The Diversity of Vascular Plants on the Granitic Inselberg in Songkla Province, Peninsular Thailand

Janejaree Inuthai

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Botany
Prince of Songkla University
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ชื่อวิทยานิพนธ์	ความหลากหลายของพืชมีท่อลำเลียงบนเขาหินแกรนิตลูกโดดในจังหวัดสงขลา
ผู้เขียน	นางสาวเจนจรีย์ อินอุทัย
สาขาวิชา	พฤกษศาสตร์
ปีการศึกษา	2553

บทคัดย่อ

จากการศึกษาพรรณพืชและสังคมพืชมีท่อลำเลียงบนเขาเหรง ซึ่งมีลักษณะเป็นภูเขาหินแกรนิตลูกโดดขนาดเล็กในจังหวัดสงขลา ระหว่างเดือนตุลาคม พ.ศ. 2551 ถึงเดือนกุมภาพันธ์ พ.ศ. 2553 สามารถจำแนกพืชมีท่อลำเลียงได้ทั้งสิ้น 83 ชนิด จาก 80 สกุล 39 วงศ์ วงศ์ที่พบทั่วไปและมีจำนวนชนิดมากที่สุด คือ Orchidaceae (12 ชนิด) รองลงมา คือ Rubiaceae (8 ชนิด) และ Poaceae (7 ชนิด) สภาพแหล่งอาศัยย่อยบนเขาหินลูกโดดแห่งนี้แบ่งออกเป็น 7 แบบ ดังนี้ 1. บริเวณรอยแตกและรอยแยกบนลานหิน 2. กลุ่มหินที่กองซ้อนกัน 3. แอ่งเว้าตื้นที่มีการสะสมตะกอนเป็นชั้นบาง 4. แอ่งเว้าลึกที่มีการสะสมตะกอนปริมาณมาก 5. ลานหินลาดเอียงเปิดโล่ง 6. ลานหินราบภายใต้ร่มเงา และ 7. บริเวณรอยต่อระหว่างลานหินและขอบป่า เมื่อพิจารณาจากสภาพแหล่งอาศัยย่อยทั้งหมด สภาพแหล่งอาศัยย่อยที่มีจำนวนชนิดพรรณพืชมากที่สุด คือ บริเวณรอยต่อระหว่างลานหินและขอบป่า (50 ชนิด) ซึ่งเป็นสภาพแหล่งอาศัยที่มีความหลากหลาย ทั้งความหนาของชั้นดินและปริมาณความเข้มของแสง การศึกษาครั้งนี้ได้แสดงภาพตัดขวางของสังคมพืชตามถิ่นอาศัยย่อยแบบต่าง ๆ บนลานหินที่ต่อเนื่องกันของเขาเหรงไว้ด้วย

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ABSTRACT

The diversity as well as a plant community's structure of vascular plants at Khao Reng, a small "granitic inselberg" in Songkhla province as well as a floristic composition were carried out, from October 2008 to February 2010. Eighty-three species of vascular plants on Khao Reng granitic inselberg were identified. These species belong to 80 genera in 39 families. The most common three families are Orchidaceae (12 species), Rubiaceae (8 species) and Poaceae (7 species). The microhabitats on the Khao Reng inselberg were categorized based on the topography into seven types i.e., 1) the rock crevices and clefts, 2) the rock-falls, 3) the shallow depressions, 4) the deep depressions, 5) the exposed rock slopes, 6) the shady flat rocky slopes and 7) the rock-platform fringe habitat. The rock-platform fringes, which render various conditions of soil accumulation and light intensities, accommodate the highest plant species numbers (50 species). The illustration of the vegetation profiles were carried out.

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Finally, I wish to express my deepest respect and profound gratitude to my parents for their love and their moral encouragement.

Janejaree Inuthai

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CHAPTER 1

INTRODUCTION

The term "inselberg" was first used by Bornhardt (1900) to describe the isolated rock outcrops which are characterized by large areas of bare rocky slopes that were found in southern Africa. The inselbergs are an isolated hill or groups of hills that rise abruptly from the surrounding plains. They are widely distributed in tropical and subtropical regions but can be found in temperate zones as well, e.g., Australia, USA, etc. (Porembski *et al.*, 1993; Hunter & Clarke, 1998; Pigott & Sage, 1997; Oosting & Anderson, 1937, 1939; Mc Vaugh, 1943; Wyatt & Stoneburner, 1982; Sarthou & Villiers, 1998). In general, Precambrian granites and gneisses are the major rock types of inselbergs. However, the granite inselbergs would occur as dome-shaped rock outcrops (Porembski *et al.*, 1997). The studies on the vegetation of these granitic outcrops have been undertaken throughout the world particularly in Africa and America (e.g., Oosting & Anderson, 1937, 1939; Mc Vaugh, 1943; Wyatt & Fowler, 1977; Wentworth, 1981; Walters, 1982; Walters & Wyatt, 1982; Wyatt & Stoneburner, 1982; Houle & Phillips, 1989; Barthlott *et al.*, 1993; Porembski *et al.*, 1993; Groger & Barthlott, 1996; Beard, 1997; Pigott & Sage, 1997; Porembski *et al.*, 1997; Porembski *et al.*, 1998; Hunter & Clarke, 1998; Sarthou & Villiers, 1998; Porembski & Barthlott, 2000; Burke, 2001, 2002a, 2002b, 2003, 2004, 2005; Parmentier, 2003; Parmentier *et al.*, 2005; Müller, 2007; Scarano, 2007). On the other hand, the granitic inselbergs in Tropical Asia have not attracted many biologists yet, especially, the local ones.

Inselbergs can be regarded as terrestrial habitat-islands because they have unique ecological characteristics. In contrast to oceanic islands, terrestrial habitat-islands have been rather neglected among the surrounding areas in terms of species diversity (Porembski, 2007). This habitat may house many particular plant species which can thrive on the rock platforms. The floristic information of the rock platforms, especially on the inselberg in Southeast Asia, is very sparse. In Thailand, the inselbergs or the isolated rocky hills are distributed sparsely throughout the

country (except the central part). Any publications concerning vegetation over this type of landscape in Thailand is still not known. It is, unfortunately, that the areas where granitic inselbergs occur have been disturbed or modified by human activities, e.g., selected reforestation programs which introducing the alien species to the areas; agriculture (e.g., rubber plantations etc.); granite-mining etc. The vegetation and flora of the inselberg granitic hills, especially in the peninsular Thailand, should urgently be surveyed and recorded before they would be soon permanently gone from their natural habitats. The present study is, thus, aiming as the documentation on the diversity of vascular plants and their habitats on the inselberg of Khao Reng hill, Songkhla province, peninsular Thailand.

OBJECTIVES

1. To document the diversity of vascular plants on Khao Reng granitic inselberg in Songkhla province, Peninsular Thailand.

2. To gain information about vascular plants in the boundary between the Sub-continental Southeast Asian region and the Malesian region.

3. To get ecological data including abundance and distribution of vascular plants in the area.

LITERATURE REVIEW

The publications of the vegetation on granitic outcrops have been undertaken throughout the world. The dome-shaped hill of granitic rock base performs a characteristic of an "inselberg-like" formation, which is an isolated rock outcrop that rises abruptly from the surrounding plains.

The vegetation of granitic rock outcrop surveys on a global scale

Oosting & Anderson (1939) investigated plant succession on granite rock in Eastern North Carolina. Succession on that area follows two major lines, originating (1) anywhere on the rock surface and (2) in depressions. The depressions may be dry, moist or pools.

Wyatt & Fowler (1977) provided a more complete account of the location, flora and vegetation of granite outcrops in North Carolina. Six general patterns of distribution of characteristic granite outcrop species, i.e., endemic, restricted endemic, near-endemic, Coastal Plain species, Mountain species, and weedy species were shown. Successional trends on the outcrops are seen as short-term, self-perpetuating fluctuations.

Wentworth (1981) suggested that over similar ranges of elevation and topographic position granitic sites had higher species richness, greater importance of herbaceous and arborescent species and lower importance of shrubby species than limestone sites in the Mule Mountains, Arizona.

Walters & Wyatt (1982) studied the vascular flora of granite outcrops in the Central Mineral Region of Texas. A comparison of the granite outcrop floras of central Texas and the southeastern United States showed similar types of microenvironments despite major differences in the climate and surrounding vegetation of each region.

Houle & Phillips (1989) documented seasonal variation and annual fluctuation in granite outcrop plant communities. The result showed that seasonal species turn-over was significant in communities on shallow soil, but not in communities on deeper soil where seasonal dominance shifts were common.

Barthlott *et al.* (1993) surveyed the vegetation of neo- and paleo-tropical rock outcrops in West Africa, East Africa, Madagascar, Brazil, Venezuela and French Guyana. In the same year, Porembski *et al.* (1993) documented ecological conditions and floristic diversity of an inselberg in the savanna zone of Ivory Coast: Mt Niangbo. They suggested that inselbergs are terrestrial systems with insular attributes and provide suitable models for studying biogeographical and ecological aspects.

Groger & Barthlott (1996) studied biogeography and diversity of the inselberg (Laja) vegetation of Southern Venezuela. The Venezuelan study area comprised the northwestern margin of the Guayana Shield. This study showed that evaluation of the distributional ranges of plant species revealed that a northern and a southern phytogeographical subunit of the inselberg flora could be distinguished.

Pigott & Sage (1997) surveyed remnant vegetation, priority flora and weed invasions at Yilliminning Rock, a granite inselberg near Narrogin, Western Australia. The vegetation and flora of the area and adjacent remnant vegetation were described and the current threats to the nature conservation values of the remnant vegetation, as a basis for future management were discussed. Porembski *et al.* (1997) provided a general overview of plant communities on tropical inselbergs in combination with some comments on the relation between regional floristic richness and species numbers on inselbergs. They also defined inselberg habitats, e.g., cryptogamic crusts, rock pools, monocotyledonous mats, ephemeral flush vegetation, etc. based on physiognomy. Beard (1997) studied geography, environment and flora of Mt Mulanje, Central Africa that rising to 3,002 m, and it is one of the world's largest granite inselberg.

Porembski *et al.* (1998) provided the details about the floristic and vegetational characteristics of mat communities on Brazilian inselbergs along both an altitudinal and a latitudinal gradient in the southeastern part of the Brazilian Atlantic rainforest. They found that monocotyledonous mats form one of the most characteristic communities of this ecosystem. Dominating were Bromeliaceae, Velloziaceeae, Cactaceae and Cyperaceae. The vegetation of granitic outcrop communities on the New England Batholith of eastern Australia was reported by

Hunter & Clarke (1998). The communities were diverse and widespread and were significant in terms of the high number of rare and restricted taxa. They also suggested that granitic outcrops retained remnants of native vegetation in modified rural landscapes. Sarthou & Villiers (1998) observed epilithic plant communities on inselbergs in French Guinana. Poaceae and Cyperaceae were the prominent families.

Porembski & Barthlott (2000) reported granitic and gneissic outcrops (inselbergs) as Centers of Diversity for Desiccation-Tolerant Vascular Plants. The most desiccation-tolerant vascular plants were represented by the monocotyledons and ferns.

Burke (2001) investigated the relationship between inselberg floras in floristic and functional terms and their correlation with environmental variables at macro-scale and landscape level in arid Nama Karoo landscapes.

Burke (2002a) published plant communities of a Central Namib inselberg landscape. She proposed that longer lived perennial species, such as trees and shrubs, were unlikely to change between seasons, while species composition of short-lived annuals varied greatly between seasons. She also published Island-matrix relationships in Nama Karoo inselberg landscape, Part I: Do inselbergs provide a refuge for matrix species? (Burke, 2002b). The result showed that inselbergs could serve as source for degraded range land, but at regional and landscape level employed in this analysis, the species attribute growth form and seed dispersal did not provide any conclusive trends.

Parmentier (2003) investigated the vegetation composition of three inselbergs from continental Equatorial Guinea in relation to six environmental variables. The most influent factors on vegetation appeared to be soil depth, pH and the position relative to the upper or lower forest fringe. There was no effect of slope or aspect. The three inselbergs differ in their vegetation could partly be explained by the insular property of inselberg vegetation surrounded by rainforest. Burke (2003) said that with regard to the role of inselbergs in contributing to local and regional plant species richness, many species restricted to inselberg habitats occurred and so contributed to local and regional species richness. Shrub thicket vegetation on tropical granitic inselbergs in French Guiana was investigated by Sarthou *et al.* (2003).

Burke (2004) proposed a process to select plant species that provided suitable candidates for monitoring climate change impacts in areas where complete biological inventories are lacking.

One year later, she published biodiversity patterns in arid, variable environments. Perennial plants provided a fair reflection of biogeographic patterns at the regional scale in arid areas, but indicated that the importance of explanatory environmental variables may change, depending on whether or not a complete set or a subset of the flora was used (Burke, 2005). Parmentier *et al.* (2005) studied of the floristic composition and patterns of diversity of rain forest inselbergs from the western part of Central Africa. The results showed that niche differentiation is a major determinant of species assemblages at the local scale. At the regional scale, these ecological niches are occupied by different species depending on the available local species pool.

Porembski (2007) documented tropical inselbergs: habitat types, adaptive strategies and diversity patterns. He distinguished habitat types based on physiognomy (e.g., ephemeral flush vegetation, monocotyledonous mats, rock pools, etc.). Scarano overviewed rock outcrop vegetation in Brazil. The main topics covered by phytogeography and vegetation ecology, plant life on shallow soils, plant reproduction and auto-ecology, morpho-physiology and plant adaptation and finally conservation and global change (Scarano, 2007). Müller (2007) proposed a first synopsis of herbaceous vegetation of seasonally wet habitats on inselbergs, mountain ridges and lateritic crusts. Small inselberg and rock outcrop habitats were often affected by heavy fluctuations of their environmental and climatic conditions. In addition, depending on the location and accessibility, herbaceous, seasonally wet vegetation on those habitats were differently influenced by humans.

The vegetation of rock outcrop surveys in South-East Asia.

Only few studies have described the vegetation on granitic outcrops in South-East Asia.

Wong (1998) investigated Patterns of plant endemism and rarity in Borneo and the Malay Peninsula. In both Borneo and the Malay Peninsula, special

groups of diversity were pointed out, including mountain peaks and ranges, areas of ultramafic and volcanic substrate, limestone outcrops, quartzite and sandstone ridges and plateauw, swampheath forest systems and river systems, most of these characteristically habitat islands.

The vegetation of rock outcrop surveys in Thailand.

In Thailand, the most comprehensive studies of flora and vegetation on inselbergs or rock outcrops are still lacking. Nevertheless, some rock platforms flora were explored in some selected places.

In 1982, Congdon documented 10 types of vegetation of Tarutao National Park, Satun province. The nature of the flora of Tarutao Island as compared with the flora of the Adang Islands (granite formation) was investigated. Some typically Malayan species were found on the granite hills of the Adang Islands, but the lowland forests of these Islands structurally and floristically resembles the Thai-type forests.

Sridith (1989) studied flowering plants on rock platform of Phu Hin-Rong-Kla National park (sandstone), Phitsanulok province. The results showed that 88 species were collected. Among them were 54 species of 33 dicotyledonous families and 34 species of 9 monocotyledonous families. The largest group and also the most abundance species were the orchids.

Suddee (1995) studied and collected flowering plants at Hin Ngam and Sud Phan Din of the Pa-Hin-Ngam Forest Park (sandstone), Chaiyaphum province. One hundred and forty one numbers of dicotyledonous plants were collected. Interestingly, the area was high diversity of plants, but there were many species with only one of few representatives.

In 2002, taxonomy of flowering plants in Pha Taem National Park (sandstone), Ubon Ratchathani province was reported by Boonjaras (2002). The largest families were Orchidaceae, Fabaceae and Scrophulariaceae.

Chayamarit & Welzen (2005) published the Flora of Doi Chaiangdao (limestone). The information about flora and vegetation were provided together with the list of species.

Sae Wai (2009) studied diversity of vascular plants on the cliffs and rocky ridges of Sankalakhiri Range in Betong District, Yala province. Two hundred and twenty three species were recorded. The most species-rich family was Orchidaceae. There were 16 species recorded and two species were expected to be new to science.

CHAPTER 2

MATERIALS AND METHODS

STUDY AREA

1. Location

Khao Reng hill is located in Songkhla province, southern Thailand. It is located at 6°54'27.49"–6°55'58.23" North and 100°36'33.24"–100°37'48.12" East. It is the boundary between Chana and Namom districts of Songkhla province and bounded on the East by Chana district; on the West by Namon district.

2. Topography and geology

Khao Reng hill is a small dome-shaped inselberg which is a part of Bantad ranges (Plate 1, A.). The elevation range of this hill is 55-559 m above the sea level (Fig. 1). The rock formation is mainly composed of two types, i.e., Triassic granites and Lower Carboniferous sandstones (Mineral Resource Department, 2007) (Fig. 2). However, the granite rock is dominant. And the granitic rock platforms could be found scattering on this inselberg, especially in the eastern and middle parts of the hill. These rock platforms comprise many topographic features including crevices, cliffs, boulders, thin and thick layers of soil, as well as small streams. The platform slopes are about 30–80 degrees.

3. Climate

According to Köppen's classification system of climatic region analysis in Kottek *et al.* (2006), the climate of Songkhla belongs to the tropical monsoon climate (Am). There are two distinct seasons, i.e., dry season from February–September and rainy season from October–January. The precipitation in this area is affected by the southwest and northeast monsoons. The average annual temperature is about 27.99 °C. The average monthly rainfall is about 168.36 mm.

(Fig. 3). During study period (October 2008 to February 2010), the average annual temperature is about 27.73 °C. The average maximum temperature is 29.5°C in June 2009 and the average minimum temperature is 26.2°C during December 2008 and January 2009. The average monthly rainfall is about 227.37 mm. The highest monthly rainfall is 1,044 mm in November 2008 and the lowest monthly rainfall is 1.3 mm in February 2010. A total of 224 rain days were recorded and heavy rainfalls occurred in November 2009 (24 days) (Meteorological Department, 2010).

4. Vegetation

According to Whitmore (1990), the forest type at Khao Reng hill is tropical semi-evergreen rain forest or evergreen seasonal forest (Richards, 1996). The number of species in this forest type is high, but less than in evergreen rain forest in lower latitude of Malesian region. Deciduous trees may be up to one-third of the taller trees. There are not many large trees (7–15 m high). Epiphytes are common and include many ferns and orchids. (Plate 1, B.)

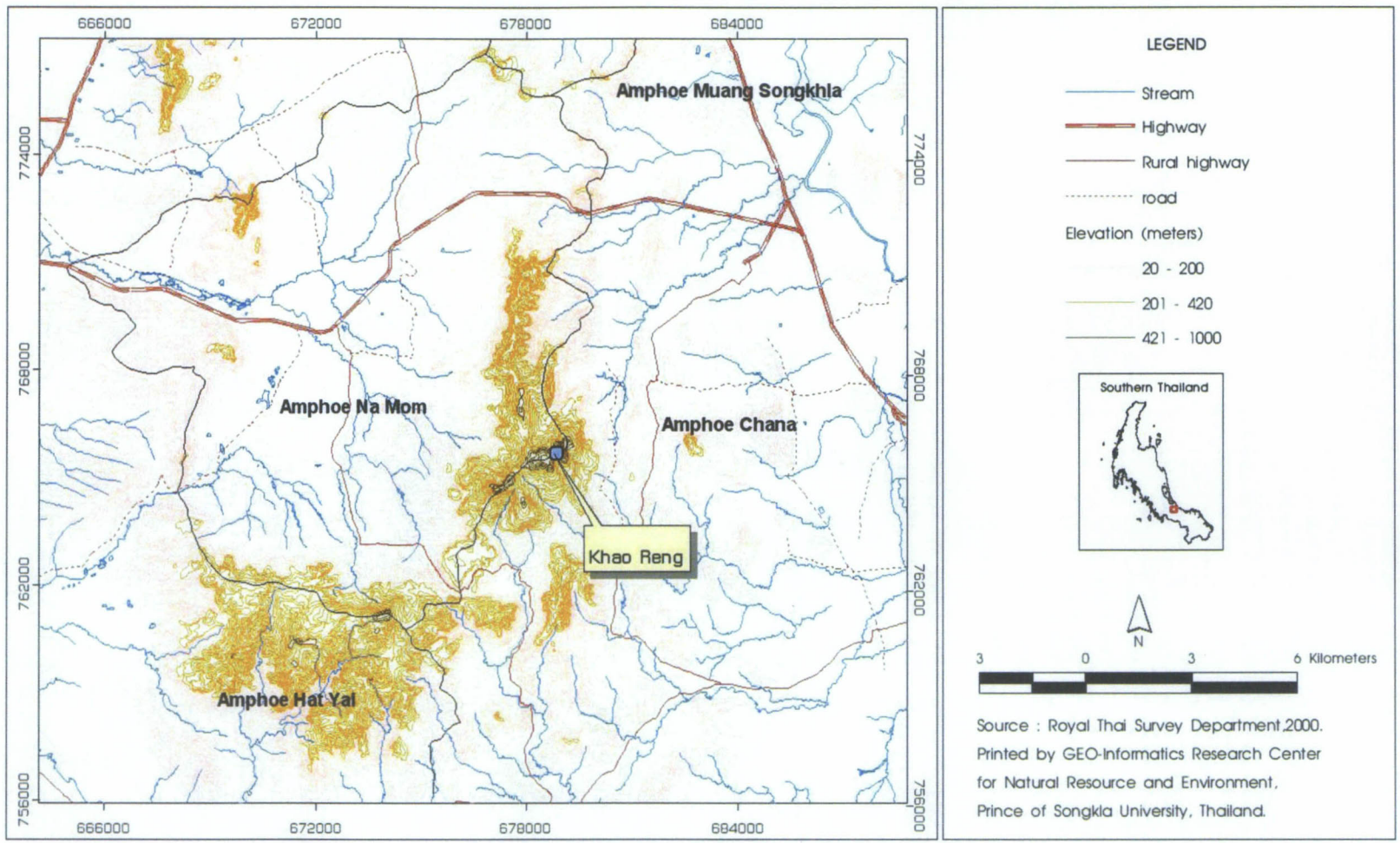

Figure 1. Topographic map of Songkhla province showing Khao Reng hill's elevations.

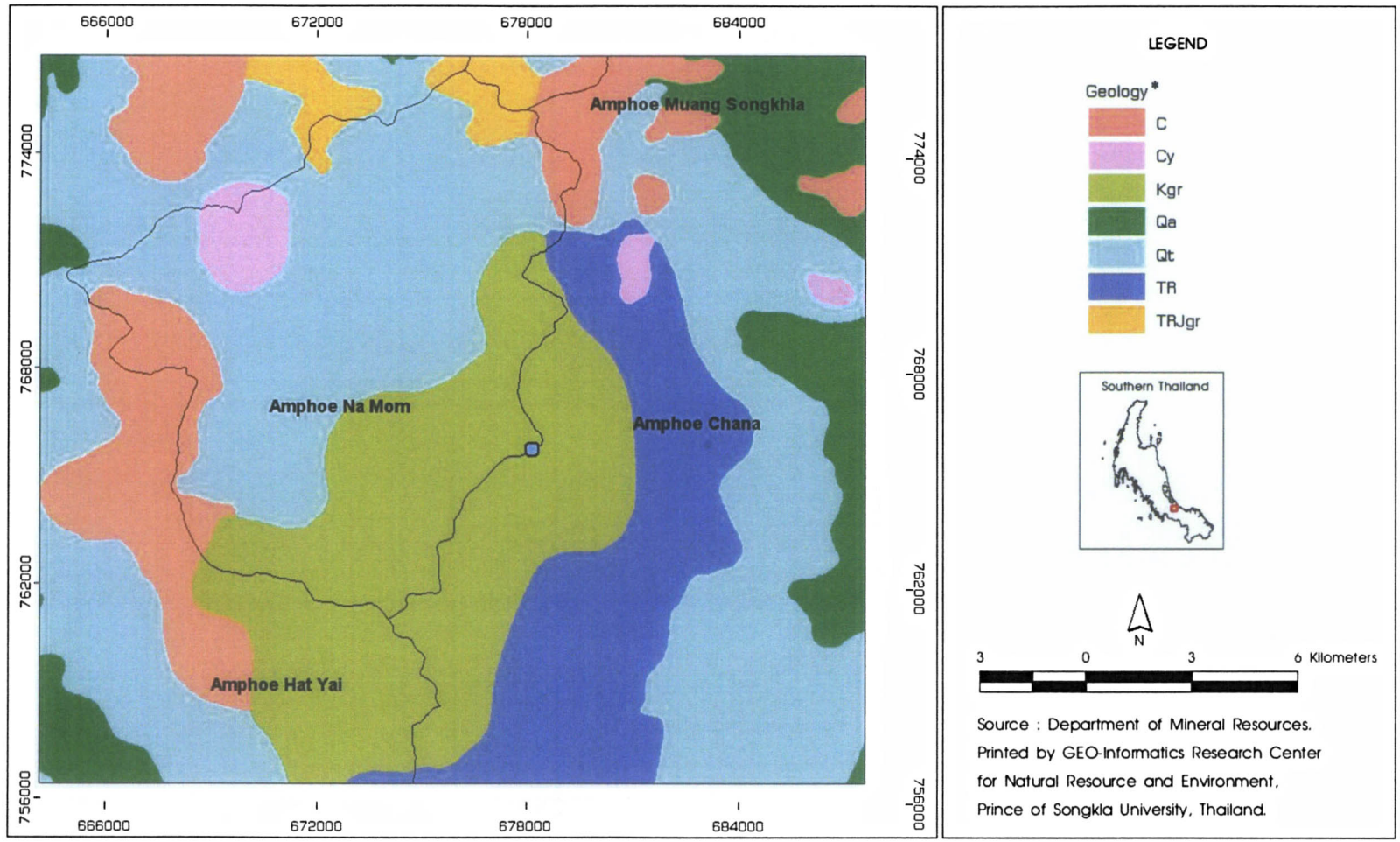

Figure 2. Geological map of Songkhla province showing the geological structure of Khao Reng hill.

(Geology*: C- Quartzite, quartzitic sandstone, beded chert, shale, sandy shale, siliceous shale, and siltstone; Cy- Shale, sandstone, siliceous shale, and conglomerate; Kgr- Granite, quartz-monzonite, pegmatite, aplite, and fine-grained tourmaline-granite; Qa- Alluvial deposits: Gravel, sand, silt, clay, and beach sand; Qt- Terrace deposits: Gravel, sand, silt, and laterite; TR- Conglomerate, sandstone, silstone, mudstone snd shale, with Daonella, Posidonia, and ammonite trace; TRJgr- Biotite granite, tourmaline granite, porphyritic granite and quartz veins)

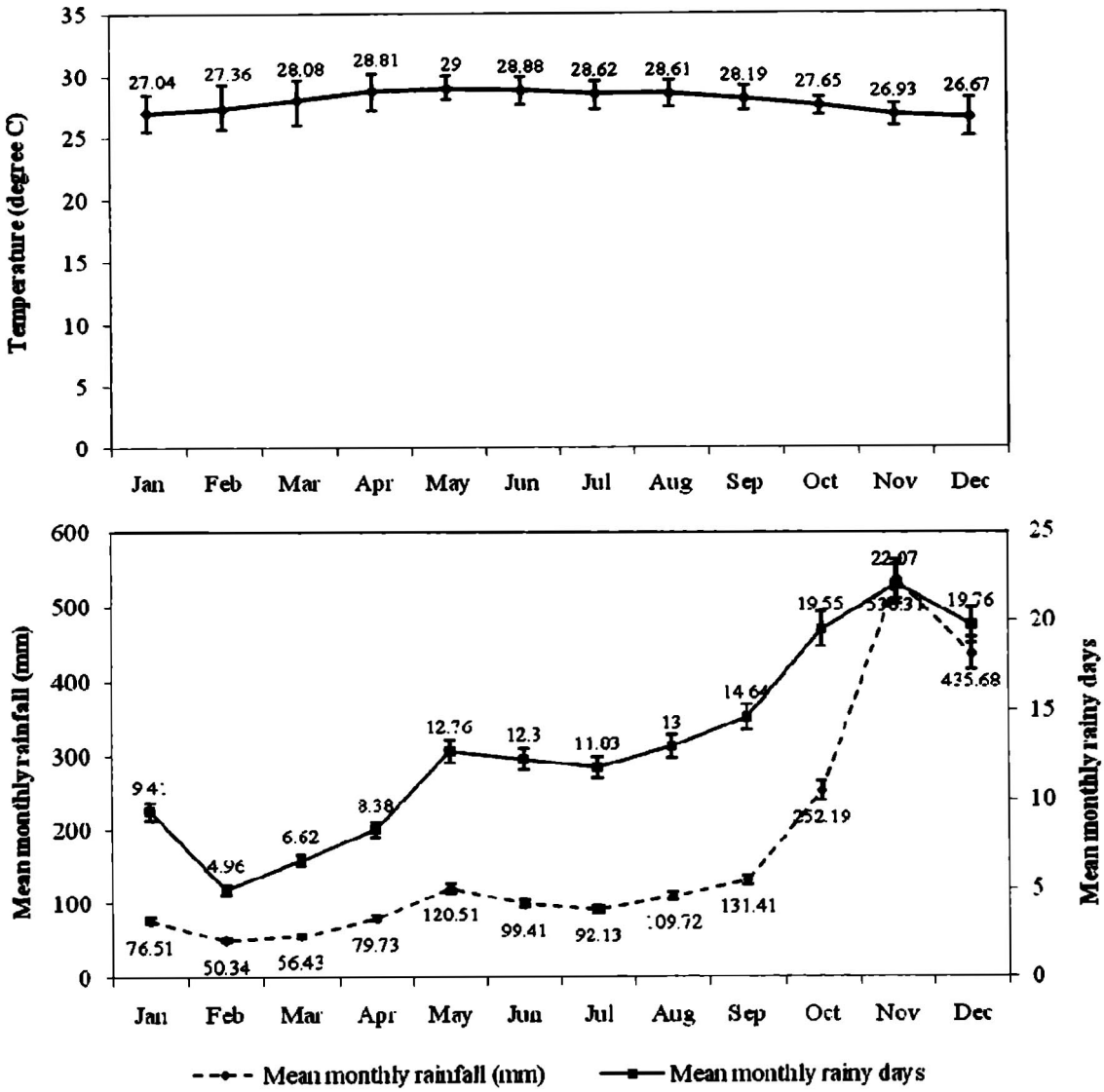

Figure 3. Climatological data during the period, 1981-2010, from Songkhla Climatic Station in Had-Yai district (568501) (Data from the Meteorology of Songkhla province, Thailand).

Note: Vertical Error Bars (I) of temperature graph showing the variation of average maximum temperature and average minimum temperature in each month.

DATA COLLECTION

Floristic study

1. Field survey

Exploring the granitic inselbergs in Songkhla province and selecting research study sites. Though there are some other granitic inselbergs in Songkhla, Khao Reng hill was selected in the present study due to the fact that there has been least disturbs.

2. Data collection

2.1 Plants specimens were collected at intervals (at least once a month from October 2008 to February 2010) from Khao Reng granitic inselberg in Songkhla province. This present study had focused on vascular plants occurring on the rock-platforms and the adjacent areas along the slope of the hill, not including the woodland community on the top of the hill. All specimens were prepared as described by Bridson & Forman (1998).

2.2 All plant collections were made with field notes of some important morphological and ecological characters (e.g., habit, latex, smell and color of flowers, abundance, distribution, etc.) together with photographs of selected interesting species.

The abundance of each species was estimated by eye in terms of percentage cover followed by Kent & Coker (1992). The percentage cover values were given average scores as follow:

5 = highly abundant (76–100% cover)

4 = abundant (51–75% cover)

3 = common (26–50% cover)

2 = few (6–25% cover)

1 = rare (1–5% cover)

0 = absent

3. Laboratory study

3.1 All plant collections were identified as far as possible with the available taxonomic literatures.

3.2 Descriptions of all species found were made together with line drawings of some interesting species. The plant name authors, other citations and abbreviation used in this thesis followed International Plant Names Index (IPNI) (The Plant Names Project, 1999). The terminologies concerning the morphology of plants followed Harris & Harris (2001) and Beentje (2010).

3.3 The voucher specimens have been deposited at the Herbarium, Department of Biology (**PSU**), Princess Maha Chakri Sirindhorn Natural History Museum, Faculty of Science, Prince of Songkla University, Songkhla and Forest Herbarium (**BKF**), Department of National Parks, Wildlife and Plant Conservation, Bangkok, Thailand.

Vegetation study

Three sampling plots (100 m x 30 m) along the transect slope of 45–75 degrees from the foothill upwards on the top of this granitic inselberg of Khao Reng hill were selected for vegetation studies, namely plots A, B and C. They were at the elevations of 125–189 m, 240–305 m and 337–386 m, respectively. The distance between three plots A–B, B–C and C–A were about 500 m. The vegetation profiles of the three plots along the slope of this dome-shaped granitic inselberg were illustrated.

CHAPTER 3

RESULTS

PART I: FLORISTIC STUDY

Species richness

Eighty-three species of vascular plants on Khao Reng granitic inselberg were identified and listed in Table 1. They belong to 80 genera, 39 families. Among these, one species is Lycophyte, 12 species are Pterophytes and 70 species are flowering plants. The most common three families are Orchidaceae (12 species), Rubiaceae (8 species) and Poaceae (7 species). Other widely dispersed tropical families are also encountered, such as Fabaceae, Asclepiadaceae, Cyperaceae, Euphorbiaceae and Memecylaceae.

Life forms

According to their habits of those taxa, five forms could be encountered (Fig. 4). The most abundant habits are herbaceous plants (48 species or 57.83%), followed by trees (15 species or 18.07%), shrubs (11 species or 13.25%), climbers (5 species or 6.03%) and small trees (4 species or 4.82%). Most of herbaceous plants are perennial species (47 species) and only one species is annual (*Cissus nodosa* Blume). Herbaceous habits are mainly represented by erect herbs, grasses, ferns and parasitic plant.

Figure 4. Pie chart showing the percentage of life forms of vascular plants on Khao Reng granitic inselberg.

Microhabitat types and species compositions

Based on topography of Khao Reng hill, six categories of microhabitat types plus a rock-platform fringe habitat were recognized (Table 1). Each microhabitat accommodated different floristic composition as follows:

1. Rock crevices and clefts. (Plate 2, A.)

The vegetation in rock crevices and clefts varies depending on the degree of exposure, the presence or absence of soil pockets as well as humidity, from a bare crevice (in the case of no soil pockets) to a dense vegetated crevice with mostly herbaceous plants or sometimes with shrubs and small trees. The vegetation is mostly composed of herbaceous plants, e.g., *Paraboea minor* (Barnett) B.L. Burtt, *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson (both species are the most abundant), *Aerides odorata* Lour., *Cyrtococcum oxyphyllum* Stapf, *Cyperus dubius* Rottb., *Fimbristylis hookeriana* Boeck, etc. in this study, "clefts" are considered, in general, broader and deeper than "crevices" and the former usually contain some woody shrubs and tree species, e.g., *Wrightia pubescens* subsp. *lanitii* (Blanco) Ngan, *Gardenia coronaria* Buch.-Ham. (both species are the most dominant), *Helicteres hirsuta* Lour., *Homalium dasyanthum* (Turcz.) W. Theob., *Canthium horridum* Blume, *Vitex pinnata* L., etc. Under shady conditions, clefts allow establishment of *Flickingeria* sp., *Elymus* sp., etc.

2. Rock-falls. (Plate 2, B.)

This habitat type is a place where there is an accumulation of many big fallen rocks, varying in size and shape (0.5–3 m in diameter). It could be found at the foothills or near the borders of the rock platforms. In this particular habitat, accumulations of boulders, organic matter and general debris occur. The thin layer of soil, present among those fractured rocks, is covered with epiphytic-lithophytic orchids and Pterophytes, e.g., *Flickingeria* sp., *Dendrobium crumenatum* Sw., *Pyrrosia adnascens* (Sw.) Ching, etc. and some woody shrubs, e.g., *Cladogynos orientalis* Zipp. ex Span., *Prismatomeris tetrandra* subsp. *malayana* (Ridl.) J.T.

