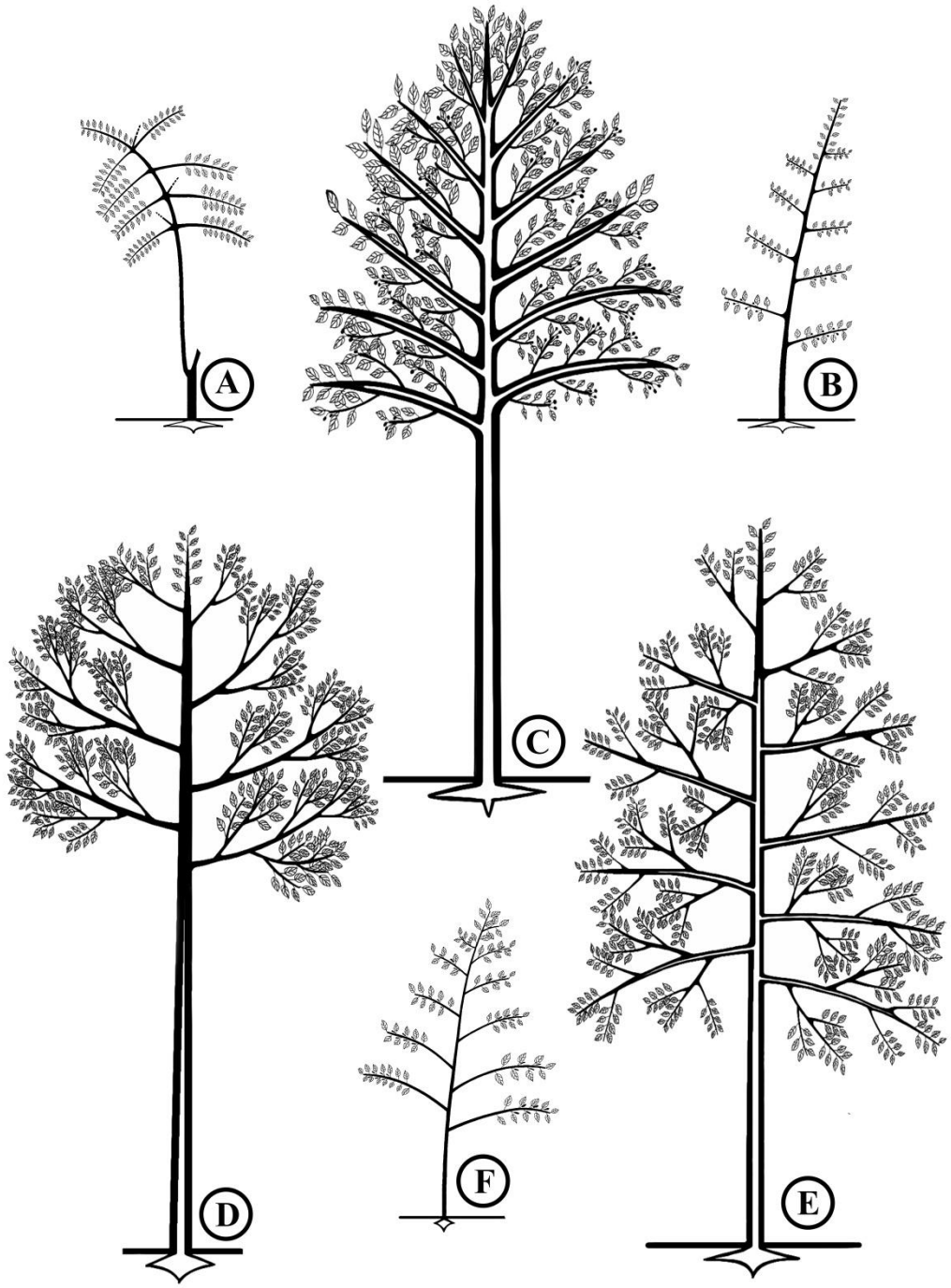

Figure 9: Architectural models of Woody Plants in Songkhla Lake Basin. **A-F. Roux's model: A.** ***Combretum trifoliatum*** Vent.; **B.** ***Maclura cochinchinensis*** (Lour.) Corner; **C.** ***Hopea odorata*** Roxb.; **D.** ***Shorea roxburghii*** *G. Don*; **E.** ***Vatica harmandiana*** Pierre; **F.** ***Colubrina asiatica*** (L.) Brongn. var. ***asiatica***

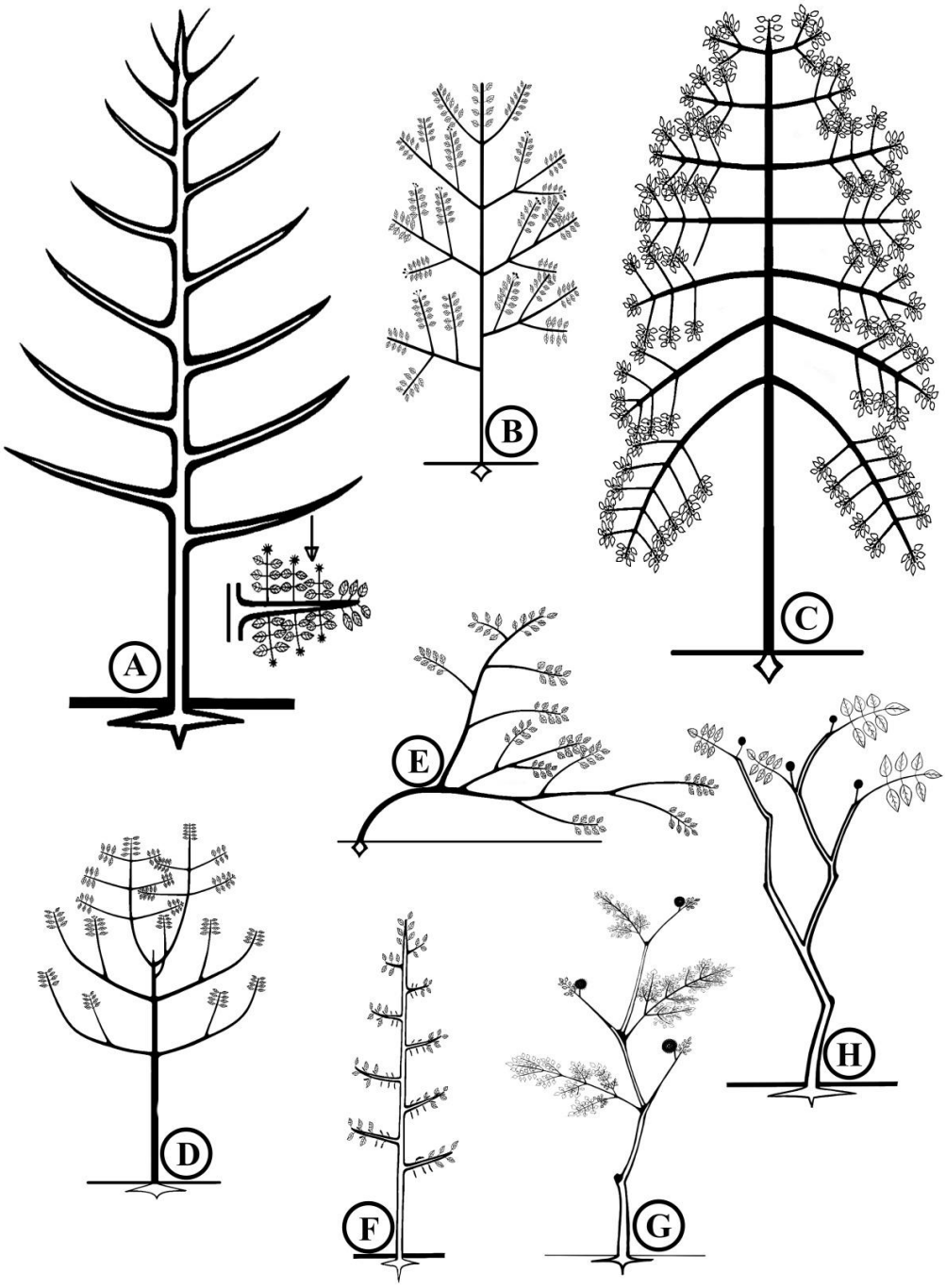

Figure 10: Architectural models of Woody Plants in Songkhla Lake Basin. **A-F. Roux's model: A.** ***Neolamarckia cadamba*** (Roxb.) Bosser; **B.** ***Prismatomeris tetrandra*** (Roxb.) K. Schum. **subsp.** ***malayana*** (Ridl.) J. T. Johanss.; **C.** ***Carallia brachiata*** (Louz.) Merr.; **D.** ***Volkameria inermis*** L.; **E.** ***Uvaria rufa*** Blume; **F.** ***Hymenocardia punctata*** Wall. ex Lindl.; **G-H. Chamberlain's model**: **G.** ***Leea rubra*** Blume ex Spreng.; **H.** ***L. indica*** (Burm. f.) Merr.

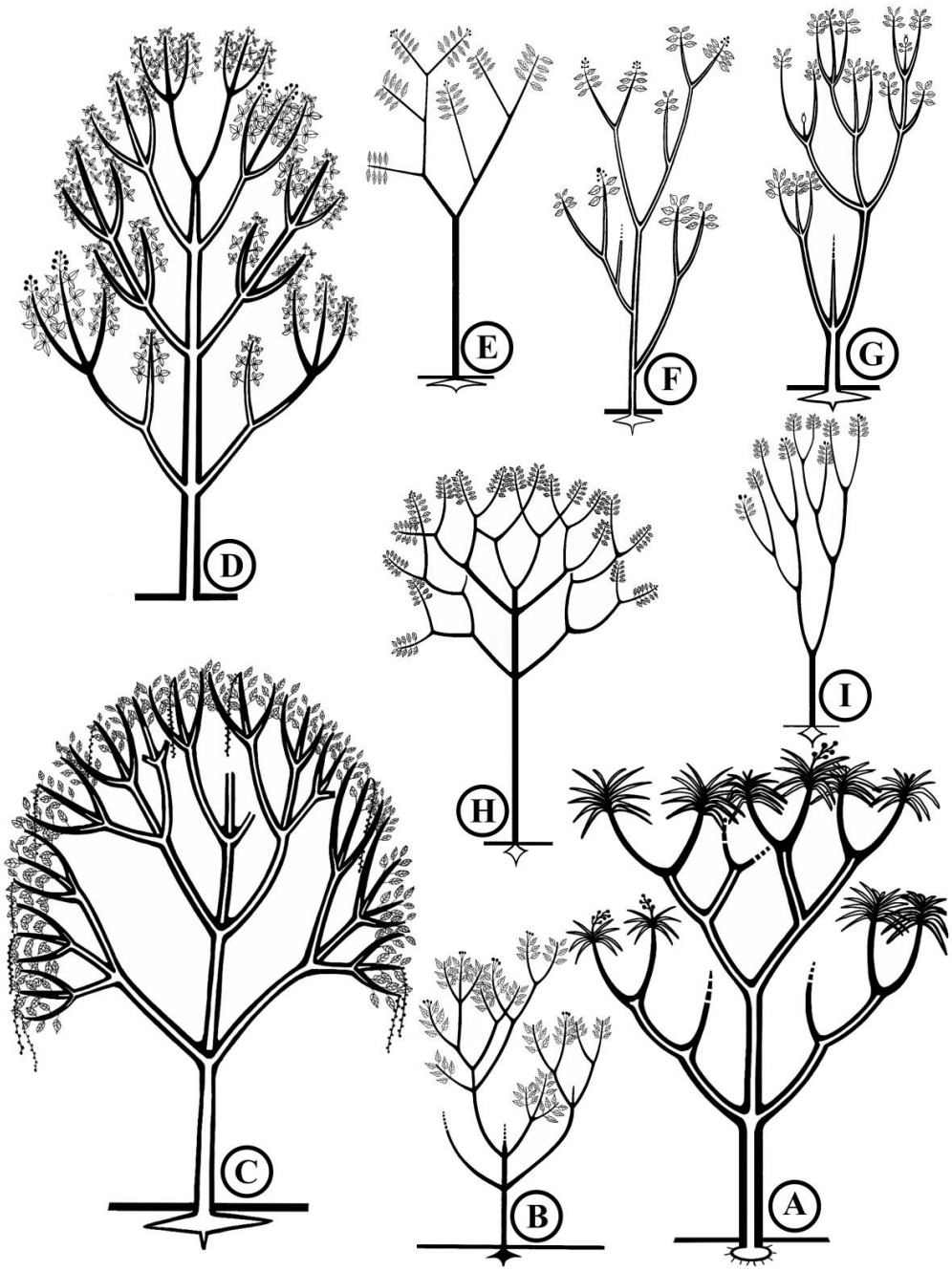

Figure 11: Architectural models of Woody Plants in Songkhla Lake Basin**. A-I. Leeuwenberg's model: A.** ***Pandanus odorifer*** (Forssk.) Kuntze; **B.** ***Melastoma malabathricum*** L. subsp. ***malabathricum***; **C.** ***Barringtonia acutangula*** (L.) Gaertn.; **D.** ***Vitex pinnata*** L.; **E.** ***Chassalia curviflora*** (Wall.) Thwaites; **F.** ***Ixora javanica*** (Blume) DC.; **G.** ***Kailarsenia campanula*** (Ridl.) Tirveng.; **H.** ***Tarenna wallichii*** (Hook. f.) Ridl.; **I.** ***Spirolobium cambodianum*** Baill.

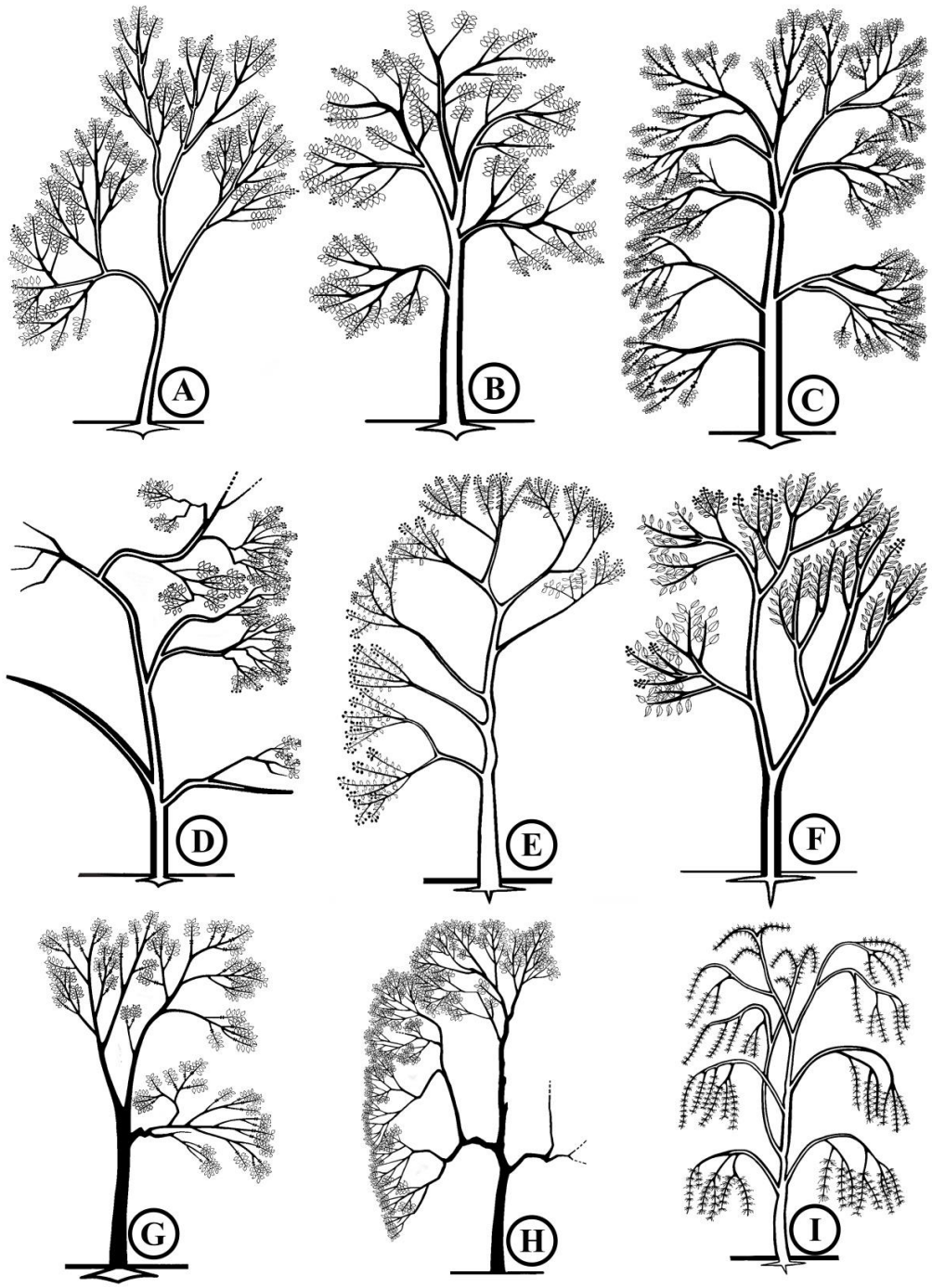

Figure 12: Architectural models of Woody Plants in Songkhla Lake Basin. **A-I. Champagnat's model: A.** ***Syzygium*** **cf.** ***craibii*** Chantar. & J. Parn.; **B.** ***S. grande*** (Wight) Walp. **var.** ***grande***; **C.** ***S.*** **cf.** ***polyanthum*** (Wight) Walp.; **D.** ***S. antisepticum*** (Blume) Merr. & L. M. Perry; **E.** ***S. cumini*** (L.) Skeels; **F.** ***Melaleuca cajuputi*** Powell; **G.** ***Memecylon ovatum*** Sm.; **H.** ***M. edule*** Roxb.; **I.** ***Baeckea frutescens*** L.