Johanss., etc. The dominant species in this microhabitat type are herbaceous plants, *Paraboea minor* (Barnett) B.L. Burtt and *Globba pendula* Roxb.

3. Shallow depressions. (Plate 2, C.)

This habitat type occurred on inclined rock surfaces (45–75 degrees). They comprise a small hollow, filled with some moist litter (up to 10 cm depth), covered with herbaceous plants, dominated by *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson, *Paraboea minor* (Barnett) B.L. Burtt, *Davallia solida* (G. Forst.) Sw., *Cheilanthes tenuifolia* (Burm.f.) Sw., *Pyrrosia adnascens* (Sw.) Ching and some epiphytic-lithophytic orchids, e.g., *Aerides odorata* Lour., *Cymbidium finlaysonianum* Lindl., *Dendrobium crumenatum* Sw., etc. Under shady conditions, this microhabitat type allows establishment of *Eria javanica* (Sw.) Blume, *Drynaria quercifolia* (L.) J. Sm., *Ottochloa nodosa* (Kunth) Dandy, etc. However, the soil is not deep enough to support large woody trees. Generally, shallow depressions are isolated and surrounded by open areas of exposed rock, though the plant species of such shallow depressions could be also found in large contiguous mats. Typical plant mats are mainly composed of Poaceae, Cyperaceae, Pterophytes and many mosses. This type of microhabitat is widely distributed throughout the granitic rock platforms all over this inselberg.

4. Deep depressions. (Plate 2, D.)

This habitat type has a gentle slope, which allows more soil accumulation (up to 1 m depth) than the shallow depressions, therefore more shrubs and woody trees are found there. Species composition varies depending on the thickness of the substrate. The habitat includes a number of tree species, but each is represented by a few individuals. The ground species are abundant with herbaceous plants, e.g., *Paraboea minor* (Barnett) B.L. Burtt, *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson, *Davallia solida* (G. Forst.) Sw., *Cheilocostus speciosus* (J. König) C.D. Specht, etc. The shrubs and trees include *Memecylon edule* Roxb., *Vitex pinnata* L. (both species are the most dominant), *Ochna integerrima* (Lour.) Merr., *Wrightia pubescens* subsp. *lanitii* (Blanco) Ngan, etc.

5. Exposed rock slopes. (Plate 2, E.)

The dry bare rock surfaces are strongly exposed to sunlight with the angles of inclination their slopes varying from 30–80 degrees. This habitat is usually covered with bryophytes and lichens which apparently turn the colors of the rock surface brownish to black. Water films often occur. In the wet periods, water continuously flows throughout the rocky slopes, however it soon dries off. The exposed rock slopes with no cracks or crevices do not support any vegetation (the bare rock).

6. Shady flat rocky slopes. (Plate 2, F.)

This habitat is located within the forest and therefore there is less sunlight than out in the open and the atmospheric humidity and soil moisture is likely to be higher than in exposed areas. Isolated small patches of moss develop on some rock surfaces where, in the wet period water drainage occurs. The herbaceous plant layer is dominated by many orchids, e.g., *Cleisostoma subulatum* Blume, *Dienia ophrydis* (J. König) Seidenf., *Tainia penangiana* Hook.f. (it was found in only one population), etc. and Pterophytes, e.g., *Parahemionitis cordata* (Hook. & Grev.) Fraser-Jenk., etc.

7. Rock-platform fringes. (Plate 2, G.–H.)

This habitat is located along the fringe of the forest and the foothills. It is defined as a band 2–3 m wide between the two habitats (forest *versus* rock platform). The soil layer is thick enough to allow the growth of some trees (up to 15 m tall). Rocks and boulders of different sizes and shapes are abundant. The vegetation is dominated by shrub and tree species as well as epiphytes, e.g., *Memecylon edule* Roxb., *Cladogynos orientalis* Zipp. ex Span. (both species are the most abundant), *Sterculia cordata* Blume, etc. orchids, e.g., *Aerides odorata* Lour., *Doritis pulcherrima* Lindl., *Eria javanica* Blume, *Plocoglottis quadrifolia* J.J. Sm., etc. and Pterophytes, e.g., *Pyrrosia adnascens* (Sw.) Ching, *Drynaria bonii* H. Christ, *Drynaria quercifolia* (L.) J. Sm., etc. Some species could be found only in this microhabitat type, *Asplenium pellucidum* Lam., *Dischidia bengalensis* Colebr., *Hoya*

micrantha Hook.f., *Secamone elliptica* R. Br., *Bombax anceps* Pierre, *Acacia megaladena* var. *indo-chinensis* I.C. Nielsen, *Fagraea auriculata* Jack, *Chionanthus microstigma* (Gagnep.) P.S. Green, *Jasminum simplicifolium* subsp. *funale* (Decne.) Kiew, *Pavetta indica* L., *Epipremnum giganteum* Schott and *Stemona tuberosa* Lour.

Comparison of species richness in each of microhabitat types (Fig. 5), the highest of plant species richness were found along the rock-platform fringes (50 species), followed by on the shallow depressions (26 species), the rock crevices and clefts (20 species), the deep depressions (18 species), the rock-falls (8 species) and the shady flat rocky slopes (6 species). While, the exposed rock slopes do not sustain any plants to grow.

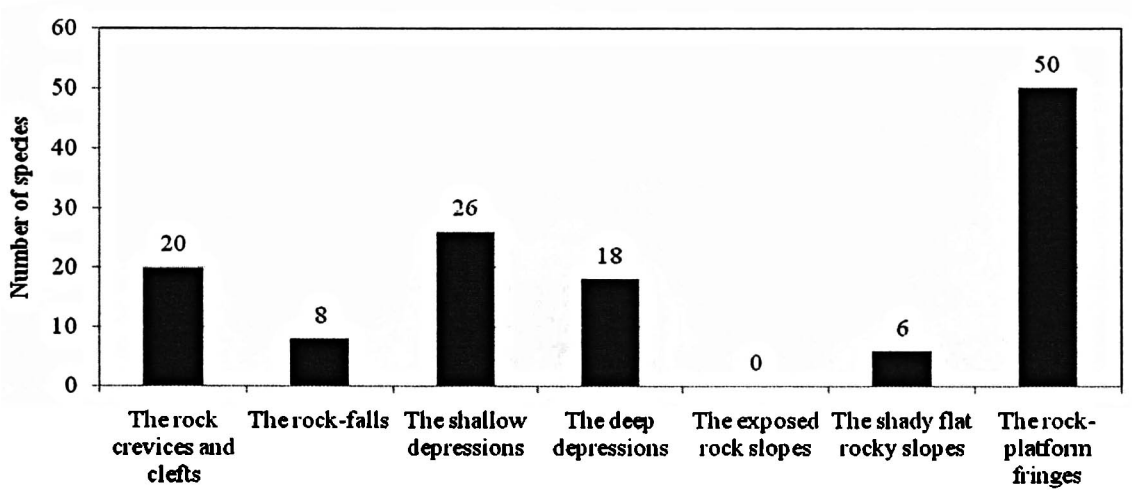

Figure 5. Bar chart showing the number of species in each microhabitat types of Khao Reng granitic inselberg.

Considering to the rock-platform fringe, in this current study is termed by the zone between the rock platforms and the forest habitats, so as to indicate the distinct boundary between the rock platform and the adjacent tropical semi-evergreen rain forest. The vegetation on rock platforms blends with forest to form a sort of transition zone called an ecotone. In this study, the vegetation along ecotone is quite distinct. This is the result from change in sizes and shapes of rocks and microclimate such as light intensity, temperature, humidity, etc. Of 83 species of vascular plants, 44 species were found on rock platforms, 50 species were found along ecotone and 37 species were found in the forest. (Fig. 6)

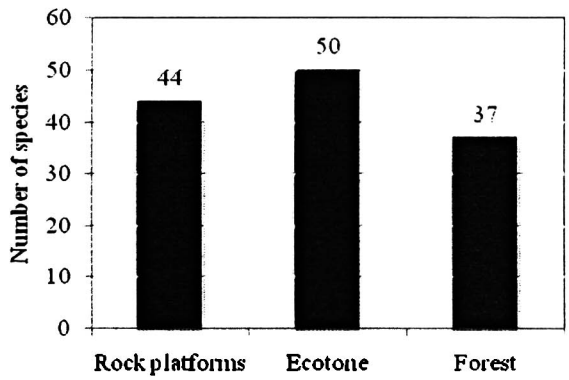

Figure 6. Bar chart showing the number of species in major different habitats on Khao Reng hill (Remark: "Forest" refers specifically to the tropical semi-evergreen rain forest on this inselberg).

Table 1. List of vascular plants occurring at Khao Reng inselberg, Songkhla province.

Scientific name	Life form[1]	Rock-platform microhabitat type[2]							Forest[3]
		A	B	C	D	E	F	G	
Lycophytes									
Selaginellaceae									
1. *Selaginella willdenowii* (Desv.) Baker	H	0	0	0	0	0	0	0	1
Pterophyte									
Aspleniaceae									
2. *Asplenium pellucidum* Lam.	H	0	0	0	0	0	0	2	0
Davalliaceae									
3. *Davallia solida* (G. Forst.) Sw.	H	0	0	5	3	0	0	1	0
Dennstaedtiaceae									
4. *Microlepia speluncae* (L.) T. Moore	H	0	0	0	0	0	0	0	2
Lygodiaceae									
5. *Lygodium polystachyum* Wall. ex T. Moore	H	0	0	0	0	0	0	0	2
Polypodiaceae									
6. *Drynaria bonii* H.Christ	H	0	1	3	0	0	0	1	1
7. *Drynaria quercifolia* (L.) J. Sm.	H	0	0	4	0	0	0	2	0
8. *Pyrrosia adnascens* (Sw.) Ching	H	0	2	4	0	0	0	5	2
Pteridaceae									
9. *Adiantum caudatum* L.	H	0	0	0	0	0	0	1	1
10. *Cheilanthes tenuifolia* (Burm.f.) Sw.	H	0	0	4	0	0	0	0	0
11. *Parahemionitis cordata* (Hook. & Grev.) Fraser-Jenk.	H	0	0	0	0	0	1	0	0
12. *Pteris dalhousiae* Hook.	H	0	0	0	0	0	0	1	1
Thelypteridaceae									
13. *Thelypteris opulenta* (Kaulf.) Fosberg	H	0	0	0	0	0	0	0	2
Angiosperms									
Dicots									
Acanthaceae									
14. *Pseuderanthemum graciliflorum* Ridl.	H	0	0	0	0	0	0	1	3
15. *Thunbergia fragrans* Roxb.	H	0	0	2	0	0	2	0	0
Apocynaceae									
16. *Wrightia pubescens* subsp. *lanitii* (Blanco) Ngan	T	4	0	0	2	0	0	3	3
Asclepiadaceae									
17. *Dischidia bengalensis* Colebr.	C	0	0	0	0	0	0	3	0
18. *Hoya micrantha* Hook.f.	C	0	0	0	0	0	0	3	0
19. *Secamone elliptica* R. Br.	ST	0	0	0	0	0	0	1	0
Asteraceae									
20. *Elephantopus scaber* L.	H	0	0	0	0	0	0	0	3
Bombacaceae									
21. *Bombax anceps* Pierre	T	0	0	0	0	0	0	2	0
Clusiaceae									
22. *Mesua kunstleri* (King) Kosterm	S	0	0	0	0	0	0	0	1
Euphorbiaceae									
23. *Bridelia tomentosa* Blume	ST	0	0	0	0	0	0	0	2
24.*Cladogynos orientalis* Zipp. ex Span.	S	0	3	0	1	0	0	5	0

[1]**Life form:** H = Herbaceous plant, S = Shrub, ST = Small tree, T = Tree, C = Climber

[2]**Rock-platform microhabitat type: A** = Rock crevices and clefts, **B** = Rock-falls, **C** = Shallow depressions, **D** = Deep depressions, **E** = Exposed rock slopes, **F** = Shady flat rocky slopes, **G** = Rock-platform fringes.
Abundance score: 5 = highly abundant, 4 = abundant, 3 = common, 2 = few, 1 = rare, 0 = absent.

[3]**Forest** refers specifically to the tropical semi-evergreen rain forest on Khao Reng inselberg.

Table 1. Continued.

Scientific name	Life form[1]	Rock-platform microhabitat type[2]							Forest[3]
		A	B	C	D	E	F	G	
Fabaceae									
25. *Abrus pulchellus* subsp. *cantoniensis* (Hance) Verdc.	H	0	0	2	0	0	1	0	0
26. *Acacia megaladena* var. *indo-chinensis* I.C. Nielsen	T	0	0	0	0	0	0	1	0
27. *Indigofera* sp.	H	0	0	2	0	0	0	0	2
28. *Tadehagi triquetrum* (L.) H. Ohashi	S	0	0	0	0	0	0	0	2
Flacourtiaceae									
29. *Homalium dasyanthum* (Turcz.) W. Theob.	T	3	0	0	3	0	0	3	0
Gesneriaceae									
30. *Paraboea minor* (Barnett) B.L. Burtt	H	5	4	4	3	0	0	5	1
Hydnocarpaceae									
31. *Hydnocarpus ilicifolia* King	T	0	0	0	0	0	0	0	2
Lamiaceae									
32. *Vitex pinnata* L.	T	3	0	3	4	0	0	2	3
Loganiaceae									
33. *Fagraea auriculata* Jack	C	0	0	0	0	0	0	1	0
Memecylaceae									
34. *Memecylon edule* Roxb.	T	0	0	0	5	0	0	5	0
35. *Memecylon fruticosum* King	S	0	0	0	3	0	0	3	4
Moraceae									
36. *Ficus hispida* L.f.	T	0	0	0	0	0	0	0	1
37. *Streblus taxoides* Kurz	ST	0	0	0	0	0	0	3	5
Myrsinaceae									
38. *Ardisia crenata* var. *crenata* Sims	S	0	0	0	0	0	0	0	2
39. *Maesa ramentacea* (Roxb.) A. DC.	T	0	0	0	0	0	0	0	2
Ochnaceae									
40. *Ochna integerrima* (Lour.) Merr.	T	2	0	0	3	0	0	2	0
Oleaceae									
41. *Chionanthus microstigma* (Gagnep.) P.S. Green	S	0	0	0	0	0	0	1	0
42. *Jasminum simplicifolium* subsp. *funale* (Decne.) Kiew	S	0	0	0	0	0	0	2	0
Rafflesiaceae									
43. *Rafflesia kerrii* Meijer	H	0	0	0	0	0	0	0	1
Rubiaceae									
44. *Canthium horridum* Blume	S	0	0	0	3	0	0	2	0
45. *Catunaregam* sp.	T	1	0	0	0	0	0	1	1
46. *Gardenia coronaria* Buch.-Ham.	T	4	0	0	0	0	0	2	3
47. *Ixora javanica* (Blume) DC.	S	0	0	0	0	0	0	0	1
48. *Oldenlandia pinifolia* (Wall. ex. G. Don) Kuntze	H	0	0	1	0	0	0	0	0
49. *Pavetta indica* L.	T	0	0	0	0	0	0	1	0
50. *Prismatomeris tetrandra* subsp. *malayana* (Ridl.) J.T. Johanss.	S	2	3	0	0	0	0	1	0
51. *Psydrax* sp.	ST	0	0	0	1	0	0	0	0
Sterculiaceae									
52. *Helicteres hirsuta* Lour.	S	2	0	4	3	0	0	2	1
53. *Sterculia cordata* Blume	T	0	0	0	2	0	0	3	0

Table 1. Continued.

Scientific name	Life form[1]	Rock-platform microhabitat type[2]							Forest[3]
		A	B	C	D	E	F	G	
Vitaceae									
54. *Cissus nodosa* Blume	C	0	0	1	0	0	0	1	0
Monocots									
Araceae									
55. *Epipremnum giganteum* Schott	H	0	0	0	0	0	0	2	0
56. *Scindapsus scortechinii* Hook.f.	H	0	0	0	0	0	0	3	2
Arecaceae									
57. *Livistona speciosa* Kurz	T	0	0	0	0	0	0	0	2
Costaceae									
58. *Cheilocostus speciosus* (J. König) C.D. Specht	H	0	0	3	2	0	0	2	0
Cyperaceae									
59. *Carex* sp.	H	0	0	0	0	0	0	1	1
60. *Cyperus dubius* Rottb.	H	3	0	3	0	0	0	0	0
61. *Fimbristylis hookeriana* Boeckeler	H	3	0	3	0	0	0	0	0
62. *Scleria lithosperma* subsp. *linearis* (Benth.) T. Koyama	H	0	0	0	0	0	0	0	3
Orchidaceae									
63. *Aerides odorata* Lour.	H	5	0	5	0	0	0	5	0
64. *Cleisostoma subulatum* Blume	H	0	0	0	0	0	3	2	0
65. *Cymbidium finlaysonianum* Lindl.	H	3	0	4	3	0	0	1	2
66. *Dendrobium crumenatum* Sw.	H	3	2	2	0	0	0	3	0
67. *Dienia ophrydis* (J. König) Seidenf.	H	0	0	0	0	0	3	0	2
68 .*Doritis pulcherrima* Lindl.	H	0	0	0	0	0	0	2	0
69. *Eria javanica* (Sw.) Blume	H	0	0	5	0	0	0	5	0
70. *Flickingeria* sp.	H	3	2	4	0	0	0	5	0
71. *Plocoglottis quadrifolia* J.J. Sm.	H	0	0	0	2	0	0	2	0
72. *Rhynchogyna luisifolia* (Ridl.) Seidenf. & Garay	H	0	0	0	0	0	0	0	2
73. *Tainia penangiana* Hook.f.	H	0	0	0	0	0	1	0	0
74. *Vanilla aphylla* Blume	H	0	0	0	0	0	0	0	1
Poaceae									
75. *Coelorachis helferi* (Hook.f.) Henrard	H	0	0	0	0	0	0	1	1
76. *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson	H	5	0	5	4	0	0	3	0
77. *Cyrtococcum oxyphyllum* Stapf	H	5	0	3	0	0	0	0	0
78. *Cyrtococcum patens* A. Camus	H	2	0	3	0	0	0	0	0
79. *Elymus* sp.	H	2	0	0	0	0	0	0	0
80. *Melinis repens* (Willd.) Zizka	H	1	0	2	1	0	0	0	0
81. *Ottochloa nodosa* (Kunth) Dandy	H	0	0	3	0	0	0	2	0
Stemonaceae									
82. *Stemona tuberosa* Lour.	C	0	0	0	0	0	0	2	0
Zingiberaceae									
83. *Globba pendula* Roxb.	H	0	4	0	0	0	0	3	0

LYCOPHYTE

SELAGINELLACEAE

Selaginella willdenowii (Desv.) Baker, Gard. Chron. 738, 950. 1867; Tagawa & K. Iwats. in Fl. Thailand 3(1): 19. 1979.— *Lycopodium willdenowii* Desv., Encycl., Suppl. 3(2): 552. 1814. (Plate 3, A.–B.)

Stem scandent, terete, 1.5–2 mm in diam.; branches to more than 60 cm long, tripinnate, glabrous; leaves sparsely on the main branches but densely on the lateral branches. ***Leaves*** dimorphic, green, glossy, glabrous; ventral leaves patent, oblong, slightly falcate, 2–4 by 1–1.8 mm, apex obtuse or slightly acute, margin entire, base oblique or subtruncate, usually bearing small auricles at acroscopic base; dorsal leaves adpressed, falcate-oblong, 1.5–2 by 0.5–1 mm, apex obtuse to acute, margin entire, base oblique. ***Strobilus*** solitary at apex of lateral branchlets, tetragonous, up to 15 mm long, 1–2 mm in diam.; sporophylls uniform, imbricate, broadly ovate, 1–1.5 by 0.5–1.5 mm, glabrous, apex acute, margin entire, base rounded.

Thailand.— SOUTH–WESTERN: Phachuap Khiri Khan; SOUTH–EASTERN: Chanthaburi; PENINSULAR: Chumphon, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Pattani, Yala, Narathiwat.

Distribution.— Myanmar, Indochina, Peninsular Malesia, Sumatra, Java and Philippines.

Ecology.— Partial shade or in shade along the boulders of the foothills, margins of the primary evergreen forest and in rubber plantation.

Vernacular.— Rang Kai (รังไก่) (Peninsular).

Specimen examined.— *J. Inuthai* 574, 593 (PSU)

PTEROPHYTE

ASPLENIACEAE

Asplenium pellucidum Lam., Encycl. (Lamarck) 2(1): 305. 1786; Holttum, Rev. Fl. Malaya 2: 428, fig. 246. 1954; Tagawa & K. Iwats. in Fl. Thailand 3(2): 282. 1985.— *Asplenium hirtum* Kaulf., Enum. Filic. 169. 1824. (Plate 3, C.–D.)

Rhizome short, erect, ca 5 mm in diam., bearing a tuft of fronds, densely scaly; scale gradually narrowing towards long acuminate apex, the margin with a few hair-like appendages, up to 6 by 0.8 mm, dark brown, with very thick internal cell-wall. ***Fronds*** pinnate, both surfaces bearing small scales when young. ***Stipe*** 5–9 cm long, dark purple to black, densely scaly, grooved on upper surface. ***Lamina*** oblong-lanceolate in outline, broadest at middle, gradually narrowing towards both apex and base, 15–40 by 2.5–5.5 cm, apex deeply pinnately lobed; rachis densely covered with brown linear scales; pinnae sessile, alternate, up to 40 pairs, ensiform to oblong-lanceolate, the lower ones gradually reduced to circular-shaped, middle pinnae largest, 2–3 by 0.6–1 cm, lobed usually 2/5 to costa, apex rounded to acute, auriculate acroscopic base truncate, basiscopic base narrowly cuneate; veins distinct on upper surface. ***Sori*** elongate along acroscopic branches of veins, oblique; indusia oblong, ca 5 mm long.

Thailand.— NORTHERN: Tak; EASTERN: Nakhon Ratchasima; SOUTH–WESTERN: Kanchanaburi; CENTRAL: Nakhon Nayok; SOUTH–EASTERN: Chanthaburi; PENINSULAR: Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Yala.

Distribution.— Widely distributed in the Paleotropics, from Eastern Africa to New Guinea and North to Sikkim.

Ecology.— Partial shade or in shade on rock slopes and boulders along the foothills, margins of the primary evergreen forest and sometimes found on logs.

Specimen examined.— *J. Inuthai* 461 (PSU)

DAVALLIACEAE

Davallia solida (G. Forst.) Sw., J. Bot. (Schrader) 1800(2): 87. 1801; Holttum, Rev. Fl. Malaya 2: 360, fig. 207. 1954; Tagawa & K. Iwats. in Fl. Thailand 3(2): 163. 1985; W.C. Shieh, De Vol & T.Y. Yang in Fl. Taiwan 1: 190, pl. 76. 1994; Noot., Acta Phytotax. Sin. 34(2): 174. 1996.— *Trichomanes solidum* G. Forst., Fl. Ins. Austr.: 86. 1786. (Plate 3, E.–F.)

Rhizome long-creeping, 6–11 mm in diam., scaly; old portion covered by appressed scales up to 2–3 mm long; scale peltate, oblong-triangular, 4–7 by 1–1.5 mm, pale brown, apical part thin, with hairs 1–2 mm long, caducous, basal part dark brown to nearly black, imbricate. ***Fronds*** tripinnate. ***Stipe*** 20–30 cm long, brown, grooved on upper surface. ***Lamina*** broadly subdeltoid in outline, 30–45 by 20–30 cm; pinnae stalked, alternate or subopposite, triangular, gradually narrowing towards acuminate apex; pinnules deltoid, apex acuminate; secondary pinnules sessile, narrowly oblong, apex acute, base broadly cuneate; veins distinct. ***Sori*** terminal on veinlets, at margin of ultimate segments; indusia cup-shaped to tubular-shaped, 1–2 by 0.5–1 mm.

Thailand.— SOUTH–EASTERN: Chanthaburi, Trat; PENINSULAR: Ranong, Surat Thani, Phangnga, Phuket, Nakhon Si Thammarat, Phatthalung, Trang, Songkhla, Yala.

Distribution.— Myanmar, China, Indochina, Peninsular Malaysia, Borneo, Taiwan, Philippines and Polynesia.

Ecology.— On shallow depression of rocks in open places or partial shade, in moist forest floor near stream, in secondary foreast and on tree-trunks.

Vernacular.— Phaya Nakkharat (พญานาคราช) (Northern, Peninsular); Wan Nakkharat (ว่านนาคราช) (Central); Neraphusi (เนระพูสี) (Northeastern).

Specimens examined.— *J. Inuthai* 442, 509, 550, 564 (PSU)

DENNSTAEDTIACEAE

Microlepia speluncae (L.) T. Moore, Index Fil. (T. Moore) 93. 1857; Holttum, Rev. Fl. Malaya 2: 314. 1954; Tagawa & K. Iwats. in Fl. Thailand 3(1): 118. 1979; W.C. Shieh in Fl. Taiwan 1: 161. 1994.— *Polypodium speluncae* L., Sp. Pl. 2: 1093. 1753.— *Microlepia speluncae* var. *hancei* (Prantl) C. Chr. & Tradieu., Notul. Syst. (Paris) 6(1): 9. 1937; Holttum, Rev. Fl. Malaya 2: 315, fig. 182. 1954.— *Microlepia speluncae* var. *villosissima* C. Chr., Grad. Bull. Straits Settlem. 4(11-12): 399. 1929; Holttum, Rev. Fl. Malaya 2: 315, fig. 183. 1954. (Plate 3, G.–H.)

Rhizome creeping, bearing fronds close together, 5–7 mm in diam., hairy; hair 2–3 mm long, pale brown. ***Fronds*** bipinnate-quadripinnatifid. ***Stipe*** 30–110 cm long, stramineous to brownish, with short hairs, grooved on upper surface. ***Lamina*** deltoid to ovate in outline, 60–100 by 50–70 cm, hairy; pinnae stalked, alternate or subopposite, oblong-triangular, lower second or third pinnae largest, 25–35 by 8–10 cm, gradually narrowing towards acuminate apex, basiscopic pinnae reduced; pinnules sessile, oblong-triangular or oblong-lanceolate, 4–6.5 by 1–1.5 cm, apex acute to acuminate, base obliquely cuneate; secondary pinnules (segments) sessile, lobed to pinnatisect, oblong to subtetragonal, apex obtuse, base oblique at sessile base; veins indistinct. ***Sori*** terminal on veinlets, at margin of ultimate segments; indusia cup-shaped, 0.5–1 mm in diam., hairy.

Thailand.— NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Lampang, Tak; NORTH–EASTERN: Phetchabun, Loei; CENTRAL: Nakhon Nayok; SOUTH–EASTERN: Chon Buri, Chanthaburi; PENINSULAR: Chumphon, Surat Thani, Phuket, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Yala, Narathiwat.

Distribution.— Pantropics.

Ecology.— In open places or partial shade on granitic bedrock and limestone outcrops in lowland forest, in moist places along stream and in secondary forest.

Vernacular.— Kut Phi (กูดผี), Kut Yi (กูดยี), Hora Phak Kut (โหราผักกูด) (Central); Chon (โชน) (Southweatern); Neraphusi (เนระพูสี) (Peninsular).

Specimens examined.— *J. Inuthai* 557, 571, 598 (PSU)

Pteris dalhousiae Hook., Sp. Fil. 2: 170, t. 121A. 1858; Holttum, Rev. Fl. Malaya 2: 401. 1954.

Rhizome short, erect, bearing fronds close together, 5–7 mm in diam., scaly at apex; scale linear, 4–6.5 by 0.2–0.3 mm, dark brown, apical part thin, margin hyaline, crisped. ***Fronds*** pinnate. ***Stipe*** 25–50 cm long, brownish to dark brown, glabrous above, bearing dark brown scales at base, grooved on upper surface. ***Lamina*** deltoid to oblong-ovate in outline, 25–40 by 30–35 cm, glabrous; pinnae 4–5 pairs, sessile or subsessile, alternate or subopposite, lowest or lower second pinnae largest, 20–30 cm long, deeply lobed nearly to rachis, apex with widely spaced, connected by a broad wing on either side of the costa, basiscopic pinnae reduced; lobes 6–8, falcate, 8–12.5 by 4.5–1.6 cm, gradually smaller towards acuminate apex, almost confined to the basiscopic side of each pinna, with some lobes on the acroscopic side, apex acute, margin of sterile pinnae slightly toothed; costae of lobes grooved on upper surface; veins free, indistinct. ***Sori*** elongate along margin of lobes, usually not reach to apex of lobes; indusia linear, formed by reflexed margin of lobes, glabrous.

Thailand.— SOUTH–EASTERN: Chanthaburi; PENINSULAR: Surat Thani, Songkhla, Yala.

Distribution.— Peninsular Malesia, Sumatra and West Java.

Ecology.— In partial shade of lowland forests.

Specimen examined.— *J. Inuthai* 627 (PSU)

LYGODIACEAE

Lygodium polystachyum Wall. ex T. Moore, Gard. Chron. 167. 1859; Holttum, Rev. Fl. Malaya 2: 56, fig. 10. 1954; Tagawa & K. Iwats. in Fl. Thailand 3(1): 59. 1979. (Plate 4, A.–B.)

Rhizome creeping. ***Fronds*** climbing, indefinite growth, up to 3 m long; stipe terete, brownish or reddish-brown, densely hairy throughout; rachis like stipe; pinnae numerous, stalked, alternate or subopposite, oblong or oblong-triangular, 20–30 by 6–12 cm, gradually narrowing towards acute apex pinnate with loose subsessile pinnules, sparsely white hairy. ***Primary rachis-branches*** short. ***Secondary rachis-branches*** densely hairy throughout, pinnately arranged; pinnules 10–13 pairs, short-stalked, oblong-triangular or subdeltoid, 2–6 by 1–2 cm, apex acute or obtuse, base subtruncate, margin lobed half-way to midrib; lobes oblong-triangular, apex obtuse, margin sparsely hairy, base oblique at sessile base; costae and veins with scattered stiff hairs. ***Sporangia-bearing lobes*** narrow, up to 6.5 by 1.5 mm; indusia 0.5–1 mm in diam., sparsely stiff hairs.

Thailand.— NORTHERN: Chiang Mai, Chiang Rai, Lampang, Phitsanulok; NORTH–EASTERN: Phetchabun; SOUTH–WESTERN: Phachuap Khiri Khan; CENTRAL: Nakhon Nayok; SOUTH–EASTERN: Chon Buri; PENINSULAR: Chumphon, Surat Thani, Nakhon Si Thammarat, Phuket, Trang, Songkhla, Narathiwat.

Distribution.— Myanmar, Southwest China, Indochina, and Peninsular Malesia.

Ecology.— Climbing on tree-trunks in partial shade or in shade.

Vernacular.— Kut Khua (กูดเดือ), Kut Khruea (กูดเครือ), Kut Kong (กูดก๊อง) (Northern); Liphao (ลิเภา), Liphao Yong (ลิเภาย่อง), Liphao Pa (ลิเภาป่า) (Peninsular).

Specimens examined.— *J. Inuthai* 572, 592 (PSU)

POLYPODIACEAE

Drynaria bonii H. Christ, Notul. Syst. (Paris) 1: 186. 1910; Tagawa & K. Iwats. in Fl. Thailand 3(4): 545. 1989. (Plate 4, C.–D.)

Rhizome creeping, tightly fixed on substrate, 1–3 cm wide, ca 5 mm thick, densely scaly; scale peltate, ovate with long tip, margin slightly toothed, base rounded, 4–7 mm long with tips 2–4 mm long, 1–1.5 mm wide, brownish to dark brown in central portion, apical part stiff. ***Nest leaves*** many, sessile, imbricate, elliptic-ovate to ovate in outline, 4–11 by 3–9 cm, apex rounded, margin subentire, base cordate. ***Foliage leaves***: stipe 10–15 cm long, narrowly winged nearly to base, scaly at base; lamina pinnatifid to pinnatisect, oblong in outline, 25–40 by 10–20 cm, apex bifid; lobes oblique, adnate to neighbourings with laminae up to 1 mm from midrib, oblong-lanceolate, 7–10 by 1.5–2.5 cm, apex acute to acuminate, margin entire, sometimes narrowed towards base; vein anastomosing, distinct. ***Sori*** rounded, naked, irregularly placed on lower surface between main veins.

Thailand.— NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Lampang, Phrae, Tak, Phitsanulok; NORTH–EASTERN: Loei, Nong Khai; EASTERN: Chaiyaphum, Nakhon Ratchasima; SOUTH–WESTERN: Prachuap Khiri Khan, Kanchanaburi; CENTRAL: Saraburi, Sing Buri, Uthai Thani; SOUTH–EASTERN: Prachin Buri, Chon Buri; PENINSULAR: Songkhla.

Distribution.— China and Indochina.

Ecology.— In rock crevices, on shallow depression of rocks and also found on tree-trunks in partial shade.

Specimens examined.— *J. Inuthai* 458, 459, 578 (PSU)

Drynaria quercifolia (L.) J. Sm., J. Bot. (Hooker) 3: 398. 1841; Holttum, Rev. Fl. Malaya 2: 182, fig. 88. 1954; Tagawa & K. Iwats. in Fl. Thailand 3(4): 546. 1989.— *Polypodium quercifolium* L., Sp. Pl. 2: 1087. 1753. (Plate 4, E.–F.)

Rhizome creeping, 1.5–2 cm in diam., densely scaly; scale peltate, narrowly triangular, 3–10 by 0.5–2 mm, brownish to dark brown in central portion, apical part stiff, apex acute, margin fimbriate to finely toothed, base rounded. ***Nest leaves*** sessile, oval to ovate in outline, ca 32 by 23 cm, lobed to a depth of 1–3.5 cm; lobes pointed, deltoid to triangular, 2.5–4 by 2.5–3.5 cm, apex rounded, margin entire. ***Foliage leaves***: stipes 15–20 cm long, narrowly winged nearly to base; lamina pinnatifid to pinnatisect, oblong in outline, ca 65 by 35 cm, apex acute; lobes oblique, adnate to neighbourings with laminae of less than 1 cm from midrib, oblong-ensiform, ca 22 by 4.5 cm, apex acute, margin entire; veins anastomosing, distinct. ***Sori*** rounded, naked, two regular rows placed on lower surface of lobes.

Thailand.— NORTHERN: Chiang Mai, Chiang Rai, Tak, Phitsanulok; NORTH–EASTERN: Nong Khai; SOUTH–WESTERN: Kanchanaburi, Phachuap Khiri Khan; SOUTH–EASTERN: Chon Buri, Chanthaburi, Trat; PENINSULAR: Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Yala.

Distribution.— India, Sri Lanka to South China and Indonesia, Peninsular Malaysia throughout to Fiji and tropical Australia.

Ecology.— On shallow depression of rocks and in partial shade at edges, sometimes found on tree-trunks.

Vernacular.— Kut Kha Hok (กูดขาฮอก), Chao-Wa-Na (เช้าวะนะ), Phu-Dong-Khae (พุดองแคะ) (Northern); Kratae Tai Mai (กระแตไต่ไม้) (Central); Sa-Mong (สะโมง) (Eastern); Bai Hu Chang (ใบหูช้าง), Sabai Nang (สะใบนาง), Hua Wao (หัวว่าว) (Southwestern); Dao-Ka-Lo (เดากาโละ) (Peninsular).

Specimen examined.— *J. Inuthai* 565 (PSU)

Pyrrosia adnascens (Sw.) Ching, Bull. Chin. Bot. Soc. 1: 45. 1935; Holttum, Rev. Fl. Malaya 2: 144, f. 60. 1954; Tagawa & K. Iwats. in Fl. Thailand 3(4): 496. 1989.— *Polypodium adnascens* Sw., Syn. Fil. (Swartz.) 25, 222. t. 2. f. 2. 1806. (Plate 4, G.–H.)