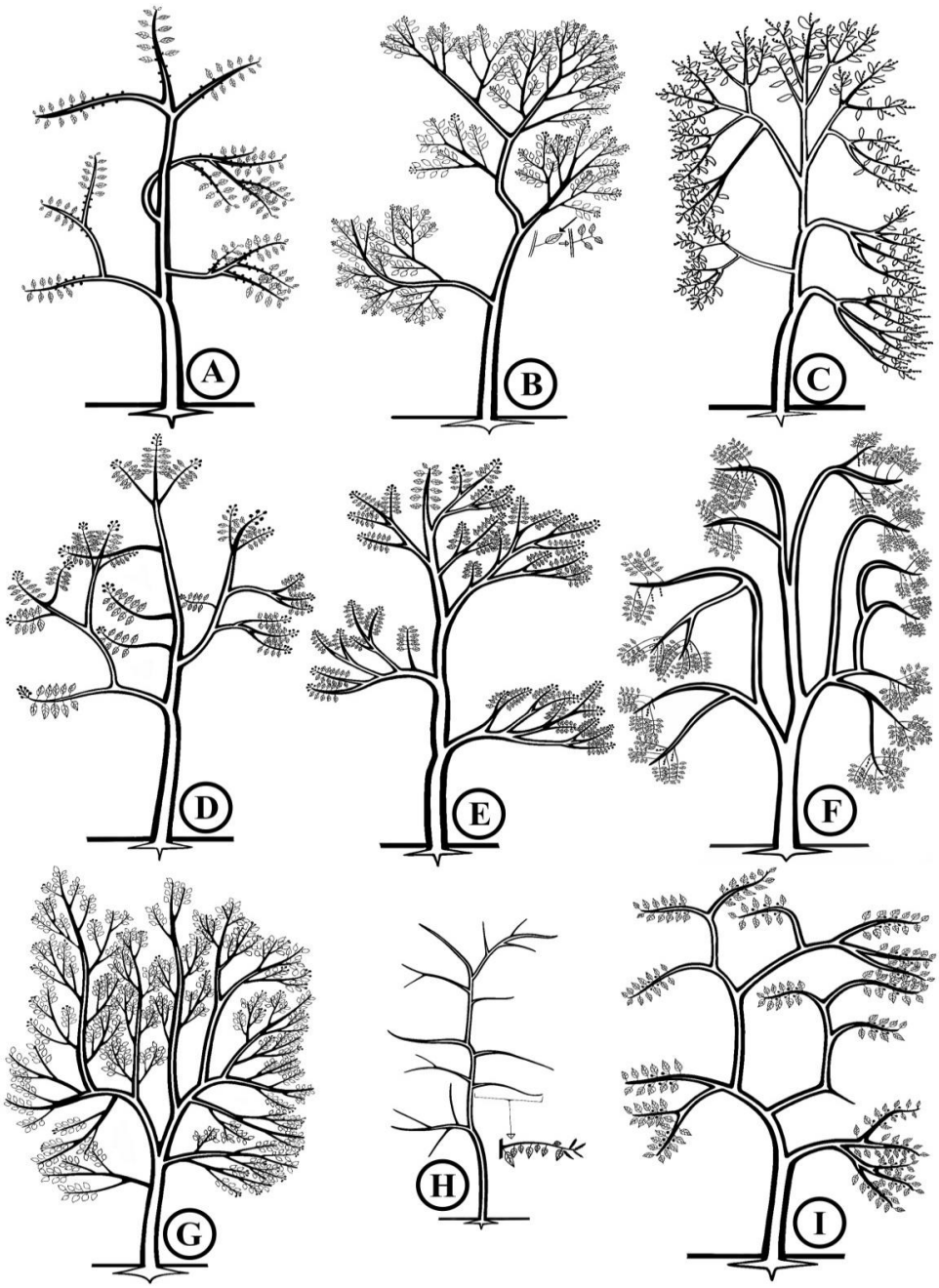

Figure 13: Architectural models of Woody Plants in Songkhla Lake Basin**. A-I. Champagnat's model: A.** ***Aporosa octandra*** (Buch.-Ham ex D. Don) Vickery var**.** ***malesiana*** Schot; **B.** ***Mischocarpus sundaicus*** Blume; **C.** ***Symplocos sumuntia*** Buch.-Ham. ex D. Don; **D.** ***Lagerstroemia floribunda*** Jack; **E.** ***L. speciosa*** (L.) Pers.; **F.** ***Aphanamixis polystachya*** (Wall.) R. Parker**; G.** ***Shirakiopsis indica*** (Willd.) Esser; **H.** ***Antidesma montanum*** Blume **var.** ***salicinum*** (Ridl.) P. Hoffm.; **I.** ***Flacourtia jangomas*** (Lour.) Raeusch.

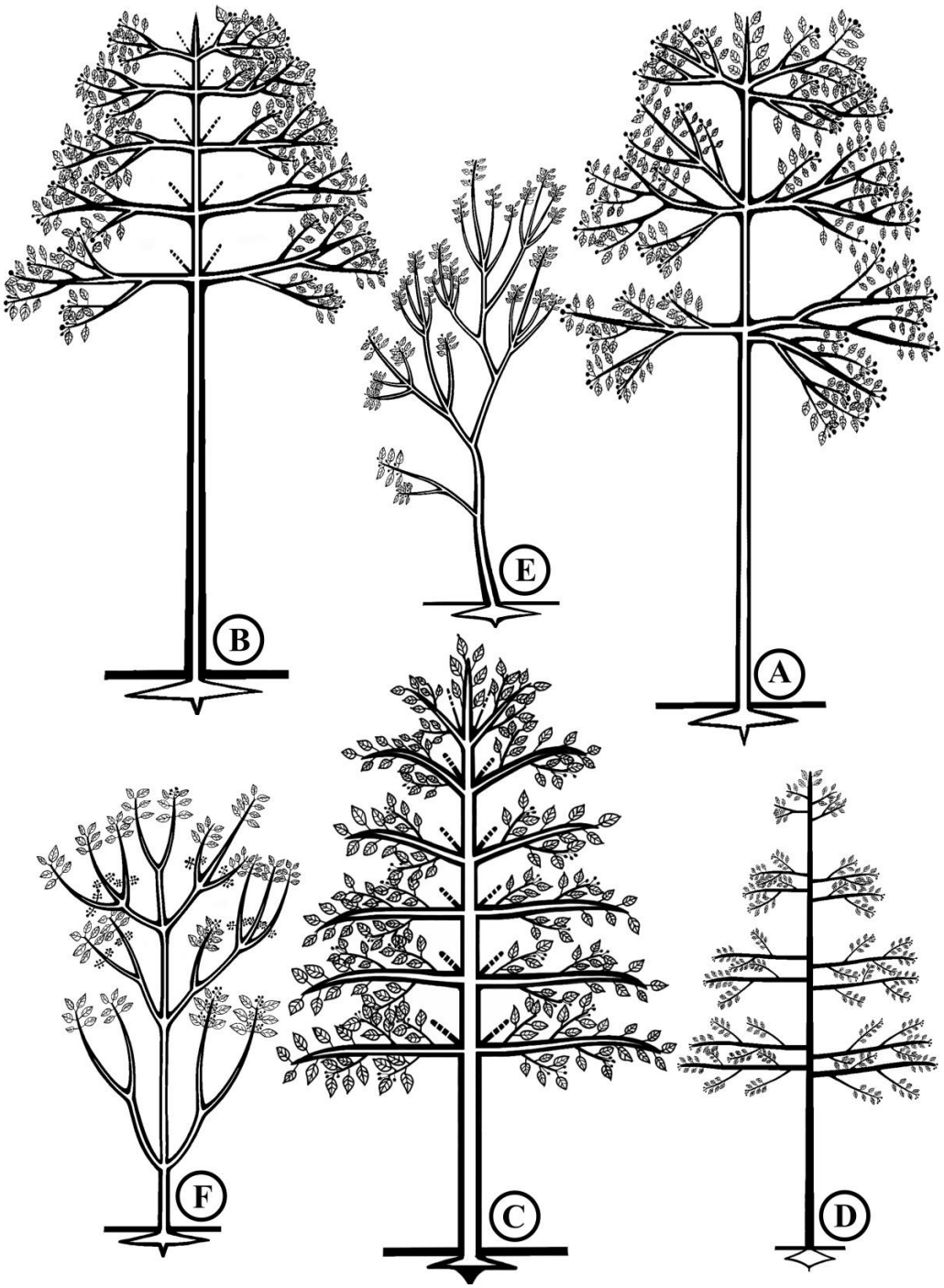

Figure 14: Architectural models of Woody Plants in Songkhla Lake Basin. **A-D. Massart's model: A.** ***Dipterocarpus alatus*** Roxb. ex G. Don; **B.** ***D. chartaceus*** Symington; **C.** ***D. obtusifolius*** Teijsm. ex Miq.; **D.** ***Ardisia crenata*** Sims −**E. Rauh/Koriba's model:** ***Neolitsea zeylanica*** (Nees & T. Nees) Merr. −**F. Leeuwenberg/Rauh's model:** ***Alyxia reinwardtii*** Blume

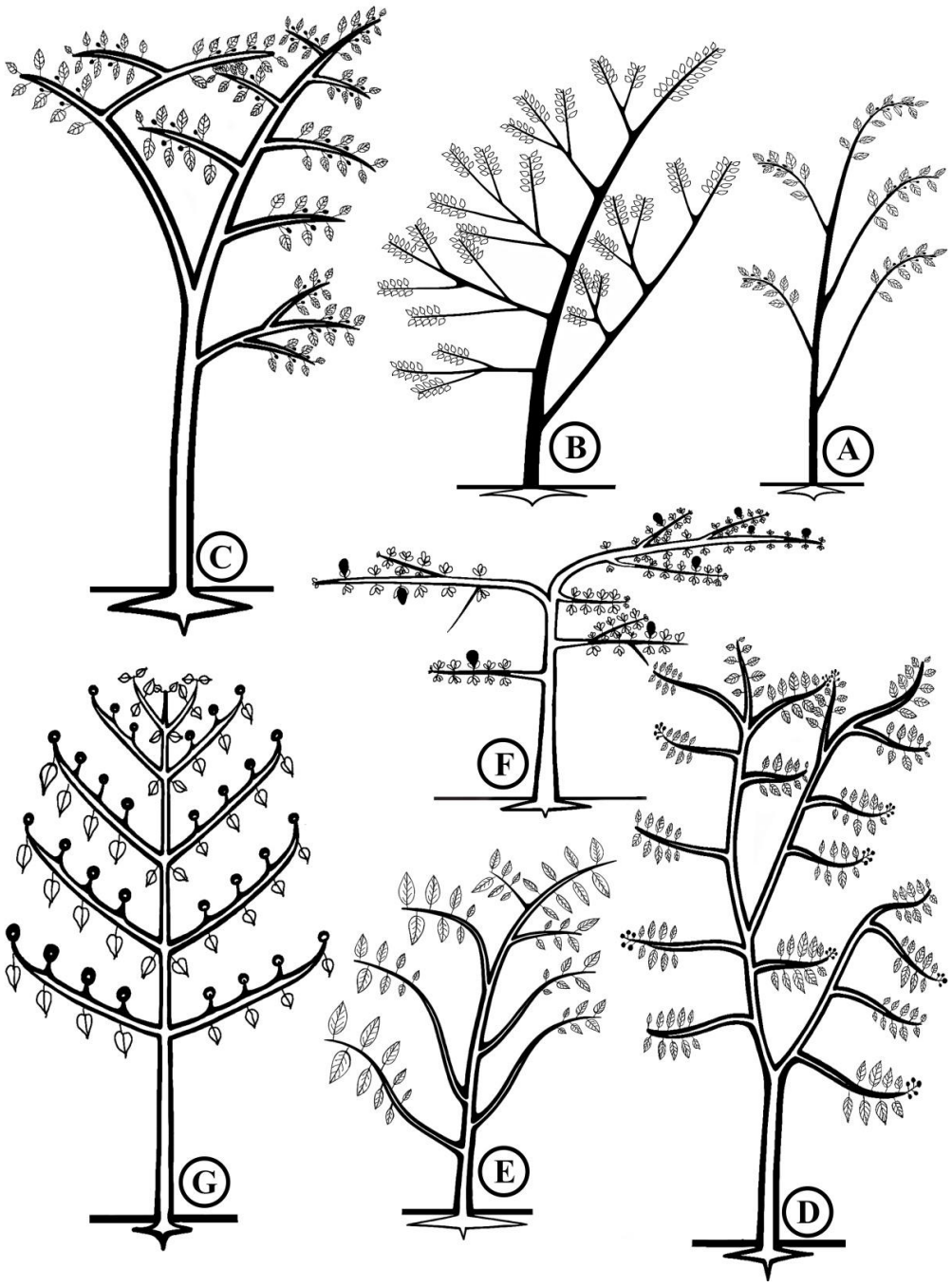

Figure 15: Architectural models of Woody Plants in Songkhla Lake Basin. **A-C. Troll's model: A.** ***Helicteres hirsuta*** Lour.; **B.** ***Antidesma ghaesembilla*** Gaertn.; **C.** ***Commersonia bartramia*** (L.) Merr. **−D-F. Mangenot's model: D.** ***Microcos tomentosa*** *Sm*; **E.** ***Uvaria siamensis*** (Scheff.) L. L. Zhou, Y. C. F. Su & R. M. K. Saunders; **F.** ***Catunaregam tomentosa*** (Blume ex DC.) Tirveng. **−G. Petit's model:** ***Morinda citrifolia*** L.

CHAPTER 4

DISCUSSION AND CONCLUSION

The tree architecture diversity in the Songkhla Lake Basin.

The architectural models of the tree as well as shrubby tree species in the Songkhla Lake Basin areas are quite diverse. In any case, the architectural model of most species found had fallen into the category of the Champagnat's model (Fig. 2). The plants that performed such Champagnat's model varied from one to another plant taxa e.g. *Baeckea frutescens* L. (Fig. 12, I); *Sysygium cumini* (L.) Skeels (Fig. 12, E) - Myrtaceae; *Symplocos sumuntia* Buch.-Ham. ex D. Don – Symplocaceae (Fig. 13, C); *Aporosa octandra* (Buch.-Ham.) ex D. Don Vickery var. *malesiana* Shot (Fig. 13, A); *Antidesma montanum* Blume var. *salicinum* (Ridl.) P. Hoffm.–Phyllanthaceae (Fig. 13, H); *Lagerstoemia floribunda* Jack (Fig. 13, D); *L. speciosa* (L.) Pers. (Fig. 13, E) - Lythraceae; *Aphanamixis polystachya* (Wall.) R. Parker – Meliaceae (Fig. 13, F); *Flacourtia jangomas* (Lour.) Raeusch. – Malvaceae (Fig. 13, I) etc. and this could be seen in almost every type of vegetation (Fig. 16). The shoot of the plants that performed this Champagnat's Model of growth might not differentiate into a distinct "trunk". The stem had, then, differentiated into mostly free forms branches without a main axe, hence such branching had turned into various canopy-forms. It is to be noticed that most tree species of Champagnat's model occurred in such vegetation of low canopy with more/less space between trees e.g. coastal scrub forest; coastal heath; floodplain vegetation etc. (see also table 1). There are quite extreme cases of the stress environment in such vegetation e.g. sandy soil with low humidity in the terrestrial forest along the coastal sandbars; acidic condition with water-log in the bog areas; periodic flooding condition in the floodplain forest etc. Furthermore, the condition of the environment in such vegetation type could change dramatically throughout the year from quite dry to very wet/flooded condition, plant species in those vegetation types occurred mostly in a patch of low canopy and not so dense. In such extreme environmental conditions, an arrangement of tree species with Champagnat's model of growth might be appropriated for such vegetation type. In additions, some other

architectural models of growth could be seen in those mentioned vegetation types as well e.g. Attim's model: *Sonneratia caseolaris* (L.) Engl. – Lythraceae (Fig. 5, B), *Hibiscus tiliaceus* L. - Malvaceae (Fig. 4, D); Aubréville's model: *Fagraea fragrans* Roxb. – Gentianaceae, *Terminalia catappa* L. – Combretaceae, *Sterculia foetida* L. – Malvaceae etc. (Fig. 3, A-C); Koriba's model: *Dolichandrone columnaris* Santisuk – Bignoniaceae (Fig. 7, F), *Olea brachiata* (Lour.) Merr. – Oleaceae etc. (Fig. 7, A); Roux's model: *Neolamarckia cadamba* (Roxb.) Bosser – Rubiaceae (Fig. 10, A), *Hymenocardia punctata* Wall. – Phyllanthaceae (Fig. 10, F), *Hopea odorata* Roxb. – Dipterocarpaceae etc. (Fig. 9, C); Leeuwenberg's model: *Vitex pinnata* L. – Lamiaceae (Fig. 11, D), *Kailarsenia campanula* (Ridl.) Tirveng. – Rubiaceae (Fig. 11, G), *Ixora javanica* (Blume) DC. – Rubiaceae (Fig. 11, F), *Barringtonia acutangula* (L.) Gaertn. – Lecythidaceae (Fig. 11, C), *Melastoma malabathricum* L. – Melastomaceae etc. (Fig. 11, B); Troll's model: *Commersonia bartramia* (L.) Merr. – Malvaceae (Fig. 15, C) etc.

On the other hand, in the areas with more stable condition (less of stresses from the coastal areas i.e. strong wind, salt spray and high density of the sun) of an environment e.g. in the coastal woodland vegetation (Laongpol et al., 2009), could accommodate various species of plant. On that account, many architectural models of growth form of trees could be also recognized. In such case, more trees are able to grow together in a dense patch and due to such stable condition of the surround environment, the plant species of Massart's model of growth with mostly belonging to the family Dipterocarpaceae would dominate in such vegetation type e.g. *Dipterocarpus alatus* Roxb. ex G. Don (Fig. 14, A); *D. chartaceus* Symington(Fig. 14, B); *D. obtusifolius* Teijsm. ex Miq. (Fig. 14, C) etc. In additions, there are many tree species with various architectural models could be seen in such vegetation type as well e.g. Petit's model: *Morinda elliptica* (Hook.f.) Ridl.- Rubiaceae (Fig. 15, G) etc.; Mangenot's model: *Catunaregum tomentosa* (Blume ex DC.) Tirveng. – Rubiaceae (Fig. 15, F), *Uvaria siamense* (Scheff.) L. L. Zhou, Y. C. F. Su & R. M. K. Saunders – Annonaceae (Fig. 15, E) etc., *Microcos tomentosa* Sm.- Malvaceae (Fig. 15, D) etc.; Rauh's model: *Planchonella obovata* (R. Br.) Pierre – Sapotaceae etc. (Fig. 6, F),

Litsea glutinosa (Lour.) C. B. Rob.- Lauraceae etc. (Fig. 6, C) etc.; Roux's model: *Neolamarckia cadamba* (Roxb.) Bosser – Rubiaceae (Fig. 10, A); *Hopea odorata* Roxb. – Dipterocarpaceae (Fig. 9, C) etc.

Besides, some architectural models of the plant growth are restricted to only some taxon and can be change within the genus or even family. It could, therefore, characterize the specific taxon occurred in the area as seen in the case of some selected families e.g. family Arecaceae that some selected of taxa could be characterized by given architectural models e.g. Holttum's model: *Corypha utan* Lam. (Fig. 8, B); Corner's model: *Livistona saribus* (Lour.) Merr. ex Chev. (Fig. 8, E); Tomlinson's model: *Metroxylon sagu* Rottb. (Fig. 8, C) and *Oncosperma horridum* (Griff.) Scheff. (Fig. 8, D); Schoute's model: *Nypa fruticans* Wurmb (Fig. 8, A). In fact, the specific growth characteristic of a plant was the result of the differentiation of the vegetative axes which had fixed and restricted to the specific architectural growth model through the time and space. Such specific growth characteristic of the plant was not easily change and it was always constant (Vester, 1999).

Moreover, some plant species might performed more than one architectural growth models e.g. Rauh/Koriba's model: *Neolitsea zeylanica* (Nees & T. Nees) Merr. – Lauraceae (Fig. 14, E); Leeuwenberg/ Rauh's model: *Alyxia reinwardii* Blume – Apocynaceae (Fig. 14, F). Prévost (1974) and Tomlison (1983) used to mention about the transition between two architectural models. It is impossible to claim every tree has to fix to one described name of the tree architectural model of Hallé et al. (1970, 1978). There are some examples of tree/shrub which grew according to such two architectural models e.g. *Dendropanax arboreus* (L.) Decne. & Planchon (Rauh/Koriba's model) (King, 1998).

The expected vegetation profile of the Songkhla Lake Basin. (Fig. 17)

When the transect line across the Songkhla Lake Basin from the East, on the Sathing Phra sandbar to the West, to the old sandbars of the mainland of the Thai-Malay Peninsula had been taken into account (see also Fig. 17), the expected profile

of the vegetation of the Songkhla Lake Basin across the Sathing Phra Peninsula throughout the mainland had been dominated by the plant species with Champagnat's and Leewenberg's models. They had dominated the coastal scrub vegetation that had marked the first zone of vegetation with woody species next to the open sea towards the East. This has continued to the coastal heath forest westwards which is the zone of small – medium sizes (ca. 5-10 m tall) trees and shrubby species. The vegetation zone next to the coastal heath is the coastal woodland that has been dominated by the plant species with Massart's model which had characterized mostly the species of the Dipterocarpaceae family that occurred in the areas together with the woody plant species of Champagnat's model which mostly belong to plants in Myrtaceae family. They are mostly the under-canopy trees as well as the shrub species. Three layers of the vegetation could be clearly seen in this coastal woodland. Moreover, the coastal woodland might be the most developed vegetation type of the coastal sandbars on both sides of Songkhla Lake which bordered this huge Lake Basin area with a "Sathing Phra" sandbar on the East-side (a sandbar between the South China Sea and the Songkhla Lake) and the main land of the Peninsular Thailand on the West- side. The less physiological stress condition than the nearby habitats had made the area suitable for various plant species and this could be seen from various architectural tree/shrub models of growth. The architectural models of the tropical bog, a special type of wet land along the coast, are also diverse. However in selected cases, it may be dominated by some model such as Corner's model which belonged to the palm species with monopodial crown, while the architectural models of other swamp forest are rather uniform with some selected type of model as this was due to the plant species diversity in such vegetation type.

Conservation aspects

The architectural models of plant species, specific and consistent in a given plant species, could be considered as good characters in recognition of the woody plant species in the Songkhla Lake Basin. It provided typical characters of the native tree/shrub species occurring in the areas and had supported in recognition of the relic vegetation of the areas, since the diversity of such groups of plants in the area is not

that much. This had provided an opportunity in identifying relic vegetation out of the man-made plantations due to the agriculture and/or reforestation. Furthermore, this could give a clear picture in studying the natural vegetation and its development/ change of the study areas.

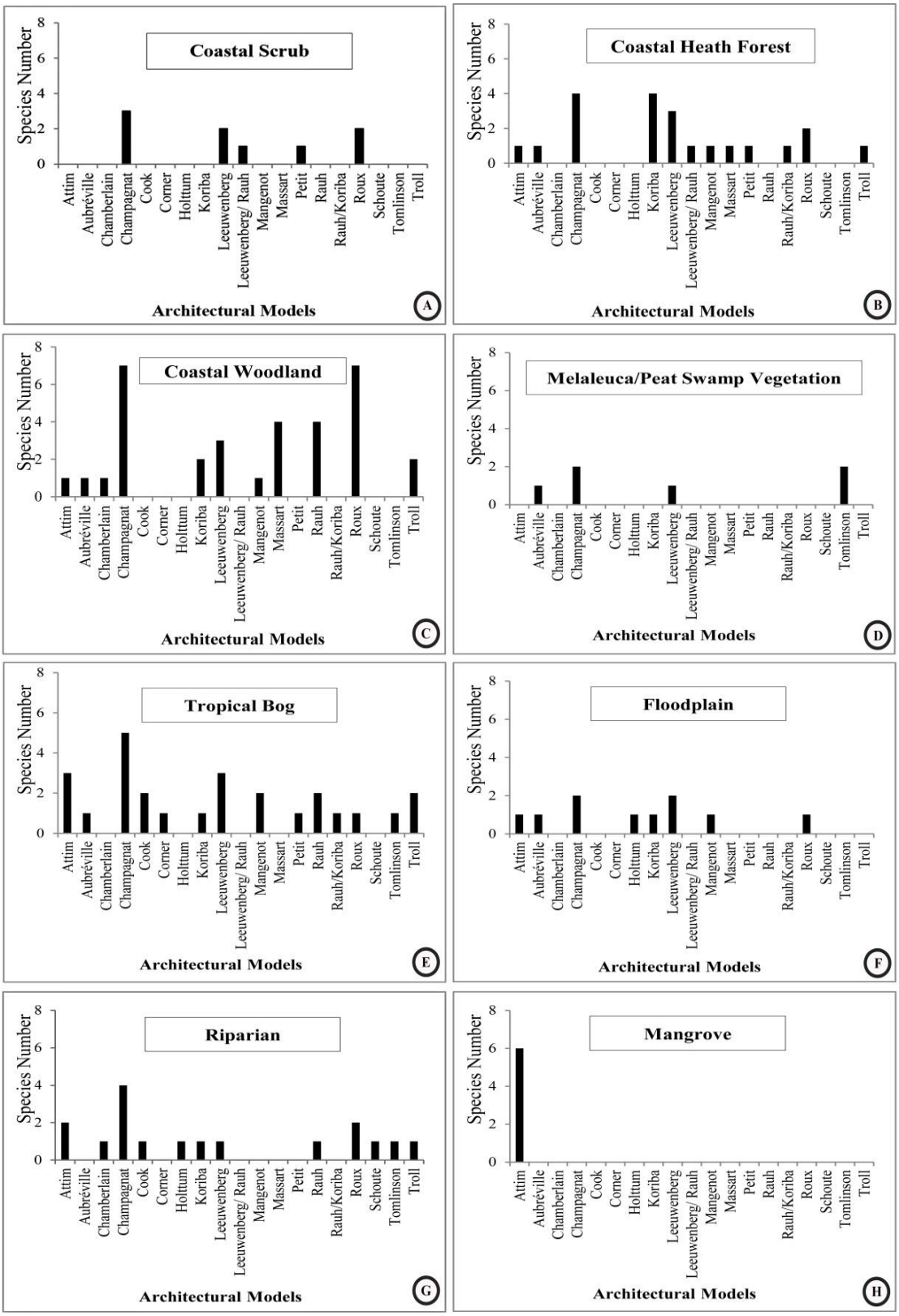

Figure 16: A-H: The numbers of species in each tree architectural model due to different vegetation types.

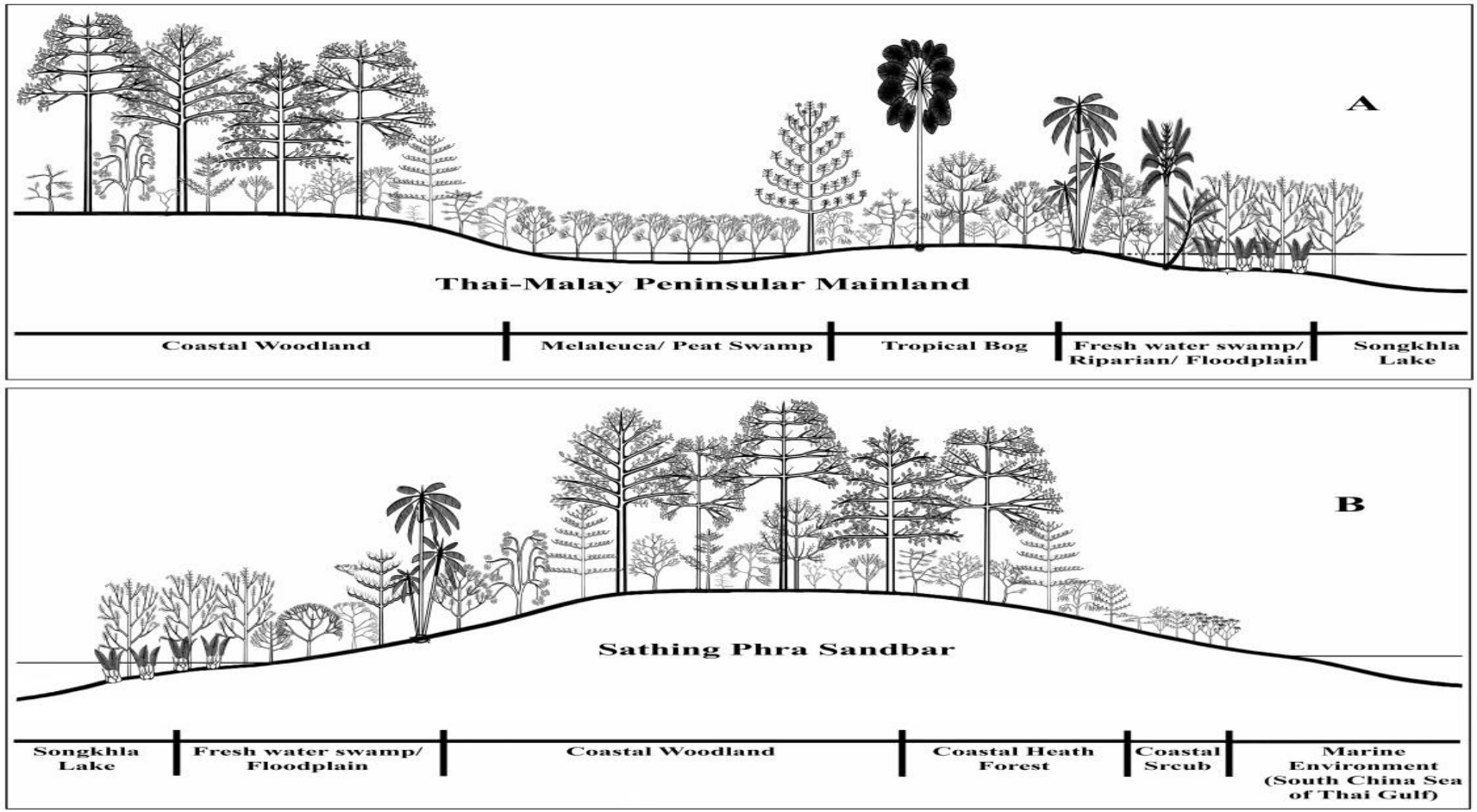

Figure 17: The woody Plant Architectural models along the Landscape of the Songkhla Lake Basin: (A) West Side of the Songkhla Lake and (B) East Side of the Songkhla Lake.

REFERENCES

Angiosperm Phylogeny Group (2009). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. *Botanical Journal of the Linnean Society* 161:105-121.

Backer, C. A. & Bakhuizen van den Brink, R. C. (1963). *Flora of Java* (Spermatophytes). Vol. 1. N.V. P. Noordhoff, Groningen, The Netherlands.

Backer, C. A. & Bakhuizen van den Brink, R. C. (1965). *Flora of Java* (Spermatophytes). Vol. 2. N.V. P. Noordhoff, Groningen, The Netherlands.

Barthélémy, D. & Caraglio, Y. (2007). Plant Architectural: A Dynamic, Multilevel and Comprehensive Approach to Plant Form, Structure and Ontogeny. *Annals of Botany* 99: 375-407.

Berg, C. C. & Corner E. J. H. (2005). Moraceae-Ficus. In Nooteboom H.P. (ed.), *Flora Malesiana*-Series 1, Spermatophyta. Vol.17(2): 1-730. The National Herbarium Nederland, Universiteit Leiden branch, The Netherlands.

Berg, C. C., Corner, E. J. H. & Jarret, F. M. (2006). Moraceae-General Other than Ficus. In Nooteboom H.P. (ed.), *Flora Malesiana*-Series 1, Spermatophyta Vol.17(1): 1-146. The National Herbarium Nederland, Universiteit Leiden branch, The Netherlands

Berg, C. C., Pattharahirantricin, N. & Chantarasuwan, P. (2011). Moraceae. In Santisuk, T. & Larsen, K., *Flora of Thailand* Vol. 10(4):475-675. Prachachon Co. Ltd., Bangkok.

Bridson, D. & Forman, L. (1998). *The Herbarium Handbook*. 3rd ed.Whitstable Litho Printers Ltd., London

Brummit, R. K. & Powell, C. E. (1992). Authors of Plant Names. Royal Botanic Gardens, Kew.

Castellanos, C., Kolterman, D. A. & Vester, H. F. M. (2011). Architectural analysis of *Buxus vahlii* Baill. (Buxaceae) in two different environments in Puerto Rico. *Adansonia*, sér. 3, 33(1): 71-80.

Chantaranothai, P. & Parnell, J. (1994). A revision of Ac*mena, Cleistocalyx, Eugenia* s.s and *Syzygium* (Myrtaceae) in Thailand. *Thai Forest Bulletin* (Botany) 21:1-123.

Chen, C. M., Qing, Q. L. & Green, P. S. (1996). Oleaceae. In *Flora of China* Vol. 15: 272-319.

Chayamarit, K. & Welzen P. C. V. (2005). Euphorbiaceae. In Santisuk, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 8(1):1-303. Prachachon Co. Ltd. Bangkok.

Chen, S. J. & Gilbert, M. G. (1994). Verbenaceae. In *Flora of China* Vol. 17:1-49.

Chen, S. K., Ma, H., Feng, Y., Barriera, G. & Loizeau, P. A. (2008). Aquifoliaceae. In *Flora of China* Vol. 11: 359-438.

Chen, T. & Taylor, C. M. (2011). The Genus *Chassalia*. In Rubiaceae, *Flora of China* Vol. 19: 87-88.

Chen, J. & Turland, N. J. (2007). Combretaceae. In *Flora of China* Vol. 13: 309-320.

Chen, J. & Craven, L. A. (2007). Myrtaceae. In *Flora of China* Vol. 13:321-359.

Chen, Z. D. & Jun, W. (2007). Leeaceae. In *Flora of China* Vol. 12:169-172.