Rhizome long-creeping, 1–2 mm in diam., bearing fronds 1–3 cm apart, densely scaly; scale peltate, lanceolate, 2–3 mm long, brownish to dark brown in central portion, appressed, imbricate, apex acuminate, margin villous, base rounded. ***Fronds*** simple, dimorphic, thick and fleshy, sparsely scattered with stellate hairs on upper surface, densely stellate-hairy on lower surface; midrib grooved on upper surface, raised lower; veins indistinct. ***Stipe*** brownish to dark brown, scaly at base, stellate hairy throughout, longest in fertile fronds, grooved on upper surface. ***Sterile lamina*** shorter, with stipes 0.5–2 cm long, linear-oblong, 2–7 by 0.5–1 cm, apex rounded, base attenuate. ***Fertile lamina*** longer, with stipes 1.5–7 cm long, linear-oblong, 8–20 by 0.5–0.8 cm, apex obtuse to slightly acute, apical part more or less narrowing, margin of soriferous portion curved back when dried. ***Sori*** rounded, naked, closely, restricted on lower surface of apical half.

Thailand.— NORTHERN: Chiang Mai, Chiang Rai, Lampang, Tak, Phitsanulok; NORTH–EASTERN: Loei, Nong Khai, Mukdahan, Khon Kaen; EASTERN: Chaiyaphum, Nakhon Ratchasima, Buri Ram; SOUTH–WESTERN: Kanchanaburi, Prachuap Khiri Khan; CENTRAL: Saraburi, Nakhon Nayok; SOUTH–EASTERN: Chon Buri, Chanthaburi, Trat; PENINSULAR: Ranong, Surat Thani,

Phangnga, Phuket, Nakhon Si Thammarat, Trang, Phatthalung, Songkhla, Yala, Narathiwat.

Distribution.— Widely distributed in tropical Asia and Polynesia.

Ecology.— On rocks in exposed places along forest edges, in partial shade and on dry tree-trunks in lowland forest and in a sandy area near the beach.

Vernacular.— Phak Pik Kai (ผักปีกไก่) (Northern).

Specimens examined.— *J. Inuthai* 437, 438, 466, 491, 585 (PSU)

PTERIDACEAE

Adiantum caudatum L., Mant. Pl. Altera. 308. 1771; Holttum, Rev. Fl. Malaya 2: 599, fig. 351. 1954; Tagawa & K. Iwats. in Fl. Thailand 3(2): 207. 1985; W.C. Shieh in Fl. Taiwan 1: 237, pl. 98. 1994. (Plate 5, A.–B.)

Rhizome short, erect, 0.5–1 cm in diam., bearing a dense tuft of fronds, scaly; scale narrowly triangular to linear, 3–5 mm long, slightly entire, dark brown with brownish edges. ***Fronds*** pinnate. ***Stipe*** 4–8 cm long, dark reddish-brown to black, polished, scaly at base, densely brown hairy throughout with sparsely long-hairy. ***Lamina*** linear-ensiform narrowing to a caudate tip in outline, 15–30 by 2–2.5 cm, pinnate with close subsessile pinnae, white setose hairy on both surfaces, with short hairs on lower surface; rachis densely brown hairy on upper surface with brownish setose hairs, prolonged into a whip-like stolon, rooting at tip; pinnae subsessile, alternate or subopposite, gradually smaller in size towards apex, lower ones smaller and reflexed; largest pinnae almost parallelogram-shaped, apex rounded, lower margin almost straight, upper margin nearly parallel to it, inner edge straight, at narrow angle to rachis, to form narrowly cuneate base with lower margin, ca 13 by 4 mm, upper and outer margins rather deeply lobed to about half the width of pinna, forming narrow lobes and very narrow sinuses; lobes usually including 4–6 veinlets,

apex truncate and slightly toothed, margin entire; veins distinct. ***Sori*** on apices of lobes, reflexed flaps nearly circular, hairy.

Thailand.— NORTHERN: Chiang Mai, Chiang Rai, Lampang, Phrae, Phitsanulok; NORTH–EASTERN: Loei, Nong Khai; EASTERN: Nakhon Ratchasima; SOUTH–WESTERN: Kanchanaburi, Prachuap Khiri Khan; CENTRAL: Phra Nakhon Si Ayutthaya, Saraburi; SOUTH–EASTERN: Chon Buri, Chanthaburi; PENINSULAR: Surat Thani, Phangnga, Nakhon Si Thammarat, Phatthalung, Satun, Songkhla, Pattani, Yala.

Distribution.— Widely distributed in the Paleotropics, from Africa to the Pacific.

Ecology.— Terrestrial in forest near rock slopes.

Vernacular.— Kut Namkhao (กูดน้ำข้าว) (Northern); Tin Tukkae (ตีนตุ๊กแก), Hang Nak Bok (หางนาคบก) (Central).

Specimens examined.— *J. Inuthai* 506, 539 (PSU)

Cheilanthes tenuifolia (Burm.f.) Sw., Syn. Fil. (Swartz) 129: 332. 1806; Holttum, Rev. Fl. Malaya 2: 590, fig. 347. 1954; Tagawa & K. Iwats. in Fl. Thailand 3(2): 201. 1985; W.C. Shieh in Fl. Taiwan 1: 211. 1994.— *Trichomanes tenuifolium* Burm.f., Fl. Indica 237. 1768. (Plate 5, C.–D.)

Rhizome short, suberect, 3–5 mm in diam., bearing a tuft of fronds, scaly; scale very narrow, entire, 4–6 mm long, greenish to brownish. ***Fronds*** dimorphic, tripinnate-quadripinnatifid, with scattered stiff hairs on upper surface. ***Stipe*** 10–50 cm long, dark reddish-brown to dark brown, densely scaly at base, with scattered short hairs throughout, grooved on upper surface. ***Sterile lamina*** smaller, with stipe about 10 cm long, deltoid narrowing to caudate tip, ca 12.5 by 12 cm. ***Fertile lamina*** triangular narrowing to acuminate-caudate tip, 20–37 by 10–15 cm; pinnae stalked, subopposite, lanceolate-triangular, basiscopic pinnae largest, 5–7 by

2–3.5 cm, apex acute; secondary rachis narrowly winged above; pinnules pinnatisect with a few lobes, oblong-triangular, apex slightly acute to obtuse, its pellucid edges, 1.5–2 by 0.5–1 cm; veins indistinct. ***Sori*** confined to the end of veinlets but appearing continuous at margin of lobes, when young protected by reflexed margin of lobes.

Thailand.— NORTHERN: Mae Hong Son, Chiang Mai, Lamphun, Lampang, Phrae, Tak, Phitsanulok; CENTRAL: Nakhon Nayok; SOUTH–EASTERN: Chanthaburi, Trat; PENINSULAR: Chumphon, Surat Thani, Phangnga, Trang, Satun, Songkhla, Yala.

Distribution.— Widely distributed in tropical Asia, Australia, New Zealand and Polynesia.

Ecology.— On shallow depression of rocks in exposed places, sometimes growing in large patches.

Vernacular.— Chon Phi (โชนผี) (Peninsular).

Specimens examined.— *J. Inuthai* 532, 589 (PSU)

Parahemionitis cordata (Hook. & Grev.) Fraser-Jenk., New Sp. Syndrome Indian Pterid. & Ferns Nepal 187, 1997.— *Hemionitis arifolia* (Burm.) T. Moore, Index Fil. (T. Moore) 114. 1859; Holttum, Rev. Fl. Malaya 2: 596. 1954; Tagawa & K. Iwats. in Fl. Thailand 3(2): 191. 1985. (Plate 5, E.)

Rhizome short, suberect, bearing a tuft of fronds, scaly; scale narrow, peltate, 3–3.5 mm long, entire, brownish or brown. ***Fronds*** simple, dimorphic, with scattered narrow scales on lower surface. ***Stipe*** 20–30 cm long in fertiles and 1.5–4 cm in sterile fronds, dark reddish-brown to dark brown, scaly throughout, densely scaly at base, grooved on upper surface. ***Sterile lamina*** thickly papyraceous, oblong-ovate, 3.5–8 by 2–4 cm, upper surface green or dark green, glabrous, lower surface greenish, sparsely scaly and hairy, apex rounded, margin entire, densely hairy, base

cordate; costa raised on lower surface; veins reticulate, indistinct. ***Fertile lamina*** papyraceous, oblong-triangular, 4–9.5 by 2.5–4.5 cm, upper surface green or dark green, glabrous, lower surface greenish, sparely scaly, apex slightly acute, margin entire, sparsely hairy, base subcordate to sagittate; costa raised on lower surface; veins reticulate, indistinct. ***Sporangia*** placed along veins, forming a network all over lower surface, naked.

Thailand.— NORTHERN: Chiang Mai, Phitsanulok; NORTH–EASTERN: Khon Kaen; SOUTH–EASTERN: Chon Buri; PENINSULAR: Surat Thani, Nakhon Si Thammarat, Songkhla.

Distribution.— From India through Myanmar to Indochina and southwards through Peninsular Malesia to Philippines.

Ecology.— Terrestrial on rocks or thin soil, usually found near rock slopes in shade.

Vernacular.— Foen Bai Hua Jai (เฟินใบหัวใจ), Foen Bai Bua (เฟินใบบัว), Kut Bai Bon (กูดใบบอน), Kut Bai Bua (กูดใบบัว), Lin Wua (ลิ้นวัว), Puk Pao (ปักเป้า) (General).

Specimens examined.— *J. Inuthai* 434, 435, 436 (PSU)

THELYPTERIDACEAE

Thelypteris opulenta (Kaulf.) Fosberg in Fosberg & Sachet, Smithsonian Contr. Bot. 8: 3. 1972; Tagawa & K. Iwats. in Fl. Thailand 3(3): 432. 1988.— *Aspidium opulentum* Kaulf., Enum. Filic. 238. 1824.— *Cyclosorus extensus* (Blume) H. Itô, Bot. Mag. (Tokyo) 51(608): 713. 1937; Holttum, Rev. Fl. Malaya 2: 264, fig. 150. 1954. (Plate 5, F.–G.)

Rhizome short, erect, ca 5 mm in diam., scaly; scale ca 4 mm long, dark brown. ***Fronds*** pinnate. ***Stipe*** 35–75 cm long, green to brownish, scaly at base, with short hairs throughout, grooved on upper surface. ***Lamina*** oblong-lanceolate in outline, 35–80 by 25–50 cm, apex deeply pinnately lobbed, gradually pinnatifid narrowing to caudate tip, margin ciliate, hairy on veins of both surfaces; pinnae sessile to shortly stalked, subopposite, linear-ensiform, lower third or fourth pinnae longest, 12–25 by 1–2.5 cm, usually lobed to half-way, apex acuminate-caudate; segments oblong, ca 8 by 4 mm, apex rounded to slightly acute, margin entire; veins distinct, only one pair of basal veinlets or less uniting below the sinus forming more acute curve. ***Sori*** subterminal on veinlets, at margin of segments, not strictly confined to segments; indusia reniform, 0.5–1 mm in diam., hairy.

Thailand.— NORTHERN: Lampang, Tak; NORTH–EASTERN: Nong Khai; SOUTH–WESTERN: Uthai Thani, Kanchanaburi; CENTRAL: Saraburi; SOUTH–EASTERN: Chon Buri, Rayong, Chanthaburi, Trat; PENINSULAR: Chumphon, Surat Thani, Phangnga, Nakhon Si Thammarat, Trang, Satun, Songkhla, Pattani, Yala, Narathiwat.

Distribution.— Sri Lanka to Peninsular Malaysia, Micronesia and Polynesia.

Ecology.— In partial shade of lowland forest.

Specimens examined.— *J. Inuthai* 566, 599 (PSU)

DICOTS

ACANTHACEAE

Pseuderanthemum graciliflorum Ridl., Fl. Malay. Penin. 2: 591. 1923; M.R. Hend., Malay. Wild Fls., Dicots.: 376, fig. 349. 1974.— *Eranthemum malaccense* C.B. Clarke in Fl. Brit. India (J.D. Hooker) 4: 498. 1884. (Plate 6, A.)

Small shrub, 40–60 cm high. ***Stem*** terete, slender, brown, scattered setulose. ***Leaves*** simple, opposite; petiole slender, 0.7–1.3 cm long, setulose; blade papyraceous, lanceolate or oblong-elliptic, 6–11.5 by 1.5–3.5 cm, sparsely short hairs, upper surface green, drying black, lower surface greenish, drying dark brown, scattered setulose on veins, apex acute or acuminate, margin entire to slightly crenate, base cuneate; secondary veins 5–8 pairs. ***Inflorescence*** dense spike, ca 3.5 cm long, many-flowered, scattered setulose. ***Flowers*** subsessile; bracteoles very small, narrowly triangular, ca 1.5 by 0.3–0.4 mm, densely hairy. ***Calyx*** greenish, basally connate, deeply lobed; lobes narrowly lanceolate, 3–4.5 by 0.5–0.7 mm, pubescent, apex acute. ***Corolla*** 5-lobed, divided into 2-lipped, spreading, pale purple with white on middle lobe; tube 3.2–4 mm long, outside sparsely short hairs, inside long hairs; lobes obovate, upper lip 2-lobed smaller than lower lip 3-lobed, glabrescent, apex rounded, margin entire. ***Stamens*** 2, epipetalous, exerted from corolla tube; filaments tapering at base, glabrous; anthers oblong. ***Ovary*** superior, 2–2.5 mm long, with short hairs at apex; styles filiform, ca 3 mm long, glabrous; stigma rounded or slightly bilobed.

Thailand.— NORTHERN: Chiang Mai; NORTH–EASTERN: Khon Kaen; SOUTH–EASTERN: Chon Buri; PENINSULAR: Surat Thani, Krabi, Phatthalung, Trang, Songkhla.

Distribution.— Vietnam and Peninsular Malaysia.

Ecology.— In shade and partial shade along rock platform edges and in rubber plantation, also growth along the stream and in disturbed places.

Vernacular.— Thao Lang Lai (เท่าหลังลาย) (Southeastern); Chiang Phra Pa (เฉียงพร้าป่า), Yai Plang (ยายปลัง), Rong Mai (รงไม้), Rong Mai (ร่องไม้) (Peninsular).

Specimen examined.— *J. Inuthai* 482 (PSU)

Thunbergia fragrans Roxb., Pl. Corom. 1: 47, t. 67; C.B. Clarke in Fl. Brit. India (J.D. Hooker) 4: 391. 1884; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 552. 1965; M.R. Hend., Malay. Wild Fls., Dicots.: 366, fig. 340. 1974. (Plate 6, B.)

Twinner. ***Stem*** terete, slender, green, pubescent. ***Leaves*** simple, opposite; petiole slender, up to 1 cm long, pubescent; blade papyraceous, ovate or elliptic, 3–7 by 1.5–3 cm, sparsely hairy, upper surface green, lower surface greenish, apex acute, margin entire, hairy, base rounded or subcordate; basally 3–5-veined. ***Flowers*** solitary from leaf-axils, 3–4 cm in diam.; pedicels ca 2.5 cm long, pubescent; bracteoles large, broadly ovate, 1–1.2 by 0.5–0.6 cm, pubescent. ***Calyx*** small, with 8–12 teeth, hairy; hidden between a pair of bracteoles. ***Corolla*** pure white; tube slender, ca 1.5 cm long, glabrous; lobes 5, subquadrangular, 1.5–2 by 1.2–1.5 cm, spreading, glabrous, apex truncate, margin entire. ***Stamens*** 4, didynamous, inserted near base of corolla tube, glabrous; shorter filaments 3.5–4 mm long, longer filaments 7–8 mm long; anthers 2.5–2.8 mm long. ***Disc*** annular. ***Ovary*** superior, with short hairs. ***Fruit*** capsular, 7.5–8.5 mm in diam. ***Seeds*** 4, globose.

Thailand.— NORTHERN: Chiang Mai; NORTH–EASTERN: Nong Bua Lam Phu, Ubon Ratchathani; CENTRAL: Saraburi; PENINSULAR: Chumphon, Songkhla.

Distribution.— Throughout India, Sri Lanka, Myanmar, Peninsular Malaysia to Philippines and North Australia.

Ecology.— In shallow depression of rock platforms.

Vernacular.— Chingcho (จิงจ้อ), Chingcho Khao Ta Paen (จิงจ้อเขาตาแป๋น) (Central); Hu Pakka (หูปากกา) (Peninsular).

Specimen examined.— *J. Inuthai* 619 (PSU)

APOCYNACEAE

Wrightia pubescens subsp. **lanitii** (Blanco) Ngan, Ann. Missouri Bot. Gard. 52(2): 153. 1965; Whitmore, Tree Fl. Mal. 2: 23. 1973; D.J. Middleton, Harvard Pap. Bot. 10(2): 176. 2005.— *Anasser lanitii* Blanco, Fl. Filip.: 112. 1837.— *Wrightia javanica* A. DC., Prodr. (DC.) 8: 405. 1844; Ridl., Fl. Malay. Penin. 2: 353. 1923; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 241. 1965. (Fig. 7; Plate 6, C.)

Shrub or tree, up to 15 m high. ***Branchlets*** lenticellate, young parts tomentose. ***Leaves*** simple, opposite; petiole 3–8 mm long; blade papyraceous, elliptic to elliptic-ovate, 3–12.5 by 1.5–4.5 cm, upper surface sparsely puberulent to glabrescent, lower surface densely tomentose, apex obtuse to acuminate, margin entire, base cuneate to rounded; secondary veins 9–13 pairs. ***Inflorescence*** terminal, cymose, 3–5 cm long, puberulent to tomentose; peduncle 5–8 mm long. ***Flowers***: pedicels 6–12 mm long. ***Sepals*** 5, ovate, slightly united at base, ca 2 by 1.5 mm, puberulent to tomentose, apex acute to slightly obtuse, margin sparsely fimbriate; colleters large. ***Corolla*** subrotate, greenish, white or yellowish; tube 3–6 mm long, glabrous; lobes 5, oblong, up to 2 cm long, papillose, apex obtuse or rounded. ***Corona*** of antepetalous and alternipetalous lobes; sparsely pubescent; antepetalous lobes medially adnate to corolla lobes, 8–10 mm long, apex dentate; alternipetalous lobes shorter than antepetalous lobes, bifid, up to 6 mm long. ***Stamens*** 5, inserted at corolla mouth; filaments ca 1 mm long; anthers 7–8 by 1–2 mm, densely pubescent. ***Ovary*** of two carpels, superior, connate throughout their length, 2 by 1.8 mm, glabrous; style and sigma 8–11 mm long. ***Fruit*** 2-follicled, fusiform, 18.5–23 by 1–1.5 cm, with very short hairs, more or less sparsely lenticellate. ***Seeds*** fusiform, 11–15 by 1–2.5 mm; coma ca 4 cm long.

Thailand.— NORTHERN: Nakhon Sawan; NORTH–EASTERN: Nakhon Phanom, Khon Kaen; EASTERN: Si Sa Ket; SOUTH–WESTERN: Kanchanaburi, Phetchaburi, Phachuap Khiri Khan; CENTRAL: Lop Buri, Saraburi, Krung Thep Maha Nakhon; SOUTH–EASTERN: Chachoengsao, Chon Buri, Chanthaburi; PENINSULAR: Surat Thani, Phangnga, Satun, Songkhla, Pattani.

Distribution.— China, Indochina, Peninsular Malaysia, Sumatra, Western Java, Sulawesi, Philippines and Northeastern Australia.

Ecology.— In rock crevices and deep depression of rocks and also found in shade of lowland forest.

Vernacular.— Muk (มูก), Mok (โมก) (Central); Mok Man (โมกมัน), Muk Kuea (มูกเกี๊ย) (Southeastern).

Specimens examined.— *J. Inuthai* 476, 493, 579 (PSU)

ASCLEPIADACEAE

Dischidia bengalensis Colebr., Trans. Linn. Soc. London 12: 357, t. 15. 1818; Hook.f., Fl. Brit. India 4: 50. 1883; Ridl., Fl. Malay. Penin. 2: 405. 1923; M.R. Hend., Malay. Wild Fls., Dicots.: 300. 1950; Kerr in Fl. Siam. 3: 43. 1951; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 263. 1965; Rintz, Blumea 26: 97, fig. 17. 1980. (Fig. 8; Plate 6, D.)

Epiphytic twiner; stem glaucous-green, fleshy, glabrous. ***Leaves*** simple, opposite, glabrous; petiole very short, fleshy; blade glaucous-green, thickly fleshy, linear-spathulate or oblanceolate, 1.5–2 by 0.3–0.5 cm, apex obtuse to rounded, margin entire, base narrowed. ***Inflorescence*** axillary, racemose, 1–7-flowered; peduncle 2–3 mm long. ***Flowers*** small, greenish, white to cream, 5-merous; pedicels 2–3 mm long, puberulous. ***Calyx*** glabrescent; tube short; lobes ovate, apex acute. ***Corolla*** urceolate-globose, ca 3 mm long; throat glabrous; lobes triangular or oblong-ovate, reflexed, valvate in bud, apex acute, papillose inside. ***Gynostegium*** conical; corona-appendages 5, stalked, inserted on the staminal tube, 2 recurved lobes each corona-appendage; twin-pollinia obovoid, erect; translators broadly triangular. ***Ovaries*** 2, superior, 0.6–0.7 mm long; style very short; stigma thick.

Thailand.— Throughout the country.

Distribution.— Northeastern India, Nepal, Indochina, Myanmar, Peninsular Malaysia, Sumatra, Java, Borneo, Philippines, New Guinea and Bismarck Archipelago.

Ecology.— Climbing and rooting on tree-trunks along rock platform edges in open places.

Vernacular.— Thao Wan Duan (เถาวัลย์ด้วน) (Southwestern); Aw Lop (อ้อลบ), Thao Hua Duan (เถาหัวด้วน) (Peninsular).

Specimens examined.— *J. Inuthai* 511, 540, 630 (PSU)

Hoya micrantha Hook.f., Fl. Brit. India 4: 55. 1883; Rintz, Blumea 30(3/4): 486, fig. 7. 1978. (Fig. 9; Plate 6, E.)

Epiphytic twiner; stem stout, brown to grayish, glabrescent. ***Leaves*** simple, opposite; petiole 1–1.5 cm long, fleshy, glabrescent; blade greenish, thickly fleshy, oblong-ovate to lanceolate, 5–10.5 by 2–3 cm, glabrous, upper surface green, lower surface greenish, drying white, apex acute, margin entire, base abruptly cuneate. ***Inflorescence*** extra-axillary, positively-geotropic, pseudoumbels concave, 15–50-flowered; peduncle rigid, 6–12 cm long, puberulous. ***Flowers*** pinkish; pedicels slender, unequal, 1–4.5 cm long, glabrous. ***Calyx*** *lobes* 5, small, ovate or broadly triangular, ca 1 cm long, apex obtuse to acute, margin entire. ***Corolla*** rotate; lobes 5, triangular or ovate, 3–4 by 2–3 mm, strongly reflexed, valvate in bud, pubescent inside, apex acute, margin entire, base slightly ridge. ***Corona*** star-shape; coronal scales 5, lanceolate, outer angle bifid; twin-pollinia winged, erect; translators broadly winged. ***Ovaries*** 2, superior, 1–1.5 mm long; style very short; style head conical.

Thailand.— Throughout the country.

Distribution.— Indochina and Myanmar.

Ecology.— Climbing on tree-trunks along rock platform edges in open places or in partial shade.

Vernacular.— Nom Mia (นมเมีย) (Northern, Peninsular); U Bi Kae Nae (อูบีแกแน) (Peninsular).

Specimens examined.— *J. Inuthai* 459, 494, 517, 518 (PSU)

Secamone elliptica R. Br., Prodr. Fl. Nov. Holland. 464. 1810; Klack. Kew Bull. 47(4): 600 fig. 2. 1992; P.T. Li, M.G. Gilbert & W.D. Stevens in Fl. China 16: 201. 1995. (Fig. 10; Plate 6, F.)

Woody twiner; stem brown, lenticellate. ***Branchlets*** green, lenticellate, young parts pubescent. ***Leaves*** simple, opposite; petiole 3–5 mm long, hairy to glabrous, grooved on upper side; blade membranous, oblong-elliptic to narrowly lanceolate, 3–7.5 by 0.7–2 cm, glabrescent on veins, upper surface green, lower surface greenish, apex acute or narrowly acuminate, margin entire, base cuneate or attenuate; secondary veins 8–10 pairs, distinct when dry. ***Inflorescence*** axillary, compound cyme, ca 1.5 cm long, 10–20-flowered; peduncle 3–10 mm long, pubescent; bracts small, ovate. ***Flowers*** pale yellow to greenish yellow; pedicels slender, 2–3 mm long, pubescent. ***Calyx*** obconical; lobes 5, ovate or broadly triangular, ca 1 mm long, imbricate in bud, sparsely hairy outside, apex obtuse, margin fimbrillate. ***Corolla*** rotate; tube ca 0.5 mm long; lobes 5, oblong-elliptic or ovate, ca 1.5 by 0.5 mm, slightly convex, contorted in bud, apex obtuse or rounded, margin entire, base slightly ridge. ***Corona*** 5-lobed; lobes falcate, shorter than staminal column. ***Column*** 1–1.3 mm high. ***Stigma*** head exserted from anthers. ***Pollinia*** small, 4 per pollinarium, ellipsoid. ***Ovaries*** 2, superior, glabrous. ***Fruit*** 2-follicled, fusiform, 5.5–6.5 cm long, glabrous, apex acuminate.

Thailand.— PENINSULAR: Songkhla.

Distribution.— China southwards to Southern Australia and Eastern New Caledonia.

Ecology.— Climbing on tree canopies along rock platform edges in open places or in partial shade.

Vernacular.—

Specimen examined.— *J. Inuthai* 536 (PSU)

ASTERACEAE

Elephantopus scaber L., Sp. Pl. 2: 814. 1753; Hook.f. in Fl. Brit. India (J.D. Hooker) 3: 242. 1881; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 374. 1965; M.R. Hend., Malay. Wild Fls., Dicots.: 235, fig. 215. 1974. (Plate 6, G.)

Perennial herb, 30–60 cm high. ***Stem*** erect, rigid, dark green, subterete, dichotomously branched, densely white strigose. ***Leaves*** simple, alternate, in cluster at base of stem; petiole very short, sparsely strigose on lower surface; blade subcoriaceous, oblong-oblanceolate, 11–17.5 by 3.5–4.5 cm, upper surface dark green, glabrescent, lower surface green, densely white strigose, apex obtuse or rounded, margin serrate, densely white strigose, base tapered; secondary veins 15–18 pairs. ***Inflorescence*** terminal, branched, head-like, many heads per fascicle; fascicles of heads 1–2 cm in diam., surrounded by broad-ovate or cordate leafy bracts; bracts stiff, dark green, 1–1.7 by 0.8–1.5 cm, thinly long-hairy; without ray florets. ***Disc florets*** sessile; involucral bracts (of the single heads) imbricate, oblong-lanceolate, concave, apex acute or acuminate, margin entire, 4 outermost glabrescent, ca 5 by 1 mm, 4 innermost hairy, 7.5–8 by 1.8–2 mm. ***Pappus-bristles*** 4–5, rigid, 4.5–5.5 mm long. ***Corolla*** tubular, glabrous; tube white, 4–4.5 mm long; lobes 5, linear, purplish or pink, ca 2.5 by 0.2–0.3 mm, spreading. ***Stamens*** 5, glabrous; filaments short; anthers oblong, white to purple, ca 1.5 mm long, joined into a tube. ***Ovary*** inferior;

style 6–6.5 mm long; stigma bilobed, 0.7–1 mm long. ***Fruit*** an achene, 2–2.5 mm long, hairy.

Thailand.— NORTHERN: Lampang, Phitsanulok; NORTH–EASTERN: Loei; EASTERN: Ratchasima, Buri Ram, Yasothon, Ubon Ratchathani; CENTRAL: Nonthaburi; SOUTH–EASTERN: Chachoengsao, Chon Buri, Rayong, Chanthaburi, Trat; PENINSULAR: Surat Thani, Krabi, Trang, Satun, Songkhla.

Distribution.— Tropical Asia, Australia and America.

Ecology.— At the foothills near roadsides and in open and disturbed places.

Vernacular.— Ta Si Ko Wa (ตะซีโกวะ), Khoei Po (เคยโป้), Ya Kai Nok Khum (หญ้าไก่นกคุ่ม), Ya Fai Nok Khum (หญ้าไฟนกคุ้ม), Ya Prap (หญ้าปราบ), Ya Sam Sip Song Hap (หญ้าสามสิบสองหาบ), Nat Pha (หนาดผา) (Northern); Khi Fai Nok Khum (ขี้ไฟนกคุ่ม) (Northeastern); Kkhing Fai Nok Khum (คิงไฟนกคุ่ม) (Eastern); Do Mai Ru Lom (โด่ไม่รู้ล้ม) (Central); Nat Mi Khlaen (หนาดมีแคลน) (Peninsular).

Specimen examined.— *J. Inuthai* 560 (PSU)

BOMBACACEAE

Bombax anceps Pierre, Fl. Forest. Cochinch. t. 175. 1888; Kochummen in Tree Fl. Mal. 1: 104. 1972; Phengklai in Fl. Thailand 9(1): 11, fig. 1. 2005. (Fig. 11; Plate 6, H.)

Deciduous tree, 10–15 m high; bark gray or brown, lenticellate, covered with many conical prickles. ***Leaves*** spirally arranged; palmately compound with 5–7 unequal leaflets, glabrous; middle leaflet largest; petiole 7–12 mm long, glabrous; leaflets coriaceous, elliptic to oblanceolate, 7–14.5 by 2–4 cm, upper surface dark green, lower surface pale or yellow, apex acuminate, margin entire, base

narrowly cuneate; secondary veins 7–16 pairs. ***Flowers*** solitary, ovoid to ellipsoid in bud; pedicels glabrous. ***Calyx*** campanulate or cup-shaped, with 3–4 unequal lobes, ca 4 by 3 cm, pubescent inside. ***Corolla*** free, 5, greenish or white, convolute in bud, oblong to obovate, ca 9.5 by 2.5 cm, sparsely pubescent inside, densely pubescent outside, apex obtuse. ***Stamens*** numerous, 5–7 cm long, joined into a short tube at base, divided into 5 groups; anthers 1-celled. ***Ovary*** superior, pubescent; style dark pink to red, hairy, ca 9 cm long; stigma divided into 5 lobes.

Thailand.— NORTHERN: Chiang Mai, Nan, Phrae, Uttaradit, Tak, Kamphaeng Phet; SOUTH–WESTERN: Kanchanaburi, Phachuap Khiri Khan; CENTRAL: Saraburi; SOUTH–EASTERN: Chanthaburi; PENINSULAR: Songkhla.

Distribution.— China, Cambodia, Myanmar and Peninsular Malaysia.

Ecology.— In deep depression near rock platform edges.

Vernacular.— Ngiu Pa Dok Khao (งิ้วป่าดอกขาว), Ngiu Dok Khao (งิ้วดอกขาว), Ngiu Pha (งิ้วผา), Krai (ไกร) (Northern); Ngiu Pa (งิ้วป่า) (Southwestern-Peninsular); Nun Pa (นุ่นป่า) (Central).

Remarks.— This species was recorded throughout Northern, South-Western, Central and South-Eastern of Thailand, however, there is no recorded in Southern part of Thailand before. The result is probably due to lack of data collection.

Specimen examined.— *J. Inuthai* 469 (PSU)

CLUSIACEAE

Mesua kunstleri (King) Kosterm, Reinwardtia 7. 427. 1969; Whitmore, Tree Fl. Mal. 2: 228. 1973.

Shrub, 1–2 m high; bark dark gray-brown, slender, glabrous, fissured, lamellate. ***Leaves*** simple, opposite, glabrous; petiole slender, dark brown, 4–10 mm long, fissured, lamellate; blade coriaceous, oblong-elliptic or suboblanceolate, 7.5–14 by 1.5–4.5 cm, upper surface dark green, lower surface green, apex acuminate or long acuminate to caudate, margin entire, base cuneate; secondary veins 15–18 pairs. ***Fruit*** broadly ovoid or subglobose, yellow-greenish, 2.5–2.8 by 2–2.8 cm long, apiculate, glabrous; sepals persistent. ***Seeds*** 1–4, irregular in shape, fragile.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Peninsular Malaysia.

Ecology.— In moist shade and rocky areas in secondary forest.

Vernacular.—

Specimen examined.— *J. Inuthai* 556 (PSU)

EUPHORBIACEAE

Bridelia tomentosa Blume, Bijdr. Fl. Ned. Ind. 12: 597. 1826; Hook.f., Fl. Brit. India (J.D. Hooker) 5: 271. 1887; Ridl., Fl. Malay. Penin. 3: 184. 1924; Whitmore, Tree Fl. Mal. 2: 74. 1973; S. Dressler & Welzen in Welzen et al., Thai Forest Bull. (Bot.) 28: 67. 2000; Chayam. & Welzen in Fl. Thailand 8(1): 151, Pl. V4. 2005; H.S. Kiu & M.G. Gilbert in Fl. China 11: 175. 2008. (Plate 7, A.)

Shrub 2–5 m high. ***Branchlets*** densely brown tomentose. ***Stipules*** early caducous, narrowly triangular, 2.5–3 by 0.5–0.8 mm, tomemtose, apex acuminate. ***Leaves*** simple, alternate, distichous; petiole 3–5 mm long, tomentose; blade papyraceous, elliptic, obovate or lanceolate, 4.5–15 by 1.5–6 cm, upper surface green, sparsely villose or glabrescent, lower surface greenish, sometimes glaucous, scattered rusty brown tomentose, apex acute, margin entire or slightly crenate, base

broadly cuneate or rounded; secondary veins 10–12 pairs, ending in marginal vein. ***Inflorescence*** axillary, fascicled, many-flowered. ***Staminate flowers*** small, sessile or subsessile, greenish yellow, 2.5–3.5 mm in diam., glabrous; sepals 5, united at base, valvate in bud, triangular, up to 1.5 by 1 mm, thick, apex acute, margin entire; petals 5, white, variable in shape, ca 0.5 mm long, ca 0.8 mm wide, apex rounded, margin entire, base tapered; disc annular; stamens 5, united into a gynoecium with a pistillode and lobed style at top; staminal column 0.7–0.8 mm long; free part of filaments 0.5–0.6 mm long; anthers ellipsoid, bright yellow, 0.2–0.3 by 0.3–0.4 mm.

Thailand.— NORTHERN: Chiang Mai, Chiang Rai, Lampang, Phrae, Sukhothai, Phitsanulok, Nakhon Sawan; NORTH–EASTERN: Loei, Nakhon Phanom, Khon Kaen; EASTERN: Chaiyaphum, Nakhon Ratchasima, Surin, Ubon Ratchathani; SOUTH–WESTERN: Kanchanaburi, Phachuap Khiri Khan; CENTRAL: Saraburi, Nonthaburi; SOUTH–EASTERN: Sa Kaeo, Chon Buri, Chanthaburi; PENINSULAR: Ranong, Surat Thani, Phangnga, Phuket, Nakhon Si Thammarat, Trang, Songkhla, Yala, Narathiwat.

Distribution.— Throughout India to Australia.

Ecology.— Along roadsides in open places and in open bedrock along rivers.

Vernacular.— Krabue (กระบือ), Sri Fan Krabue (สีฟันกระบือ) (Northern); Lo Ko (โล่โก๊ะ), Sa Lao (สะเหล่า) (Eastern); La-ai (ละไอ), Sam Phan Ta (สามพันตา) (Southwestern); Ma Kae (มะแก), Men True (เมนตรือ) (Southeastern); Ka-ai (กะไอ), Kue Fung (กือฟุง), Ma Fang (มาฟาง), Ai (ไอ), Khon Non (ขนหนอน), Kue Nung (กือนุง) (Peninsular).