Clarke, C. B. (1878). Combretaceae. In Hooker, J. D. (ed.), *Flora of British India* Vol. 2:443-461. L. Reeve & Co. Ltd., London.

Clarke, C. B. (1879). Barringtonieae. In Hooker, J. D. (ed.), *Flora of British India* Vol. 2:506-511. L. Reeve & Co. Ltd., London.

Clarke, C. B. (1879). Melastomataceae. In Hooker, J.D. (ed.), *Flora of British India* Vol. 2:512-565. L. Reeve & Co. Ltd., London.

Clarke, C. B. (1882). Oleaceae. In Hooker, J. D. (ed.), *Flora of British India* Vol. 3:590-618. L. Reeve & Co. Ltd., London.

Clarke, C. B. (1883). Loganiaceae. In Hooker, J. D. (ed.), *Flora of British India* Vol. 4:78-93. L. Reeve & Co. Ltd., London.

Clarke, C. B. (1885). Verbenaceae. In Hooker, J. D. (ed.), *Flora of British India* Vol. 4:560-604. L. Reeve & Co. Ltd., London.

Corner, E. J. H. (1952). *Wayside Trees of Malaya* Vol. 1. Government Printing office, Singapore.

Cremers, G. (1973). Architecture de quelques lianes d'Afrique Tropicale. *Candollea* 28: 249-280

Cremers, G. (1974). Architecture de quelques lianes d'Afrique Tropicale 2.*Candollea* 29: 57-110

Cremers, G., & Edelin, C. (1995). Etude de l'architecture aérienne de quelques plantes tropicales à ramification basitone: vers une révision du modèle de Tomlinson. *Canadian journal of botany* 73(9): 1490-1503.

De Wilde, W. J. J. O., Duyfjes, B. E. E. & Phonsena, P. (2014). Lythraceae. In Santisuk, T. & Balslev, H. (eds.), *Flora of Thailand* Vol. 11(4): 547-597. Prachachon Printing Co. Ltd., Bangkok.

Everett, B. & Whitmore, T. C. (1973). Lythraceae. In Whitmore, T. C. (ed.), *Tree Flora of Malaya* Vol. 2: 276-280. Wing Tai Cheung Printing Co. Ltd. Hong Kong.

Ewel, J. J., & Bigelow, S. W. (1996). Plant life-forms and tropical ecosystem functioning. In *Biodiversity and ecosystem processes in tropical forests*: 101-126. Springer Berlin Heidelberg.

Green, P. S. (2000). Oleaceae. In Santisuk, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 7(2): 271-340. Diamond Printing Co. Ltd., Bangkok.

Griffin, O. & Parnell, J. (1997). Loganiaceae, in Santisuk, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 6(3): 197-225. Diamond Printing Co. Ltd., Bangkok.

Hallé, F. & Oldeman R. A. A. (1970). *Essai sur l'architecture et la dynamique de croissance des arbres tropicaux*. Paris: Masson.

Hallé, F. (1974). Architecture of trees in the rain forest of Morobe District, New Guinea. *Biotropica* 6: 43-50.

Hallé, F., Oldeman, R. A. A. & Tomlinson, P. B. (1978). *Tropical Trees and Forests: An Architectural Analysis*. Berlin: Springer-Verlag.

Hamilton, C. W. (1985). Architecture in Neotropical Psychotria L. (Rubiaceae): Dynamics of Branching and Its Taxonomic Significance. *American Journal of Botany* 72(7): 1081-1088.

Hoffmann, P. (1999). New Taxa and New Combination in Asian Antidesma (Euphorbiaceae). *Kew Bulletin* 54(2): 347-362.

Hoffmann, P. (2000). Checklist of the genus Antidesma (Euphorbiaceae) in Thailand. *Thai Forest Bulletin* (Botany) 28:139-156.

Hooker, J. D. (1875). Rutaceae. In Hooker, J. D. (ed.), *The Flora of British India* Vol. 1: 484-517. L. Reeve & Co. Ltd., London.

Hoogland, R. D. (1972). Dilleniaceae. In Smitinand T. & Larsen K. (eds.), *Flora of Thailand* Vol. 2(2): 95-108. The Tistr Press, Bangkok.

Hoogland, R. D. (1948). Dilleniaceae. *Flora Malesiana*-Series 1, Spermatophyta, Vol. 4(1): 141-174.

Hou, D. (1970). Rhizophoraceae. In Smitinand, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 2(1): 5-15. The Tistr Press, Bangkok.

King, D. A. (1998). Relationship between Crown Architecture and Branch Orientation in Rain Forest Trees. *Annals of Botany* 82: 1-7.

Kochummen, K. M. (1972). Combretaceae. In Whitmore T. C. (ed.), *Tree Flora of Malaya* Vol 1:172-178. Wing Tai Cheung Printing Co. Ltd. Hong Kong.

Kochummen, K. M. (1973). Loganiaceae. In Whitmore T. C. (ed.), *Tree Flora of Malaya* Vol. 2:267-265. Wing Tai Cheung Printing Co. Ltd. Hong Kong.

Kochummen, K. M. (1978). Moraceae. In Ng. F.S.P. (ed), *Tree Flora of Malaya*. Vol. 3: 119-168. Multiprints Services, Singapore.

Kochummen, K. M. (1978). Myrtaceae. In Ng, F. S. P. (ed.), *Tree Flora of Malaya* Vol. 3:169-254. Multiprints Services, Singapore.

Kochummen, K. M. (1978).Verbenaceae. In Ng, F. S. P. (ed.), *Tree Flora of Malaya* Vol. 3:297-313. Multiprints Services, Singapore.

Kochummen, K. M. (1989). Rhizophoraceae. In Ng, F. S. P. (ed.), *Tree Flora of Malaya* Vol. 4:302-323. Art Printing Works Sdn. Bhd., Kuala Lumpur.

Kochummen, K. M. (1989).Verbenaceae. In Ng, F. S. P. (ed.), *Tree Flora of Malaya* Vol. 4:98-178. Art Printing Works Sdn. Bhd., Kuala Lumpur.

Kottek, M., Grieser, J., Beck, C., Rudolf, B. & Rubel, F. (2006). World map of Köppen-Geiger Climate Classification updated. *Meteorologische Zeitschrift* 15:259-263.

Laongpol, C., Suzuki, K., Katzensteiner, K., & Sridith, K. (2009). Plant community structure of the coastal vegetation of Peninsular Thailand. *Thai Forest Bulletin*, Special Issue: 106-133.

Laongpol, C., Suzuki, K. & Sridith, K. (2005). Floristic composition of the terrestrial coastal vegetation in Narathiwat, Peninsular Thailand. *Thai Forest Bulletin* 33: 44-70.

Larsen, K. & Hu, C. M. (1996). Myrsinaceae. In Larsen, K. (ed.), *Flora of Thailand* Vol. 6(2): 81-178. Diamond Printing Co. Ltd. Bangkok.

Lee, S. K. & Pennington, T. D. (1996). Sapotaceae. In *Flora of China* Vol. 15:205-214.

León Enriquez, B. L., Vester, H. F. M. & Hallé, F. (2008). The Architecture of *Phyllanthus acuminatus* Vahl: A Prelude to Understanding the Architectural Evolution in the Phyllanthaceae. *Adansonia*, sér. 3, 30(1): 137-149.

Lestari, D. A. & Hapsari L. (2013). Architectural models of trees selected from Purwodadi Botanic Garden. In Proceedings of Humboldt Kolleg: Synergy, Networking and The Role of Fundamental Research Development in South East Asia, in Conjunction with: The International Conference on Natural Science (ICONS) 2011, 9-11 July, Batu, East Java, Indonesia. Shaker Verlag Gmbh. Aachen. Germany. Pp. 283-287.

Li, B. & Esser, H. J. (2008). The Genus ***Shirakiopsis*** Esser. In Euphorbiaceae, *Flora of China* Vol. 11: 285-286.

Li, P. T. & Gilbert, M. G. (2011). Annonaceae. In *Flora of China* Vol. 19: 672-713.

Li, S., Li, X.W., Huang, P., Wei, F. N., Cui, H. & Werff, H. V. D. (2008). Lauraceae. In *Flora of China* Vol. 7:102-254.

Long, D. G. & Rae, S. J. (1991). Myrtaceae. In Grierson, A. J. C. & Long, D.G. (eds.), *Flora of Bhutan* Vol. 2(1): 277-287. Royal Botanical Garden, Edinburgh.

Mabberley, D. J. (2008). Mabberley's Plant-Book: A portable dictionary of plants, their classification and uses. Cambridge University Press.

Maxwell, J. F. (1989). Melastomataceae. In Ng. F.S.P. (ed.), *Tree Flora of Malaya* Vol. 4: 179-198. Art Printing Works Sdn. Bhd. Kuala Lumpur.

Middleton, D. J. (1999). Apocynaceae. In Santisuk T. & Larsen K. (eds.), *Flora of Thailand* Vol. 7(1): 1-153. Diamond Printing Co. Ltd. Bangkok.

Millet, J., Bouchard, A., & Édelin, C. (1998). Plant succession and tree architecture: an attempt at reconciling two scales of analysis of vegetation dynamics. *Acta biotheoretica* 46(1): 1-22.

Meteorological Department (1994). *Meteorological Data Report* No.582. Bangkok, Thailand.

Nanakorn, W. (1985). The genus ***Terminalia*** (Combretaceae) in Thailand. *Thai Forest Bulletin* (Botany) Vol. 15:59-107.

Nanakorn, W. (1986). The genus ***Combretum*** (Combretaceae) in Thailand. *Thai Forest Bulletin* (Botany) 16:154-204.

Navarro, T., Pascual, V., Cabezudo, B. & Alados, C. (2009). Architecture and functional traits of semi-arid shrub species in Cabo de Gata Natural Park, SE Spain. *Candollea* 64(1): 69-84.

Niklas, K. J. (2000). The Evolution of Plant Body Plans – A Biomechanical Perspective. *Annals of Botany* 85: 411-438.

Nooteboom, H. P. (1981). Symplocaceae. In Smitinand, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 2(4): 448-464. The Tistr Press, Bangkok.

Parnell, J. & Chantaranothai, P. (2002). Myrtaceae. In Santisuk, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 7(4): 778-914. Prachachon Co. Ltd., Bangkok

Peng, H., Mabberley, D. J., Pannell, C. M., Edmonds, J. M. & Bartholomew, B. (2008). Meliaceae. In *Flora of China* Vol.11: 111-131.

Phengklai, C. (2001). Sterculiaceae. In Santisuk, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 7(3): 539-654. Prachachon Co. Ltd., Bangkok.

Phengklai, C. (1993). Tiliaceae. In Smitinand, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 6(1): 10-80. The Rumthai Press Co. Ltd. Bangkok.

Pipoly, J. J. & Chen, J. (1996). Myrsinaceae. In *Flora of China* Vol. 15: 1-38.

Prévost, M. F. (1967). Architecture de quelques Apocynacées ligneuses. Bulletin de la Société Botanique de France 114: 23-36.

Prévost, M. F. (1978). Modular construction and its distribution in tropical woody plants. *Tropical trees as living systems, Cambridge Univ. Press, Cambridge*. 223-231

Pongsaputra, P. (ed.) (1991). *Illustrated landforms of Thailand*. Chulalongkorn University, Darnsutha Press, Bangkok, Thailand. Pp. 121-122.

Pooma, R. & Newman, M. (2001). Checklist of Dipterocarpaceae in Thailand. *Thai Forest Bulletin* (Botany) 29:110-187.

Qin, H., Graham, S. A. & Gilbert, M. G. (2007). Lythraceae. In *Flora of China* Vol. 13:274-289.

Raunkiaer, C. (1934). *The Life Forms of Plants and Statistical Plant Geography*. The Clarendon Press, Oxford.

Renner, S. S., Clausing, G., Cellinese, N. & Meyer, K. In Santisuk, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 7(3): 412-497.

Ridley, H. N. (1922). *The Flora of the Malay Peninsula*. Vol. 1. L. Reeve & Co., Ltd., London.

Ridley, H. N. (1923). *The Flora of the Malay Peninsula*. Vol. 2. L. Reeve & Co., Ltd., London.

Ridley, H. N. (1924). *The Flora of the Malay Peninsula*. Vol. 3. L. Reeve & Co., Ltd., London.

Ridsdale, C. E. (1975). Leeaceae. In van Steenis, C. G. G. J. (ed.), *Flora Malesiana*. Series 1. Spermatophyta. Vol. 7(4): 435-753. Noordhoff International Publishing, Leyden, The Netherland.

Robinson, D. F. (1996). A symbolic framework for the description of tree architecture models. *Botanical Journal of the Linnean Society* 121: 243-261

Robinson, D. F. (2000). Three gradients in the architecture of trees. *Annals of Forest Science* 57: 439-444.

Santisuk, T. (1987). Bignoniaceae. In Smitanand, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 5(1): 32-66. The Chutima Press., Bangkok.

Santisuk, T. (1992). Sonneratiaceae. In Smitinand, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 5(4): 434-441. The Chutima Press., Bangkok.

Shukla, R. P. & Ramakrishnan, P. S. (1986). Architecture and Growth Strategies of Tropical Trees in Relation to Successional Status. *Journal of Ecology* 74(1): 33-46.

Smitinand, T., Santisuk T., Phengklai C. (1980). The Manual of Dipterocarpaceae of Mainland South-East Asia. *Thai Forest Bulletin* (Botany) 12:1-110.

Smitinand, T. 2014. *Thai Plant Names-Tem Smitinand*: Revised Edition. The Forest Herbarium, Royal Forest Department, Bangkok.

Sievänen, R., Nikinmaa, E., Nygren, P., Ozier-Lafontaine, H., Perttunen, J., & Hakula, H. (2000). Components of functional-structural tree models. *Annals of forest science* 57(5), 399-412.

Stecconi, M., Puntieri, J., & Barthélémy, D. (2000). Annual shoot-growth in *Nothofagus antarctica* (G. Forster) Oersted (Nothofagaceae) from northern Patagonia. *Trees* 14: 289–296.

Stone, B. C. (1972). Rutaceae. In Whitmore, T.C. (ed.), *Tree Flora of Malaya* Vol. 1: 367-387. Wing Tai Cheung Printing Co. Ltd. Hong Kong.

Sussex, I. M., & Kerk, N. M. (2001). The Evolution of Plant Architecture. *Current Opinion in Plant Biology* 4(1): 33-37.

Tang, Y.; Gilbert M. G. & Dorr L. J. (2007). Malvaceae. In *Flora of China* Vol. 12: 264-298.

Tang, Y., Gilbert, M. G. & Dorr, L. J. (2007). Sterculiaceae. In *Flora of China* Vol. 12: 303-330.

Tomlinson, P. B. (1987). Architecture of Tropical Plants. *Annual Review of Ecology and Systematics* 18: 1-21.

Tomlinson, P. B. (1983). Tree architecture: new approaches help to define the elusive biological property of tree form. *American Scientist* 71(2): 141-149.

Vester, H. F. M. (1999). Architectural diversification within the genus Vismia (Clusiaceae) in the Amazonian rain forest (Araracuara, Colombia). In: M. H. Kurmann & A. R. Hemsley (editors). *The evolution of plant architecture. Kew: Royal Botanic Gardens*, 147-158.

Vester, H. F. M. (2002). Modelos arquitectónicos en la fl ora arbórea de la Península de Yucatán. *Boletín de la Sociedad Botánica de México* 71: 45-57.

Welzen, P. C. V. & Chayam, K. (2007). Euphorbiaceae. In Santisuk, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 8(2):305-592. Prachachon Co. Ltd., Bangkok.

Welzen, P. C. V. (1999). Sapindaceae. In Santisuk, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 7(1):169-250. Diamond Printing Co, Ltd. Bangkok.

Welzen, P. C. V. (2010). Leeaceae. In Santisuk, T. & Larsen, K. (eds.), *Flora of Thailand* Vol. 10(2): 209-230. Prachachon Co. Ltd., Bangkok.

Whitmore, T. C. (1973). Apocynaceae. In Whitmore, T. C. (ed.), *Tree Flora of Malaya* Vol. 2:3-24. Wing Tai Cheung Printing Co. Ltd. Hong Kong.

Whitmore, T. C. (1973). Euphorbiaceae. In Whitmore, T. C. (ed.), *Tree Flora of Malaya* Vol. 2:34-136. Wing Tai Cheung Printing Co. Ltd. Hong Kong.

Whitmore, T. C. (1973). Sterculiaceae, In Whitmore, T. C. (ed.), *Tree Flora of Malaya* Vol. 2:353-382. Wing Tai Cheung Printing Co. Ltd. Hong Kong.

Whitmore, T. C. (1972). Sonneratiaceae. In Whitmore, T. C. (ed.), *Tree Flora of Malaya* Vol. 1:442-445. Wing Tai Cheung Printing Co. Ltd. Hong Kong.

Wong, K. M. (1989). Rubiaceae. In Ng. F.S.P. (ed.), *Tree Flora of Malaya* Vol. 4: 324-425. Art Printing Works Sdn. Bhd. Kuala Lumpur.

Wu, R. F. & Nooteboom, H. P. (1996). Symplocaceae. In *Flora of China* Vol. 15: 235-252.

Xia, N. & Gadek, P. A. (2007). Sapindaceae. In *Flora of China* Vol. 12: 5-24.