Specimens examined.— *J. Inuthai* 595, 607 (PSU)

Cladogynos orientalis Zipp. ex Span., Linnaea 15: 349. 1841; Ridl., Fl. Malay. Penin. 3: 276. 1924; Backer & Bakh.f., Fl. Java (Spermatoph.) 1: 486. 1963; Whitmore, Tree Fl. Mal. 2: 78. 1973; Chayam. & Welzen in Fl. Thailand 8(1): 158. 2005; H.S. Kiu & M.G. Gilbert in Fl. China 11: 248. 2008. (Fig. 12; Plate 7, B.)

Shrub up to 3 m high, monoecious. ***Branchlets*** densely softly whitish stellate tomentose. ***Stipules*** small, triangular. ***Leaves*** simple, alternate; petiole 1.5–6.5 cm long; blade papyraceous, elliptic-ovate to broadly-ovate, 9.5–21.5 by 3.5–11.5 cm, upper surface dark green, glabrous, lower surface densely white-floccose, apex acute to acuminate, margin coarsely double dentate, base slightly auriculate, obtuse to rounded; basally 3-veined, secondary veins 5–8 pairs. ***Inflorescence*** terminal, axillary, 1–1.5 cm long, densely capitate cluster of staminate flowers and basally a single pistillate flowers. ***Staminate flowers*** sessile, dense in heads of 3–5 mm in diam.; sepals 3–4, united at base, valvate in bud, ovate, 1–1.5 mm long, stellate hairy outside; petals absent; disc absent; stamens 4, ca 3 mm long, filaments free, longer than sepals, anthers yellow. ***Pistillate flowers*** pedicellate; sepals 5–6, linear, 2–4 mm long; petals absent; ovary 3-lobed, densely white stellate-hairy; style ca 3 mm long, stigma-branches divergent. ***Fruit*** capsular, trilobed, ca 9 by 6 mm, densely white stellate-hairy; columella persistent. ***Seeds*** globose, 3–4 mm in diam.

Thailand.— NORTHERN: Sukhothai, Nakhon Sawan; NORTH–EASTERN: Loei, Ubon Ratchathani, Sakon Nakhon, Khon Kaen; EASTERN: Nakhon Ratchasima; SOUTH–WESTERN: Kanchanaburi, Ratchaburi, Phetchaburi, Phachuap Khiri Khan; CENTRAL: Saraburi, Nakhon Nayok; SOUTH–EASTERN: Chon Buri; PENINSULAR: Surat Thani, Phangnga, Nakhon Si Thammarat, Trang, Songkhla.

Distribution.— South China, Indochina, Peninsular Malaysia, Java, Philippines and Lesser Sunda Islands.

Ecology.— In rock crevices along rock platform edges.

Vernacular.— Chet Tha Phung Khi (เจตพังคี) (Northern); Takia (ตะเกีย), Plao Ngoen (เปล้าเงิน), Nat Takua (หนาดตะกั่ว) (Eastern); Tong Ta Phran Mok (ตองตาพราน), Bai Lang Khao (ใบหลังขาว) (Central); Sami (สมี) (Southwestern); Mon Khao (มนเขา), Plao Nam Ngoen (เปล้าน้ำเงิน) (Peninsular).

Specimens examined.— *J. Inuthai* 477, 577 (PSU)

FABACEAE

Abrus pulchellus subsp. **cantoniensis** (Hance) Verdc., Kew Bull. 24: 248. 1970; B.J. Bao & M.G. Gilbert in Fl. China 10: 195. 2010.— *Abrus cantoniensis* Hance, J. Bot. 6: 112. 1868. (Plate 7, C.)

Lianas. ***Branchlets*** terete, brown to dark brown, densely white hairy. ***Stipules*** narrowly triangular, 3.5–4 by 0.6–0.8 mm, densely white strigose. ***Leaves*** paripinnate, alternate; petiole slender, up to 1 cm long, densely white strigose; leaflets opposite, many-paired; petiolule short; blade papyraceous, oblong or obovate, 0.5–2 by 0.3–1 cm, upper surface green, sparsely pilose, lower surface greenish, with scattered white strigose hairs, apex truncate with mucronate tip, margin entire, densely strigose, base subcordate; secondary veins indistinct. ***Inflorescence*** axillary, racemose, 3–7 cm long, many-flowered, 3–4-flowered per each node, densely white strigose. ***Flowers*** pedicels short, densely white strigose; bracteoles very small, ovate, 0.8–1 mm long, densely white strigose. ***Calyx*** campanulate, 1.5–2.5 mm long, densely strigose, with 4 shallow lobes; lobes obtuse or acute at apex. ***Corolla*** pinkish or white, glabrous; standard broadly elliptic or ovoid, ca 9 by 6–7 mm, apex emarginated, margin entire; wings oblong, auriculate, 9–10 by 1.8–2 mm, apex obtuse, margin entire, base clawed; keels arcuate, auriculate, ca 10 by 2.8–3 mm, apex obtuse, margin entire, base clawed. ***Stamens*** 9, monadelphous. ***Ovary*** superior, 5–6 mm long, pubescent; style ca 8.5 cm long, glabrous on upper part; stigma capitate. ***Fruit*** legume, oblong, flat, 4–8-jointed, 2.5–4.5 cm long, densely white hairy, with 4–6 seeds. ***Seeds*** dark brown to black, elliptic or ovoid, compressed.

Thailand.— PENINSULAR: Songkhla.

Distribution.— China, Vietnam and Peninsular Malaysia.

Ecology.— In shallow depression or slopes of rocks, sometimes found in shade.

Vernacular.— Ma Kham Yan (มะขามย่าน) (Peninsular).

Specimens examined.— *J. Inuthai* 445, 446, 620 (PSU)

Acacia megaladena var. **indo-chinensis** I.C. Nielsen, Adansonia, Ser. 2, 19: 351. 1980; I.C. Nielsen in Fl. Thailand 4(2): 178, fig. 44. 1985.— *Acacia pennata* (L.) Willd. var. *arrophula* D. Don, Baker in Fl. Brit. India (J.D. Hooker) 2: 298. 1878. (Plate 7, D.)

Woody spiny climber. ***Branchlets*** puberulose. ***Stipules*** linear or narrowly triangular, ca 2.5 by 0.7 mm, sparsely puberulous. ***Leaves*** pinnately compound, glabrous; petiole 1–2 cm long; rachis 3–13 cm long; petiolar gland at middle of petiole; pinnae 22–26 pairs; leaflets 45–50 pairs per pinnae, opposite, linear-oblong, 2–4 by 0.5–0.7 cm, apex obtuse to rounded, margin ciliate, base obliquely truncate; lateral vein indistinct. ***Inflorescence*** axillary, head-like, 10–35 cm long; peduncle puberulous. ***Flowers*** 5-merous, bisexual, in pedunculate heads. ***Calyx*** ca 1.5 by 0.5 mm, glabrous; tube 0.5–0.7 mm long; teeth triangular, apex acute. ***Corolla*** 1.8–2 by 0.3–0.5 mm, glabrous; lobes elliptic, 0.5–1 mm long, apex acute to obtuse, margin entire. ***Stamens*** numerous. ***Ovary*** superior, stipitate, ca 0.5 mm long, densely hairy; style ca 3 mm long.

Thailand.— NORTHERN: Chiang Rai, Chiang Mai, Lampang, Sukhothai, Nakhon Sawan; EASTERN: Chaiyaphum, Nakhon Ratchasima, Surin; SOUTH–EASTERN: Prachin Buri, Chon Buri, Chanthaburi; SOUTH–WESTERN: Kanchanaburi, Ratchaburi; PENINSULAR: Nakhon Si Thammarat, Songkhla.

Distribution.— Eastern Himalayan to Indochina.

Ecology.— In rock boulders and deep depression along rock platform edges and in shade of lowland forest.

Vernacular.— Khi Raet (ขี้แรด), Hang Lai Daeng (หางไหลแดง) (Central); Khruea Chaep (เครือแจบ), Han Daeng (หันแดง), Lai Daeng (ไหลแดง) (Northern); Lae (แหล) (Shan/Northern).

Specimen examined.— *J. Inuthai* 534 (PSU)

Indigofera sp.

Small herb, ca 50 cm high. ***Stem*** erect, densely white strigose. ***Stipules*** persistent, narrowly triangular, densely white strigose, 3–5 mm long. ***Leaves*** simple, alternate; petiole up to 1.5 cm, hairy; blade papyraceus, ovoid, 4.5–8 by 3–6 cm, densely white hairy, upper surface green, lower surface greenish, apex rounded, margin entire, densely hairy, base rounded; secondary veins 5–7 pairs. ***Inflorescence*** axillary or terminal, racemes, up to 5 cm long, many-flowered, 2–3-flowered per each node. ***Flowers*** hairy; pedicels slender, up to 2.5 mm long; bracteoles very small, narrowly triangular. ***Calyx*** campanulate, greenish, densely hairy; tube ca 1 mm long; lobes 5, triangular, greenish, ca 1 mm long, apex acute. ***Corolla*** pink, bluish-purple to bright purple, glabrous; standard suborbicular, ca 3 by 5 mm, apex rounded, margin entire, base tapered; wings spathulate or oblong, auriculate, ca 5 by 1.5 mm, apex rounded, margin entire, base clawed; keels arcuate, spathulate, ca 5 by 1.5 mm, apex obtuse, margin entire, base clawed. ***Stamens*** 10, diadelphous, only vexillary one free, glabrous. ***Ovary*** superior, ca 3 mm long, pubescent; style glabrous on upper part, 1–1.5 mm long; stigma capitate.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Only known from this study.

Ecology.— Along the roadside and in rubber plantation.

Vernacular.—

Remarks.— According to all of the available taxonomic literatures, this specimen is still unidentified. More literatures and time are needed to clarify its status.

Specimens examined.— *J. Inuthai* 562 (PSU)

Tadehagi triquetrum (L.) H. Ohashi, Ginkgoana 1: 290. 1973; P.H. Huang & H. Ohashi in Fl. China 10: 284. 2010.— *Hedysarum triquetrum* L., Sp. Pl. 2: 746. 1753.— *Desmodium triquetrum* DC., Prodr. (DC.) 2: 326. 1825; Ridl., Fl. Malay. Penin. 1: 611. 1922. (Plate 7, E.)

Small shrub, 1–2 m high. ***Stem*** erect, triangular to subterete, dark green, with scattered white strigose hairs. ***Stipules*** large, ovate or broadly lanceolate, greenish brown, 1.2–1.5 by 0.3–0.5 cm. ***Leaves*** simple, alternate; petiole broadly winged, 0.8–2.8 by 0.5–1.2 cm, sparsely strigose on lower surface of midrib; blade subcoriaceous, oblong-lanceolate, 5–14 by 1.3–3.3 cm, upper surface green, glabrous, lower surface greenish, sparsely white strigose and with short hairs on veins, apex acute or acuminate, margin entire, sparsely strigose, base rounded or subcordate; secondary veins 12–15 pairs. ***Inflorescence*** axillary, racemose, 7–30 cm long, many-flowered, 2–3-flowered per each node, with spreading very small hooked hairs. ***Flowers***: pedicels greenish with reddish at base, up to 2 mm long, with dense, very small hooked hairs; bracteoles narrowly triangular, up to 4 by 0.7 mm, glabrous except for a few strigose hairs along margin. ***Calyx*** campanulate, reddish, turning to greenish, sparsely white strigose; tube 1.5–2 mm long; lobes 5, ovate or triangular, greenish, 1.5–2.5 by 0.8–1 mm, 2 upper lobes connate, apex acute-acuminate. ***Corolla*** pink, bluish-purple to bright purple, glabrous; standard suborbicular, ca 6 by 7 mm, apex emarginated, margin entire; wings spathulate or oblong, auriculate, 6–6.5 by 2.5–2.8 mm, apex rounded, margin entire, base clawed; keels arcuate, auriculate, 2–

2.5 by 5–5.5 mm, apex obtuse, margin entire, base clawed. ***Stamens*** 10, diadelphous, axillary ones connate at base to other, glabrous. ***Ovary*** superior, ca 2.5 mm long, pubescent; style glabrous on upper part; stigma green, capitate. ***Fruit*** legume, 5–8-jointed, 6–7 mm long, densely white strigose.

Thailand.— PENINSULAR: Songkhla, Pattani.

Distribution.— Throughout India to Australia, Japan and Taiwan.

Ecology.— At the foothills in shade near rubber plantation.

Vernacular.— Khi Ka Tuet (ขี้กะตืด), Khi Ka Tuet Pae (ขี้กะตืดแป), Ya Kho Tung (หญ้าคอตุง), Ma Hae nok (มะแฮนก) (Northern); Khao Mao Nok (ข้าวเม่านก), Kho Kio (คอกิ่ว) (Central).

Specimens examined.— *J. Inuthai* 561, 609 (PSU)

FLACOURTIACEAE

Homalium dasyanthum (Turcz.) W. Theob., Burmah [Mason], ed. 3. 2: 451. 1883; Sleumer in Fl. Males., Ser. 1, Spermat. 5(1): 56, fig. 25d–e. 1954.— *Blakwellia dasyantha* Turcz., Bull. Soc. Imp. Naturalistes Moscou 36. 610. 1863.— *Homalium griffithianum* Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 40: 57. 1871; C.B. Clarke in Fl. Brit. India (J.D. Hooker) 2: 597. 1879; Ridl., Fl. Malay. Penin. 1: 835, fig. 68. 1922; Whitmore in Tree Fl. Mal. 2: 145. 1973. (Plate 7, F.)

Shrub or tree, 3–10 m high; bark gray-brown or brown. ***Branchlets*** lenticellate, young parts densely hairy. ***Stipules*** caducous, narrowly triangular, ca 4 mm long, hairy. ***Leaves*** simple, alternate; petiole 3–5 mm long, densely pubescent; blade coriaceous, elliptic-ovate to oblong-elliptic, 4.5–11 by 2–6 cm, sparsely hairy on veins, upper surface dark green, shining, lower surface green, apex obtuse or acute, margin slightly crenate-serrate, base subcordate or rounded; secondary veins 7–10

pairs. ***Inflorescence*** axillary, racemose, 6–12 cm long, many-flowered; peduncle 2–3.5 cm long. ***Flowers***: pedicels short, 2–3 mm long; bracteoles lanceolate, hairy outside. ***Calyx*** obconical; tube ca 3 mm long; lobes 9–11, linear or narrowly triangular, hairy outside, apex acute. ***Corolla*** free, 12, cream to pale green, oblanceolate or spathulate, 3–5 by 1 mm, inserted in throat of calyx, pubescent, apex rounded, margin spreading tomentose. ***Stamens*** 20, 2 before each petal; filaments 2–3 mm long, glabrous. ***Ovary*** half-inferior, tomentose, unilocular; styles 5, filiform.

Thailand.— SOUTH–WESTERN: Phachuap Khiri Khan; PENINSULAR: Ranong, Chumphon, Surat Thani, Krabi, Songkhla.

Distribution.— Southern Myanmar, Indochina and Peninsular Malaysia.

Ecology.— In rock crevices, slopes and deep depression of rock platforms.

Vernacular.— Chum Pun (จำปุน) (Southwestern); Kring Liang (กริ่งเลียง), Chi Mut (ชีหมุด), Khon Ta Chang (ขนตาช้าง), Khao Kwang (เขากวาง), Tam Sao Nu (ตำเสาหนู) (Peninsular).

Specimens examined.— *J. Inuthai* 472, 480, 492, 527 (PSU)

GESNERIACEAE

Paraboea minor (Barnett) B.L. Burtt, Notes Roy. Bot. Gard. Edinburgh 41(3): 433. 1984.— *Boea minor* Barnett in Nat. Hist. Bull. Siam Soc. 20: 19. 1961; in Kew Bull. 15: 255. 1961. (Fig. 13; Plate 7, G.–H.)

Herb, 10–40 cm high. ***Stem*** densely white woolly. ***Leaves*** simple, opposite, decussated; petiole 2–5 cm long, grooved on upper surface; blade subcoriaceous, ovate to oval, elliptic or oblong-elliptic, 6.5–10 by 1.5–6 cm, upper

surface green to dark green, sparsely arachnoid, becoming glabrous, lower surface covered with cobwebby white woolly hairs, apex acute or obtuse, margin entire or slightly crenate, base cuneate or attenuate; secondary veins 3–5 pairs, slightly raised below. ***Inflorescence*** axillary, compound cyme, 12–20 cm long, many-flowered; peduncle green to reddish-brown, 10–13 cm long, sticky, with scattered sessile glands; bracts small, linear, ca 3 by 0.7 mm, glabrous. ***Flowers*** 1–1.5 cm in diam., globose or obovoid in bud; pedicels slender, 1–4 cm long, sticky, with scattered sessile glands. ***Calyx*** greenish, slightly united at base; lobes 4–5, small, narrowly triangular, ca 2 mm long. ***Corolla*** pale purple, 5-lobed; lobes rounded, upper 3 lobes slightly larger than lower 2 lobes. ***Stamens*** 2, yellow; filaments short; anthers reniform, ca 2.5 by 1.5 mm. ***Ovary*** linear, narrowly at top, superior, glabrous; style 0.7–1.3 cm long. ***Fruit*** capsular, fusiform, twisted, 1.5–3.5 mm long.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Known only from Thailand.

Ecology.— In rock crevices and shallow depression along rock platforms edges.

Vernacular.—

Remarks.— This specie is endemic species to Thailand (only found in Songkhla). It was previously collected from Toan Ngachang in Songkhla province, at the elevation 50–500 m in tropical rain forest.

Specimens examined.— *J. Inuthai* 427, 428, 443, 444, 463, 531, 541, 560 (PSU)

HYDNOCARPACEAE

Hydnocarpus ilicifolia King, in Ann. Bot. Gard. Calc. 5: 130; Whitmore, in Tree Fl. Mal. 3: 167. 1978.

Large tree, up to 5–8 m high. ***Branchlets*** grayish-brownish, glabrous or glabrescent. ***Leaves*** simple, alternate; petiole grayish, 4–6 mm long, with scattered strigose to strigillose; blade subcoriaceous, dark green, drying yellowish-brown, oblong-elliptic, 4.5–10 by 1.5–3.5 cm, glabrous, apex acute to acuminate, margin entire to slightly crenate, undulate, base cuneate; secondary veins 5–8 pairs. ***Inflorescence and Flowers*** not seen. ***Fruit*** large, black, globose, 3–4 mm in diam., wall woody, without radial lines, densely villous. ***Seeds*** numerous, packed closely in a pulp, 1.2–1.8 by 0.9–1 cm.

Thailand.— NORTHERN: Phrae; NORTH–EASTERN: Udon Thani; EASTERN: Nakhon Ratchasima, Surin; SOUTH–WESTERN: Phachuap Khiri Khan; CENTRAL: Saraburi; SOUTH–EASTERN: Chon Buri, Chanthaburi; PENINSULAR: Surat Thani, Krabi, Songkhla, Pattani.

Distribution.— Indochina and Peninsular Malesia.

Ecology.— In shade and in dry places of lowland forest.

Vernacular.— Kra Bao Ling (กระเบาลิง) (General); Cha Miang (ข้าเมี่ยง) (Northern, Central); Kra Bao Hin (กระเบาหิน) (Northeastern); Kra Bao Pha Nom (กระเบาพนม) (Eastern); Hua Khang (หัวค่าง), Khom Khwan (คมขวาน) (Southwestern, Peninsular); Kra Bao Klak (กระเบากลัก) (Central); Kra Bian (กระเบียน), Khi Mot (ขี้มอด), Kra Rian (กระเรียน), Kra Bao Sa wa (กระเบาขาวา) (Southeastern); Duk Change (ดูกช้าง), Bak Krai (บักกราย), Pha Lo Lu Tum (พะโลลูตุ้ม) (Peninsular).

Remarks.— The genus *Hydnocarpus* Gaertn. is sometimes placed in the family Flacourtiaceae.

Specimen examined.— *J. Inuthai* 515 (PSU)

LAMIACEAE

Vitex pinnata L., Sp. Pl. 2: 638. 1753; Kochummen in Tree Fl. Mal. 3: 311, fig. 3. 1978; de Kok, Kew Bull. 63: 28. 2008.— *Vitex pubescens* Vahl, Symb. Bot. 3: 85. 1794; C.B. Clarke in Fl. Brit. India (J.D. Hooker) 4: 585. 1885; Ridl., Fl. Malay. Penin. 2: 632. 1923; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 606. 1965. (Plate 8, A.)

Tree 10–20 m high; bark yellowish to grayish, sometimes fissured. ***Branchlets*** quadrangular, pubescent. ***Leaves*** opposite-arranged; palmately compound with 3–5 unequal leaflets; middle leaflet largest; petiole 2.5–11.5 cm long, pubescent; leaflets chartaceous, elliptic to ovate; middle leaflets 5.5–19.5 by 2.5–7.5 cm; side leaflets 3–17 by 1.5–7.5 cm, upper surface green to dark green, pubescent on veins, lower surface yellowish-green, pubescent on veins to velutinous, covered with glands, apex acute to acuminate, margin entire, base broadly cuneate to rounded; secondary veins 7–20 pairs. ***Inflorescence*** terminal, paniculate, pyramidal in outline, 5–10 cm long, dense, many-flowered; peduncle 2.5–3 cm long, pubescent; bracts leaflike, densely pubescent, persistent; bracteloes clavate, elliptic or oblanceolate, 5–10 by 2–4 mm, densely pubescent, persistent. ***Calyx*** campanulate, densely pubescent; tube ca 0.4 mm long; lobes 5, small, broadly triangular, apex acute to rounded. ***Corolla*** 5-lobed, divided into 2-lipped with 2 lobes on upper lip and 3 lobes on lower lip, white with violet blue on lower lobe, pubescent outside; tube pubescent, base glabrous; middle lobe of lower lip suborbicular, 7–14 by 8–12 mm, hairy at the middle, apex rounded, margin entire. ***Stamens*** 4, exserted from corolla tube, epipetalous; filaments 11–13 mm long, base hairy; anthers dark violet to black, ca 1 mm long. ***Ovary*** superior, globose, 1–2 mm in diam., glabrous; style 1.4–1.5 cm long; stigma bilobed. ***Fruit***

drupe, green, turning to black, globose, up to 1 cm in diam., glabrous. ***Seeds*** globose, up to 6 mm in diam.

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.

Distribution.— Throughout Southeast Asia.

Ecology.— In rock crevices and deep depression of rock platforms and in exposed places of rocks.

Vernacular.— Ka Sam Pik (กาสามปีก) (Northern); Tin Nok (ตีนนก) (Northern, Northeast, Central); Khon Samo (โคนสมอ), Sawong Hin (สวองหิน) (Eastern); Khai Nao (ไข่เน่า) (Eastern, Central); Kanon (กานน), Samo Kanon (สมอกานน), Samo Pa (สมอป่า), Samo Hin (สมอหิน) (Southwestern); Nao (เน่า), Samo Buang (สมอบ่วง) (Central); Ka Phun (กะพุน), Ta Phrun (ตะพรุน), Ta Phun (ตะพุน), Ta Phun Thong (ตะพุนทอง), Ta Phum (ตะพุ่ม) (Southeastern); Non (นน), Samo Tin Pet (สมอตีนนก), Non Den (นนเด็น), Lue-Mae (ลือแม) (Peninsular).

Specimens examined.— *J. Inuthai* 510, 548 (PSU)

LOGANIACEAE

Fagraea auriculata Jack, Mal. Misc. 2: 82. 1822; C.B. Clarke in Fl. Brit. India (J.D. Hooker) 4: 83. 1883; Ridl., Fl. Malay. Penin. 2: 416. 1923; Kerr in Fl. Siam. 3: 54. 1951; Leenh., Fl. Males., Ser. 1, Spermat. 6(2): 326, fig. 20. 1962; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 211. 1965; Fagraeus, Tree Fl. Mal. 2: 270. 1973; Griffin & J. Parn. in Fl. Thailand 6(3): 204. 1997. (Fig. 14–15; Plate 8, C.–D.)

Woody climber, up to 10 m high; bark brownish; twigs usually quadrangular. ***Leaves*** simple, opposite, glabrous; petiole robust, quadrangular, 1–2 mm long, base auricled; blade thickly coriaceous, obovate to oblong-elliptic, 12.5–35 by 6–18 cm, upper surface dark green, lower surface greenish, apex acute to acuminate, margin entire, base cuneate. ***Inflorescence*** terminal, sessile, cymose, 3-flowered. ***Flowers*** large; pedicels robust, 2–3 cm long; bracteoles present, 2–3 by 0.7–1 cm. ***Calyx*** campanulate, deeply lobed; lobes 3.5–7 by 2.5–4 cm, imbricate-quincuncial in bud, glabrous, apex rounded to truncate. ***Corolla*** white or creamy white, turning to yellow, thick-fleshy, ca 30 cm in diam., caducous; tube widely to narrowly funnel-shaped, 12–16 mm long; lobes 5, oblong-obovate, 7–9 by 5–7 mm, contorted in bud, apex rounded, margin entire. ***Stamens*** 5, subexerted from corolla tube; filaments 7.5–10 cm long, unequal, base thickness; anthers 1.8–2 mm long. ***Ovary*** superior, ca 2 cm long, with 2 parietal placentas, glabrous; style 12.5–14 cm long; stigma peltate, subconcave. ***Fruit*** greenish, oblong-cylindrical, 11–12 by 3.5–6 cm. ***Seeds*** numerous, ovate, 2–2.5 mm long.

Thailand.— SOUTH-WESTERN: Phachuap Khiri Khan; SOUTH-EASTERN: Trat; PENINSULAR: Ranong, Phangnga, Krabi, Songkhla, Narathiwat.

Distribution.— Indochina, South Myanmar, Peninsular Malaysia, Java, Bali, Borneo, Philippines, Moluccas and Japan.

Ecology.— In deep depression of rock platform edges.

Vernacular.— Thian Ruese (เทียนฤาษี) (Northern); Chaba Chang (ชะบาช้าง) (Peninsular).

Specimens examined.— *J. Inuthai* 540, 631, 632 (PSU)

MEMECYLACEAE

Memecylon edule Roxb., Pl. Coromandel 1: 59, t. 82. 1795; C.B. Clarke in Fl. Brit. India (J.D. Hooker) 2: 563. 1879; Ridl., Fl. Malay. Penin. 1: 819. 1922; J.F. Maxwell, Tree Fl. Mal. 4: 186. 1989. (Fig. 16; Plate 8, B.)

Tree, up to 15 m high; bark brownish, lenticellate. ***Leaves*** simple, opposite, glabrous; petiole 1–1.5 cm long; blade thick, coriaceous, ovate to broadly elliptic, 9–13.5 by 4–7.5 cm, upper surface dark green, lower surface greenish, apex acute to acuminate, margin entire, base cuneate or rounded; secondary veins indistinct. ***Inflorescence*** axillary, panicled cymes, subglobose, many-flowered; peduncle stout, 1.5–2.5 cm long. ***Flowers*** small, ovoid-acute in bud; pedicels 2.5–4 mm long. ***Calyx*** small, pale blue-purple, persistent; tube campanulate, ca 2 mm long, with slightly 4-lobed, apex truncate. ***Corolla*** free, 4, bright blue-purple, thin, caducous, suborbicular or broadly ovate, ca 3 by 3 mm, apex acute, margin entire, base short-clawed. ***Stamens*** 8, bright blue-purple; filaments equal, ca 4 mm long; anthers ca 0.5 mm or a little bit more long, connective with a thick appendage and a hollow gland on dorsal side. ***Ovary*** inferior; style filiform, 5–6 mm long, glabrous; stigma punctiform. ***Fruit*** fleshy drupe, green, turning to black, globose, 5–8 mm in diam.

Thailand.— NORTHERN: Chiang Mai, Phayao, Phitsanulok; NORTH–EASTERN: Phetchabun, Loei, Ubon Ratchathani, Nong Khai, Sakon 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 to Eastern Peninsular Malaysia.

Ecology.— In deep depression along rock platform edges and open area in lowland forest.

Vernacular.— Miat (เหมียด) (Eastern); Phlong Dam (พลองดำ) (Southwestern); Phlong Mueat (Central).

Specimens examined.— *J. Inuthai* 479, 487, 504, 522, 537 (PSU)

Memecylon fruticosum King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 69: 74. 1900; Ridl., Fl. Mal. Pen. 1: 812. 1922; J.F. Maxwell, Tree Fl. Mal. 4: 187. 1989.

Shrub, up to 3 m high; bark brownish, lenticellate. ***Leaves*** simple, opposite, glabrous; petiole stout, very short or almost sessile; blade thick, coriaceous, ovate to lanceolate, 7–13 by 3.5–7.5 cm, upper surface dark green, lower surface greenish, apex obtuse or acute, margin entire, base rounded; secondary veins indistinct. ***Inflorescence*** axillary, paniculate, up to 10-flowered, ovoid-acute in bud; peduncle stout, short, up to 3 mm long. ***Flowers*** small; pedicels ca 5 mm long. ***Calyx*** small, pale pink-purple, persistent; tube cup-shaped, thick, stout, ca 3 mm long, with slightly 4-lobed, apex truncate. ***Corolla*** free, 4, bright blue with pale blue edges, caducous, broadly triangular or quadrangular, ca 3 by 2 mm, apex acute, margin entire, base truncate. ***Stamens*** 8, bright blue-purple; filaments thick, ca 3 mm long, equal; anthers ca 1 mm long, connective with a thick appendage and a hollow gland on dorsal side. ***Ovary*** inferior; style filiform, ca 5 mm long, glabrous; stigma punctiform. ***Fruit*** drupe, pinkish, turning to dull pink, suburceolate, ca 8 by 6 mm.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Peninsular Malaysia.

Ecology.— Along rock platform edges in shade and partial shade.

Vernacular.—

Specimens examined.— *J. Inuthai* 507, 535, 547, 555 (PSU)

MORACEAE

Ficus hispida L.f., Suppl. Pl. 442. 1782; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 28. 1965; Kochummen in Tree Fl. Mal. 3: 149. 1978; Z.H. Wu, S.Q. Zhou & M.G. Gilbert in Fl. China 5: 48, fig. 55. 2003; C.C. Berg & Corner in Fl. Males., Ser. 1, Seed Plants 17(2): 426, fig. 84, Map 11. 2005.— *Gonosuke hispida* (L.f.) Raf. Sylva Tellur. 58. 1838.— *Covellia hispida* (L.f.) Miq., J. Bot. (Hooker) 7: 462. 1848. (Plate 8, E.)

Shrub or small tree, 3–5 m high, coarsely hairy; dioecious. ***Branchlets*** grayish-brownish, coarsely hairy, with a ring-like stipule-scar at each node. ***Leaves*** simple, opposite; petiole brownish, 1–3 cm long, coarsely hairy; blade thickly papyraceous, elliptic or oblong-elliptic, 15–30 by 5–10.5 cm, upper surface with scattered short thick hairs, lower surface with coarse white hairs, apex acuminate to mucronate, margin slightly toothed, base cuneate to rounded; secondary veins 6–9 pairs, raised below. ***Inflorescence*** hypanthodium, axillary on leafless branchlets or branchlets from trunk, solitary of paired, globose, compressed on the upper side, 2.5–3.5 cm in diam., with short scattered hairs. ***Flowers*** small, set inside the fleshy hypanthodium. ***Staminate flower*** with 1 stamen, subsessile, 1–2 mm long; many-flowered, near apical pore; calyx lobes 3, thinly membranous. ***Pistillate flower*** not seen. ***Gall flower*** like the female but swollen, with a short funnel-shaped style, not setting seed.

Thailand.— NORTHERN: Mae Hong Son, Chiang Mai; CENTRAL: Saraburi, Krung Thep Maha Nakhon; PENINSULAR: Nakhon Si Thammarat, Songkhla, Narathiwat.

Distribution.— India, Sri Lanka, Bhutan, Nepal, Indochina, South China, Andaman Islands, Peninsular Malesia, Sumatra, Java, Borneo, Celebes, Lesser Sunda Islands, Moluccas, New Guinea and Australia.

Ecology.— In the open on edges of forest, along the roadside and along streams.

Vernacular.— Ma Duea Plong (มะเดื่อปล้อง) (General); Duea Sai (เดื่อสาย) (Northern); Duea Pong (เดื่อป่อง) (Central); Ha-Ko-Sa-Nee-Ya (ฮะกอสะนียา) (Peninsular.)

Specimens examined.— *J. Inuthai* 610 (PSU)

Streblus taxoides Kurz, Forest Fl. Burma2. 465. 1877; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 16. 1965; Kochummen in Tree Fl. Mal. 3: 167. 1978; C.C. Berg, Corner & F.M. Jarrett in Fl. Males., Ser. 1, Seed Plants 17(1): 59, fig. 12. 2006.— *Trophis taxoides* Roth, Nov. Pl. Sp.: 368. 1821.— *Phyllochlamys spinosa* Bureau, Prodr. (DC.) 17: 218. 1873; Hook.f. in Fl. Brit. Ind. 5: 488. 1888; Ridl., Fl. Mal. Pen. 3: 323. 1924.— *Phyllochlamys wallichii* King ex Hook.f., Fl. Brit. Ind. 5: 489. 1888; Ridl., Fl. Mal. Pen. 3: 322. 1924. (Plate 8, F.)

Shrub or small tree, dioecious, up to 5 m high, with thorns 0.5–1.2 cm long. ***Branchlets*** grayish-brownish, young parts puberulous. ***Stipules*** small. ***Leaves*** simple, alternate, distichous; petiole brownish, 2–4 mm long, puberulose; blade subcoriaceous to coriaceous, elliptic or oblong-lanceolate, 3–12.5 by 0.7–4.5 cm, glabrous, apex acute to acuminate, margin entire to slightly toothed, base obtuse to rounded; secondary veins 6–12 pairs. ***Staminate inflorescence*** axillary, subsessile, capitate, 5–7 mm long; staminate flowers 7–9, subsessile; tepals 4, white, ovate, 1.5–2 by 1 mm, puberulous; stamens 4, 2.5–3 mm long; anthers reniform, 0.6–0.8 mm long; bracts basally attached, ovate or broadly triangular, suborbicular, 2–2.5 by 1.2–2 mm, puberulous. ***Pistillate inflorescence*** axillary, solitary to clustered on short-shoots; pistillate flowers 4-merous, shortly pedicelled; tepals 4, greenish, lanceolate, 8.5–15 by 2.5–6 mm, in fruit up to 2 by 0.9 cm, glabrous; ovary superior, 2–2.3 mm long, style 0.4–0.8 mm long, stigmas bilobed, 2.5–3 mm long; bracts 2, broadly ovate, ca 1.5 by 1.5 mm, glabrescent. ***Fruit*** drupe, subellipsoid or globose, ca 7 by 6 mm. ***Seeds*** large, globose, ca 5 mm in diam.

Thailand.— NORTHERN: Uttaradit; NORTH–EASTERN: Sakon Nakhon; SOUTH–WESTERN: Ratchaburi, Phachuap Khiri Khan; PENINSULAR: Chumphon, Surat Thani, Phatthalung, Songkhla.

Distribution.— Throughout India to Philippines, Celebes (Southeastern) and Lesser Sunda Islands.

Ecology.— On rock boulders in shade and in dry places.

Vernacular.— Khoi Nam (ข่อยหนาม) (General); Khoi Nam (ข่อยน้ำ), Khoi Yong (ข่อยหยอง) (Northern); Sam Phan Ta (สามพันตา) (Northeastern); Khi Reat (ขี้แรด), Nam Khi Reat (หนามขี้แรด), Katae Mai (กระแตไต่ไม้) (Peninsular).

Specimens examined.— *J. Inuthai* 484, 520, 597 (PSU)

MYRSINACEAE

Ardisia crenata var. **crenata** Sims, Bot. Mag. 45: pl. 1950. 1817; Ridl., Fl. Malay. Penin. 2: 253. 1923; Ng, Tree Fl. Mal 4: 270. 1989; Pipoly & C. Chen in Fl. China 15: 19. 1996; K. Larsen & C.M. Hu in Fl. Thailand 6(2): 135. 1996.— *Ardisia crispa* A. DC., Trans. Linn. Soc. London 17(1): 124. 1834; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 197. 1965; M.R. Hend., Malay. Wild Fls., Dicots.: 272. 1974. (Plate 8, G.)

Shrub, 1–2 m high; bark brown. ***Branchlets*** terete, glabrous. ***Leaves*** simple, alternate, glabrous; petiole 0.3–1 cm long; blade subcoriaceous, elliptic-lanceolate or oblanceolate, 7.5–15 by 2.5–5.5 cm, with conspicuous glandular dots, upper surface green, lower surface greenish, apex acute, margin crenate, base cuneate; secondary veins 12–20 pairs. ***Inflorescence*** terminal on branchlets, corymbose or subumbelliform, many-flowered; peduncle short. ***Flowers*** pink to pinkish; pedicels unequal, 1–1.7 cm long; bracteoles ovate. ***Calyx*** obconical, united at base; lobes 5, ovate, ca 2 by 0.5 mm, apex acute. ***Corolla*** rotate, deeply lobed; lobes 5, ovate, 6–7

by 3–4 mm, contorted in bud, with scattered dark dots, apex acute, margin entire. ***Stamens*** 5, epipetalous; filaments very short, glabrous; anthers lanceolate-triangular, ca 5 mm long, with scattered dots on back. ***Ovary*** superior, glabrous, unilocular; styles filiform, 5–9 mm long, glabrous. ***Fruit*** fleshy drupe, red when ripe, globose, 7–9 mm in diam.

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

Distribution.— Throughout India to Philippines and Japan.

Ecology.— At the foothills in shade and in rubber plantation.

Vernacular.— Ta Kai Bai Kwang (ตาไก่ใบกว้าง) (General).

Specimens examined.— *J. Inuthai* 603, 611 (PSU)

Maesa ramentacea (Roxb.) A. DC. in DC., Prodr. 8: 77. 1844; C.B. Clarke in Fl. Brit. India (J.D. Hooker) 3: 508. 1882; Ridl., Fl. Malay. Penin. 2: 227. 1923; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 196. 1965; B.C. Stone in Tree Fl. Mal 4: 283. 1989; K. Larsen & C.M. Hu in Fl. Thailand 6(2): 171, Pl. XV: 1. 1996.— *Baeobotrys ramentacea* Roxb., Fl. Ind. (Carey & Wallich ed.) 2: 231. 1820. (Plate 8, H.)

Small tree, 4–5 m high; bark brown. ***Branchlets*** terete, glabrous. ***Leaves*** simple, alternate, glabrous; petiole 8–10 mm long; blade subcoriaceous, ovate or elliptic-lanceolate, 5–12 by 1.5–4.5 cm, upper surface green, lower surface greenish, apex acute or acuminate, subcaudate, margin entire, base broadly cuneate; secondary veins 5–7 pairs. ***Inflorescence*** axillary, paniculate, ca 10 cm long, many-

flowered; peduncle short, glabrous or glabrescent. ***Flowers*** small, bisexual; pedicels up to 2.5 mm long, sparsely short-hairy; bracteoles in pairs on pedicels or at base of calyx, ovate, 6–7 mm long, sparsely short-hairy or glabrescent. ***Calyx*** greenish, basally connate, glabrescent or glabrous; tube adnated half-way to ovary; lobes 5, broadly ovate, 6–7 by 7–8 mm, apex acute, margin entire. ***Corolla*** white, broadly campanulate, glabrous; lobes 5, suborbicular, up to 1 by 1.3 mm, imbricate in bud, apex rounded, margin slightly crisped. ***Stamens*** 5, epipetalous; filaments ca 0.3 mm long, glabrous; anthers small, suborbicular, yellow, 0.2–0.3 mm long. ***Ovary*** half-inferior, subglobose; styles very short, cylindrical, glabrous; stigma bilobed.

Thailand.— NORTHERN: Mae Hong Son, Chiang Mai, Nan, Nakhon Sawan; NORTH–EASTERN: Loei; EASTERN: Nakhon Ratchasima; CENTRAL: Nakhon Nayok; SOUTH–EASTERN: Prachin Buri, Chanthaburi, Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Narathiwat.

Distribution.— Widely distributed in the Paleotropics.

Ecology.— At the foothills in shade near rubber plantation.

Vernacular.— Khao San Luang (ข้าวสารหลวง), Khao Luang (เขาหลวง), Khrai Yoi (ไคร้ย้อย), Lot Khao (หลอดเขา), Ton Maeng Tap (ต้นแมงทับ) (Northern) (ex Fletcher); Ma Khua Phueak (มะเขือเผือก) (Central); Kraduk Kai (กระดูกไก่), Mao Mot (เม้าหมด), Khi Non (ขี้หนอน) (Southeastern); Kapha Salai (กะผ้าสลาย), Siat Nok (เสียดนก), Pan (ปัน), Luai (ลวย) (Peninsular).

Specimen examined.— *J. Inuthai* 605 (PSU)

OCHNACEAE

Ochna integerrima (Lour.) Merr., Trans. Amer. Philos. Soc. ser. 2, 24(2): 265. 1935; Kanis in Fl. Thailand 2(1): 25. 1970; Kanis in Fl. Males., Ser. 1, Spermat. 7: 99, fig. 1. 1971; Ng, Tree Fl. Mal 3: 260. 1978; Z.G. Zhang & M.C.E. Amaral in Fl. China 12: 362. 2005.— *Elaeocarpus integerrimus* Lour., Fl. Cochinch. 338. 1790.— *Ochna wallichii* Planch., London J. Bot. 5: 650. 1846; A.W. Benn. in Fl. Brit. India (J.D. Hooker) 1: 524. 1875.— *Ochna brevipes* Planch., London J. Bot. 5: 652. 1846; A.W. Benn. in Fl. Brit. India (J.D. Hooker) 1: 525. 1875.— *Ochna grandis* Ridl., J. Straits Branch Roy. Asiat. Soc. 59: 83. 1911; Ridl., Fl. Malay. Penin. 1: 365. 1922. (Fig. 17; Plate 9, A.)

Deciduous tree, up to 15 m high; bark brownish. ***Leaves*** simple, alternate, glabrous; petiole 3–5 mm long; blade subcoriaceous, elliptic-obovate to oblong-oblanceolate, 8.5–16.5 by 2.5–6 cm, upper surface green, lower surface greenish, apex acute to acuminate, margin finely serrate, base cuneate, obtuse to rounded. ***Inflorescence*** axillary, corymbose, 1–4-flowered; peduncle 1–2.5 cm long. ***Flowers***: pedicels 3–3.5 cm long. ***Torus*** ca 1.5 mm high, 4 mm in diam., in fruit ca 5 mm high, 10 mm in diam. ***Sepals*** 5, greenish, turning to red in fruit, oblong-ovate, ca 2 by 0.5 cm, glabrous, apex obtuse or rounded. ***Petals*** 5, yellow, caducous, subcircular-obovate, 3–3.5 by 1.8–2.1 cm, apex rounded, margin entire, base clawed. ***Stamens*** ca 50, 3-whorled; filaments 7–15 cm long, unequal, the outermost longer, red in fruit; anthers ca 4 by 0.5 mm. ***Ovaries*** 8–10, superior, glabrous; style glabrous, 2.5–3.5 cm; stigma 7–10, slightly curved. ***Fruits*** drupes, greenish, turning to black, compressed globose, 7–8 by 6–7 mm.

Thailand.— Throughout the country.

Distribution.— Northeast India, East Pakistan, Myanmar, Indochina, the Andaman, Nicobar Islands and Peninsular Malaysia.

Ecology.— In deep depression near rock platform edges and in shade of lowland forest.

Vernacular.— Tan Luang (ตาลเหลือง) (Northern); Ngaeng (แง่ง) (Northeastern); Chang Nao (ช้างน้าว) (Northeastern, Eastern); Tan Nok Krot (ตานนกกรด) (Eastern); Kradong Daeng (กระโดงแดง), Kamlang Chang San (กำลังช้างสาร) (Central); Chang Nom (ช้างโน้ม) (Southeastern); Chang Hom (ช้างโหม), Fin (ฝิ่น) (Southwestern); Krachae (กระแจะ) (Peninsular).

Specimen examined.— *J. Inuthai* 475 (PSU)

OLEACEAE

Chionanthus microstigma (Gagnep.) P.S. Green, Kew Bull. 51: 768. 1996; P.S. Green in Fl. Thailand 7(2): 291. 2000.— *Linociera microstigma* Gagnep., Bull. Soc. Bot. France 79: 786. 1933. (Fig. 18; Plate 9, B.)

Shrub or small tree, 4 m high; bark grayish to brownish. ***Leaves*** simple, opposite, glabrous; petiole brown to dark brown, 0.8–1 cm long; blade coriaceous, ovate to oblong-elliptic, 5–12 by 1.5–4.5 cm, upper surface dark green, lower surface greenish, apex acute to acuminate, margin entire, base cuneate. ***Inflorescence*** axillary, paniculate, 3–5 cm long, 5–10-flowered; peduncle 1.5–3.5 cm long, puberulous; pedicels 3–7 mm long. ***Calyx*** small, puberulous; tube 0.7–1 mm long; lobes 4, triangular, up to 1 mm long, apex acute. ***Corolla*** white; tube 2–3 mm long; lobes 4, divided nearly to base in paired lobes, oblong-linear, 7–10 by 1.5–2 mm, induplicate-valvate in bud, apex acute to obtuse, margin entire, involute. ***Stamens*** 2, inserted at base of corolla tube, epipetalous; filaments very short, ca 0.5 mm long; anthers 1.5–1.8 mm long. ***Ovary*** superior, flask-shaped, ca 1.5 by 1 mm, glabrous; style 0.7–0.8 mm long; stigma bilobed.

Thailand.— EASTERN: Chaiyaphum, Nakhon Ratchasima; SOUTH–WESTERN: Phachuap Khiri Khan; CENTRAL: Saraburi; PENINSULAR: Songkhla, Narathiwat.

Distribution.— Laos, Vietnam and Peninsular Malaysia.

Ecology.— In deep depression of rock platforms.

Vernacular.— Kradong Daeng (กระโดงแดง), Padong Daeng (ปะดงแดง), Fin (ฝิ่น) (General).

Specimen examined.— *J. Inuthai* 545 (PSU)

Jasminum simplicifolium subsp. **funale** (Decne.) Kiew, Sandakania 5: 11. 1994; P.S. Green, Kew Bull. 50(3): 574. 2010.— *Jasminum funale* Decne. in Nouv. Ann. Mus. Hist. Nat. 3: 405. 1834; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 217. 1965.

Small shrub, 0.5–1.5 m high. ***Branchlets*** terete, brownish, finely puberulous or glabrous. ***Leaves*** simple, opposite; petiole 3–5 mm long, finely puberulous; blade subcoriaceous, elliptic or broadly ovate, 4–9.5 by 1.5–5 cm, glabrous, upper surface dark green, lower surface greenish, apex acute or obtuse, margin entire, base cuneate or obtuse; secondary veins 3–5 pairs. ***Inflorescence*** terminal, cymose, few-flowered; bracts ovate, up to 4 by 2 mm, sometimes almost subulate. ***Flowers:*** pedicels 2–3 mm long; bracteoles elliptic, ca 2.3 by 0.8 mm. ***Calyx*** persistent, greenish, cup-shaped or subquadrangular, ca 1.5 mm long, shortly many-toothed, finely short-hairy. ***Corolla*** salverform or subrotate, white, 1.8–2 mm in diam.; tube 1.8–2 cm long, finely puberulous; lobes 4–5, oblong-elliptic or broadly ovoid, 9–10 by 5–6 mm, glabrous, imbricate in bud, apex rounded, margin entire. ***Stamens*** 4–5, inserted at corolla mouth; filaments ca 1.5 mm long; anthers linear, yellow, 4–4.5 by 0.6–0.7 mm. ***Disc*** annular. ***Ovary*** inferior; style glabrous; stigma bilobed, ca 0.8 mm long.

Thailand.— NORTHERN: Tak; NORTH–EASTERN: Loei, Udon Thani; EASTERN: Chaiyaphum; SOUTH–WESTERN: Kanchanaburi, Rayong; PENINSULAR: Surat Thani, Songkhla.

Distribution.— Myanmar, Cambodia, Peninsular Malaysia and Java.

Ecology.— Along rock platform edges in partial shade or in exposed places.

Vernacular.—

Specimen examined.— *J. Inuthai* 623 (PSU)

RAFFLESIACEAE

Rafflesia kerrii Meijer, Blumea 30. 212. 1984; Meijer, Fl. Males., Ser. 1, Spermat. 13. 26. 1997. (Fig. 19; Plate 9, C.–E.)

Parasitic plants. ***Flower buds*** sessile, ca 15 cm in diam. ***Flower*** up to 60 cm diam. ***Perigone lobes*** 5, imbricate, reddish, suborbicular, up to ca 20 by 24 cm, 0.5–1 cm thick, with scattered rather numerous white warts, with 3–4 mm space between them, the warts smallest relative to the red background of any species known. ***Perigone tube*** with ramenta which are mostly unbranched and only slightly swollen at apex, those near the diaphragm ca 10 mm long, those near the base of the tube 5 mm. ***Diaphragm*** circular, only slightly lighter red than the perigone lobes, ca 15 cm in diam. with a central opening ca 12 cm across; upper face with ca 3 to 4 concentric rings of circular whitish; lower face with 7 concentric rings of white blots, which are up to 6 mm across. ***Central part of disk*** ca 12 cm in diam., with numerous bristles on the lower surface of the corona, with 38–50 processes; processes orange-red, 1.5–2 cm long. ***Staminate flowers*** with 25–32 anthers; anthers white, ca 5 mm diam., anther cavity on underside of disk 1 cm wide with densely fine bristles

Thailand.— PENINSULAR: Surat Thani, Songkhla, Yala.

Distribution.— Peninsular Malesia

Ecology.— In shady place and in lowland forest.

Vernacular.—

Remarks.— This specimen is a staminate flower which showed anthers in the line drawing of Figure 19. *Rafflesia kerrii* Meijer is found in the rain forest of southern part of Thailand and Peninsular Malaysia. The most famous population of this species in Thailand is located in the Khao Sok National Park, Surat Thani province. This is the first specimen of *Rafflesia kerrii* Meijer that was collected in Songkhla province, particularly from a Khao Reng hill. It doesn't even mean that *Rafflesia kerrii* Meijer is a rare species of Thailand but also reminds us about a lack of data collection, especially in southern part of Thailand. It was collected once in the forest, however, its vitaceous host was not found in the forest. It is possible that *Cissus nodosa* Blume (Vitaceae) in the rock-platform fringe might be the host plant of this species.

Specimens examined.— *J. Inuthai* 640 (PSU)

RUBIACEAE

Canthium horridum Blume, Cat. Gew. Buitenzorg (Blume) 45. 1823; Hook.f., Fl. Brit. India (J.D. Hooker) 3: 135. 1880; Ridl., Fl. Malay. Penin. 2: 123. 1923; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 319. 1965; K.M. Wong, Tree Fl. Mal. 4: 341. 1989. (Fig. 20; Plate 9, F.)

Erect spiny shrub, 3–5 m high. ***Branchlets*** densely brown strigose; spine recurved. ***Stipules*** interpetiolar, small, triangular, hairy. ***Leaves*** simple, opposite; petiole very short, hairy; blade subcoriaceous, ovate to oval, 2–3 by 1–1.7

cm, glabrous with scattered short hairs, densely hairy on veins, upper surface green, lower surface greenish, apex acute, margin entire, base cuneate to rounded; secondary veins 3–4 pairs. ***Inflorescence*** axillary, fascicled, 3–4-flowered. ***Flowers*** small; pedicels very short. ***Calyx*** green, persistent; tube cup-like, ca 2 mm long; lobes 4–5, shallow, apex white hairy. ***Corolla*** campanulate, greenish-yellowish, fleshy, ca 8 mm in diam; tube 2.5–3 mm long, throat with a ring of long hairs; lobes 4–5, triangular or ovate, 3–3.5 by 1–1.5 mm, reflexed, valvate in bud, apex acute, margin entire. ***Stamens*** 4–5, filaments ca 1 mm long; anthers a little bit longer than filaments. ***Disc*** annular, short hairy. ***Ovary*** inferior; style 4–5 mm long, hairy; stigma large, green, bilobed, exserted from corolla mouth.

Thailand.— PENINSULAR: Trang, Pattani, Songkhla, Yala.

Distribution.— Indochina, Peninsular Malaysia, Lankawi, Java, Borneo and Philippines.

Ecology.— In rock crevices of rock platforms and in partial shade, also found in open area along the stream.

Vernacular.— Kae (แกะ), Khlet Nu (เคล็ดหนู), Nam Lep Rok (หนามเล็บรอก) (Peninsular).

Specimens examined.— *J. Inuthai* 489, 505, 533, 559 (PSU)

Catunaregam sp.

Erect spiny shrub to small tree, 3–5 m high. ***Branchlets*** densely hairy, with paired leafy shoot and paired shoot thorns. ***Stipules*** interpetiolar, small, triangular, 3–5 mm long, hairy. ***Leaves*** simple, opposite, mostly clusters on short shoots; petiole short, hairy; blade subcoriaceous, elliptic, 3–12 by 2–5 cm, densely hairy, upper surface green, lower surface greenish, apex acute, margin entire, base

cuneate; secondary veins 6–8 pairs. ***Fruit*** crowned by persistent calyx, obpyriform, indehiscent, hairy.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Only known from this study.

Ecology.— On the deep depression of the granitic rock platform, in the granitic rock clefts, open areas on edges of forest and in the forest.

Vernacular.—

Remarks.— This specimen was found when it produced fruits. According to all of the available taxonomic literatures, this specimen is still unidentified. The characters of flowers are needed to clarify its status.

Specimens examined.— *J. Inuthai* 588, 625 (PSU)

Gardenia coronaria Buch.-Ham. in M. Symes, Embassy Ava, ed. 2, 3: 307. 1809; Hook.f., Fl. Brit. India (J.D. Hooker) 3: 117. 1880; K.M. Wong, Tree Fl. Mal. 4: 349. 1989. (Fig. 21; Plate 9, G.)

Small tree, 5–15 m high. ***Branchlets*** stout; buds hairy, resinous. ***Stipules*** interpetiolar, fused into an ocrea, hairy. ***Leaves*** simple, opposite; petiole 0.5–1 cm long; blade subcoriaceous, broadly obovate or broadly oblanceolate, 8–19 by 3–8 cm, upper surface bright green, glabrous, lower surface green, hairy on veins, apex acute to cuspidate, margin entire, base cuneate; secondary veins 15–17 pairs. ***Flowers*** solitary, axillary, fragrant, resinous; pedicels short, 0.5–1 cm long. ***Calyx*** green, persistent, hairy, resinous; tube tubular, 1–1.5 cm long, with 5-toothed, apex truncate. ***Corolla*** trumpet-shaped, bright yellow, turning to orange, fleshy, 5.5–8 cm in diam.; tube 5.5–7.5 cm long, with scattered short hairs; lobes 5, rounded or broadly ovoid, 3.7–4 by 3 cm, apex slightly acute or rounded, margin entire. ***Stamens*** 5, inserted at

corolla mouth; anthers sessile, linear, ca 1.5 cm long. ***Ovary*** inferior; style ca 6.5 cm long; stigma bilobed, 0.8–1 cm long. ***Fruit*** ellipsoid, 3–4.5 by 2.5 cm, with 5 longitudinally ribbed. ***Seeds*** small, numerous, compressed.

Thailand.— SOUTH–WESTERN: Ratchaburi; PENINSULAR: Surat Thani, Krabi, Satun, Songkhla.

Distribution.— Indochina and Peninsular Malaysia.

Ecology.— In rock crevices of rock platforms and in shade of lowland forest.

Vernacular.— Pha Dam (ผ่าด้าม) (General); Khammok (คำมอก) (Northern); Chan Yot (ชันยอด), Pan Yot (ปันยอด), Ang Wa (อ้างวา) (Southwestern); Khongkha (คงคา), Phut Nam (พุดน้ำ), Phut Yai (พุดใหญ่) (Peninsular).

Specimens examined.— *J. Inuthai* 481, 488, 584 (PSU)

Ixora javanica (Blume) DC., Prodr. (DC.) 4: 487. 1830; M.R. Hend., Malay. Wild Fls., Dicots.: 218. 1950; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 325. 1965; K.M. Wong, Tree Fl. Mal. 4: 360. 1989.— *Pavetta javanica* Blume, Bijdr. 949. 1826.— *Ixora amoena* Wall. ex G. Don, Gen. Syst. 3: 571. 1834; Hook.f., Fl. Brit. India (J.D. Hooker) 3: 146. 1880.— *Ixora stricta* Roxb. var. *blumeana* Kurz, For. Fl. Burma 2: 26. 1877; Hook.f., Fl. Brit. India (J.D. Hooker) 3: 146. 1880. (Plate 9, H.)

Shrub, 1–3 m high. ***Branchlets*** brownish, glabrous. ***Stipules*** interpetiolar, small, united into sheath, 1.5–2 mm long, glabrous, with few long hairs; awn 2–3 mm long. ***Leaves*** simple, opposite, glabrous; petiole 5–7 mm long; blade papyraceous, oblong-elliptic, 10–21 by 2.5–6 cm, upper surface dark green, lower surface greenish, apex acute to acuminate, margin entire, base cuneate; secondary veins 8–12 pairs. ***Inflorescence*** terminal, erect, trichotomously branched, loose, many-flowered; peduncle 1.5–3 cm long, hairy; bracts narrowly triangular, 4–7 mm

long, glabrous. ***Flowers*** orange, fading to pale orange; pedicels ca 1.5 mm long, the central flower shorter than the lateral one; bracteoles very small. ***Calyx*** cup-shaped; tube 1.2–1.3 mm long, with scattered short hairs; lobes 4, shallow, apex rounded. ***Corolla*** salverform, orange, fading to pale orange, 2–2.2 cm in diam., glabrous; tube 3–4.2 cm long; lobes 4, broadly elliptic, 9–10 by 5.5–6.5 mm, valvate in bud, apex rounded, margin entire. ***Stamens*** 4; filaments ca 1.5 mm long; anthers linear, 3.5–3.8 by 0.7–0.8 mm. ***Disc*** annular. ***Ovary*** inferior; style 4.2–4.4 mm long, glabrous; stigma 1–2 mm long, bilobed, exerted from corolla mouth. ***Fruit*** fleshy drupe, green, turning to black, globose, 4–7 mm in diam., glabrous.

Thailand.— NORTHERN: Lampang, Tak; NORTH–EASTERN: Ubon Thani, Nong Khai, Sakon 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 Kaeo, 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 and Java.

Ecology.— In partial shade and shade in lowland forest.

Vernacular.— Khem (เขี้ม), O (อ้อ), Khem Thong (เขี้มทอง), Khem Saet (เขี้มแสด), Khem Daeng (เขี้มแดง), Pue Cho Pu Yo (บือเจาะปูโยะ), Ya Rang (ยาราง) (Peninsular).

Specimens examined.— *J. Inuthai* 553, 594, 606 (PSU)

Oldenlandia pinifolia (Wall. ex. G. Don) Kuntze, Revis. Gen. Pl. 1: 292. 1891; *Hedyotis pinifolia* Wall. ex G. Don, Gen. Hist. 3: 526. 1834; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 285. 1965. (Plate 10, A.)

Annual herb, 25–35 cm long. ***Stem*** rigid, quadrangular, black, sparsely hispidulous. ***Stipules*** interpetiolar, united into sheath and adnate to base of petiole; lobes shallow, 1.5–2 mm long, with stiff fimbriate edge. ***Leaves*** simple, opposite, sessile or subsessile; blade linear, 1–3 cm by 0.5–1 mm, upper surface dark green, grooved, sparsely white setulose, lower surface dull dark green, costa raised, glabrous, apex acuminate, margin entire, revolute, base tapered. ***Flowers*** axillary, solitary, in cluster of 1–4 flowers per each node, small; pedicels very short. ***Calyx*** campanulate, dark green, sparsely white bristles, with keels along middle of lobes downward to end of tube; tube 1–1.5 mm long, adnate to ovary; lobes 4, triangular, 1–1.5 by 0.5 mm, more or less spreading. ***Corolla*** tubular, white, glabrous except inside corolla mouth; tube ca 2 mm long; lobes 4, elliptic, 2.5–3 by 0.7–1 mm, apex acute, margin entire. ***Stamens*** 4, epipetalous; filaments 0.8–1 mm long, glabrous, exerted from corolla mouth; anthers 0.6–0.8 by 0.3–0.4 mm. ***Ovary*** inferior, bilocular, each with numerous ovules; style ca 3 mm long, glabrous; stigma bilobed, ca 0.5 mm long. ***Fruit*** capsular, crowned, ca 3 by 2 mm. ***Seeds*** very small, numerous, dark brown to black, angular.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Tropical Asia.

Ecology.— In shallow depression of rock platforms.

Vernacular.—

Specimen examined.— *J. Inuthai* 622 (PSU)

Pavetta indica L., Sp. Pl. 1: 110. 1753; Hook.f., Fl. Brit. India (J.D. Hooker) 3: 150. 1880; Ridl., Fl. Malay. Penin. 2: 100. 1923. (Plate 10, B.)

Small tree or shrub, 3–4 m high. ***Branchlets*** slender, tomentose. ***Stipules*** interpetiolar, broadly triangular, united into sheath, densely tomentose, apex cuspitate. ***Leaves*** simple, opposite; petiole 1–2 cm long, densely tomentose; blade

coriaceous, broadly elliptic, 7–15.5 by 3–6 cm, with dark bacterial nodules, upper surface dark green, drying black, scattered tomentose, lower surface green, densely tomentose, apex acute or acuminate, margin entire, base cuneate; secondary veins 10–12 pairs. ***Inflorescence*** terminal, corymbs panicled, many-flowered. ***Flowers***: pedicels up to 1 cm long, hairy. ***Calyx*** small, green, with short hairs, persistent; tube cup-shaped, ca 1.5 mm long, apex truncate; lobes 4, small. ***Corolla*** tubular, greenish, turning to white, glabrous; throat hairy; lobes 4, elliptic, contorted in bud, apex acute, margin entire. ***Stamens*** 4; filaments short; anthers linear. ***Disc*** annular. ***Ovary*** inferior; stigma bilobed. ***Fruit*** globose, up to 6 mm in diam., glabrous.

Thailand.— NORTHERN: Chiang Mai; NORTH–EASTERN: Phetchabun; EASTERN: Nakhon Ratchasima; PENINSULAR: Songkhla.

Distribution.— Throughout India from the western Himalaya to Bhutan, Southern China, and southwards to Sri Lanka, Peninsular Malaysia and Northern Australia.

Ecology.— In deep depression near rock platform edges.

Vernacular.— Khem Khom (เข็มโคม) (Northeastern); Khem Pa (เข็มป่า) (Central).

Remarks.— All of description of this species was investigated from young buds.

Specimens examined.— *J. Inuthai* 496, 514, 546 (PSU)

Prismatomeris tetrandra subsp. **malayana** (Ridl.) J.T. Johanss., Opera Bot. 94: 29. 1987; K.M. Wong, Tree Fl. Mal. 4: 395. 1989.— *Prismatomeris malayana* Ridl., J. Fed. Malay States Mus. 10: 142. 1920; Ridl., Fl. Malay. Penin. 2: 116. 1923. (Plate 10, C.)

Small shrub, 1–2 m high. ***Branchlets*** slender, brownish. ***Stipules*** interpetiolar, small, triangular. ***Leaves*** simple, opposite, glabrous; petiole ca 0.5 cm long; blade subcoriaceous, elliptic, 5–8 by 1.5–4 cm, upper surface dark green, lower surface greenish, apex acute to acuminate, margin entire, base cuneate; secondary veins 5–8 pairs. ***Inflorescence*** axillary, fascicled, 5–15-flowered. ***Flowers***: pedicels 1–1.5 cm long. ***Calyx*** greenish, persistent; tube cup-shaped, ca 1.3 mm long, apex truncate; lobes 5–6, shallow. ***Corolla*** tubular to subrotate, white, 1–1.2 cm in diam.; tube 1–1.3 cm long, throat glabrous; lobes 5–6, triangular or lanceolate, ca 8 by 3 mm, valvate in bud, apex acute, margin entire. ***Stamens*** 5–6, inserted in corolla tube; filaments ca 2 mm long; anthers linear, ca 2.5 mm long. ***Disc*** annular. ***Ovary*** inferior; style ca 1.5 cm long; stigma 2–3 mm long, bilobed, inserted in corolla tube. ***Fruit*** ellipsoid to globose, 5–7 mm in diam., glabrous.

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

Distribution.— Cambodia, Peninsular Malaysia, Lankawi, Sumatra and Borneo.

Ecology.— In rock crevices and along rock platform edges.

Vernacular.— To Kraduk (ต่อกระดูก) (Northeastern); Son Pa (ซ้อนป่า) (Eastern); Krak (กรัก) (Southwestern); Son Kra (สนกระ) (Central); Kraduk Kai (กระดูกไก่), Krak Phi (กรักผี), Duk Kai Khao (ดูกไก่ขาว), Duk Kai Dam (ดูกไก่ดำ) (Peninsular).

Specimens examined.— *J. Inuthai* 490, 498, 512, 524 (PSU)

Psydrax sp. (Plate 10, D.)

Shrub 2–3 m high. ***Branchlets*** glabrous, scattered domatia; side branches with one branch horizontal on the opposite side and the other branch

abortive. ***Stipules*** interpetiolar, triangular, 8–10 mm long, glabrous, apex caudate, strongly keel. ***Leaves*** simple, opposite; petiole 5–10 mm long, scattered domatia; blade coriaceous, broadly elliptic, 9–12 by 3.5–5.5 cm, glabrous, upper surface dark green, dark brown when dry, lower surface green, apex acuminate, margin entire, base broadly cuneate; secondary veins 4–6 pairs. ***Inflorescence*** axillary, umbel-like, many-flowered. ***Flowers***: pedicels up to 1 cm long. ***Calyx*** green, small, persistent; tube cup-shaped, ca 1 mm long, apex truncate; lobes 4–5, shallow. ***Corolla*** broadly tubular, greenish or yellowish, glabrous, throat hairy; lobes 4, oblong, ca 4 by 1.3 mm, valvate in bud, reflexed, apex acute, margin entire. ***Stamens*** 4; filaments short; anthers linear. ***Disc*** annular. ***Ovary*** inferior; style ca 8 mm long, stigma bilobed, exserted from corolla mouth.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Only known from this study.

Ecology.— In the granitic rock clefts.

Vernacular.—

Remarks.— Only one specimen of this specie, was collected from this study. According to all of the available taxonomic literatures, this specimen is still unidentified. More literatures and time are needed to clarify its status.

Specimens examined.— *J. Inuthai* 495 (PSU)

STERCULIACEAE

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, fig. 71. 2001; Y. Tang, M.G. Gilbert & Dorr in Fl. China 12: 319,

fig. 272. 2007.— *Helicteres spicata* Colebr. ex. Mast. in Fl. Brit. Ind. 1: 366. 1874. (Plate 10, E.)

Shrub, 1–3 m high; bark brownish to dark brown. ***Branchlets*** densely stellate hairy. ***Leaves*** simple, alternate; petiole 0.5–1.5 cm long, stellate hairy; blade subcoriaceous, ovate-elliptic to lanceolate-oblong, 6.5–16.5 by 2–5 cm, upper surface green, stellate hairy, lower surface greenish, densely stellate hairy, apex acute to narrowly acuminate, margin finely serrate to doubly serrate, base obliquely cuneate to rounded; basally 5-veined, secondary veins 6–8 pairs. ***Inflorescence*** axillary, spike-like, less than 1/2 as long as leaf blade, many-flowered; peduncle 3–5 mm long, stellate hairy. ***Flowers*** bisexual, subsessile, circular gland at base. ***Calyx*** tubular; tube 1.3–1.5 cm long; lobes 5, unequal, stellate hairy outside, apex acute to acuminate. ***Corolla*** free, 5, pink to purplish red, oblanceolate or spathulate, 2.3–2.5 by 0.4–0.5 cm, sparsely hairy, apex truncate, margin entire, base clawed with a pair of appendages. ***Androgynophore*** ca 1.7 cm long, glabrous. ***Stamens*** 10; column glabrous. ***Ovary*** superior, oblong-ovate, ca 1 mm long, with 5-loculed, hairy; style glabrous; style 1.5–1.8 mm long; stigma slightly 5-lobed. ***Fruit*** capsular, oblong-cylindrical, 4–5 by 1–1.5 cm, densely stellate villose hairy, apex beaked.

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

Distribution.— Throughout India to Philippines.

Ecology.— In rock crevices and deep depression of rocks and also found along roadsides.

Vernacular.— Po Don (ปอดอน) (Northern); Po Tao Hai (ปอเต่าไห้), Po Khi Ton (ปอขี้ต้น) (Northeastern); Chapan (ช้าปาน), Khi Tun (ขี้ตุ่น) (Southeastern); Khi On (ขี้อ้น), Phang Rae (พังแระ), Phumi (พูมี่), Hu Mi (หูหมี) (Peninsular).

Specimens examined.— *J. Inuthai* 468, 483, 523, 528, 561, 580, 613 (PSU)

Sterculia cordata Blume, Bijdr. Fl. Ned. Ind. 2: 83. 1825; Backer & Bakh.f., Fl. Java (Spermatoph.) 1: 412. 1963; Kochummen in Tree Fl. Mal. 2: 378, fig. 7. 1973; Phengklai in Fl. Thailand 7(3): 626. 2001.— *Sterculia javanica* R. Br., in Benn., Pl. Jav. Rar.: 230. 1844; Ridl., Fl. Malay. Penin. 1: 274. 1922. (Fig. 22; Plate 10, G.–H.)

Deciduous tree, up to 25 m high, monoecious; bark grayish to brownish, sometimes fissured. ***Branchlets*** densely reddish to brownish stellate tomentose. ***Leaves*** simple, spirally arranged; petiole 1–2.5 cm long, densely stellate hairy; blade coriaceous, ovate to oblong-elliptic, 10–17 by 4.5–7 cm, upper surface green to dark green, stellate hairy on veins, lower surface greenish to yellowish, densely stellate hairy, apex acuminate, margin entire, base narrowly peltate, broadly cuneate to rounded; midrib grooved on upper surface, secondary veins 7–12 pairs. ***Inflorescence*** terminal, paniculate, 7–15 cm long, many-flowered; peduncle 2–4.5 cm long, densely stellate tomentose; bracts narrowly triangular, densely hairy. ***Flowers*** unisexual, globose to ovoid in bud; petals absent. ***Calyx*** pinkish, obconical; lobes 5–6, 6–8 by 4–5 mm, valvate in bud, hairy, apex acute to obtuse. ***Staminate flowers*** dense in heads of ca 0.5 mm in diam.; stamens 10; staminal column glabrous; anthers yellow, sessile. ***Pistillate flowers*** with 5 apocarpous pistils. ***Ovary*** globose, long hairy; stigma 5-lobed. ***Fruit*** 5-follicled, pyriform, 6.5–7.5 by 2–2.5 cm, densely brownish hairy or woolly.

Thailand.— PENINSULAR: Nakhon Si Thammarat, Phatthalung, Satun, Songkhla.

Distribution.— Peninsular Malaysia, Langkawi, Sumatra and Java.

Ecology.— In rock crevices and deep depression along rock platform edges.

Vernacular.— Po Khon (ปอขน) (Peninsular).

Specimens examined.— *J. Inuthai* 502, 513, 514 (PSU)

VITACEAE

Cissus nodosa Blume, Bijdr. Fl. Ned. Ind. 4: 182. 1825; Backer & Bakh.f., Fl. Java (Spermatoph.) 2: 92. 1965.— *Vitis nodosa* Miq., Ann. Mus. Bot. Lugduno-Batavi 1. 87. (Fig. 23; Plate 10, F.)