Zhang, D., Hartley, T. G. & Mabberley, D. J. (2008). Rutaceae. In *Flora of China* Vol.11:51-97.

Zhou, L., Su, Y. C. F., & Saunders, R. M. K. (2009). Molecular phytogenetic support for a broader delimitation of Uvaria (Annonaceae), inclusive of Anomianthus, Cyathostemma, Ellipeia, Ellipeiopsis and Rauwenhoffia. *Systematics and Biodiversity* 7: 249-258

APPENDIX

APPENDIX 1: The Description of the Architectural Models of the study area.

Three architectural models could be divided according to their growth form as follows (Hallé et al. 1978):

1. Monoaxial Tree

Corner's Model: a single aerial/shoot with a monopodial stem and absence of branch. The Inflorescence produced in the axillary of the leaves or leafless stem i.e. ***Livistona saribus***(Lour.) Merr.ex Chev. (Fig. 8, E; Plate 4, E-F).

Holttum's Model: The architectural growth structure of woody plants in this model were exactly same as Corner's Model, except the position of the inflorescence which produced in the terminal of the stem/main axe (trunk) i.e. ***Corypha utan*** Lam. (Fig. 8, B).

2. Polyaxial Tree (The Presence of Branch)

2.1. The Vegetative axes equals and orthotropic

The apical meristems of the woody plants in this group separately produced the vegetative axes of the main axe and the lateral axes (branches). All of the vegetative axes either main or lateral axes were produced in orthotropic manner and all axes are equivalent or identical to the former axes (parent axes).

Chamberlain's model: The main vegetative axes are modular and form a vertical, linear sympodial axe. The inflorescence in the terminal of the axe and the new vegetative axe (derived axe) occur from the axillary of the uppermost leave i.e. ***Leea rubra*** Blume ex Spreng. (Fig. 10, G; Plate 3, A-D) and ***L. indica*** (Burm. f.) Merr. (Fig. 10, H)

Schoute's model: The shoot apical meristem produced the regular vertical (really horizontal) dichotomous axes in equal distance/interval and the inflorescence always produced in lateral of the stem i.e. ***Nypa fruticans*** Wurmb (Fig. 8, A).

Leeuwenberg's model: The vegetative axes are modular and produce the terminal inflorescences. The repeated vegetative axes are laterally produced in either dichotomous vertical axes i.e. ***Spirolobium cambodianum*** Baill. (Fig. 11, I), or three-dimensional orthotropic axes i.e. ***Barringtonia acutangula*** (L.) Gaertn. (Fig. 11, C; Plate 6, A-B). Some woody plants of this model displayed the common distinguished

features like “shortening the length and decreasing the width of the successive axes” i.e. ***Melastoma malabathricum*** L. subsp. ***malabathricum*** (Fig. 11, B) and ***Tarenna wallichii*** (Hook. f.) Ridl. (Fig. 11, H).

Tomlinson’s model: The vertical vegetative axes are sequentially produced from the basal part of the vertical parent axe (commonly known as **Basitonic** ramification). The inflorescence produce in terminal or axillary axes i.e. ***Oncosperma horridum*** (Griff.) Scheff. (Fig. 8, D) and ***Metroxylon sagu*** Rottb. (Fig. 8, C; Plate 4, C-D).

2.2. The Vegetative axes with distinct trunk and branches.

The apical meristems produced the vegetative axes into the distinct main axe (commonly known as Trunk) and lateral axes (commonly known as Branches). The trunk normally produced vertically, either sympodium or monopodium. The branches either produces horizontally or vertically and the inflorescences are variable, either in terminal or lateral axes.

2.2.1. The Vegetative Axes Vertical and Horizontal

The main axe produce vertically and the lateral axes are flexible, either vertical or horizontal axes.

Koriba’s model: All of the vegetative axes are modular and produce the terminal inflorescences. After the shoot apical meristems aborted, the three-dimensional vegetative axes produce laterally. One among of those three-dimensional branches is vigorous growth and stand vertically as the next main axe (trunk) and the other lateral branches play as the lateral axes (branches/relayed branches) i.e. ***Dolichandrone columnaris*** Santisuk (Fig. 7, F), ***Cerbera manghas*** L. (Fig. 7, D), ***Derris indica*** (Lam.) Bennet (Fig. 7, B), ***Psychotria sp***. (Fig. 7, C)

Petit’s model: The vegetative axes grow continuously and built the plants into the monopodial vertical trunk. The trunk produces the horizontal branches either in continuous manner or diffuse manner. The branches are sympodium and produce the inflorescence at the end of the axe i.e. ***Morinda citrifolia*** L. (Fig. 15, G)

Aubréville’s model: The shoot apical meristems grow periodically and produces a monopodial vertical trunk, associates with the sympodial horizontal

branch tiers. The branches are modular and produce the inflorescence in the axillary of the leaves i.e. ***Sterculia foetida*** L., ***Fagraea fragrans*** Roxb. and ***Terminalia catappa*** L. (Fig. 3, A-C)

Massart's model: The apical meristems grow periodically and produce the vertical monopodial trunk with the horizontal branch tires. The branches produce either in sympodial (terminal branch axes aborted) or monopodial manner. The inflorescence does not influence on the model of the branch axes i.e. ***Dipterocarpus alatus*** Roxb. ex G. Don, ***D. chartaceus*** Symington, ***D. obtusifolius*** Teijsm. ex Miq., ***Ardisia crenata*** Sims (Fig. 14, A-D).

Roux's model: The shoot apical meristem grows continuously and built a monopodial vertical trunk, associated with horizontal branches. The branches insert continuously to the trunk axe and the position of the inflorescence is variable, either in terminal or axillary of the branches i.e. ***Hopea odorata*** Roxb. (Fig. 9, C), ***Shorea roxburghii*** G. Don (Fig. 9, D), ***Carallia brachiate*** (Louz.) Merr. (Fig. 10, C).

Cook's model: The shoot apical meristem grows continuously and built a monopodial vertical main axe, associated with the spiral or decussate branches. The branches insert continuously to the trunk axe. This model differed from Roux's model because of the presence of the phyllomorphic branches (irreversible branches) i.e. ***Canthium sp.*** and ***Glochidion rubrum*** Blume (Fig. 6, A-B).

2.2.2. Vegetative Axes Orthotropic .

The apical meristems produce all vegetative axes (Trunk and Branches) in vertical manner.

Rauh's model: The apical meristem grows periodically and builds a monopodial vertical trunk and branches. The inflorescence always produce in the axillary of the leaves or the leafless-stem i.e. ***Litsea glutinosa*** (Lour.) C.B. Rob., ***L. grandis*** (Nees) Hook. f., ***Ficus hispida*** L.f. and ***Planchonella obovata*** (R. Br.) Pierre (Fig. 6, C-F).

Attim's model: The shoot apical meristem grows continuously and built a monopodial vertical trunk, associated with vertical branches. The branches insert to the trunk either in continuous or in diffused manner and the inflorescence appears in the lateral/axillary of the axes axes i.e. ***Avicennia marina*** (Forssk.) Vierh. (Fig. 5, A),

Melicope lunu-ankenda (Gaertn.) T. G. Hartley (Fig. 5, C), ***Rhodomyrtus tomentosa*** (Aiton) Hassk. (Fig. 4, A).

3. Tree with mixed axes' types

In the previous models, the combination of the meristems plays important roles in producing the trunk and branches, either in vertical or horizontal manner. However, the woody plants in these mixed axes' types are controlled by a single meristem. It means that, a single shoot apical meristem plays important role in building the vegetative axe either from vertical to horizontal manner or from horizontal to vertical manner.

Mangenot's model: The shoot apical meristem of the main axe grow vertically and later on, it turns to the horizontal manner with the noticeable leaves relatively changed from small to big size. The trunk is sympodium and the renewal shoot regrow from the proximal, vertical part of the former bended axe. The branches produce horizontally, from the distal and lateral parts of the main axe i.e. ***Microcos tomentosa*** Sm (Fig. 15, D); ***Uvaria siamensis*** (Scheff.) L. L. Zhou, Y. C. F. Su & R. M. K. Saunders (Fig. 15, E); ***Catunaregam tomentosa*** (Blume ex DC.) Tirveng (Fig. 15, F).

Champagnat's model: All vegetation axe produce vertically and later on, those axes turn to pendulous manner due to the weight and age. The trunk is sympodium and the renewal shoot reproduce from the superposition of the former pendulous axe. The branches produce horizontally, from the distal and lateral parts of the main axe (Fig. 12, A-I; Fig 13, A-I).

Troll's model: All of the vegetative axes produce horizontally. The shoot apical meristem of the proximal axe grows firstly in horizontal manner and then, its basal part turn to erected axe (vertical axe) which act similarly as the trunk. The meristems which produce laterally from that erected axe are consistently grow horizontally (never turn to erected manner) and play as the plagiotropic branches i.e. ***Helicteres hirsuta*** Lour. (Fig. 15, A); ***Antidesma ghaesembilla*** Gaertn.(Fig. 15, B); ***Commersonia bartramia*** (L.) Merr. (Fig. 15, C).

COLOUR PLATES

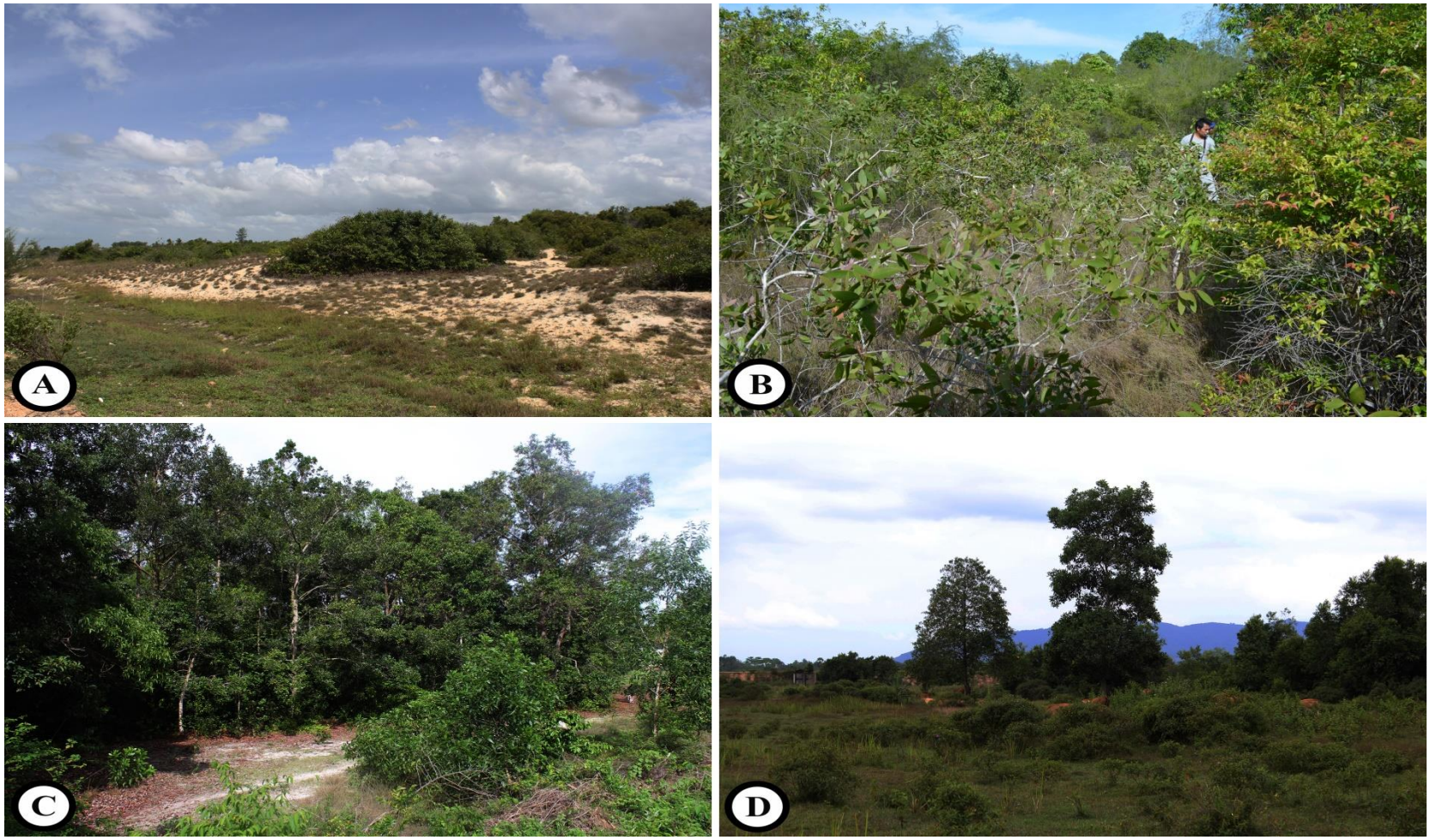

Plate 1: Vegetation Types in the Songkhla Lake Basin: **A.** Coastal Scrub; **B.** Coastal Heath Forest; **C.** Coastal Woodland with regular Canopy; **D.** Tropical Bog.

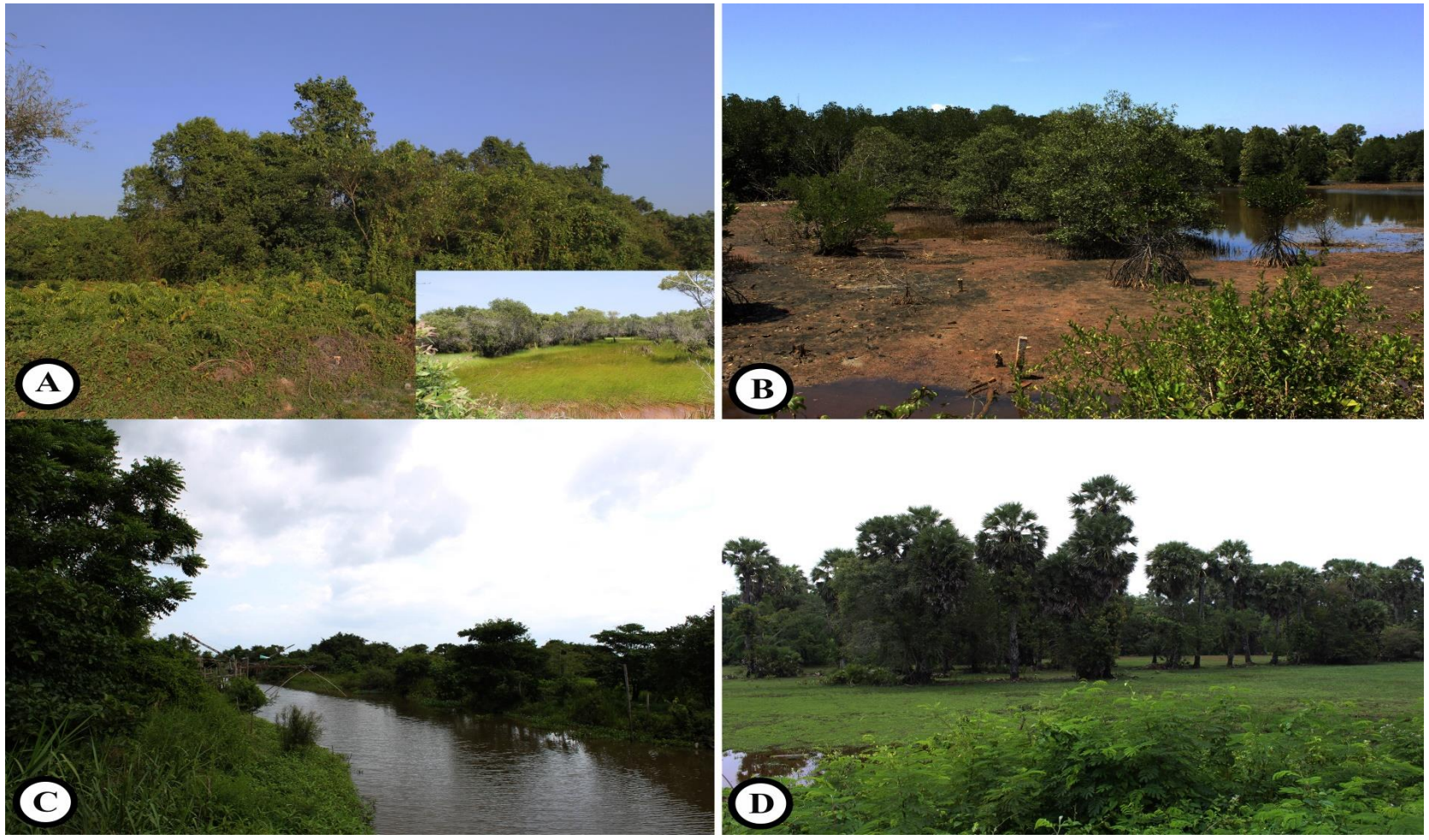

Plate 2: Vegetation Types in the Songkhla Lake Basin: **A.** Melaleuca/Peat vegetation; **B.** Mangrove; **C.** Riparian; **D.** Floodplain.