Climber with tendrils. ***Stem*** terete, dull red-purple or green, glabrous. ***Leaves*** simple, alternate, glabrous; petiole dull red-purple, up to 5.5 cm long; blade membranous, ovate to ovoid, 4–9 by 3.5–7.5 cm, upper surface dark green, lower surface greenish, apex acuminate, margin faintly serrate, base truncate; basally 3-veined, secondary veins 4–5 pairs. ***Inflorescence*** axillary, corymbose, many-flowered; bracts broadly ovate, margin fimbriate; peduncle dull red-purple, ca 3 mm long. ***Flower buds*** small, dull red-purple, ellipsoid, apex obtuse. ***Flowers*** small, 4-merous, dull red-purple; bracteoles small, ovoid, margin fimbriate; pedicels 2–3 mm long, ca 5 mm long in fruit. ***Calyx*** cup-shaped, ca 2 mm long, persistent, truncated edges. ***Corolla*** free, 4, yellowish inner, dull red-purple outer, thick, triangular, ca 2.5 by 1.5 mm, reflexed, apex acute or obtuse, margin entire. ***Stamens*** 4, bright yellow; filaments equal, ca 1 mm long; anthers a little bit shorter than filament, connective indistinct. ***Disc*** yellow, glabrous, margin thick, with 4-lobed. ***Ovary*** superior; style 1–1.5 mm long, glabrous; stigma truncate. ***Fruit*** fleshy berry, black, globose, 7–8 mm in diam.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Peninsular Malaysia and Java.

Ecology.— On shallow depression of rocks, climbing on tree canopies and usually found in exposed places.

Vernacular.—

Specimens examined.— *J. Inuthai* 464, 485, 549 (PSU)

MONOCOTS

ARACEAE

Epipremnum giganteum Schott, Bonplandia 5: 45. 1857; Hook.f., Fl. Brit. India (J.D. Hooker) 6: 548. 1892; M.R. Hend., Malay. Wild Fls., Monocots.: 235, fig. 140. 1954.— *Pothos giganteus* Roxb., Fl. Ind., ed. 1: 455. 1820. (Plate 11, A.–B.)

Woody climber, more than 10 m long. ***Stem*** stout, ca 4.5 cm in diam., glabrous. ***Leaves*** simple, alternate, glabrous; petioles stout, greenish to green, 35–60 cm long, winged throughout its length, apex pulvinate, 4–5 cm long, margin entire, base broadly attached; blade coriaceous, oblong-ovate, 60–65 by 30–37 cm, upper surface green to dark green, lower surface greenish, apex acute, margin entire, undulate, base subcordate or rounded; midrib stout; secondary veins 23–26 pairs, rising beneath. ***Inflorescence*** terminal, spadix, stout, cylindrical, yellow, drying black, 25–30 cm long; spathe large, boat-shaved, thick, greenish, turning to yellow, longer than spadix, glabrous; peduncle stout. ***Flowers*** sessile, bisexual; perianths absent. ***Stamens*** numerous; filaments flattened, ca 1 mm long; anthers linear, ca 3 mm long, opening by slits. ***Ovary*** superior, truncate, unilocular, with 2 ovules; stigma flattened.

Thailand.— SOUTH–EASTERN: Trat; PENINSULAR: Surat Thani, Pattani, Songkhla, Narathiwat.

Distribution.— Peninsular Malaysia.

Ecology.— Climbing in shallow depression of rocks and on tree-trunks near rock platform edges.

Vernacular.— Thao Nang Rong (เถานางรอง) (Southeastern); Ngot (งค), Ra Ngot Kluai (ระงคกล้วย), Ri Ngu A Ka (รีงูอะการ์) (Peninsular).

Specimen examined.— *J. Inuthai* 629 (PSU)

Scindapsus scortechinii Hook.f., Fl. Brit. India (J.D. Hooker) 6: 541. 1893; M.R. Hend., Malay. Wild Fls., Monocots.: 234, fig. 139A–B. 1954.

Climber, 30–50 cm long. ***Stem*** slender, glabrous. ***Leaves*** simple, alternate, glabrous; petiole stout, greenish, 3.5–4.5 cm long, winged throughout its length, apex pulvinate, 3–5 mm long, margin entire; blade subcoriaceous, obliquely oblong-ovate, 9.5–12.5 by 3.5–4.5 cm, upper surface green, lower surface greenish, apex mucronate, margin entire, base subcordate or rounded; with many secondary veins. ***Inflorescence*** terminal, spadix, sessile, cylindrical, stout, creamy or yellowish, drying black, ca 4 cm long. ***Flowers*** sessile, bisexual; perianths absent. ***Ovary*** superior, unilocular.

Thailand.— PENINSULAR: Songkhla.

Distribution.— China and Peninsular Malaysia.

Ecology.— Climbing on tree-trunks near rock platform edges.

Vernacular.— Phlu Chang (พลูช้าง) (Peninsular).

Remarks.— This specimen was found when the stamens anthesis, so it could not count the number of stamens.

Specimen examined.— *J. Inuthai* 485 (PSU)

ARECACEAE

Livistona speciosa Hook.f., J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 43(4): 204. 1875.— *Saribus speciosus* (Kurn) Kuntze, Revis. Gen. Pl. 2: 736. 1891.

Tree up to 15 m. Trunk roughened by the persistent leaf bases. ***Leaves*** large, simple, spirally arranged; leafstalk not split at base, with stout spines along margins, up to 2 m long; blade subcoriaceous, costapalmate, plication induplicate, 60–80 cm across, divided to one-third or half way their length, upper surface green or dull green, glossy, lower surface greenish. ***Inflorescence*** axillary within crown of leaves, paniculate, many-branched, as long as leaves. ***Fruit*** ellipsoid, bluish, smooth, shortly stalked, 1-seeded.

Thailand.— Throughout the country.

Distribution.— Myanmar and Peninsular Malaysia.

Ecology.— Common in the open on edges of forest and in the rubber plantation.

Vernacular.— Ko Lae (ก๊อแล่), Tho (ทอ), Nang Klang Chae (นางกลางแจ๊ะ), Mako Suam (มะก๊อซ่วม), Mako Daeng (มะก๊อแดง), Lo-La (โล้ละ), Lu-La(หลู่หล่า) (Northern); Kho (ค้อ) (Northern, Prachuap Khiri Khan); Si Reng (สิเหรง) (Peninsular).

Specimens examined.— *J. Inuthai* 575 (PSU)

COSTACEAE

Cheilocostus speciosus (J. König) C.D. Specht, Taxon 55: 159. 2006.— *Banksea speciosa* J. König, Observ. Bot. 3: 75. 1783.— *Costus speciosus* Sm., Trans. Linn. Soc. London 1: 249. 1791; Baker in Fl. Brit. India (J.D. Hooker) 6: 249. 1892; Ridl., Fl. Malay. Penin. 4: 256. 1924; Holttum, Gard. Bull. Singapore 13: 242, fig. 31–32.

1950; M.R. Hend., Malay. Wild Fls., Monocots.: 136, fig. 79A. 1954; Backer & Bakh.f., Fl. Java (Spermatoph.) 3: 76. 1968; M. Sabu, Zingiberaceae and Costaceae of South India. 259, fig. 70, Pl. 20C.–D. 2006. (Plate 11, C.)

Slender perennial herb, erect, 1–3 m high, sometimes branched; base of stem covered with sheath; rhizome tuberous. ***Leaves*** simple, spirally arranged; leaf-sheath purple-brownish, tubular, ca 6 cm long, finely appressed pubescent; leafstalk short, 3–5 mm long, densely hairy; blade subcoriaceous, oblong-lanceolate or oblanceolate, 11–17.5 by 3–4 cm, upper surface greenish, glabrous, lower surface pale greenish, finely appressed pubescent, apex acuminate, margin entire, base cuneate. ***Inflorescence*** terminal, dense raceme, subglobose, ca 6 cm long, many-flowered; bracts red, ovate acuminate or acute, densely hairy; peduncle very short. ***Flowers*** sessile; bracteoles red, ovate, densely hairy. ***Calyx*** red, tubular, densely appressed hairs; tube 1–1.5 cm long; lobes 3, unequal, broadly triangular, apex acute. ***Corolla*** trumpet-shaped; tube white, shorter than calyx; lobes white with faintly pinkish, oblong, 3.5–4 by 1.2–1.5 cm, finely appressed pubescent outside, apex acute, margin entire. ***Lip*** white with yellow median band, suborbicular, ca 5 by 5 cm, pubescent inside. ***Stamens*** flattened, apex yellow; anthers linear, ca 1 cm long. ***Ovary*** inferior, triangular, trilocular; style filiform, 3.8–4.5 cm long, glabrous; stigma suborbicular, flattened, margin ciliate.

Thailand.— Throughout the country.

Distribution.— Throughout India to Australia.

Ecology.— In shallow depression of rock platforms.

Vernacular.— Ueang Mai Na (เอื้องหมายนา) (General); Chu Lai Bong (ชู้ไลบ้อง); Su Le Bo (ซูเลโบ) (Northern); Ueang Phet Ma (เอื้องเพ็ดม้า) (Central); Ueang Chang (เอื้องช้าง), Ueang Ton (เอื้องต้น), Ueang Yai (เอื้องใหญ่), Ban Dai Sawan (บันได สวรรค์) (Peninsular).

Specimens examined.— *J. Inuthai* 542 (PSU)

CYPERACEAE

Carex sp. (Plate 11, D.)

Rhizomatous perennial herb. ***Culms*** densely tufted, forming tussocks, 70–100 cm long, 0.6–1.3 mm wide, triquetrous, glabrous. ***Leaves***: blade linear, grass-like, greenish, 25–60 cm long, 1.5–2.5 mm wide, globeors, apex narrowly acute, margin more or less setulose; sheath closed, pale brown, scarious. ***Involucral bracts*** leaf-like, unequal, 25–40 cm long, patent. ***Inflorescence***: stem arising from the centre of a tuft of foliage leaves, terminal, paniculate, racemose, 5–10 by 1–3 cm. ***Spikelets*** cylindrical or fusiform, 7–12 by 0.7–1 mm. ***Glumes*** numerous, spirally imbricate, membraneous, ovate or elliptic-lanceolate, brownish, 3.8–4.2 by 1.5–2 mm, apex acuminate to shortly awned, keel brown, obtuse. ***Stamens*** 3; anthers linear, ca 1 mm long. ***Ovary*** with a single ovule; style bifid; stigmas 2. ***Fruit*** nutlet, 1–2 per spikelet, obovate, trigonous, dark brown, 2–2.5 by 1.8–2 mm.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Only known from this study.

Ecology.— On the rock crevices and the shallow depression of granitic rock platforms.

Vernacular.—

Remarks.— According to all of the available taxonomic literatures, this specimen is still unidentified. More literatures and time are needed to clarify its status.

Specimens examined.— *J. Inuthai* 587, 593 (PSU)

Cyperus dubius Rottb., Descr. Icon. Rar. Pl.: 20, t. 4, f. 5. 1773; M.R. Hend., Malay. Wild Fls., Monocots.: 271, fig. 161A–B. 1954; Backer & Bakh.f., Fl. Java (Spermatoph.) 3: 473. 1968; J. Kern in Fl. Males., Ser. 1, Spermat. 7(3): 643. 1974; D.A. Simpson & T. Koyama in Fl. Thailand 6(4): 385, fig. 28. 1998. (Plate 11, E.)

Rhizomatous perennial herb. ***Culms*** densely tufted, 15.5–60 cm by 2–3 mm, triquetrous, glabrous. ***Leaves***: blade linear, grass-like, greenish to green, 25.5–32 cm long, 2–4 mm wide, apex acuminate, margin entire or generally more or less setulose; sheath closed, pale greenish to brown, scarious. ***Involucral bracts*** 3–4, unequal, 4–17 cm long, patent to reflexed. ***Inflorescence*** terminal, capitate, globose to ovoid. ***Spikes*** 1–5. ***Spikelets*** numerous, patent, oblong-lanceolate, 4–5 by 1.5–2 mm, 1–3-flowered; axis straight. ***Glumes*** distichous, overlapping closely, subcoriaceous, broadly elliptic-lanceolate, greenish or pale greenish, 3.5–4 by 2 mm, apex acuminate or mucronate. ***Stamens*** 3; anthers linear, 0.5–1 mm long. ***Ovary*** unilocular, with a single ovule; style trifid; stigmas 3. ***Fruit*** nutlet, 1–2 per spikelet, ellipsoid, trigonous, bright brown to dark brown, 1.9–2 by 0.7–0.8 mm.

Thailand.— NORTHERN: Mae Hong Son, Tak, Phitsanulok, Kamphaeng Phet; NORTH–EASTERN: Loei, Udon Thani, Nakhon Phanom, Mukdahan; EASTERN: Chaiyaphum, Nakhon Ratchasima; SOUTH–WESTERN: Kanchanaburi, Ratchaburi, Phetchaburi, Phachuap Khiri Khan; CENTRAL: Saraburi, Krung Thep Maha Nakhon; SOUTH–EASTERN: Chon Buri; PENINSULAR: Surat Thani, Phangnga, Krabi, Satun, Songkhla.

Distribution.— Tropical Africa through India, Sri lanka, Indochina and Peninsular Malesia.

Ecology.— In rock crevices and shallow depression of rocks in exposed places and in partial shade of rock platforms.

Vernacular.— Ya Hua Ngok (หญ้าหัวหงอก) (Eastern); Haeo Mu Hin (Southwestern).

Specimens examined.— *J. Inuthai* 462, 530, 581 (PSU)

Fimbristylis hookeriana Boeckeler, Linnaea 37: 22. 1871; C.B. Clarke in Fl. Brit. Ind. 6: 641. 1893; D.A. Simpson & T. Koyama in Fl. Thailand 6(4): 328, Pl. XXXVI: 2–3. 1998. (Plate 11, F.)

Annual herb. ***Culms*** densely tufted, 15–50 cm long, 0.5–1.5 mm wide, triquetrous to subterete, glabrous. ***Leaves***: blade linear, grass-like, greenish, 14.5–37 cm long, 1.5–2 mm wide, lower surface covered with scattered setulose, apex acute, margin more or less setulose; sheath closed, pale brown, scarious. ***Involucral bracts*** 5–6, leaf-like, unequal, 1–18.5 cm long, patent. ***Inflorescence*** terminal, compound, 5–12 by 2–11 cm. ***Spikelets*** 3–many per inflorescence, in finger-like clusters of 4–6, cylindrical, 0.7–1.4 cm by 1.5–2.5 mm, patent. ***Glumes*** 8–12 per spikelet, spirally imbricate, subcoriaceous, ovate to lanceolate, greenish or pale greenish, 4–7 by 1.5 mm, apex acuminate to shortly awned, keel greenish, obtuse. ***Stamens*** 2; anthers linear, ca 1 mm long. ***Ovary*** unilocular, with a single ovule; style bifid; stigmas 2. ***Fruit*** nutlet, obovate, biconvex, 1.2–1.5 by 0.7–0.8 mm.

Thailand.— NORTHERN: Mae Hong Son, Chiang Mai, Phitsanulok; NORTH–EASTERN: Phetchabun, Loei, Udon Thani, Sakon Nakhon, Khon Kaen; EASTERN: Nakhon Ratchasima; SOUTH–EASTERN: Trat; PENINSULAR: Songkhla.

Distribution.— Indochina and Peninsular Malesia.

Ecology.— In rock crevices and shallow depression of rocks in exposed places.

Vernacular.— Yaa Hua Bo (หญ้าหัวบ่อ), Yaa Hua Bua (หญ้าหัวบัว) (Northeastern).

Specimens examined.— *J. Inuthai* 455, 456, 457, 586 (PSU)

Scleria lithosperma subsp. **linearis** (Benth.) T. Koyama in Fosberg & Dassan., Rev. Handb. Fl. Ceylon 5: 353. 1985; D.A. Simpson & T. Koyama in Fl. Thailand 6(4): 432. 1998.— *Scleria lithosperma* var. *linearia* Benth. Fl. Austral. 7: 430. 1878; J. Kern in Fl. Males., Ser. 1, Spermat. 7(3): 741, fig. 105. 1974.— *Scleria lithosperma* (L.) Sw., Prodr. (Swartz) 18. 1788; C.B. Clarke in Fl. Brit. Ind. 6: 685. 1893; Ridl., Fl. Mal. Pen. 5: 176. 1925; M.R. Hend., Malay. Wild Fls., Monocots.: 289, fig. 171A–B. 1954; Backer & Bakh.f., Fl. Java (Spermatoph.) 3: 485. 1968. (Plate 11, G.)

Rhizomatous perennial herb. ***Culms*** tufted, 30–60 cm long, 1.5–2 mm wide, triquetrous, glabrous. ***Leaves*** cauline: blade linear, greenish to green, 9–30 cm by 1.5–4 mm, lower surface covered with scattered setulose, apex sharp-pointed, margin more or less setulose; sheath 3–6 cm long, closed, brown, pubescent; contraligule depressed-rounded, hirsute. ***Lowest involucral bracts*** leaf-like, up to 25.5 cm long. ***Inflorescence*** very loose, panicled raceme, narrow, up to 50 cm long, with a terminal panicle and 3–4 distant axillary ones. ***Spikelets*** bisexual, solitary or clusters of 1–2, 5–7 mm, patent. ***Glumes*** subcoriaceous, ovate, greenish-brown, ca 3 by 2 mm, apex acuminate, keel brown, obtuse. ***Stamens*** 1–2; anthers linear, ca 1 mm long. ***Ovary*** oblong, unilocular, with a single ovule; style caducous; stigmas 3. ***Fruit*** nutlet, obovoid, trigonous, white, 2.5–3 by 1.5–2 mm, bony, markedly transversely rugose, indistinct disc attached at base.

Thailand.— NORTH–EASTERN: Nakhon Phanom; EASTERN: Nakhon Ratchasima; SOUTH–WESTERN: Phachuap Khiri Khan; SOUTH–EASTERN: Trat; PENINSULAR: Songkhla.

Distribution.— India, Sri Lanka, Indochina, Peninsular Malesia, Philippines and Australia.

Ecology.— On forest floors near open places.

Vernacular.— Ya Khom Bang Lek (หญ้าคมบางเล็ก) (Eastern).

Specimens examined.— *J. Inuthai* 568, 604 (PSU)

ORCHIDACEAE

Aerides odorata Lour., Fl. Cochinch.: 525. 1790; Hook.f., Fl. Brit. India 6: 47. 1890; Ridl., Fl. Malay. Penin. 4: 182. 1924; Seidenf. & Smitinand, Orchids Thailand 3: 550, fig. 409. 1963; Holttum, Rev. Fl. Malaya 1: 698, fig. 215. 1964; Seidenf., Opera Bot. 95: 242, fig. 152, Pl. XXVIc. 1988; Opera Bot. 114: 426. 1992; Seidenf. & J.J. Wood, Orch. Penn. Mal. and Sing.: 673, fig. 303a–d. 1992; J.B. Comber, Orch. Sumatra: 843. 2001. (Fig. 24; Plate 12, A.–B.)

Monopodial epiphyte-lithophyte. ***Stem*** stout, ca 30 cm long or more, branching, internodes 2–2.5 cm long. ***Leaves*** coriaceous, slightly fleshy, linear, 25–30 by 1.5–2 cm, apex unequally bilobed. ***Inflorescence*** lateral, pendulous, unbranched, dense raceme, 20–35 cm long, many-flowered. ***Flowers*** fragrant, sepals and petals white with purple at apex, spreading; bracteoles broadly triangular; pedicels and ovaries 1.5–2 cm long. ***Sepals*** oblong-obovate, dorsal sepal 10–12 by 8–9 mm, lateral sepals circular, 10–13 by 10–13 mm. ***Petals*** oblong-obovate, 10–11 by 7–9 mm. ***Lip*** 3-lobed, white with purple blotch at distal half of midlobe, lobes enclosing column; spur turned upward, horn-shaped, ca 2 cm long, apex green to purple-green, with scattered small purple spots, with appendages inside; side-lobes white, oblong, erect, adjacent sides of column; midlobe narrow, turned upward, smaller than side-lobes. ***Column*** short; columnfoot distinct; anther cap with narrowly obtuse front edge. ***Pollinia*** 2, slightly cleft; stipe linear, slightly widened below 2 pollinia; viscidium large. ***Stigma*** subquadrangular in outline; rostellum small, ovate. ***Ovary*** inferior, slender. ***Fruit*** capsular, oblong-clavate, 3.5–5 cm long, angle obtuse; stalk stout, 1–1.5 cm long.

Thailand.— NORTHERN: Chiang Mai; NORTH–EASTERN: Loei; EASTERN: Chaiyaphum; SOUTH–WESTERN: Kanchanaburi; SOUTH–EASTERN: Rayong; PENINSULAR: Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Trang, Satun, Songkhla.

Distribution.— From Western India through most of Southeast Asia eastwards to Borneo and Philippines.

Ecology.— In rock crevices, shallow depression, on rock slopes in exposed places and also found on tree-trunks in partial shade.

Vernacular.— Ueang Pet Noi (เอื้องเปิดน้อย) (Northern); Kulap Khao (กุหลาบขาว), Ueang Pao (เอื้องเปา), Kulap Krapao Pit (กุหลาบกระเป๋าปิด), Ueang Kulap Dueai (เอื้องกุหลาบเดือยไก่), Ueang Kulap Khao (เอื้องกุหลาบขาว), Ueang Phuang Kulap (เอื้องพวงกุหลาบ) (Central); Ma Mui (ม้าหมุย) (Peninsular).

Specimens examined.— *J. Inuthai* 416, 417, 418, 419, 420, 552 (PSU)

Cleisostoma subulatum Blume, Bijdr. Fl. Ned. Ind. 8: 363. 1825; Seidenf., Dansk Bot. Ark. 29(3): 25. 1975; Seidenf., Opera Bot. 114: 390, Pl. XXVd. 1992; Seidenf. & J.J. Wood, Orch. Penn. Mal. and Sing.: 625, fig. 283l–o. 1992; J.B. Comber, Orch. Sumatra: 894. 2001.— *Sarcanthus oxyphyllus* Wall. ex Lindl., Edwards's Bot. Reg. 26(Misc.): 58. 1840; Hook.f., Fl. Brit. India 6: 70. 1890.— *Sarcanthus subulatus* Rchb.f., Bonplandia 5: 41. 1857; Holttum, Rev. Fl. Malaya 1: 654, fig. 196. 1964.— *Saccolabium secundum* Ridl., Mat. Fl. Malay. Penins. 1: 168. 1907; Fl. Malay. Penin. 4: 169. 1924. (Fig. 25; Plate 12, C.–D.)

Monopodial epiphyte-lithophyte. ***Stem*** hanging, stout, up to 30 cm long, internodes 2–2.5 cm long. ***Leaves*** fleshy, linear, 27–32 by 1.2–1.5 cm, constricted 0.5–1.5 cm from apex, apex sharply pointed. ***Inflorescence*** lateral, pendulous, unbranched, dense raceme, ca 12 cm long, many-flowered. ***Flowers*** small, sepals and petals reddish brown with greenish-yellow edges and a median band, spreading; bracteoles ovate; pedicels and ovaries ca 5 mm long. ***Sepals*** oblong-obovate, dorsal sepal ca 5 by 2 mm, lateral sepals ca 4.5 by 2 mm. ***Petals*** narrower, ca 4 by 1 mm. ***Lip*** 3-lobed, purplish pink on spur and midlobe, fading to white at base;

spur conical, 5–5.5 mm long; side-lobes yellow, folded in middle, apex pointed inward; midlobe fleshy, ovate or broad triangular, apex slightly mucronate; median keel running down to join septum in spur; back wall callus longer than broad, broadening downwards, grooved in front. ***Column*** short, columnfoot indistinct. ***Pollinia*** 4, in two pairs, in each pair units unequal each other; stipe linear, widened below 4 pollinia; viscidium small. ***Stigma*** subquadrangular in outline; rostellum triangular. ***Ovary*** inferior.

Thailand.— NORTHERN: Phitsanulok, Nakhon Sawan; EASTERN: Nakhon Ratchasima; SOUTH–WESTERN: Phachuap Khiri Khan; CENTRAL: Saraburi, Nakhon Nayok; SOUTH–EASTERN: Prachin Buri, Chon Buri, Chanthaburi, Trat; PENINSULAR: Surat Thani, Satun, Songkhla.

Distribution.— Throughout Southeast Asia.

Ecology.— On rock platforms near small canals.

Vernacular.— Ueang Bai Kio (เอื้องใบกิ่ว) (General).

Specimens examined.— *J. Inuthai* 633 (PSU)

Cymbidium finlaysonianum Lindl., Gen. Sp. Orchid. Pl.: 164. 1833; Ridl, Fl. Malay. Penin. 4: 145. 1924; Seidenf. & Smitinand, Orchids Thailand 3: 507. 1961; Holttum, Rev. Fl. Malaya 1: 520, fig. 150. 1964; Seidenf. & Smitinand, Orchids Thailand 3: 816. 1965; Seidenf., Opera Bot. 114: 338. 1992; Seidenf. & J.J. Wood, Orch. Penn. Mal. and Sing.: 551, fig. 250a–e. 1992; J.B. Comber, Orch. Sumatra: 232. 2001. (Fig. 26; Plate 12, E.–F.)

Epiphyte-lithophyte. ***Stem*** very short, flattened. ***Leaves*** fleshy, linear, 23–83 by 2–3.5 cm, apex unequally bilobed, sheath 9.5–15 by 1–2 cm. ***Inflorescence*** arising laterally from base of pseudopulb, pendulous, unbranched, racemose, 60–80 cm long, many-flowered. ***Flowers*** large; sepals and petals dull yellow with dull red-

purple down middle, spreading; pedicels and ovaries 3.8–4.2 cm long. ***Sepals***: dorsal sepal oblong-elliptic, ca 3.2 by 1 cm, lateral sepals linear-oblong, 2.7–2.8 by 0.7 cm. ***Petals*** oblong-elliptic, ca 2.5 by 0.9 cm. ***Lip*** 3-lobed, 2.5–3 by 1–1.5 cm; side-lobes dull purple outer, purplish inner, slightly oblong, erect, enclosing column; midlobe fleshy, white with purple blotch nearly edge, oblong-ovate, ca 1.3 by 0.9 cm, with two strong yellow-purple ridges, apex acute, recurved. ***Column*** dull purple, 1.5–1.7 cm long, columnfoot small. ***Pollinia*** 2, cleft; viscidium large. ***Stigma*** subrectangular in outline. ***Ovary*** inferior, stout. ***Fruit*** capsular, large, elliptic-obovoid, 8–9 cm long, 3.3–3.5 cm in diam., angle obtuse; stalk stout, ca 4 cm long.

Thailand.— SOUTH–EASTERN: Chon Buri, Trat; PENINSULAR: Surat Thani, Nakhon Si Thammarat, Songkhla.

Distribution.— Vietnam, Cambodia, Peninsular Malaysia, Sumatra, Java, Borneo, Philippines and Sulawesi.

Ecology.— In rock crevices of rock platforms, on tree-trunks and in forests as an epiphyte in rather exposed places.

Vernacular.— Kare Karon Doi (กะเรกะร่อนดอย), Kare Karawn Pakpet (กะเรกะร่อนปากเป็ด) (Central).

Specimen examined.— *J. Inuthai* 401 (PSU)

Dendrobium crumenatum Sw., Schrad. J. Bot. 2: 237. 1799; Hook.f., Fl. Brit. India 5: 729. 1890; Ridl., Fl. Malay. Penin. 4: 52. 1924; Seidenf. & Smitinand, Orchids Thailand 2(2): 259, fig. 195c, e–f. 1960; Holttum, Rev. Fl. Malaya 1: 329. 1964; Seidenf. & Smitinand, Orchids Thailand 3(2): 778. 1965; Seidenf., Opera Bot. 83: 200, fig. 138. 1985; Opera Bot. 114: 248. 1992; Seidenf. & J.J. Wood, Orch. Penn. Mal. and Sing.: 409, fig. 3, 6, 185. 1992; J.B. Comber, Orch. Sumatra: 589. 2001. (Plate 12, G.–H.)

Sympodial epiphyte-lithophyte. ***Stems*** erect, ca 20 cm or more long, branching; internodes 1.5–4 cm long; pseudobulbs fusiform, many-angled, ca 4 internodes. ***Leaves*** fleshy, oblong-linear or oblong-elliptic, 5–7 by 1.8–2 cm, apex obtuse or retuse. ***Inflorescence*** lateral from apical part of stem, 1-flowered. ***Flowers*** fragrant, sepals and petals white, spreading; pedicels and ovaries 1.3–1.5 cm long. ***Sepals***: dorsal sepal lanceolate, 2–3 cm long, 6–7 mm wide, lateral sepals triangular, ca 2 by 1.1 cm, adjacent sides of column 2–2.2 cm long. ***Petals*** linear-lanceolate, ca 2 cm long, 5–8 mm wide. ***Mentum*** 1.5–1.7 cm long. ***Lip*** 3-lobed, white with yellow at middle of midlobe, 3–3.3 by 1.8–2 cm, when flattened; side-lobes erect, rounded, crisped; midlobe ovate to subquadragular, 8–10 by 6–8 mm, with five yellow keels, apex slightly acute, crisped edges. ***Column*** short; columnfoot distinct, 1.5–1.6 cm long; anther cap with two curves and broad front edge. ***Pollinia*** 4, in two pairs, soft. ***Stigma*** broadly ovate or suborbicular in outline; rostellum small, slightly lobed. ***Ovary*** inferior, slender. ***Fruit*** capsular, fusiform, 2–3 cm long.

Thailand.— SOUTH–EASTERN: Chon Buri, Trat; SOUTH–WESTERN: Phachuap Khiri Khan; CENTRAL: Nakhon Nayok; PENINSULAR: Chumphon, Ranong, Surat Thani, Krabi, Nakhon Si Thammarat, Satun, Songkhla.

Distribution.— India, Sri Lanka, China, Indochina, Myanmar, Andamans, Peninsular Malaysia, Lesser Sunda Islands, Moluccas, Sulawesi, Sumatra, New Guinea, Christmas, Philippines and Taiwan.

Ecology.— Epiphytic on tree-trunks and rocks and in rock crevices of exposed places.

Vernacular.— Buap Klang Hao (บวบกลางหาว) (Northern); Wai Tamoi (หวายตะมอย), Ueang Mali (เอื้องมะลิ) (Central, Peninsular); Dawk Mai Wai (ดอกไม้ไหว), Sae Phra In (แส้พระอินทร์), Nok Kayang (นกกะยาง) (Southeastern); Bua Klang Hoa (บัวกลางหาว), Thiam Ling (เทียมลิง) (Peninsular).

Specimens examined.— *J. Inuthai* 497, 519 (PSU)

Dienia ophrydis (J. König) Seidenf., Contr. Orchid Fl. Thailand 13: 18. 1997.— *Epidendrum ophrydis* J. König, Observ. Bot. 6: 46. 1791.— *Malaxis latifolia* Sm. in Rees Cycl. 22: Malaxis n. 3. 1812; Holttum, Rev. Fl. Malaya 1: 195, fig. 34a–d. 1964; Seidenf., Opera Bot. 114: 146. 1992; Seidenf. & J.J. Wood, Orch. Penn. Mal. and Sing.: 219, fig. 93a–c, Pl. 13b. 1992.— *Microstylis congesta* Rchb.f., Ann. Bot. Syst. (Walpers) 6: 206. 1861; Ridl., Fl. Malay. Penin. 4: 12. 1924.— *Malaxis ophrydis* (J. König) Ormerod 18. 1995; J.B. Comber, Orch. Sumatra: 172. 2001. (Fig. 27; Plate 13, A.–B.)

Terrestrial herb. ***Stem*** fleshy, dark purple, 10–15 cm long. ***Leaves*** 4–5; blade pleated, broadly elliptic, 15–20 by 3.5–5.5 cm, apex acute or acuminate; sheath purple, broad, 3–5 by 1–1.5 cm. ***Inflorescence*** terminal, erect, unbranched, racemose, 12–23 cm long, many-flowered; peduncle stout, 9–15 cm long. ***Flowers*** small, not resupinate, sepals and petals bright purple; bracteoles persistent, narrowly triangular, 3.5–4.5 by 0.5–0.7 mm, apex acuminate; pedicels and ovaries stout, 2–3 mm long. ***Sepals***: dorsal sepal oblong, ca 3 by 1 mm, lateral sepals obliquely ovate, 3 by 1.5 mm, reflected. ***Petals*** linear, ca 3.5 by 0.5 mm. ***Lip*** 3-lobed, dark purple, broadly triangular, ca 3 by 2.5 mm, when flattened, with a hollow near base; side-lobe broadly oblong, erect; midlobe ca 1 by 0.7 mm, apex obtuse or rounded. ***Column*** very short, ca 1 mm long, without columnfoot. ***Pollinia*** 4, in two pairs; in each pair units unequal each other. ***Stigma*** subquadrangular in outline. ***Ovary*** inferior. ***Fruit*** capsular, oblong, 6–7 mm high, 3–4 mm in diam., angle crenate to dentate; pedicel stout, ca 2 mm long.

Thailand.— NORTHERN: Chiang Mai, Phitsanulok; SOUTH–WESTERN: Kanchanaburi, Ratchaburi; SOUTH–EASTERN: Sa Kaeo; PENINSULAR: Nakhon Si Thammarat, Songkhla, Narathiwat.

Distribution.— India, China, Southeast Asia and Australia.

Ecology.— On rocks in moist shade and near rock platform edges in shade.

Vernacular.— Pro Nok Khum (เปราะนกคุ้ม), Si Khun Khon (สิกุนคล) (General); Hu Tan (หูตัน) (Peninsular).

Specimens examined.— *J. Inuthai* 402, 403, 404, 423, 516 (PSU)

Doritis pulcherrima Lindl., Gen. Sp. Orchid. Pl.: 178. 1833; Hook.f., Fl. Brit. India 6: 31. 1890; Ridl., Fl. Malay. Penin. 4: 158. 1924; Seidenf., Opera Bot. 95: 31, fig. 16, Pl. IIc. 1988; Seidenf., Opera Bot. 114: 354, fig. 239. 1992; Seidenf. & J.J. Wood, Orch. Penn. Mal. and Sing.: 585, fig. 265a–f, Pl. 40c. 1992; J.B. Comber, Orch. Sumatra: 940. 2001.— *Phalaenopsis pulcherrima* (Lindl.) J.J. Sm., Repert. Spec. Nov. Regni Veg. 32: 366, 1933; Holttum, Rev. Fl. Malaya 1: 671, fig. 205. 1964. (Fig. 28; Plate 13, C.–D.)

Monopodial terrestrial. ***Stem*** very short, erect, unbranched. ***Leaves*** fleshy, oblong-elliptic, 7.5–10 by 2.5–2.8 cm, apex acute or apiculate. ***Inflorescence*** lateral from stem, erect, unbranched, racemose, ca 36.5 cm long, many-flowered; peduncle ca 20 cm long. ***Flowers*** sepals and petals pale purple to deep purple, spreading backwards; bracteoles broadly triangular; pedicels and ovaries 1.8–2.5 cm long. ***Sepals***: dorsal sepal oblong-elliptic, ca 13 by 6 mm, lateral sepals oblong-subquadrangular, ca 10 by 7 mm, attached to columnfoot ca 9 mm long. ***Petals*** obovate, 12–13 by 6–6.5 mm. ***Lip*** 3-lobed, base clawed, curve upwards enclosing the column, carrying a pair of narrow processes 3 mm long, with a callus between them; side-lobes deep orange-brown, circular, erect; midlobe pink-purple, broadly triangular, spreading. ***Column*** 6–7 mm long; columnfoot distinct, with scattered small pink spots. ***Pollinia*** 4, in two pairs, globose; stipe long, linear, slightly widened below 4 pollinia; viscidium present. ***Stigma*** ovate or elliptic in outline; rostellum beak-like, 3.5–3.8 mm long. ***Ovary*** inferior, slender. ***Fruit*** capsular, oblong-clavate, ca 5 cm high, angle slightly obtuse; stalk stout, ca 1.5 cm long.

Thailand.— NORTHERN: Chiang Mai, Phitsanulok; NORTH–EASTERN: Loei, Nong Bua Lam Phu, Udon Thani, Mukdahan; EASTERN: Nakhon Ratchasima, Buri Ram, Si Sa Ket, Ubon Ratchathani; SOUTH–WESTERN: Phachuap Khiri Khan; SOUTH–EASTERN: Sa Kaeo, Trat; PENINSULAR: Chumphon, Ranong, Nakhon Si Thammarat, Satun, Songkhla, Pattani.

Distribution.— Northeast India, Myanmar, China, Indochina, Peninsular Malaysia, Sumatra and Borneo.

Ecology.— Terrestrial in partial shade along rock platforms edges and also found on the ground beneath bushes on sandy heaths.

Vernacular.— Lamet (ละเม็ด), Ya Dok Hin (หญ้าดอกหิน) (Northeastern); Ma Wing (ม้าวิ่ง), Daeng Ubon (แดงอุบล) (Central); Kluai Hin (กล้วยหิน) (Southeastern); Kluai Mai Din (กล้วยไม้ดิน) (Peninsular).

Specimen examined.— *J. Inuthai* 421 (PSU)

Eria javanica (Sw.) Blume, Rumphia 2: 23. 1836; Seidenf. & Smitinand, Orchids Thailand 2(2): 289, fig. 218, Pl. XIII. 1960; Holttum, Rev. Fl. Malaya 1: 377, fig. 111. 1964; Seidenf. & Smitinand, Orchids Thailand 3(2): 782. 1965; Seidenf., Opera Bot. 62: 26, fig. 10. 1982; Opera Bot. 114: 165. 1992; Seidenf. & J.J. Wood, Orch. Penn. Mal. and Sing.: 271, fig. 115. 1992; J.B. Comber, Orch. Sumatra: 446. 2001.— *Dendrobium javanicum* Sw., Kongl. Vetensk. Acad. Nya Handl. 21: 247. 1800.— *Eria stellata* Lindl., Bot. Reg. 11: t. 904. 1825; Ridl., Fl. Malay. Penin. 4: 96. 1924.— *Eria striolata* Rchb.f., Gard. Chron. 3 ed. ser. 3: 554. 1888; Ridl., Fl. Malay. Penin. 4: 96. 1924. (Fig. 29; Plate 13, E.–F.)

Sympodial epiphyte-lithophyte. ***Rhizome*** creeping. ***Stem*** (pseudobulb) consisting of one distinct internode only; each new shoot of sympodium producing first a stout creeping portion, and then erect pseudobulb; pseudobulb ovoid or conical, 3–4 by 1–2 cm, with two large foliage leaves and several scale-leaves. ***Leaves*** fleshy,

erect, oblong-elliptic or oblanceolate, 27–45 by 3.5–7 cm, apex acute, sheathing base attached to pseudobulb. ***Inflorescence*** lateral, arising near apex of pseudobulb, erect, unbranched, racemose, ca 40 cm long, many-flowered; peduncle and rachis puberulose. ***Flowers*** fragrant, sepals and petals pale yellowish, with purple veins, narrowly triangular, spreading in all direction; bracteoles lanceolate, 1.5–1.6 by 0.6 cm, glabrescent; pedicels and ovaries 0.8–1 cm long, hairy. ***Sepals*** hairy outside, dorsal sepal ca 2.3 cm long, 4 mm wide at base, lateral sepals 1.8–2 cm long, 6 mm wide at base. ***Petals*** narrower, ca 2.1 cm long, 4 mm wide at base. ***Mentum*** short, hairy. ***Lip*** 3-lobed, white, with 3–5 distinct ridges, median ridge yellow; side-lobes white with pink lines and pink edges, slightly oblong, erect; midlobe oblong-triangular, apex acute. ***Column*** short; columnfoot distinct. ***Pollinia*** 8, in two groups of four, with granular caudicles. ***Stigma*** broadly obovate in outline; rostellum shallow, ovoid or suborbicular. ***Ovary*** inferior, slender.

Thailand.— NORTHERN: Chiang Mai; PENINSULAR: Songkhla, Yala.

Distribution.— From India through Myanmar, China, Laos, Peninsular Malaysia, Sumatra, Philippines, New Guinea and Taiwan.

Ecology.— In shallow depression of rocks near forest edges and in partial shade.

Vernacular.— Ueang Dao Riang (เอื้องดาวเรียง) (General); Sawet Su Kri (เสวตสุกรี) (Central).

Specimens examined.— *J. Inuthai* 414, 430, 563 (PSU)

Flickingeria sp. (Plate 13, G.–H.)

Sympodial epiphyte-lithophyte. ***Stems*** yellowish, raising from the rooting creeping rhizome at a distance of 2–4 cm, the rhizome segments with 5–6

internodes that are longer than broad, ca 5 mm in diam. The terminal node on these stems is thickened into a pseudobulb, which produces one leaf at its apex; pseudobulbs fusiform, yellow, slightly flattened, 3.5–7 cm long, largest diam. ca 1.2 cm. ***Leaves*** fleshy, oblong-elliptic, 10–13 by 3–3.7 cm, apex acute. ***Inflorescence*** appearing only in the axil of the foliage leaf. ***Flowers*** not seen. ***Fruit*** capsular, globular, greenish-yellow, ca 1.5 cm in diam.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Only known from this study.

Ecology.— Epiphytic on tree-trunks and rocks, in rock crevices of exposed places.

Vernacular.—

Remarks.— This specimen was found when it produced fruits. According to all of the available taxonomic literatures, this specimen is still unidentified. The characters of flowers are needed to clarify its status.

Specimens examined.— *J. Inuthai* 649 (PSU)

Plocoglottis quadrifolia J.J. Sm., Bull. Jard. Bot. Buitenzorg ser. 3, 8: 36. 1926; Seidenf., Opera Bot. 89: 70, fig. 36. 1986; Seidenf. & J.J. Wood, Orch. Penn. Mal. And Sing.: 181, fig. 78f. 1992; J.B. Comber, Orch. Sumatra: 290. 2001; Kurzweil, Gard. Bull. Singapore 61(1): 86. 2009. (Fig. 30; Plate 14, A.–B.)

Terrestrial herb. ***Rhizome*** thick; pseudobulb slender, ca 16 cm long. ***Leaves*** 6–8; blade pleated, narrowly oblong-elliptic or lanceolate, 18–20.5 by 1.5–5 cm, apex acuminate, sheath 6–7 cm long. ***Inflorescence*** arising from base of pseudobulb, very long, erect, unbranched, loose raceme, 80–83 cm long, many-flowered, puberulose to pubescent; peduncle stout at base, 47–67 cm long,

puberulose; rachis puberulose. ***Flowers*** spreading; bracteoles broadly ovate, ca 1 by 0.8 cm, puberulose, persistent; pedicels and ovaries 1.4–1.8 cm long, puberulose to pubescent. ***Sapals*** creamy or pale yellow outer and edge, bright pink inner, puberulose outside, dorsal sepal oblong, 2.7–3 cm long, 6.5–7 mm wide, recurved, lateral sepals obliquely obovate, strongly concaved, 1.8–2 by 1 cm. ***Petals*** narrowly triangular, 2.5–3 cm long, 4 mm wide. ***Mentum*** very short, puberulose. ***Lip*** fleshy, bright yellow with red streaks, quadrangular in outline, ca 1 by 1 cm, apex dark pink to red, triangular or acuminate, recurved, with slightly bright pink calli on either side, margin distinctly fimbriate; connected to basal part of column by two elastic bands. ***Column*** white, ca 8 mm long, with short columnfoot. ***Pollinia*** 4, in two pairs, with caudicles. ***Stigma*** obovate in outline; rostellum short beaked. ***Ovary*** inferior, slender. ***Fruit*** capsular, clavate, ca 3.5 cm high, puberulose; pedicel very short, stout pubescent.

Thailand.— PENINSULAR: Surat Thani, Phangnga, Nakhon Si Thammarat, Songkhla.

Distribution.— Peninsular Thailand and West coast of Sumatra.

Ecology.— On rock platforms or in rock crevices in moist shade, sometimes in disturbed evergreen forest, often along waterfalls.

Vernacular.— Ueang Ta Kang (เอื้องตะแคง) (Peninsular).

Specimens examined.— *J. Inuthai* 402, 403 (PSU)

Rhynchogyna luisifolia (Ridl.) Seidenf. & Garay, Bot. Tidsskr. 68: 90. 1973; Seidenf., Opera Bot. 95: 192, fig. 118, Pl. IIc. 1988; Seidenf. & J.J. Wood, Orch. Penn. Mal. and Sing.: 658, fig. 297k–p, Pl. 45c. 1992.— *Saccolabium luisifolium* Ridl., J. Linn. Soc., Bot. 32: 360. 1896; Seidenf. & Smitinand, Orchids Thailand 3: 621. 1963. (Fig. 31; Plate 14, C.–D.)

Monopodial epiphyte. ***Stem*** hanging, terete, up to 30 cm long, internodes 0.5–2.5 cm long. ***Leaves*** terete, fleshy, dark green to purple, 15.5–30.5 cm long, ca 2.5 mm in diam., grooved on upper surface, apex sharply pointed. ***Inflorescence*** lateral, pendulous, branching, loose raceme, 7–9.5 cm long, many-flowered. ***Flowers*** small, sepals and petals greenish with scattered small purple spots inside except along midline; bracteoles broadly triangular; pedicels and ovaries greenish to purple, 2–5 mm long. ***Sepals***: dorsal sepal obovate, ca 4 by 2.5 mm, apex hooded, lateral sepals broadly obovate, ca 5 by 3.5 mm. ***Petals*** obovate, ca 4 by 2 mm. ***Lip*** 3-lobed; spur pale purple, cylindrical, 5–6 mm long, with ornaments near the mouth; side-lobes light yellow with small brownish spots, folded in middle; midlobe white with scattered minute pale purple spots, fleshy, broad triangular or arrow-shaped, apex acute; back wall callus dark pink to purple, quadrangular, grooved in front. ***Column*** short; columnfoot distinct. ***Pollinia*** 4, in two pairs, in each pair units unequal each other; stipe linear, 2.2–2.4 mm long, slightly widened below 4 pollinia; viscidium small. ***Stigma*** broadly ovate in outline; rostellum beak-like, 1–1.5 mm long. ***Ovary*** inferior, slender.

Thailand.— NORTH–EASTERN: Sakon Nakhon; SOUTH–WESTERN: Phachuap Khiri Khan; SOUTH–EASTERN: Chon Buri; PENINSULAR: Phangnga, Phuket, Phatthalung, Songkhla.

Distribution.— Vietnam and Peninsular Malaysia.

Ecology.— On tree-trunks in shade.

Vernacular.— Ueang Doak Jeep (เอื้องดอกจีบ) (General).

Specimen examined.— *J. Inuthai* 431 (PSU)

Tainia penangiana Hook.f., Fl. Brit. India 5: 820. 1890; Holttum, Rev. Fl. Malaya 1: 182. 1964; Seidenf., Opera Bot. 89: 33, fig. 14. 1986; Seidenf. & J.J. Wood, Orch. Penn. Mal. And Sing.: 156, fig. 67a–c. 1992.— *Ania penangiana* (Hook.f.)

Summerh., Bot. Mag. 161, subpl. 9553. 1939.— *Ascotainia penangiana* Ridl., Mat. Fl. Malay. Penins. 1: 116. 1907; Ridl., Fl. Malay. Penin. 4: 112, fig. 167. 1924. (Fig. 32; Plate 14, E.–F.)

Terrestrial. ***Pseudobulb*** dark purple or brown, very fleshy, ovoid, ca 5 by 3.5 cm, 1-leaved. ***Leaf-blade*** pleated, elliptic, 27–30 by 6–7.5 cm, apex acute; stalk 10–12 cm long. Pseudobulb and base of leaf-stalked covered with sheath when young. ***Inflorescence*** arising from base of pseudobulb, very long, erect, unbranched, loose raceme, 65–66 cm long, 12–17-flowered; peduncle ca 37.5 cm long. ***Flowers*** sepals and petals yellowish with dark purple-brown 5–7 veins, slightly spreading; bracteoles narrowly triangular, 1.1–1.2 cm long, 2.3 mm wide, apex acuminate, persistent; pedicels and ovaries 1.3–1.5 cm long. ***Sepals***: dorsal sepal oblong-elliptic or lanceolate, 1.9–2.3 cm long, 5 mm wide, lateral sepals elliptic, 1.6–2.3 cm long, 4–5 mm wide. ***Petals*** oblong-lanceolate, 2.1–2.3 cm long, 4.5–5 mm wide. ***Mentum*** short. ***Lip*** 3-lobed, fleshy, white with greenish yellow on spur, ca 1.5 cm long; spur shortly conical, incurved, 2–3 cm long; side-lobe oblong, erect; midlobe white with pink or pale purple spots, broadly ovate, ca 7 by 7 mm, with three ridges, apex acute. ***Column*** broadly winged, with purple spot, ca 1 cm long, with very short columnfoot; anther-cap with two small curves. ***Pollinia*** 8, in two groups of four, obovate. ***Stigma*** broadly obovate in outline; rostellum slightly lobed. ***Ovary*** inferior, slender.

Thailand.— EASTERN: Surin; SOUTH–EASTERN: Trat; PENINSULAR: Ranong, Songkhla.

Distribution.— From northeastern India through China, Vietnam, Peninsular Malesia and Indonesia.

Ecology.— On rock platforms in moist shade.

Vernacular.— Ueang Sila Lueang (เอื้องศิลาเหลือง) (General).

Specimen examined.— *J. Inuthai* 628 (PSU)

Vanilla aphylla Blume, Bijdr. Fl. Ned. Ind. 8: 422. 1825; Hook.f., Fl. Brit. India 6: 91. 1890; Ridl., Fl. Malay. Penin. 4: 201. 1924; Seidenf. & Smitinand, Orchids Thailand 1: 57, fig. 39. 1959; Holttum, Rev. Fl. Malaya 1: 98. 1964; Seidenf. & Smitinand, Orchids Thailand 3(2): 728. 1965; Seidenf., Opera Bot. 114: 72. 1992; Seidenf. & J.J. Wood, Orch. Penn. Mal. And Sing.: 127, fig. 51f. 1992. (Fig. 33; Plate 14, G.)

Monopodial climbing plant. ***Stem*** nearly flattened, fleshy, green, up to 2 m or more long, internodes 5.5–7.5 cm long. ***Leaves*** reduced to small broadly triangular scales, ca 5 mm long, apex acute. ***Inflorescence*** lateral from leaf axil, very short, erect, unbranched, racemose, ca 1 cm long, 3–5-flowered; peduncle stout. ***Flowers***: sepals and petals pale greenish, elliptic, subequal, spreading; bracteoles ovate, ca 3 by 3 mm, apex acute; pedicels and ovaries stout, 2–2.7 cm long. ***Sepals***: dorsal sepal ca 3 by 1 cm, lateral sepals 2.5–2.7 by 0.8–0.9 cm. ***Petals*** slightly narrower, ca 3 by 1 mm, with strongly marked midrib. ***Lip*** joined to column, blade 3-lobed, pale greenish fading to white at apex, 2.2–2.5 cm long; side-lobes convolute, adjacent sides of column, edges rounded, crisped and reflected; midlobe oblong-ovate or rounded, ca 10 by 7 mm, covered with pale pink hairs up to 4 mm long, with crisped edges. ***Column*** white, ca 1.5 cm long, without columnfoot. ***Pollinia*** 2, granular, without caudicles, stipe and viscidium. ***Stigma*** small; rostellum subquadrangular. ***Ovary*** inferior, slender. ***Fruit*** fleshy, not dehiscent, cylindrical, ca 8 cm long.

Thailand.— CENTRAL: Saraburi; SOUTH–EASTERN: Chanthaburi; PENINSULAR: Trang, Satun, Songkhla.

Distribution.— Myanmar, Laos, Vietnam, Peninsular Malesia and Java.

Ecology.— Climbing on tree-trunks.

Vernacular.— Khruea Ngu Khiao (เครืองูเขียว) (Eastern); Thao Ngu Khieo (เถางูเขียว) (Central); Khot Nok Kut (คดนกกุด) (Peninsular).

Specimens examined.— *J. Inuthai* 405, 406, 414 (PSU)

POACEAE

Coelorachis helferi (Hook.f.) Henrard, Blumea 4. 518. 1941; Gilliland, Rev. Fl. Malaya 3: 272. 1971.— *Rottboellia helferi* Hook.f., Fl Brit. India (J.D. Hooker) 7: 158. 1896.— *Mnesithea rupincola* Ridl., J. Straits. Branch Roy. Asiat. Soc. 57: 116. 1911; Ridl. Fl. Malay. Penin. 5: 206. 1925. (Plate 15, A.)

Perennial herb. ***Culms*** tufted, erect, slender, up to 50 cm long, glabrous. ***Leaves***: blade linear, greenish to green, 10–40 by 0.5–1.2 cm, upper surface glabrescent to glabrous, lower surface glabrous, apex acuminate, margin scaberulose, base narrowed, long hairs; sheath 5.5–8.5 cm long, hairs along margins; ligule shallow membrane, 0.2–0.3 mm long, dense long hairs on back of blade/sheath junction. ***Inflorescence*** a series of spike-like, cylindrical raceme, 5–8 cm by 2–2.5 mm, ascending, glabrous, with spathe 5–6.5 cm long, base hairy; consisting of alternate pairs of spikelets on a jointed rachis, one sessile and one pedicelled, rachis fragile at nodes. ***Sessile spikelets*** bisexual, ovate, appressed, greenish, ca 3.6 mm long, glabrous; *lower glume* ovate-triangular, indurated, 2.9–3.1 by 1.5–1.7 mm, 7-nerved at base, with 2-keeled, winged on keels, apex acute or obtuse, margin short hairy, base inflexed, hairy; *upper glume* boat-shaped or ovate, concave, ca 2.8 by 1.2–1.4 mm, 3-nerved, with 1-keeled, winged on keels; *lower lemma* broadly ovate, 2.1–2.3 by 1.2–1.3 mm, smooth, apex acute, margin entire; *upper lemma* broadly ovoid, ca 2 by 1 mm, smooth; *palea* narrower, ca 1.8 by 0.8 mm, smooth; *stamens* 3, anthers yellow, 0.6–0.7 by 0.2–0.3 mm; *stigmata* 2, white, plumose. ***Pedicelled spikelets*** sterile, reduced to a minute subequal glumes; lemma absent; lanceolate, 0.7–0.8 mm long; pedicles linear, flattened, ca 2.8 by 0.5–0.6 mm long, strongly 2-nerved, persistent, base hairy.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Myanmar and Peninsular Malesia.

Ecology.— In partial shade along rock platforms and in exposed places.

Vernacular.—

Specimen examined.— *J. Inuthai* 596 (PSU)

Cymbopogon flexuosus (Nees ex Steud.) Will. Watson, Bot. Himalayan Distr. N. W. Prov. 392. 1882; Backer & Bakh.f., Fl. Java (Spermatoph.) 3: 611. 1968; Gilliland, Rev. Fl. Malaya 3: 297. 1971; S.L. Chen & S.M. Phillips in Fl. China 22: 630. 2006; Z.H. Wu, P.H. Raven & D.Y. Hong, Fl. China Illustr. 22: 881, fig. 881(1–7). 2007. (Plate 15, B.)

Rhizomatous perennial herb. ***Culms*** densely tufted, forming tussocks, erect, stout, 0.5–3 m long, 0.5–1 cm wide, terete, glabrous. ***Leaves*** aromatic: blade linear, greenish, 80–100 by 1–1.5 cm, upper surface setulose, apex acuminate or sharp-pointed, margin more or less setulose; sheath terete, up to 18 cm long, hairy at the junction with blade; ligule broadly triangular, 3–4 mm long. ***Inflorescence*** loose, panicled raceme, up to 80 cm long, many-branched, in a zigzag manner, with spathe 2–4 cm long, at each node and its axil a pair of racemes, 1.5–2 cm long, ultimately slender, internodes ca 1.5 mm long, white hairy, peduncle unequal, slightly scabrid. ***Spikelets*** in pairs, one sessile, one pedicellate, greenish, narrowly oblong to oblong. ***Sessile spikelets*** ca 5 mm long; *lower glume* lanceolate-triangular, ca 3.5 by 1 mm, glabrous, with 2-keeled, winged on keels, margins of keels finely toothed, 3-nerved between keels; margin inflexed; *upper glume* boat-shaped, slightly shorter than lower glume, glabrous, 1-nerved, keel along a upper-half, margin of keel finely toothed; *lower floret* empty; *upper floret* bisexual, lemma very narrow, apex bilobed, with long awn 5–8 mm; *stamens* 3, anthers 1–2 mm long; *stigmata* 2, plumose, bright purple.

Pedicelled spikelets bisexual or male, ca 4 mm long; *lower glume* 5-nerved between keels, otherwise similar.

Thailand.— PENINSULAR: Songkhla.

Distribution.— India, Nepal, Myanmar and Peninsular Malesia.

Ecology.— In rock crevices and in shallow depression of rocks in exposed places.

Vernacular.— Ta Khai (ตะไคร้) (General).

Specimens examined.— *J. Inuthai* 453, 501, 576, 582 (PSU)

Cyrtococcum oxyphyllum Stapf, Hooker's Icon. Pl. 31, t. 3096. 1922; Ridl., Fl. Mal. Pen. 5: 233. 1925; Backer & Bakh.f., Fl. Java (Spermatoph.) 3: 558. 1968; Gilliland, Rev. Fl. Malaya 3: 148, Colour Pl. 6, Pl. 19b. 1971; S.L. Chen & S.M. Phillips in Fl. China 22: 513. 2006; Z.H. Wu, P.H. Raven & D.Y. Hong, Fl. China Illustr. 22: 722, fig. 722(1–8). 2007.— *Panicum oxyphyllum* Hochst. ex. Steud., Syn. Pl. Glumac. 1: 65. 1853. — *Panicum pilipes* Nees & Arn. ex Buse Pl. Jungh. 376. 1854; M.R. Hend., Malay. Wild Fls., Monocots.: 331, fig. 189C–D. 1954; Hook.f. in Fl. Brit. Ind. 7: 57. 1897. (Plate 15, C.)

Perennial herb. ***Culms*** lower part creeping, rooting and branching at nodes, upper part ascending, slender, 15–30 cm long, glabrous. ***Leaves***: blade linear-lanceolate, green to dark green, 4.5–8.5 by 0.6–0.9 cm, scaberulose, apex acuminate, margin entire, base rounded, hairy; sheath up to 3 cm long, with scattered hairs, margin densely hairy; ligule suborbicular or rounded, 0.7–1 mm long. ***Inflorescence*** densely paniculate, 8–12.5 cm long, axis angled, with scattered hairs, many-branched, branches up to 4.5 cm long, ascending, flexuous, glabrescent. ***Spikelets*** numerous, laterally compressed, shortly pedicelled, gibbous, greenish to brown, 1.5–2 by 0.8–1 mm, glabrous, few hairs at base; *lower glume* broadly ovoid, 1–1.2 by 0.8–1 mm, 1–

3-nerved; *upper glume* boat-shaped, 1.2–1.5 by 1 mm, 3-nerved; *lower lemma* broadly elliptic, ca 1.5 by 1 mm, 5-nerved; *upper lemma* gibbous and D-shaped, indurated, with a blackish mark at tip, ca 1.3 by 1.5 mm, smooth; *palea* elliptic, ca 1 by 0.8 mm, 2-nerved, indurated between nerves; *stamens* 3, anthers yellow, 0.7–0.8 by 0.4–0.5 mm; *stigmata* 2, plumose.

Thailand.— Throughout the country.

Distribution.— India, Sri Lanka, Bhutan, Myanmar, China, Vietnam, Peninsular Malesia, Philippines, Polynesia and Australia.

Ecology.— In rock crevices and in shallow depression of rocks.

Vernacular.— Ya Khia Hao (หญ้าไข่เหา) (General).

Specimen examined.— *J. Inuthai* 469 (PSU)

Cyrtococcum patens A. Camus, Bull. Mus. Natl. Hist. Nat. 27: 118. 1921; Backer & Bakh.f., Fl. Java (Spermatoph.) 3: 558. 1968; Gilliland, Rev. Fl. Malaya 3: 148, Colour Pl. 7, Pl. 19f. 1971; S.L. Chen & S.M. Phillips in Fl. China 22: 513. 2006; Z.H. Wu, P.H. Raven & D.Y. Hong, Fl. China Illustr. 22: 721, fig. 721, 722, fig. 722(9–12). 2007.— *Panicum patens* L., Sp. Pl. 1: 58. 1753; Hook.f. in Fl. Brit. Ind. 7: 57. 1897.— *C. carinatum* Stapt ex Ridl. Fl. Malay. Penin. 5: 233. 1925. (Plate 15, D.)

Perennial herb. ***Culms*** lower part creeping, rooting and branching at nodes, upper part ascending, slender, 10–25 cm long, glabrous. ***Leaves***: blade linear-lanceolate, dark green, 4–8 by 0.4–0.9 cm, scaberulose, apex acuminate, margin entire, base obtuse, with bulbous-based hairs; sheath up to 2.5 cm long, hairs along one margin; ligule suborbicular or rounded, 0.6–0.8 mm long. ***Inflorescence*** loose, paniculate, 5–12.5 cm long, axis angled, glabrous, many-branched, branches up to 4 cm long, ascending, flexuous, glabrescent. ***Spikelets*** numerous, laterally compressed, pedicels usually longer than spikelets, gibbous, green, 1.5–2 by 0.8–1 mm, glabrous,

few hispid hairs at base; *lower glume* broadly ovoid, ca 1 by 0.6 mm, 3-nerved; *upper glume* boat-shaped, ca 1 by 0.8 mm, 3-nerved; *lower lemma* broadly elliptic, ca 1.5 by 1.2–1.3 mm, with tubercle-based hairs, 5-nerved, margin ciliate; *upper lemma* gibbous and D-shaped, indurated, with a blackish mark at tip, 1.2–1.3 by 1.5 mm, smooth; *palea* elliptic, ca 1.2 by 0.8 mm, 2-nerved, indurated between nerves; *stamens* 3, anthers yellow, 0.7–0.8 by 0.3–0.4 mm; *stigmata* 2, plumose.

Thailand.— NORTHERN: Chiang Mai; NORTH–EASTERN: Loei, Nong Khai; EASTERN: Surin; SOUTH–WESTERN: Kanchanaburi; PENINSULAR: Nakhon Si Thammarat, Songkhla.

Distribution.— Widespread in Southeast Asia.

Ecology.— In rock crevices and in shallow depression of rocks.

Vernacular.— Ya Man Khoa (หญ้ามันขาว) (General).

Specimens examined.— *J. Inuthai* 448, 449, 450, 570 (PSU)

Elymus sp.

Perennial. ***Culms*** densely tufted, erect, 40–55 cm long, 0.5–1 mm wide, terete, glabrous. ***Leaves***: blade linear, involuted, greenish-yellowish, 12–32 by 1–2 mm, upper surface setulose, lower surface glabrous, apex acuminate, margin finely setulose, base rounded, hairy; sheath rolled, 5–8 cm long, hairy or glabrous; ligule truncate, shallow, densely hairy, up to 2 mm long. ***Inflorescence*** very loose, spike-like, erect, 20–35 cm by 0.2–0.5 mm, with 25–42 spikelets, axis terete, smooth, up to 25 cm long. ***Spikelets*** 1 per node, shortly pedicelled, appressed to rachis, laterally compressed, narrowly elliptic, greenish, 8–10 mm long, with 4–5 florets, glabrous; *lower glume* oblong-elliptic, ca 3 by 0.5–0.7 mm, with 1-keeled; *upper glume* oblong-elliptic, 3.2–4.5 by 0.7–0.8 mm, with 1-keeled; *lemma* obovate, elliptic, 5–7 by 1 mm, 3-nerved, apex 3-awned, middle awn up to 1 mm long, densely hispid

hairy at base; *palea* oblong-elliptic, boat-shaped, 2.5–2.7 by 0.5 mm, 2-nerved, margins of keels finely toothed; *stamens* 3, anthers 0.8–1 by 0.2–0.3 mm; *stigmata* 2, plumose.

Thailand.— PENINSULAR: Songkhla.

Distribution.— Only known from this study.

Ecology.— On rock crevices and clefts and on the shallow depression of granitic.

Vernacular.—

Remarks.— This unidentified species is closely related to *Elymus tridentatus* (C. Yen & J. L. Yang) S. L. Chen, but spikelets are difference. More literatures and times are needed to clarify it status.

Specimens examined.— *J. Inuthai* 451, 452 (PSU)

Melinis repens (Willd.) Zizka, in Biblioth. Bot., 138: 55. 1988; S.L. Chen & S.M. Phillips in Fl. China 22: 539. 2006; Z.H. Wu, P.H. Raven & D.Y. Hong, Fl. China Illustr. 22: 752, fig. 752. 2007.— *Rhynchelytrum repens* (Willd.) C.E. Hubb., Bull. Misc. Inform. Kew 110. 1934; Backer & Bakh.f., Fl. Java (Spermatoph.) 3: 579. 1968; Gilliland, Rev. Fl. Malaya 3: 150, Pl. 20a. 1971.— *Tricholaena rosea* Nees, Cat. Sem. Hort. Vratisl. 1835; M.R. Hend., Malay. Wild Fls., Monocots.: 325, fig. 187C–D. 1954. (Plate 15, E.)

Perennial herb. ***Culms*** loosely tufted, erect, rooting at lower nodes, slender, 60–80 cm long, glabrous to softly hairy with bulbous-based hairs. ***Leaves***: blade linear-lanceolate, green to dark green, 10–15 by 2.5–4 cm, scaberulose, lower surface with scattered softly hairy with bulbous-based hairs, apex acuminate, margin scaberulose, base narrowly obtuse, with few long hairs; sheath 4–7 cm long, softly

hairy with bulbous-based hairs; ligule of stiff hairs 0.8–1 mm long. ***Inflorescence*** loosely paniculate, 18–22 cm long, axis subterete, many-branched, branches up to 5 cm long, spreading, glabrous. ***Spikelets*** numerous, with 2-flowered, dull yellow or brownish, lanceolate-ovate, ca 3.5 by 1.8 mm, with dense pinkish-red stiff bristles, hairs ca 6 mm long, fluffy, pedicels slender, scaberulose or with few long hairs; *lower glume* oblong, indurated, 1-nerved, 1.2–1.3 by 0.3–0.4 mm, apex obtuse, with stiff hairs on back, hairs up to 2.5 mm long; *upper glume* gibbose, indurated, 5-nerved, ca 3.8–4 by 2 mm, awn ca 0.6 mm long, with stiff hairs, hairs up to 5.5 mm long; *lower floret* male; lemma less gibbose or boat-shaped, 5-nerved, ca 3.8 by 1.5 mm, awn ca 1.8 mm long, with stiff hairs, hairs up to 6 mm long; palea narrowly elliptic, hyaline, ca 3 by 0.6–0.7 mm, 2-nerved, hairy on back of nerves; stamens 3, anthers yellow, 1.5–1.8 by 0.4 mm; *upper floret* bisexual; lemma hyaline, elliptic, ca 2 by 1.3–1.5 mm, 4–5-nerved; palea boat-shaped, hyaline, ca 2 by 0.6–0.8 mm, 2-nerved; stamens 3, anthers yellow, 1–1.8 by 0.2–0.4 mm; stigmata 2, plumose. ***Fruit*** a caryopsis, elliptic, 1.3–1.5 by 0.5 mm.

Thailand.— NORTHERN: Chiang Rai, Nan; SOUTH–EASTERN: Chon Buri; PENINSULAR: Songkhla.

Distribution.— Native of Tropical Africa. An exotic well-established in India, Peninsular Malesia and Taiwan.

Ecology.— In rock crevices, in shallow depression of rocks in exposed places and also found in disturbed places.

Vernacular.— Ya Dok Daeng (หญ้าดอกแดง), Ya Dok Chompu (หญ้าดอกชมพู) (Central).

Specimen examined.— *J. Inuthai* 591 (PSU)

Ottochloa nodosa (Kunth) Dandy, J. Bot. 69: 55. 1931; Gilliland, Rev. Fl. Malaya 3: 143, fig. 27, Pl. 18a. 1971; S.L. Chen & S.M. Phillips in Fl. China 22: 512. 2006;

Z.H. Wu, P.H. Raven & D.Y. Hong, Fl. China Illustr. 22: 719, fig. 719(1–9). 2007.— *Panicum nodosum* Kunth, Enum. Pl. 1: 97. 1833; Hook.f. in Fl. Brit. Ind. 7: 43. 1897.— *Hemigymnia multinodis* Stapf, Fl. Trop. Afr. (Oliver et al.) 9(4): 742. 1920; Ridl., Fl. Mal. Pen. 5: 228. 1925.— *Hemigymnia fusca* Ridl., Fl. Mal. Pen. 5: 228. 1925.— *Ottochloa arnottiana* (Nees) Dandy, J. Bot. 69: 55. 1931; Backer & Bakh.f., Fl. Java (Spermatoph.) 3: 559. 1968. (Plate 15, F.)

Perennial herb. ***Culms*** geniculate, lower part creeping, rooting and branching at nodes, upper part ascending, slender, 10–60 cm long, glabrous. ***Leaves***: blade linear-lanceolate, greenish to green, 5.5–13.5 by 0.5–1.5 cm, scaberulose, apex acuminate, margin finely setulose, base rounded, hairy; sheath up to 9 cm long, with scattered hairs, margin densely hairy; ligule very short, obtuse or suborbicular, 0.2–0.3 mm long. ***Inflorescence*** very loose, paniculate, 10–40 cm long, axis terete, smooth, few or many-branched, solitary or fascicled, branches up to 16 cm long, spreading. ***Spikelets*** numerous, sessile or shortly pedicelled, elliptic or oblong-elliptic, greenish, 2.8–3.2 mm long, glabrous; *lower glume* ovate, 1.8–2 by 0.8–1 mm, 5-nerved; *upper glume* elliptic-ovate, 2.2–2.5 by 0.8–1 mm, 7–9-nerved; *lemma* elliptic, 3–3.3 by 1.2–1.3 mm, 7-nerved; *palea* boat-shaped, 3.2–3.5 by 1.2–1.5 mm, smooth; *stamens* 3, anthers yellow, 1–1.2 by 0.5–0.6 mm; *stigmata* 2, plumose, white.

Thailand.— NORTHERN: Nakhon Sawan; NORTH–EASTERN: Loei, Nong Khai, Mukdahan; EASTERN: Nakhon Ratchasima, Si Sa Ket, Ubon Ratchathani; PENINSULAR: Chumphon, Trang, Satun, Songkhla, Pattani, Yala, Narathiwat.

Distribution.— India, Sri Lanka, Myanmar, China, Peninsular Malesia, Philippines, New Guinea, Northeast Australia, Polynesia and Africa.

Ecology.— In rock crevices and in shallow depression of rocks near forest edges.

Vernacular.— Ya Khui Phai Khon (หญ้าขุยไผ่ขน) (Southwestern); Ya Laman (หญ้าละมาน) (Central).

Specimens examined.— *J. Inuthai* 499, 551, 558 (PSU)

STEMONACEAE

Stemona tuberosa Lour., Fl. Cochinch. 2: 404. 1790; Hook.f. Fl. Brit. India 6: 298. 1892; Ridl., Fl. Malay. Penin. 4: 320, fig. 194. 1924; Z.H. Tsi & Duyfjes in Fl. China 24: 70. 2000. (Plate 15, G.)