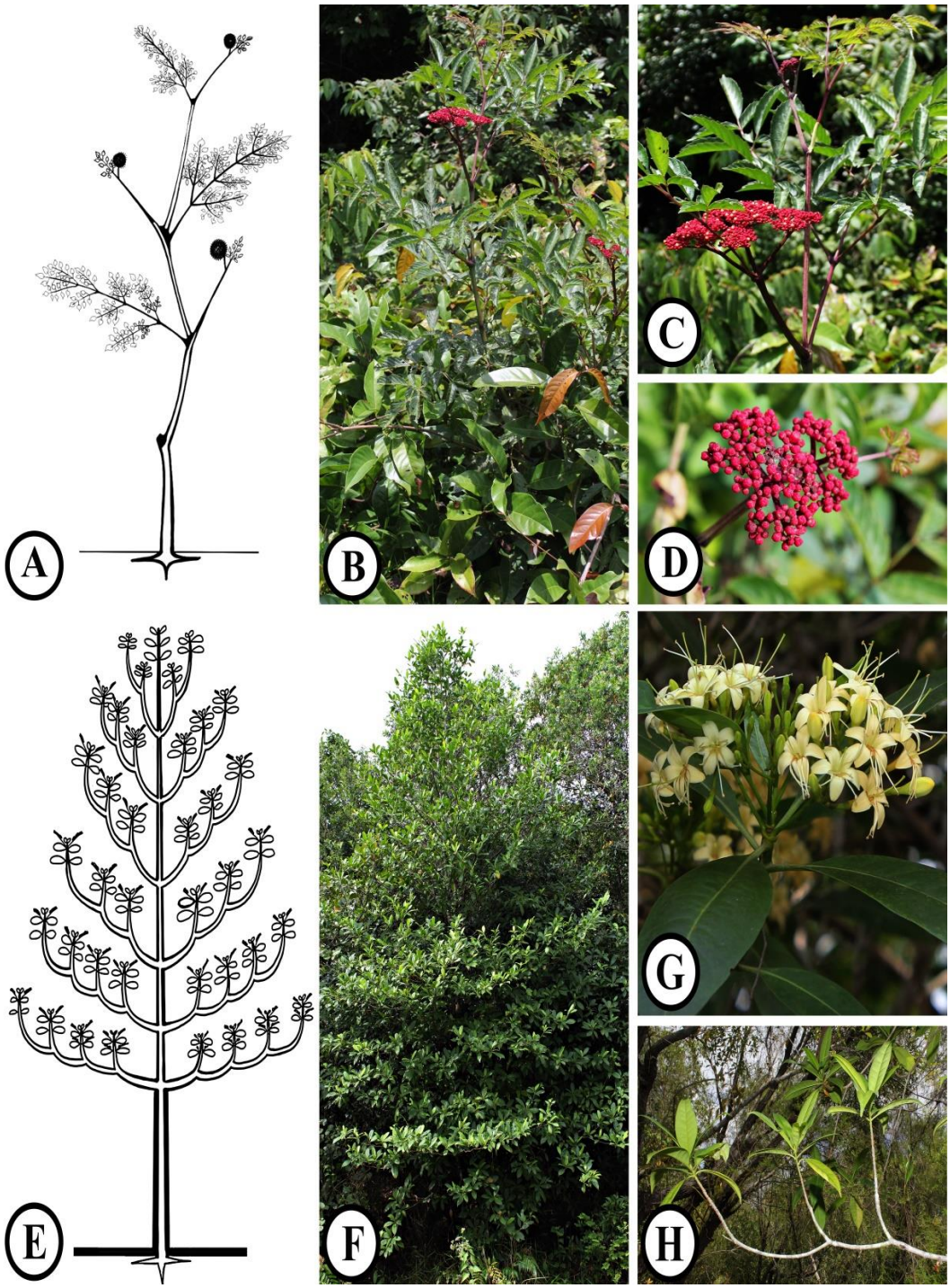

Plate 3: Architectural models with its woody plants sample. **A-D. Chamberlain's model** of ***Leea rubra*** Blume ex Spreng., **A.** Architectural growth structure, **B.** habit**, C.** Inflorecences with branch position, **D.** Inflorescense**; E-F. Aubréville's model** of ***Fagraea fragrans*** Roxb., **E.** Architectural growth structure, **F.** Habit, **G.** Inflorecences, **D.** Branch and Relayed branch position.

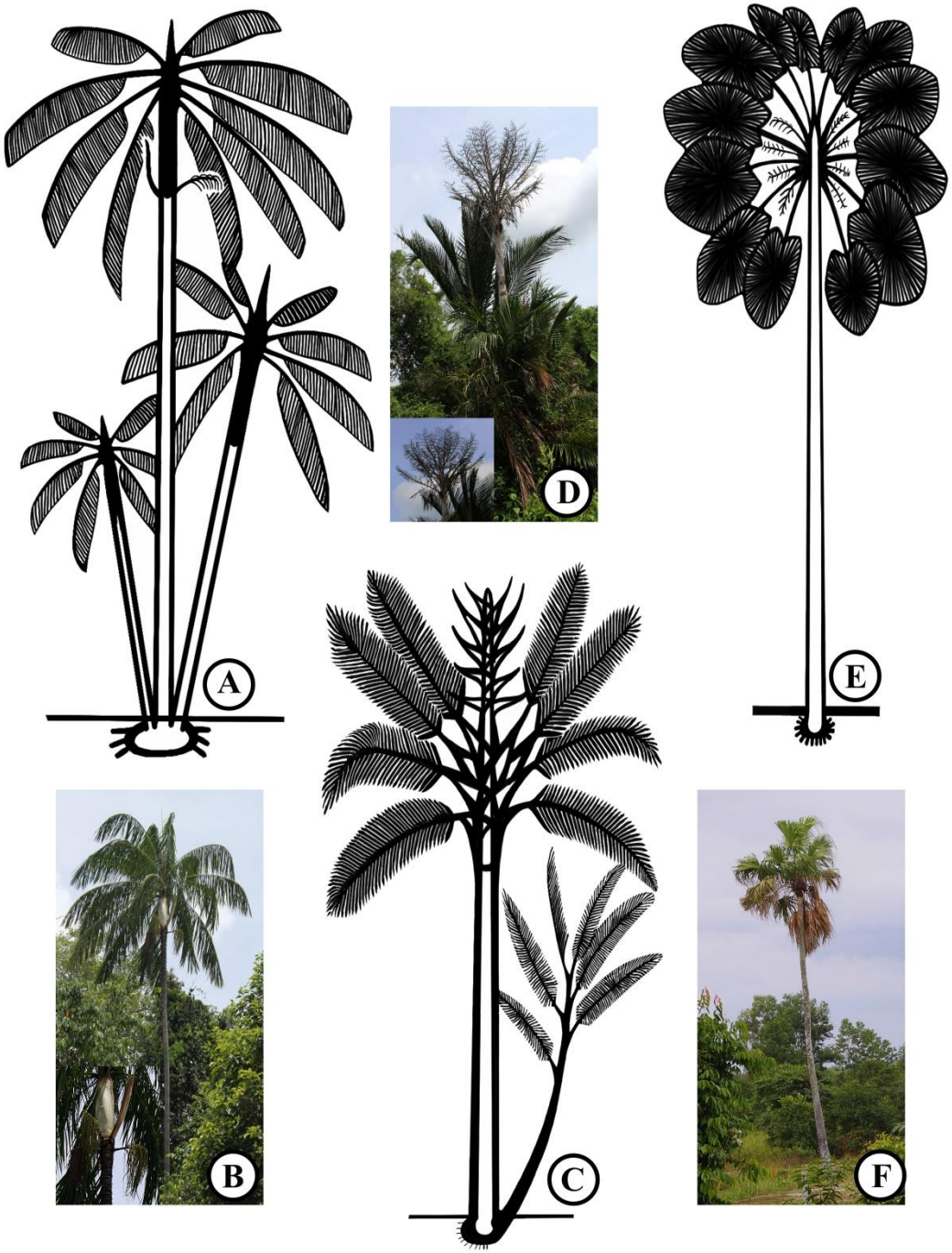

Plate 4: Architectural models with its woody plants sample. **A-D. Tomlinson's model**: **A-B.** ***Oncosperma horridum*** (Griff.) Scheff., **A.** Architectural growth structure, **B.** Habit; **C-D.** ***Metroxylon sagu*** Rottb., **C.** Architectural growth structure, **D.** Habit; **E-F. Corner's model** of ***Livistona saribus*** (Lour.) Merr. ex Chev., **E.** Architectural growth structure, **F.** Habit.

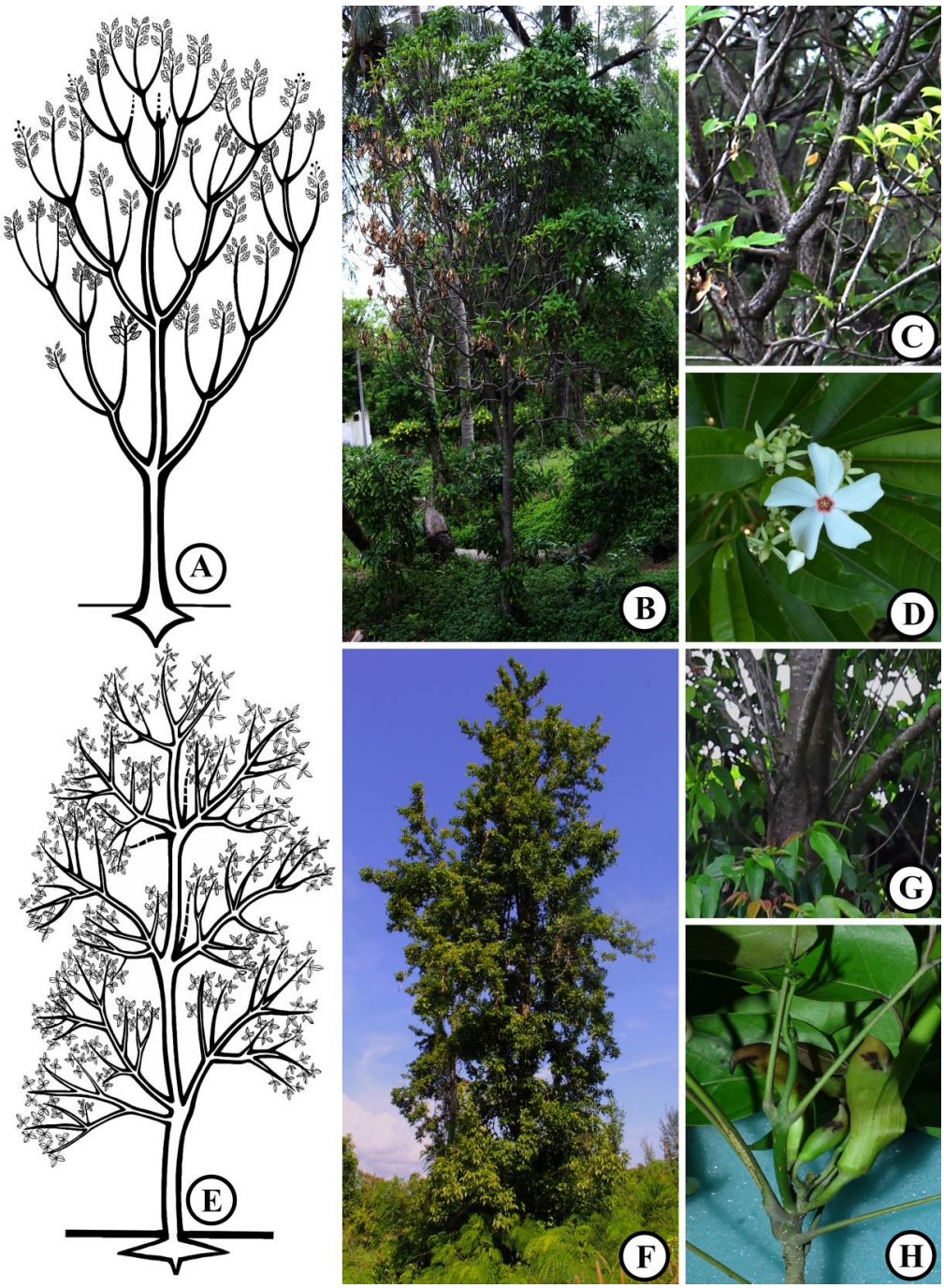

Plate 5: Architectural models with its woody plants sample.. **A-H: Koriba's model** of ***Cerbera manghas*** **L.** and ***Dolichandrone columnaris*** **Santisuk**. −**A-D.** ***Cerbera manghas*** **L., A.** Architectural growth structure, **B.** Habit, **C.** Branch position, **D.** Inflorescense; **E-H. Aubréville's model** of ***Dolichandrone columnaris*** **Santisuk, E.** Architectural growth structure, **F.** Habit, **G.** Branch position, **H.** Inflorescences with the new branched shoots.

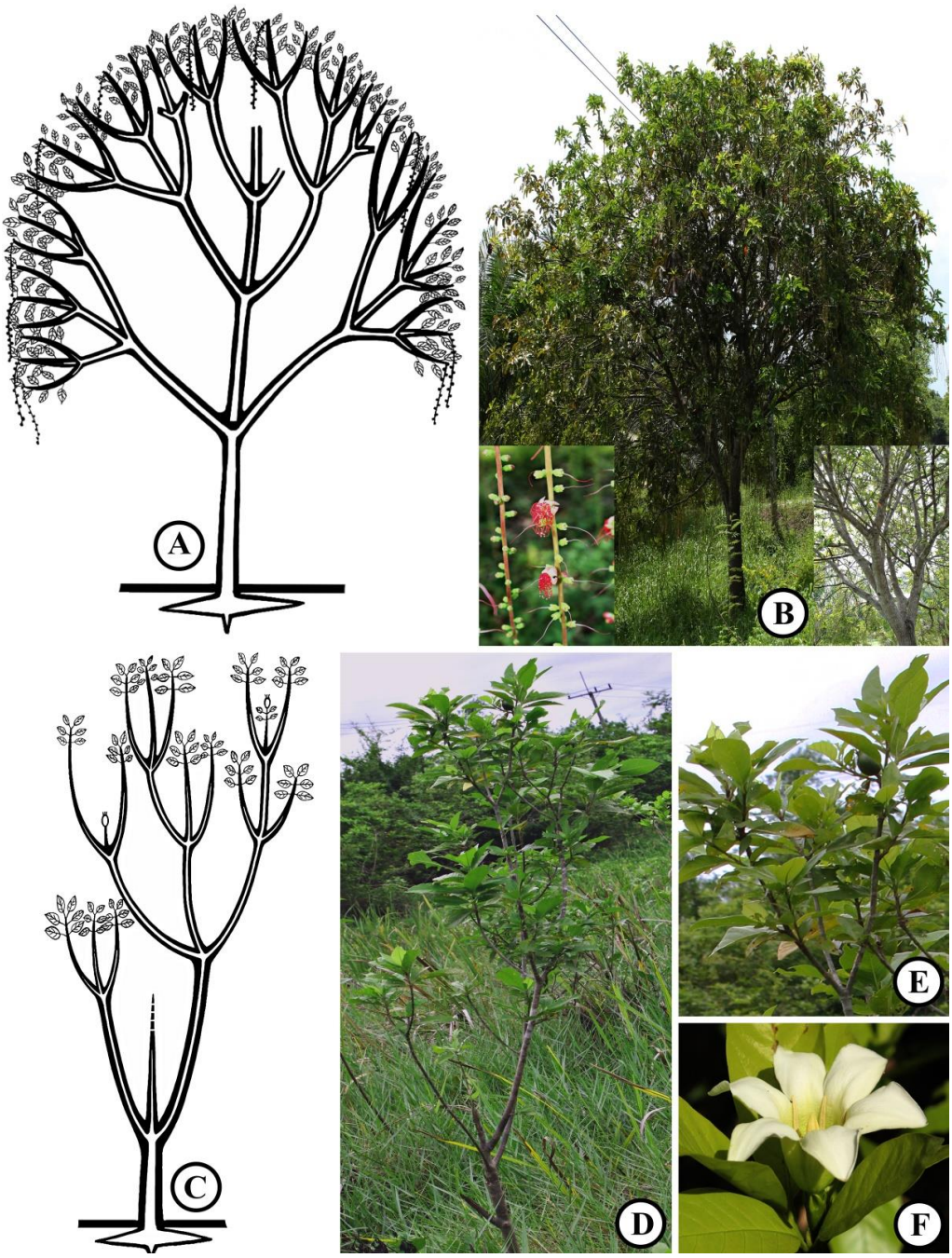

Plate 6: Architectural models with its woody plants sample. **A-F: Leeuwenberg's model** of ***Barringtonia acutangula*** **(L.) Gaertn.** and ***Kailarsenia campanula*** **(Ridl.) Tirveng. −A-B.** ***Barringtonia acutangula*** **(L.) Gaertn.**, **A.** Architectural growth structure, **B.** Habit, Inflorescence and Branch structures; **C-F.** ***Kailarsenia campanula*** **(Ridl.) Tirveng.**, **C.** Architectural growth structure, **D.** Habit, **E.** Branch position**, F.** Flowers.

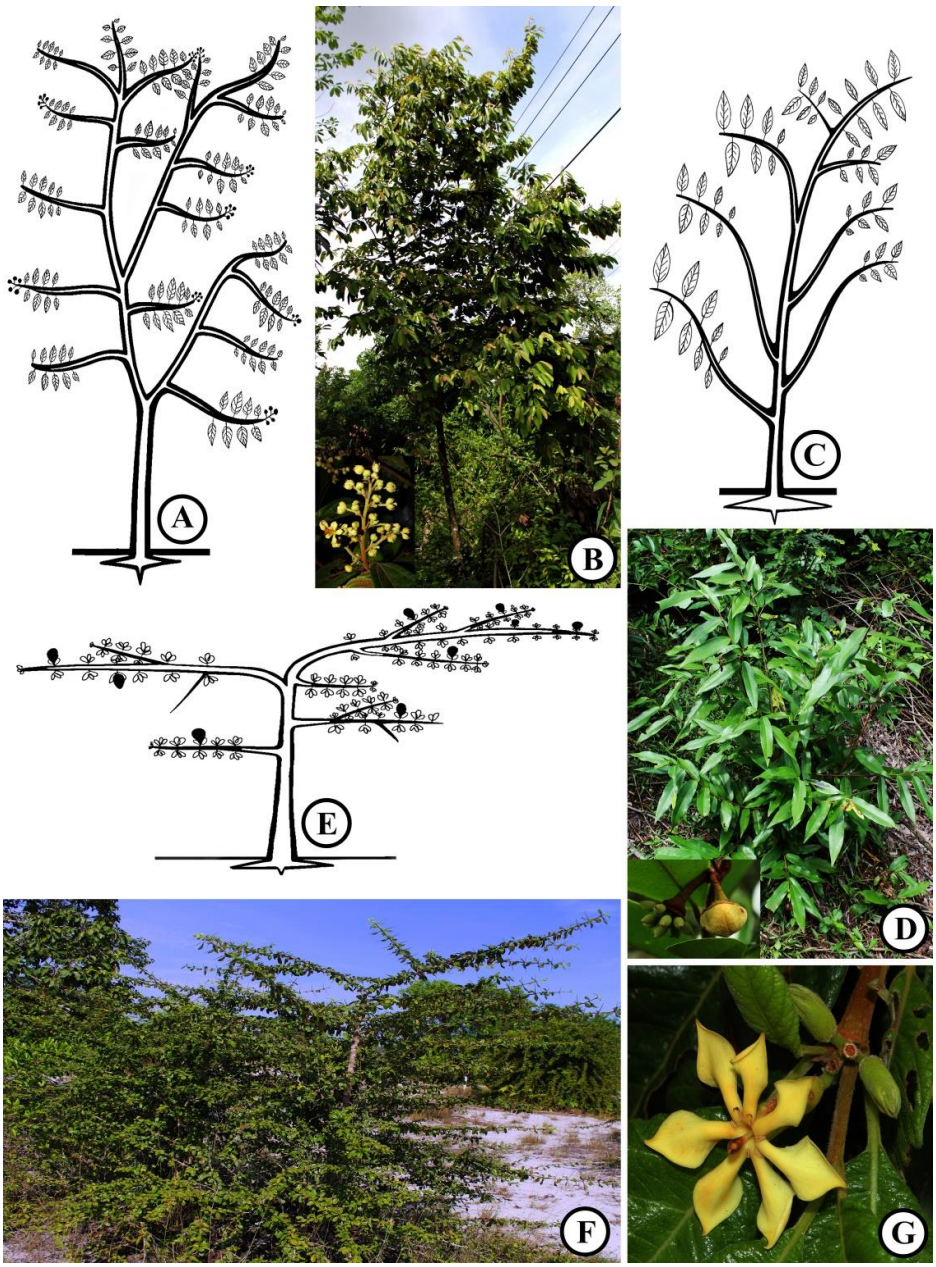

Plate 7: Architectural models with its woody plants sample. **A-G: Mangenot's model** of ***Microcos tomentosa*** Sm., ***Uvaria siamensis*** (Scheff.) L. L. Zhou, Y. C. F. Su & R. M. K. Saunders and ***Catunaregam tomentosa*** **(Blume ex DC.) Tirveng.** −**A-B.** ***Microcos tomentosa*** Sm., **A.** Architectural growth structure, **B.** Habit and Inflorescences.− **C-D.** ***Uvaria siamensis*** (Scheff.) L. L. Zhou, Y. C. F. Su & R. M. K. Saunders, **C.** Architectural growth structure, **D.** Habit and Inflorescences. −E-G. ***Catunaregam tomentosa*** (Blume ex DC.) Tirveng., **E.** Architectural growth structure, **F.** Habit, **G.** Inflorescences.

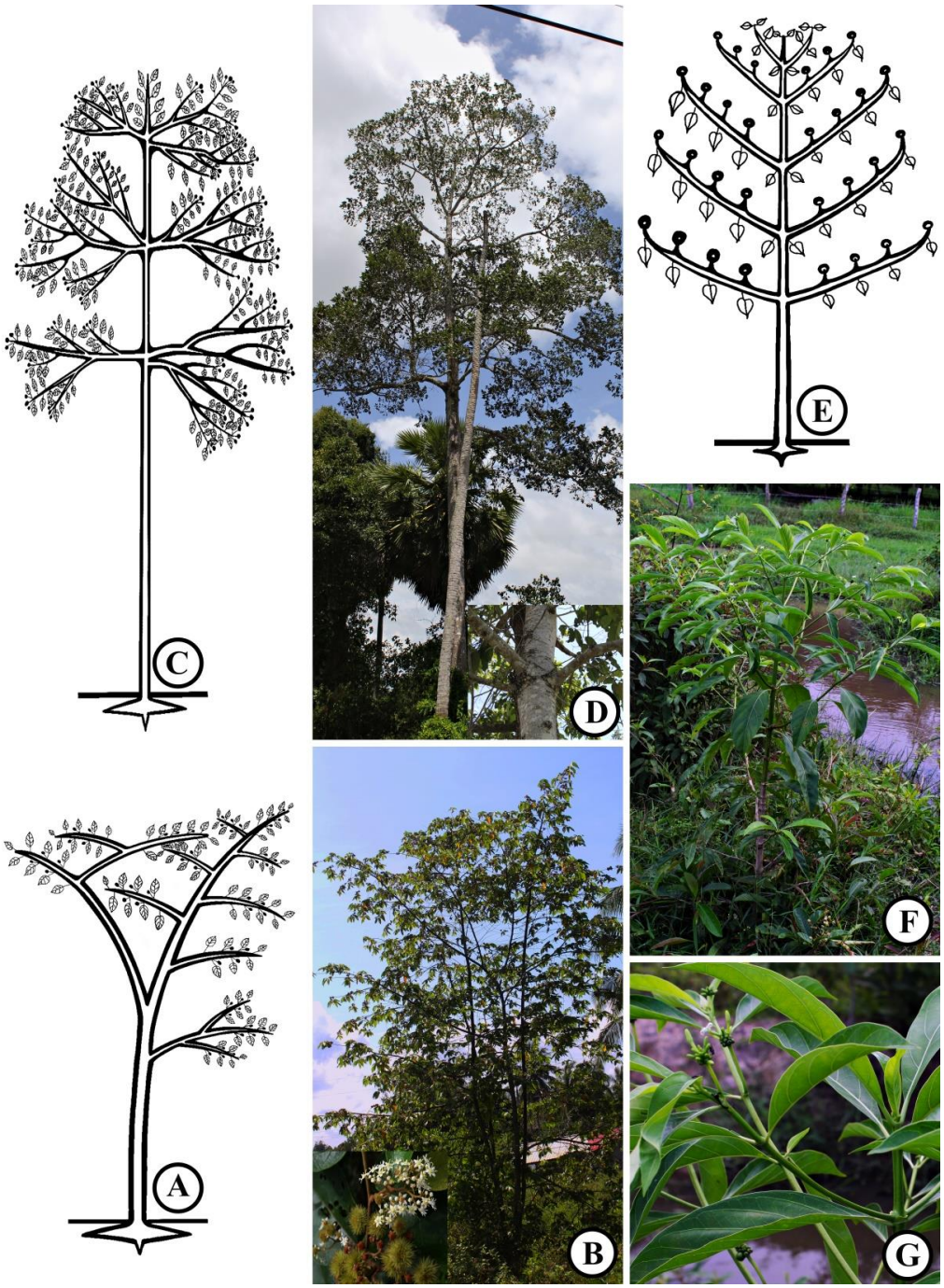

Plate 8: Architectural models with its woody plants sample. **A-B: Troll's model** of ***Commersonia bartramia*** **(L.) Merr.**, **A.** Architectural growth structure, **B.** Habit, Inflorescences and Fruits. **C-D: Massart's model** of ***Dipterocarpus alatus*** **Roxb. ex G. Don**, **C.** Architectural growth structure, **D.** Habit and Branch position. **E-G. Petit's model** of ***Morinda citrifolia*** **L.**, **E**. Architectural growth structure, **F.** Habit, **G.** Branch and inflorescences position.

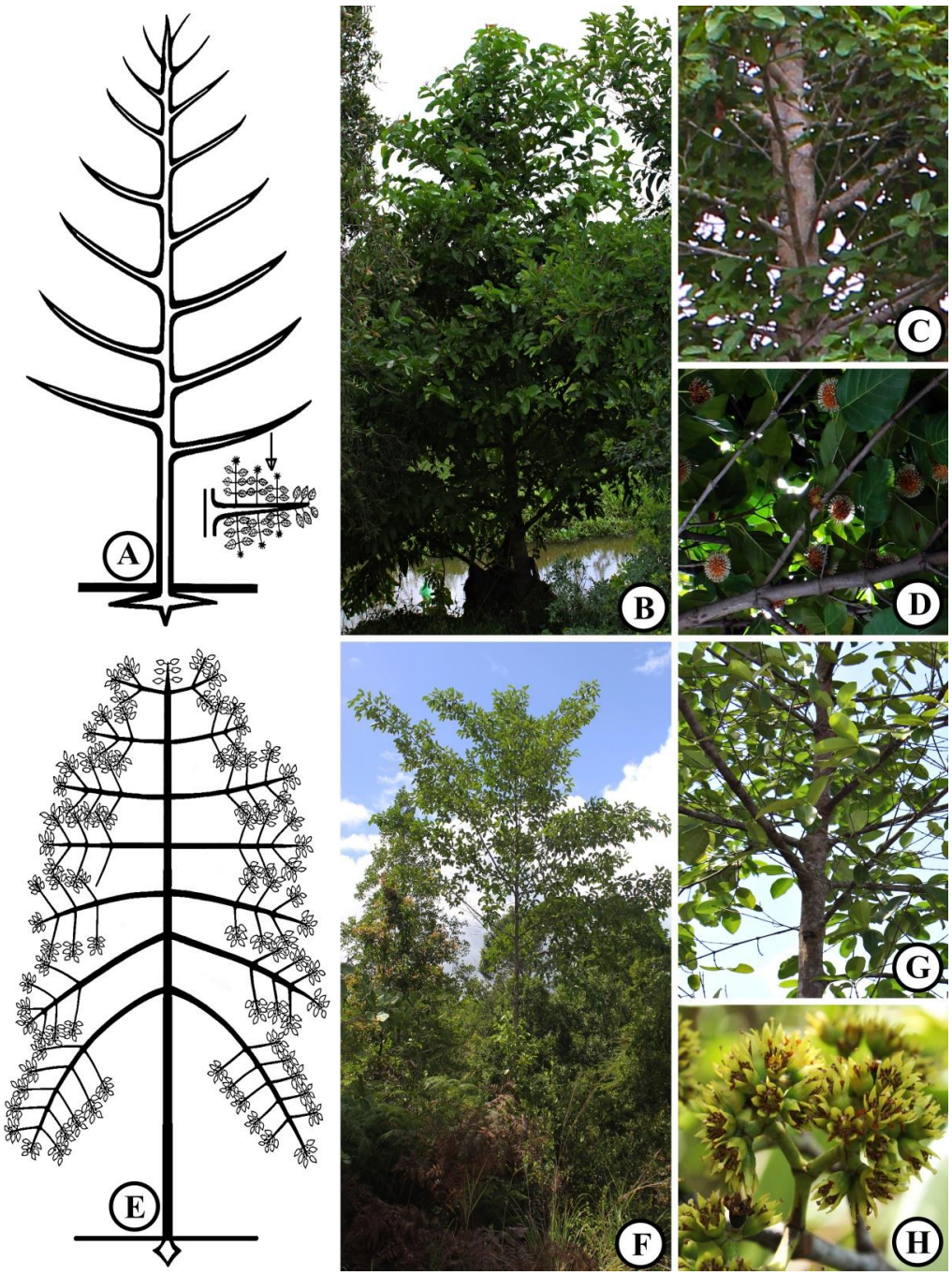

Plate 9: Architectural models with its woody plants sample. **A-H: Roux's model** of ***Neolamarckia cadamba*** **(Roxb.) Bosser** and ***Carallia brachiata*** **(Louz.) Merr. −A-D.** ***Neolamarckia cadamba*** **(Roxb.) Bosser, A.** Architectural growth structure, **B.** Habit**, C.** Branch position, **D.** Inflorescense. **E-H:** ***Carallia brachiata*** **(Louz.) Merr., E.** Architectural growth structure, **F.** Habit, **G.** Branch position, **H.** Inflorescences.

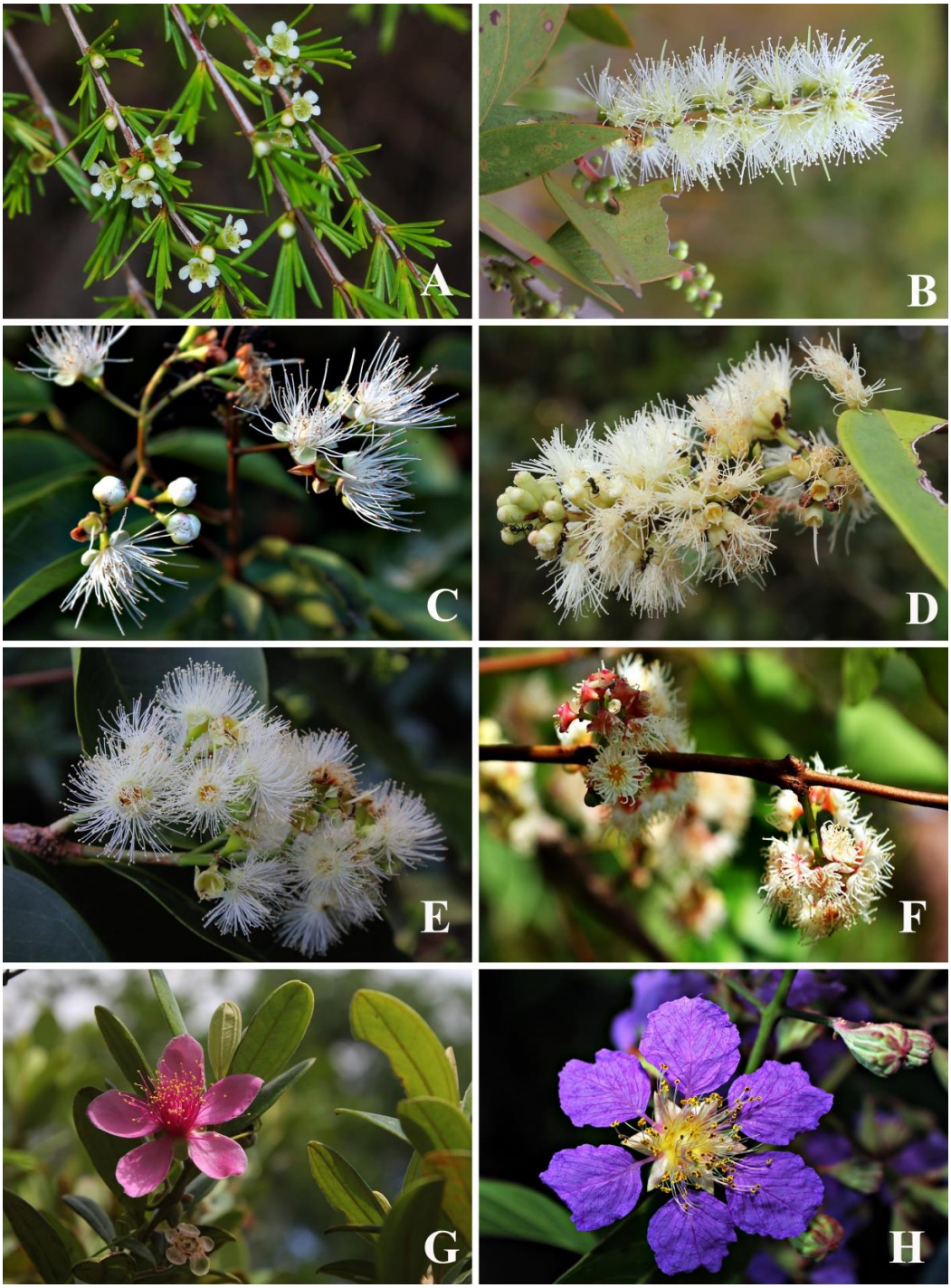

Plate 10: A. ***Baeckea frutescens*** L.−B. ***Melaleuca cajuputi*** Powell−C. ***Syzygium cf. craibii*** Chantar. & J. Parn.− D. ***Syzygium antisepticum*** (Blume) Merr. & L. M. Perry−E. ***Syzygium grande*** (Wight) Walp. var. ***grande***−F. ***Syzygium cf. polyanthum*** (Wight) Walp.− G. ***Rhodomyrtus tomentosa*** (Aiton) Hassk.−H. ***Lagerstroemia speciosa*** (L.) Pers.

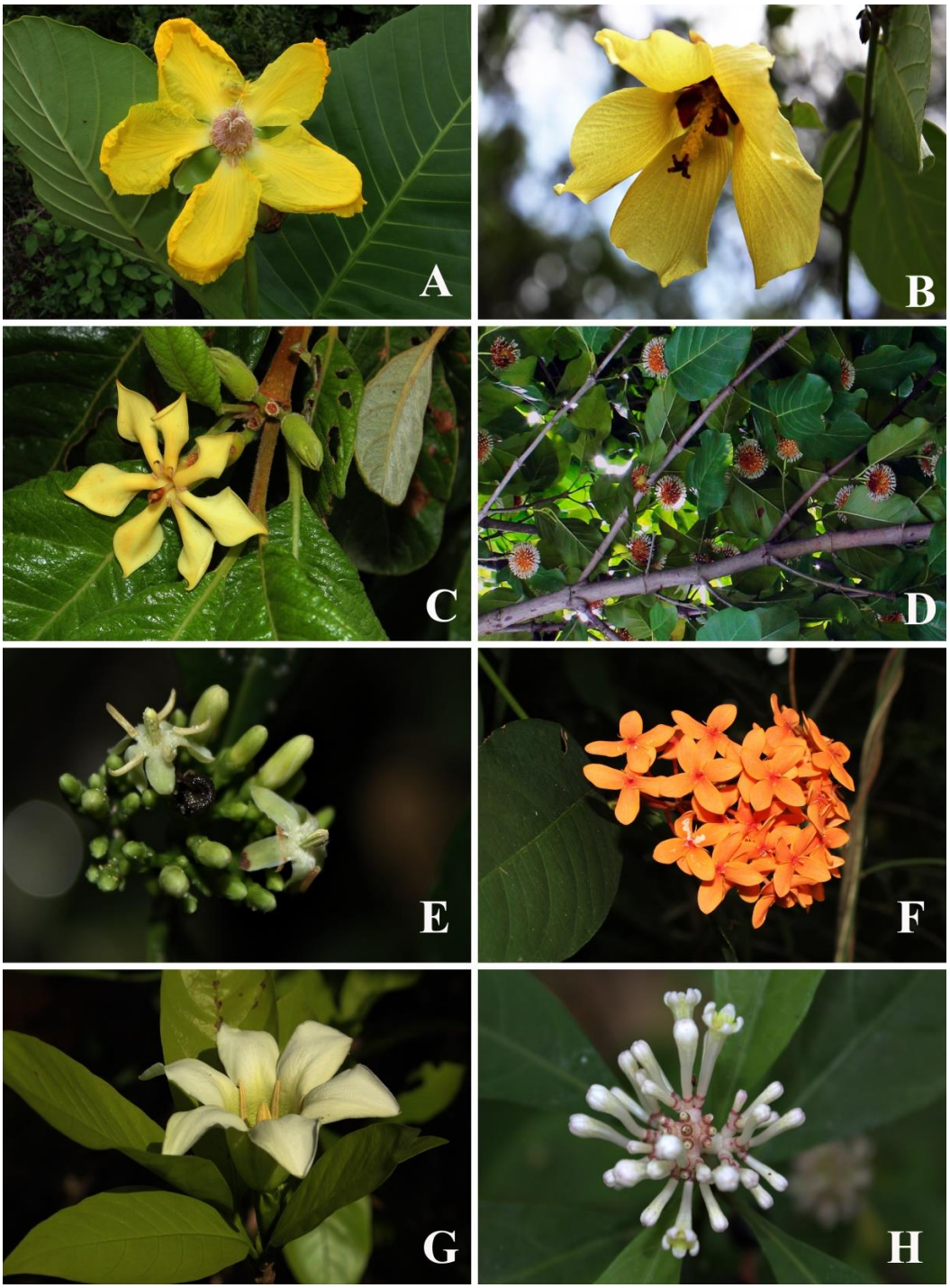

Plate 11: A. ***Dillenia suffruticosa*** (Griff.) Martelli −B. ***Hibiscus tiliaceus*** L.−C. ***Catunaregam tomentosa*** (Blume ex DC.) Tirveng.− D. ***Neolamarckia cadamba*** (Roxb.) Bosser −E. ***Tarenna wallichii*** (Hook. f.) Ridl. −F. ***Ixora javanica*** (Blume) DC.− G. ***Kailarsenia campanula*** (Ridl.) Tirveng.− H. ***Chassalia curviflora*** (Wall.) Thwaites.

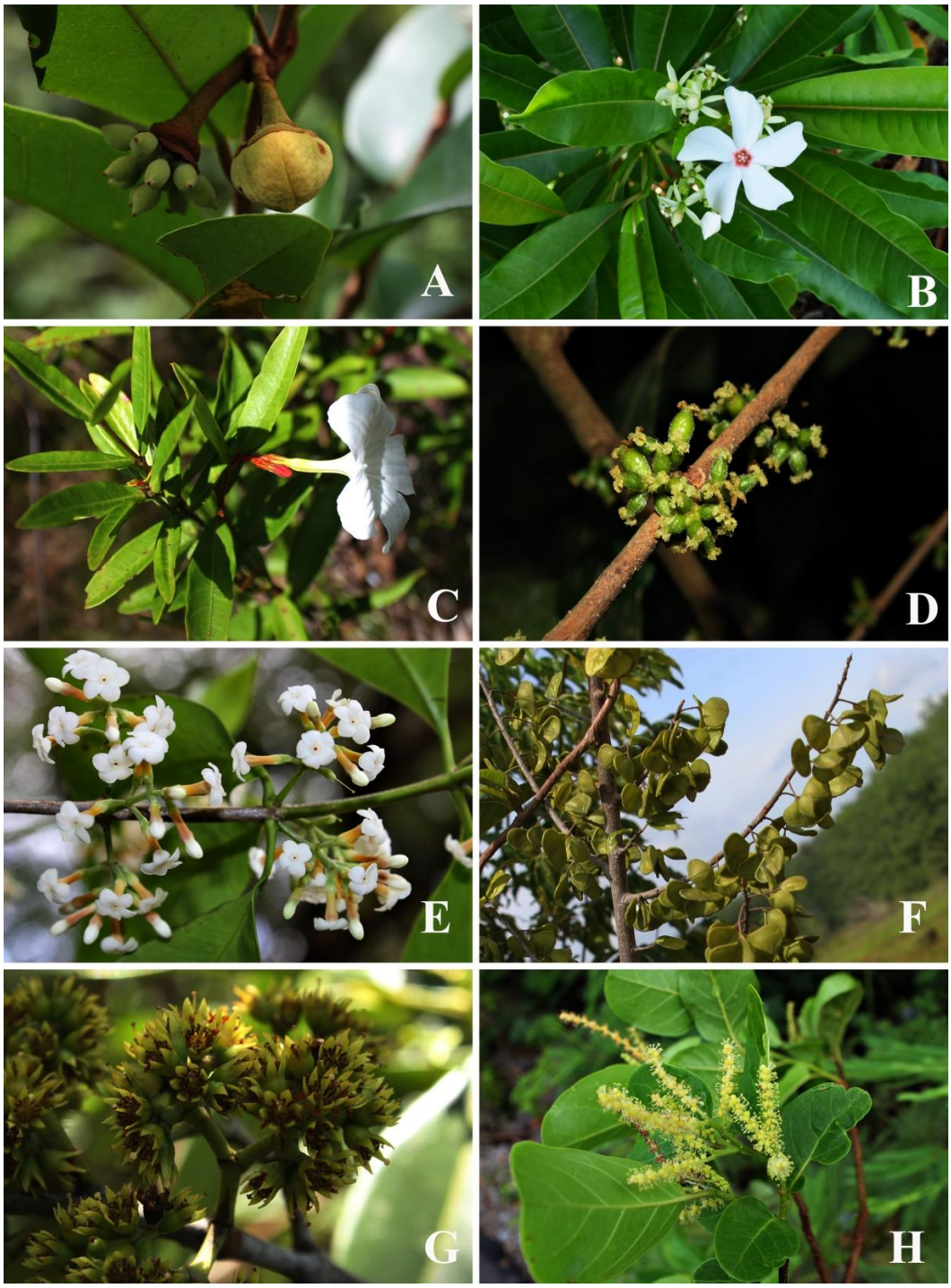

Plate 12: A. ***Uvaria*** *siamensis* (Scheff.) L. L. Zhou, Y. C. F. Su & R. M. K. Saunders −B. ***Cerbera manghas*** L.−C. ***Spirolobium cambodianum*** Baill.− D. ***Aporosa octandra*** (Buch.-Ham ex D. Don) Vickery **var. *malesiana*** Schot −E. ***Alyxia reinwardtii*** **Blume** −F. Fruits of ***Hymenocardia punctata*** Wall. ex Lindl.− G. ***Carallia brachiata*** (Louz.) Merr.− **H. *Antidesma ghaesembilla*** Gaertn.

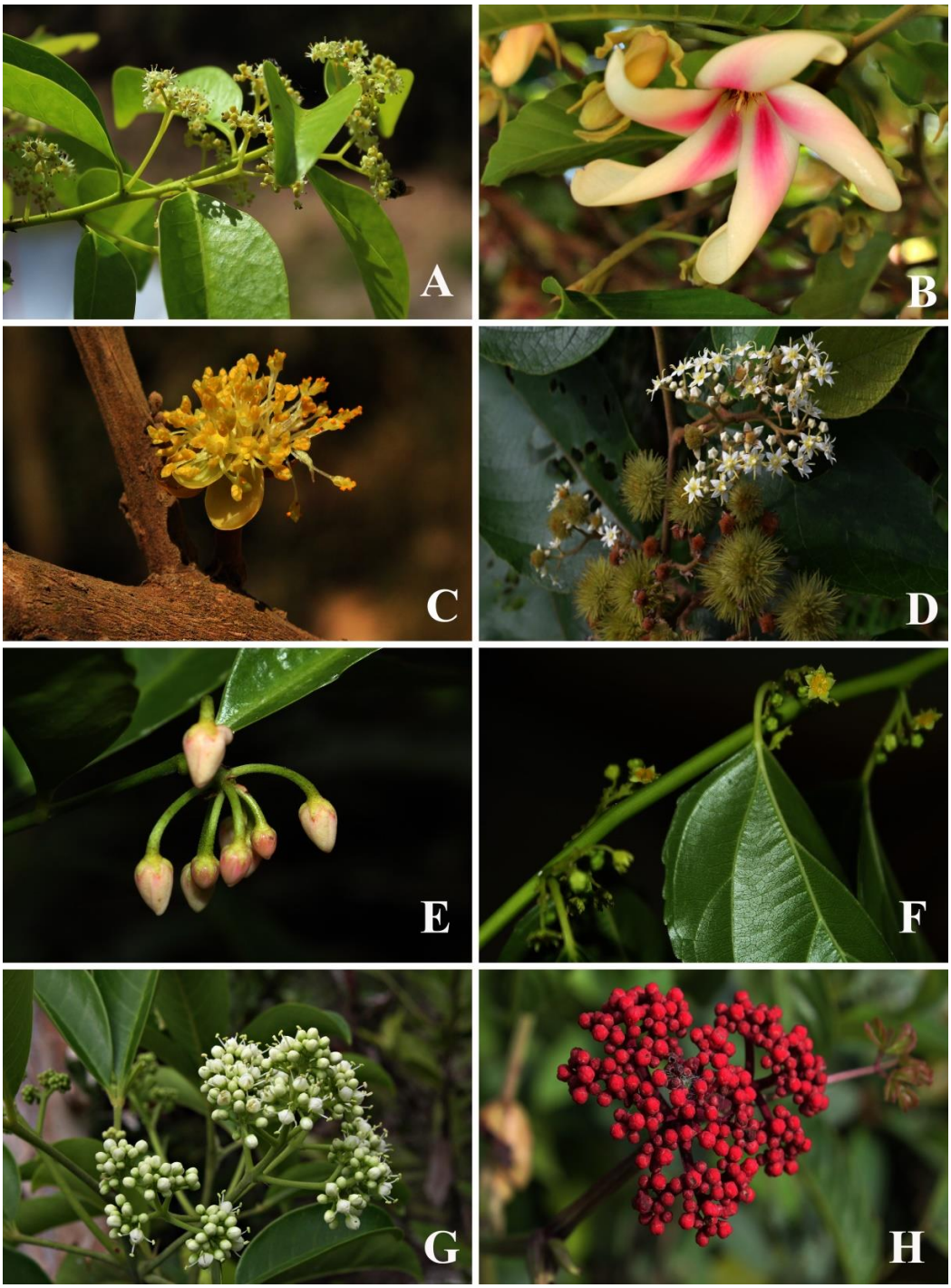

Plate 13: A. ***Ilex umbellulata*** (Wall.) Lose.−B. ***Dipterocarpus chartaceus*** Symington −C. ***Litsea grandis*** (Nees) Hook. f.− D. ***Commersonia bartramia*** (L.) Merr.−E. ***Ardisia crenata*** Sims −F. ***Colubrina asiatica*** (L.) Brongn. var. ***asiatica***−G. ***Melicope lunu-ankenda*** (Gaertn.) T. G. Hartley−H. ***Leea rubra*** Blume ex Spreng.

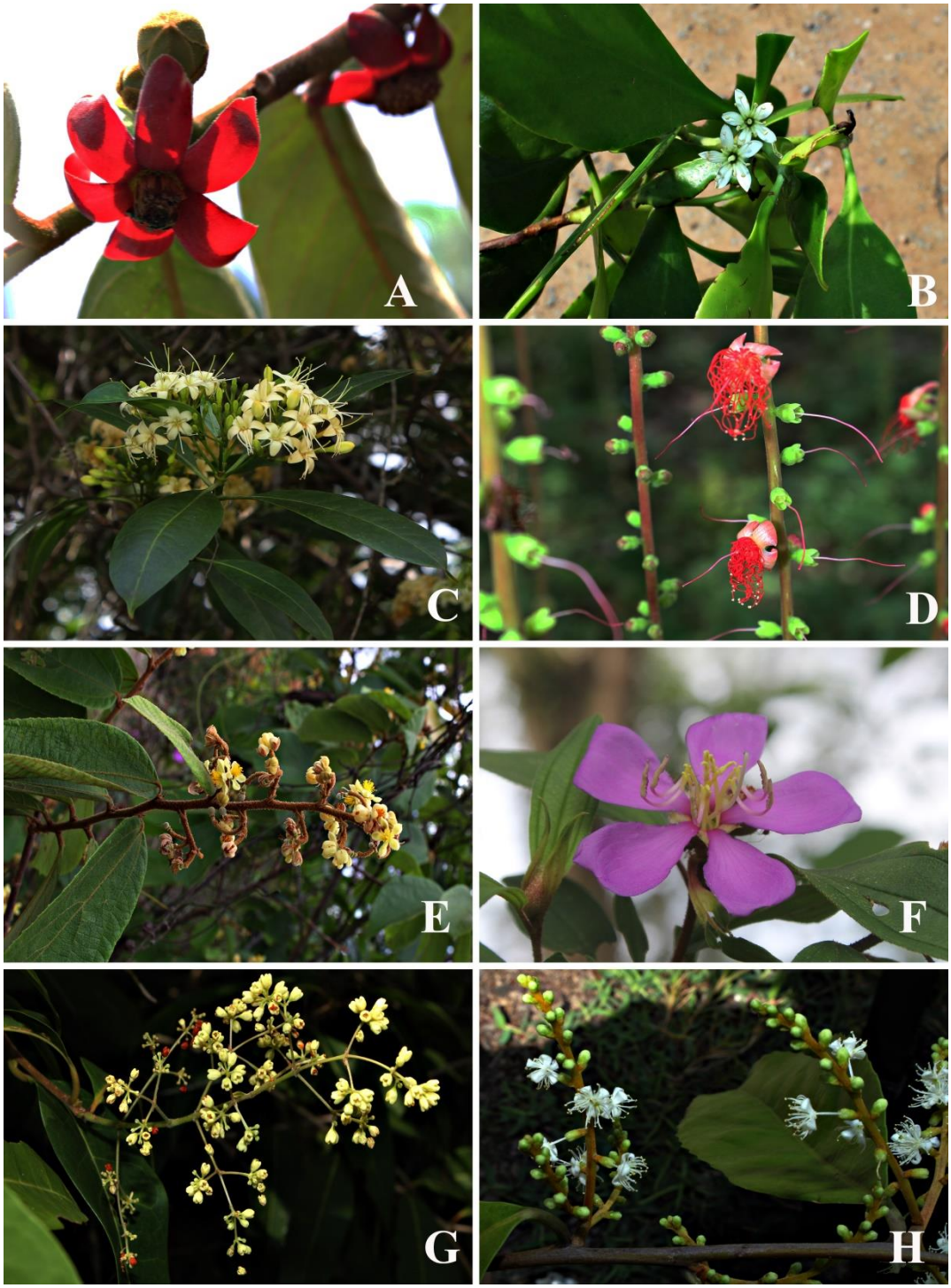

Plate 14: A. ***Uvaria rufa*** Blume −B. ***Lumnitzera racemosa*** Willd.−C. ***Fagraea fragrans*** Roxb.− D. ***Barringtonia acutangula*** (L.) Gaertn.−E. ***Microcos tomentosa*** *Sm.* −F. ***Melastoma malabathricum*** L. subsp. ***malabathricum*** −G. ***Olea*** *brachiata* (Lour.) Merr.−H. ***Symplocos sumuntia*** Buch.-Ham. ex D. Don.

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