Climber. ***Stem*** slender, glabrous. ***Leaves*** simple, alternate, glabrous; petiole 5.5–6 cm long; blade membranous, cordate, green, 10–13 by 6.5–7.5 cm, apex narrowly acuminate or caudate, margin slightly undulate, base cordate; veins 13–15 pairs. ***Inflorescence*** axillary, racemose, 1–3-flowered; peduncle 1 cm long; bracts triangular, ca 10 by 6 mm, glabrous. ***Tepals*** 4, greenish with purplish veins, lanceolate, subequal, ca 2.5 by 0.5 cm; pedicels 5–10 mm long; bracteoles lanceolate, ca 7 mm long. ***Stamens*** 2, petaloid purple, slightly shorter than tepals; filaments very short, glabrous; anthers linear, ca 1 cm long; appendages long, projective above anthers. ***Ovary*** superior, bilobed, glabrous, unilocular; stigma sessile.

Thailand.— Throughout the country.

Distribution.— Northeast India, Bangladesh, Myanmar, Cambodia, Laos, Vietnam, Peninsular Malaysia, Philippines and Australia.

Ecology.— Climbing on tree-trunks.

Vernacular.— Non Tai Yak (หนอนตายอยาก) (Northern); Ka Phiat (กะเพียด), Ka Phiat Nu (กะเพียดหนู), Ka Phiat Chang (กะเพียดช้าง) (Southwestern,

Southeastern); Non Tai Yak Lek (หนอนตายอยากเล็ก), Non Tai Yak Yai (หนอนตายอยาก ใหญ่), Pong Mod Ngam (โป่งมดง่าม) (Central).

Specimen examined.— *J. Inuthai* 478 (PSU)

ZINGIBERACEAE

Globba pendula Roxb., Asiat. Res. 11: 359. 1810; Baker in Fl. Brit. India (J.D. Hooker) 6: 205. 1890; Ridl., Fl. Malay. Penin. 4: 236. 1924; Holttum, Gard. Bull. Singapore 13: 29. 1950; M.R. Hend., Malay. Wild Fls., Monocots.: 137, fig. 80A–B. 1954; Backer & Bakh.f., Fl. Java (Spermatoph.) 3: 74. 1968. (Plate 15, H.)

Slender erect herb, 30–50 cm high; rhizome short, creeping. ***Leaves*** simple, alternate; leaf-sheath green to purple, margin stiffly hairy; ligule rounded or auricled, stiffly hairy on edges; blade membranous, oblong-lanceolate, 5.5–12 by 1–3.5 cm, upper surface green, glabrous, lower surface greenish to white, pubescent, apex acuminate to caudate, margin entire, base broadly cuneate. ***Inflorescence*** terminal, 8–12 cm long, with 10–15-cincinnae; peduncle 3–4 cm long. ***Flowers*** yellow-orange; pedicels 3–5 mm long; bracteoles ovate. ***Calyx*** funnel-shaped; tube 3–5 mm long; lobes 3, unequal, broadly triangular, apex acute. ***Corolla*** tube slender, longer than calyx, sparsely pubescent; lobes 3, unequal, boat-shaped, apex rounded, margin entire; posterior one ca 7 by 4.5 mm, lateral ones ca 6 by 3.5 mm. ***Labellum*** narrowly bilobed, ca 1 cm long; staminodes 2, linear-oblong, ca 10 by 2 mm, apex obtuse, margin entire. ***Fertile stamen*** 1; filament ca 2.5 cm long, glabrous; anthers oblong, ca 2 mm long; appendages 2, narrowly triangular, ca 2.5 mm long. ***Ovary*** inferior, globose, glabrous, unilocular, with 3 parietal placentas; style filiform, glabrous; style and stigma 3–3.5 cm long. ***Fruit*** fleshy capsule, globose, trilobed, 5 by 7 mm. ***Bulbils*** present in some inflorescences.

Thailand.— Throughout Peninsular Thailand.

Distribution.— Peninsular Malaysia and Borneo.

Ecology.— Along rock platform edges in partial shade.

Vernacular.— Put Nok Yung (ปุ่มนกยูง) (Peninsular).

Specimens examined.— *J. Inuthai* 426, 429, 562 (PSU)

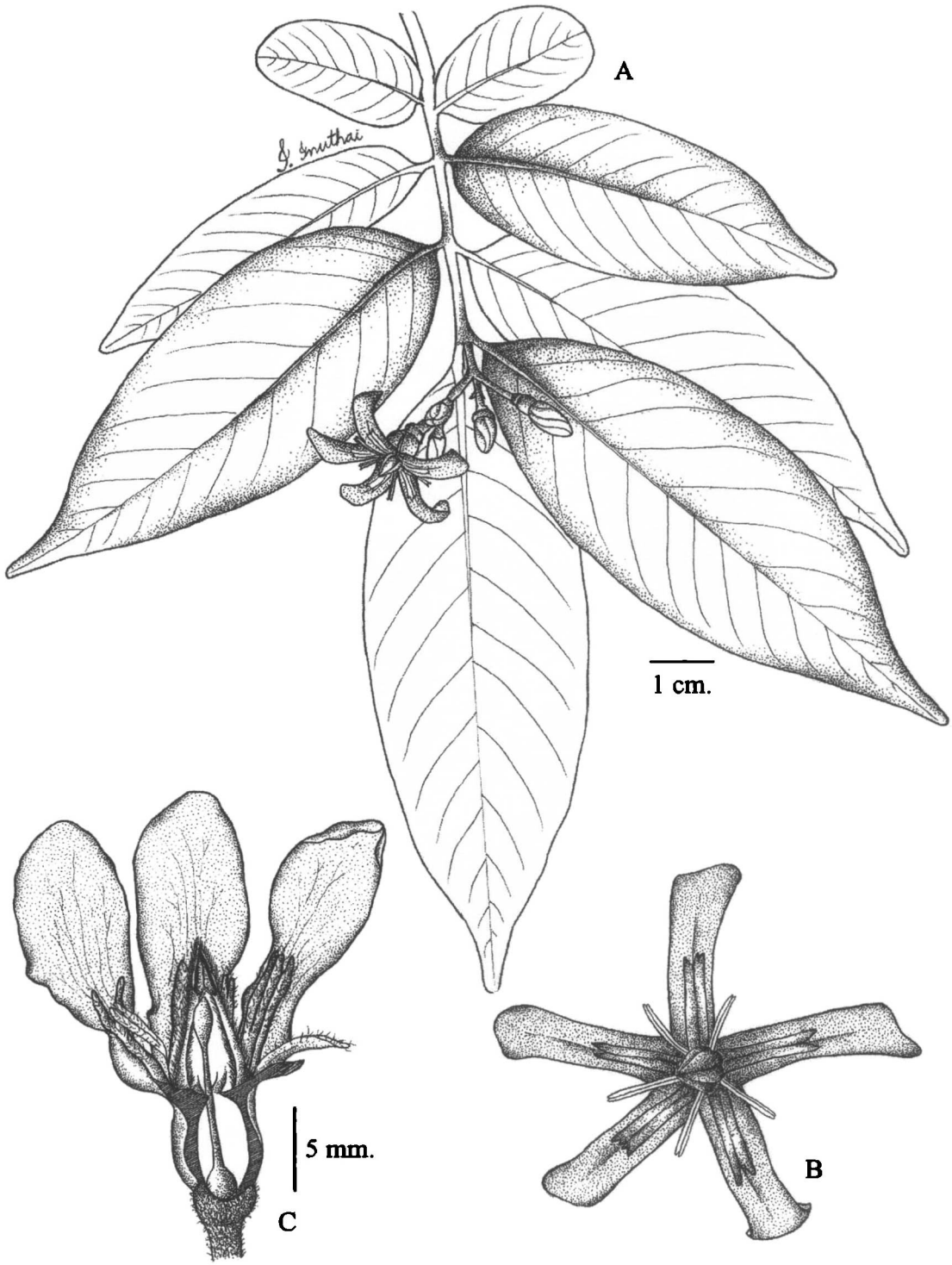

Figure 7. *Wrightia pubescens* subsp. *lanitii* (Blanco) Ngan: A. Flowering branch; B. Flower; C. Longitudinal section through flower. All drawing from *J. Inuthai* 493.

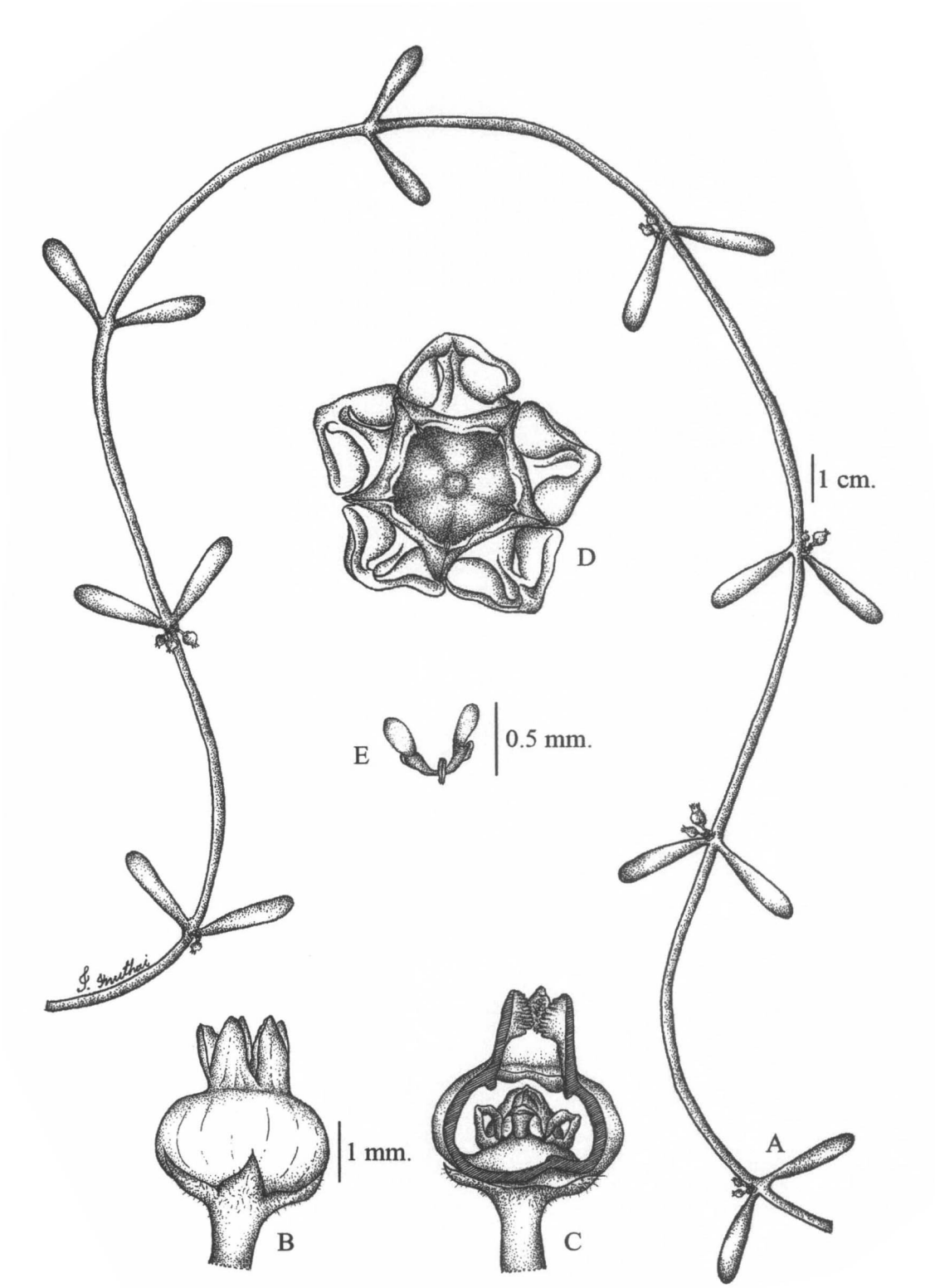

Figure 8. *Dischidia bengalensis* Colebr.: A. Plant; B. Flower; C. Flower with part of the corolla cut away; D. Corona appendages; E. Pollinarium. All drawing from *J. Inuthai* 540.

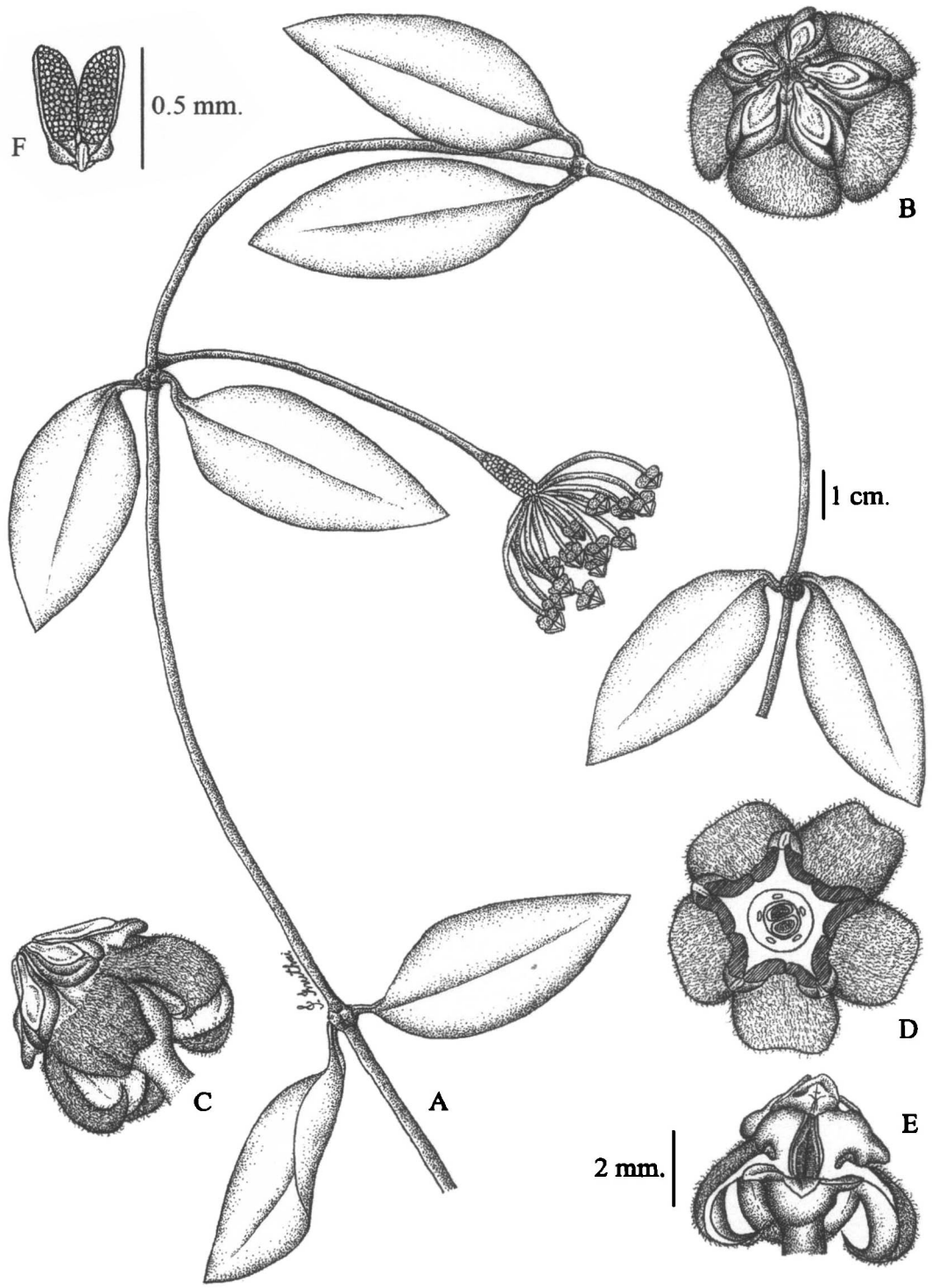

Figure 9. *Hoya micrantha* Hook.f.: A. Plant; B.–C. Flower, top and side view; D. Transverse section through flower; E. Longitudinal section through flower; F. Pollinarium. All drawing from *J. Inuthai* 494.

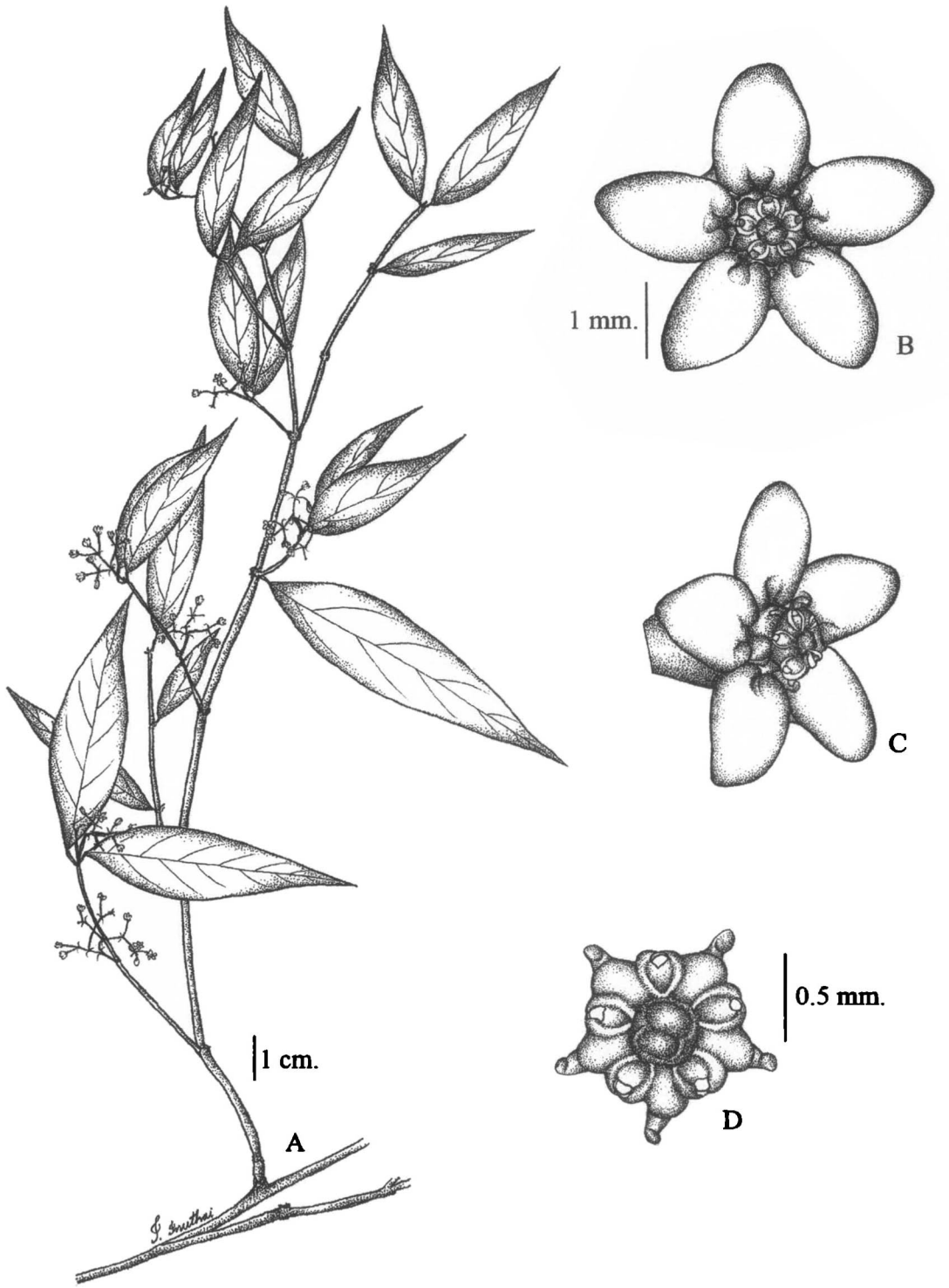

Figure 10. *Secamone elliptica* R. Br.: A. Flowering branch; B.–C. Flower, top and side view; D. Corona. All drawing from *J. Inuthai* 536.

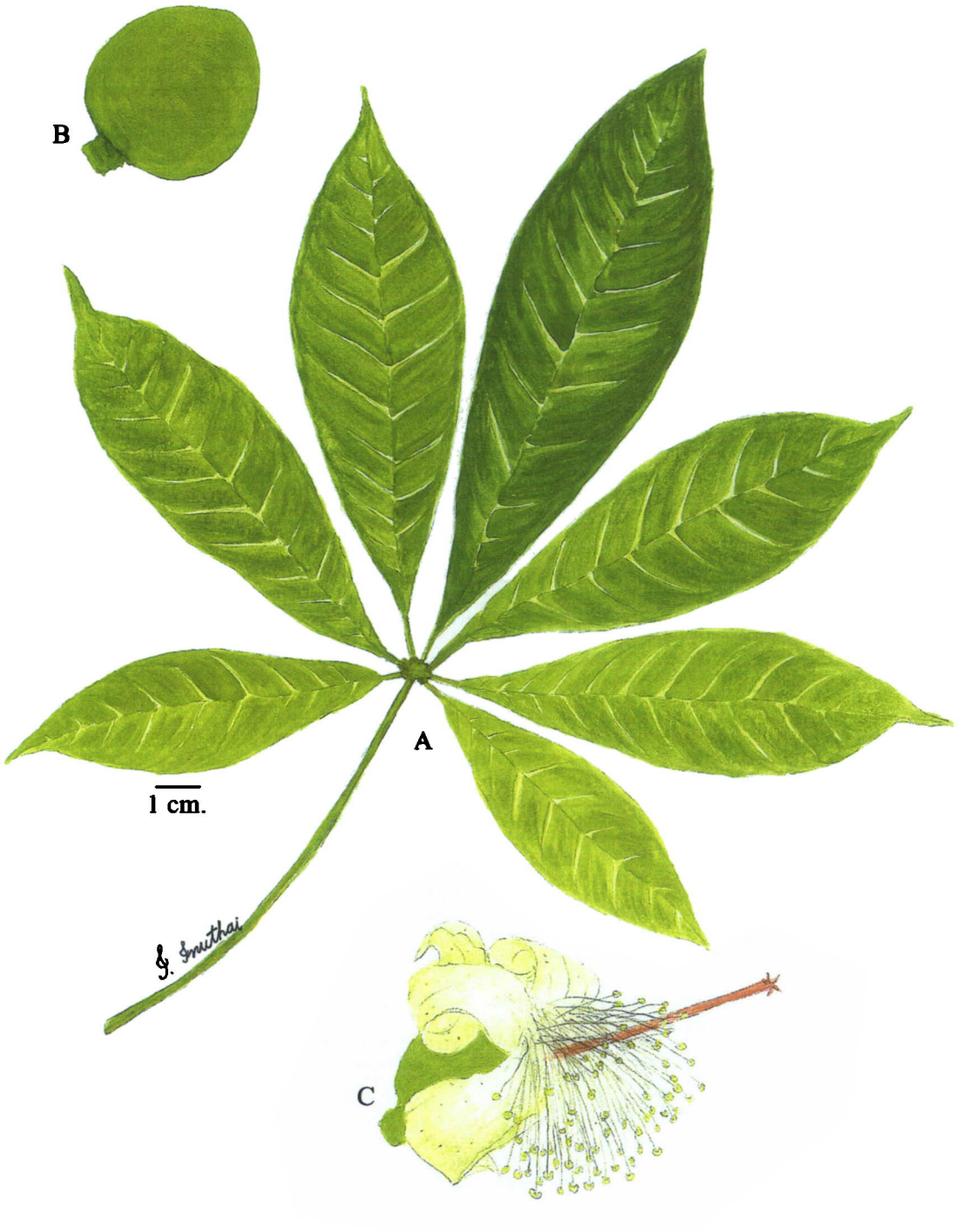

Figure 11. *Bombax anceps* Pierre: A. Leaf; B. Flower bud; C. Flower. All drawing from *J. Inuthai* 469.

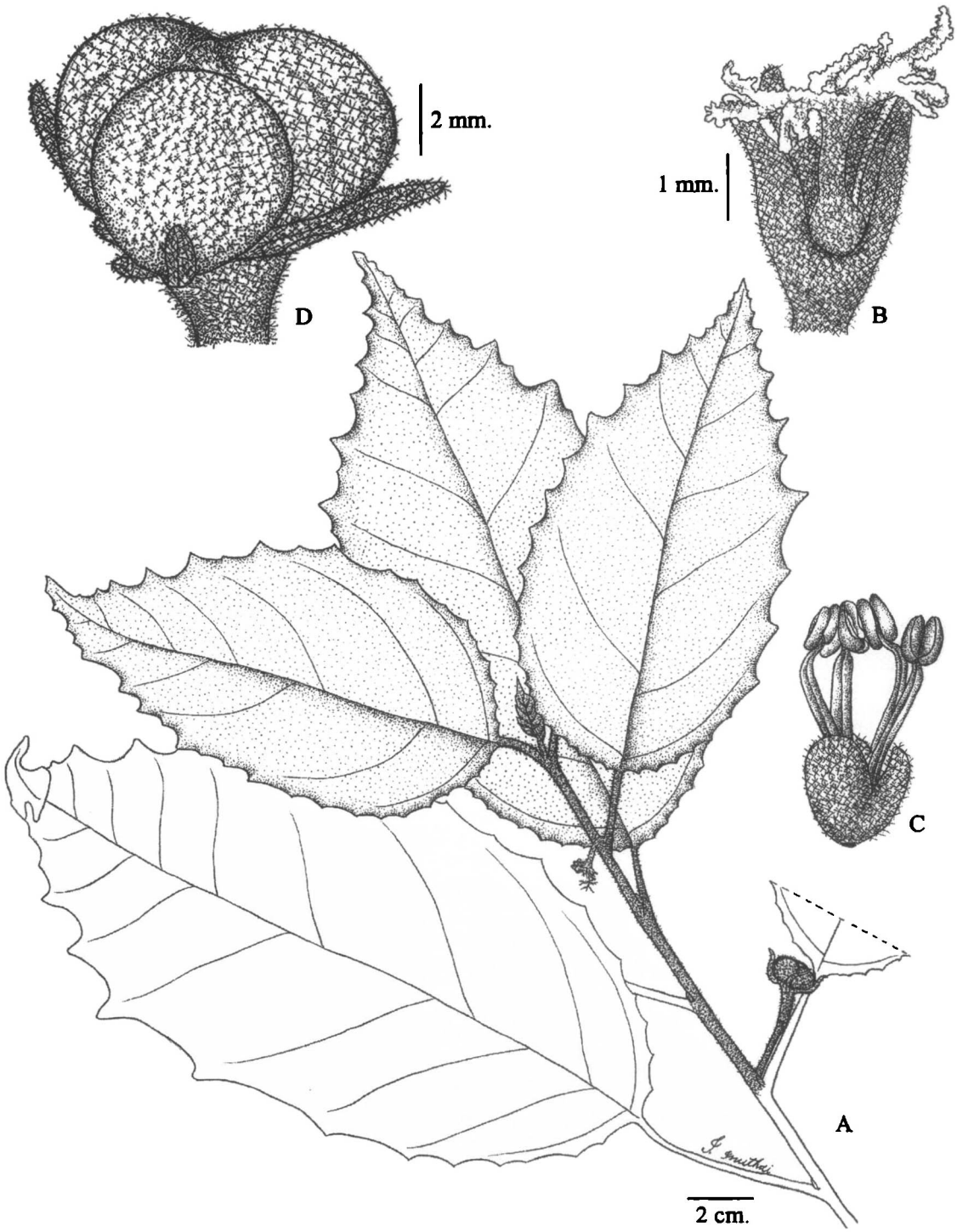

Figure 12. *Cladogynos orientalis* Zipp. ex Span.: A. Flowering branch; B. Pistillate flower; C. Staminate flower; D. Fruit. All drawing from *J. Inuthai* 477.

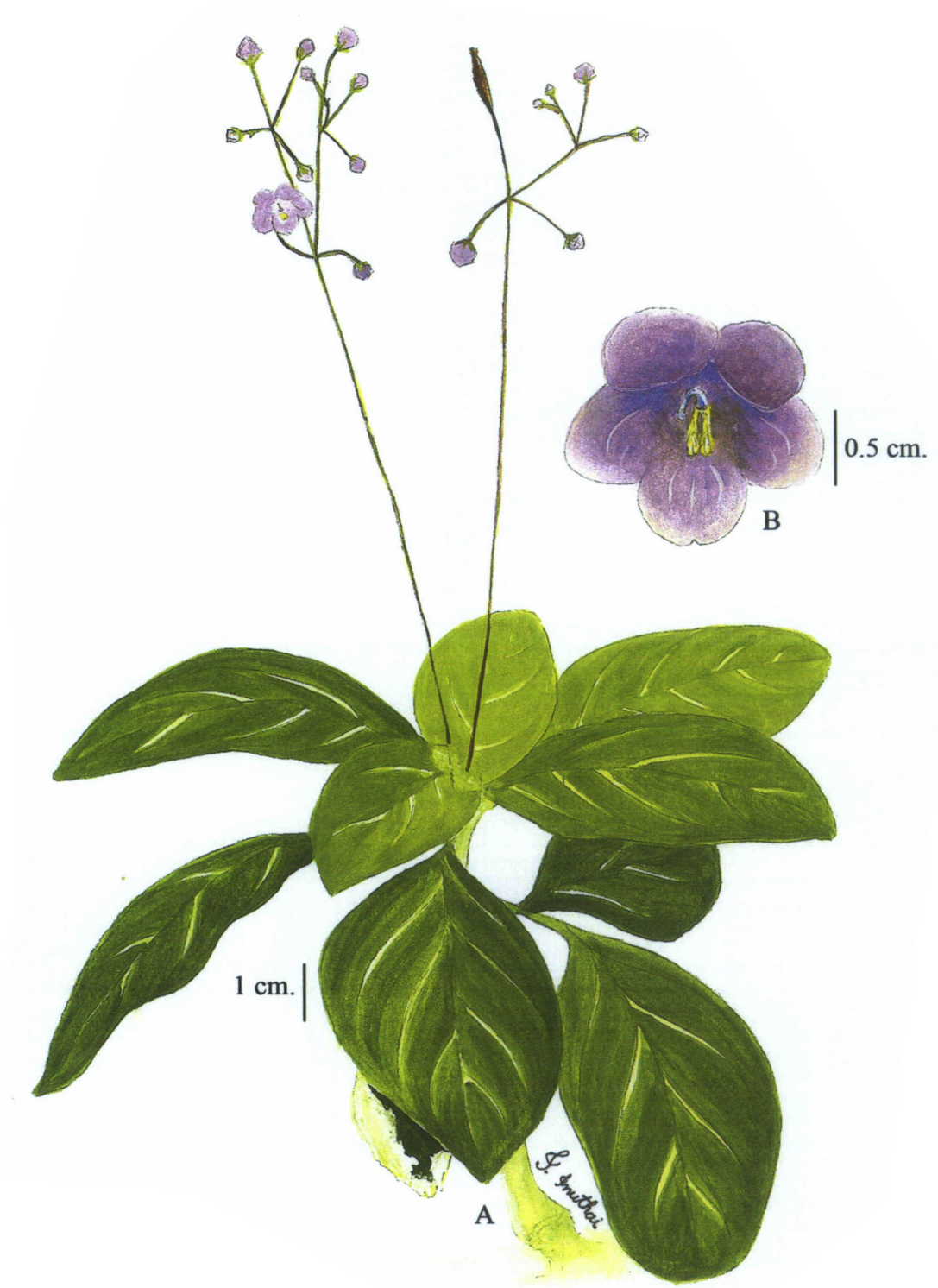

Figure 13. *Paraboea minor* (Barnett) B.L. Burtt: A. Plant; B. Flower. All drawing from *J. Inuthai* 560.

Figure 14. *Fagraea auriculata* Jack: Drawing from *J. Inuthai* 540.

Figure 15. *Fagraea auriculata* Jack: A. Flower; B. Pistil. All drawing from *J. Inuthai* 540.

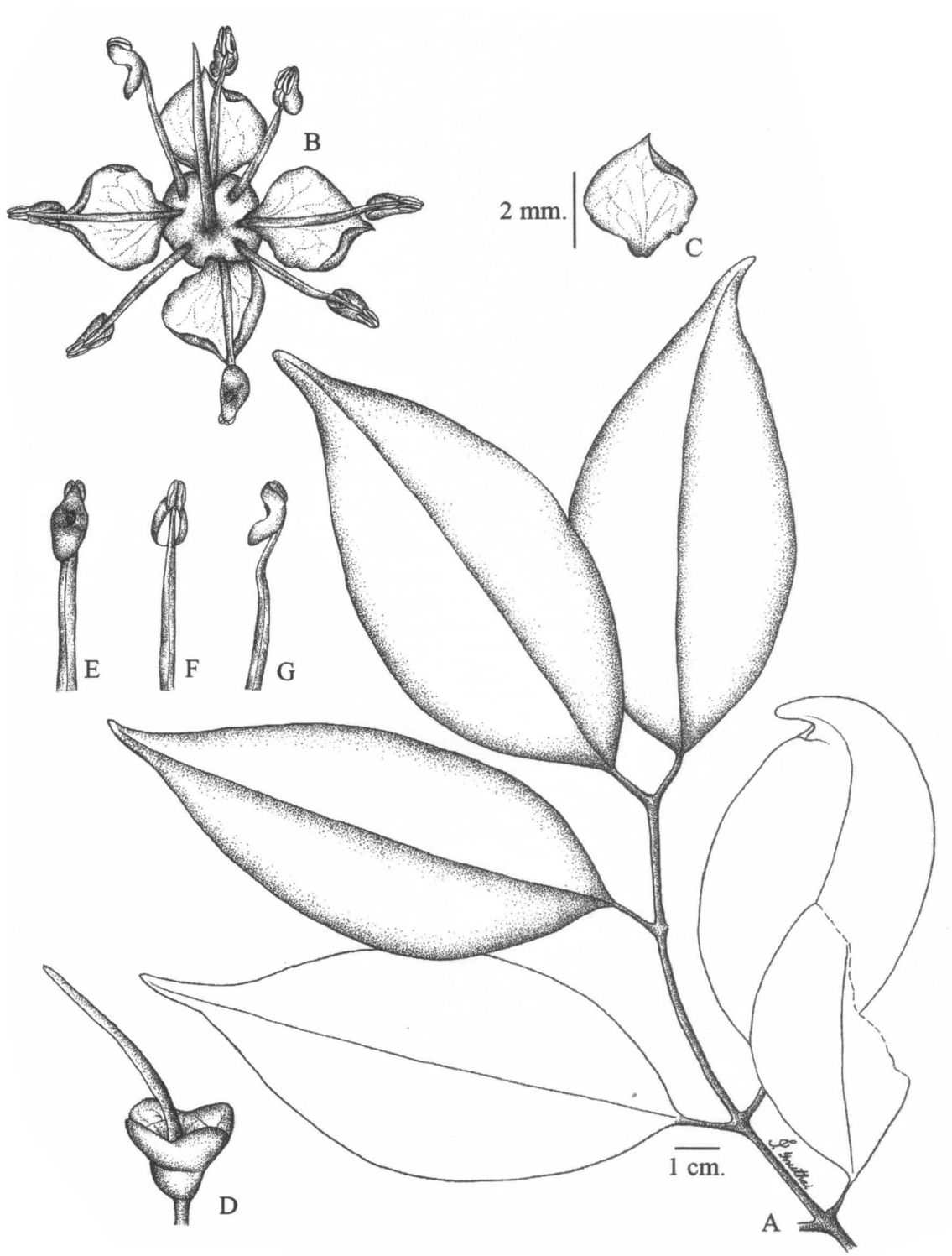

Figure 16. *Memecylon edule* Roxb.: A. Leafy branch; B. Flower; C. Petal; D. Pistil; E., F.–G. Stamen, back, front and side view. A. drawing from *J. Inuthai* 479. B.–G. drawing from *J. Inuthai* 487.

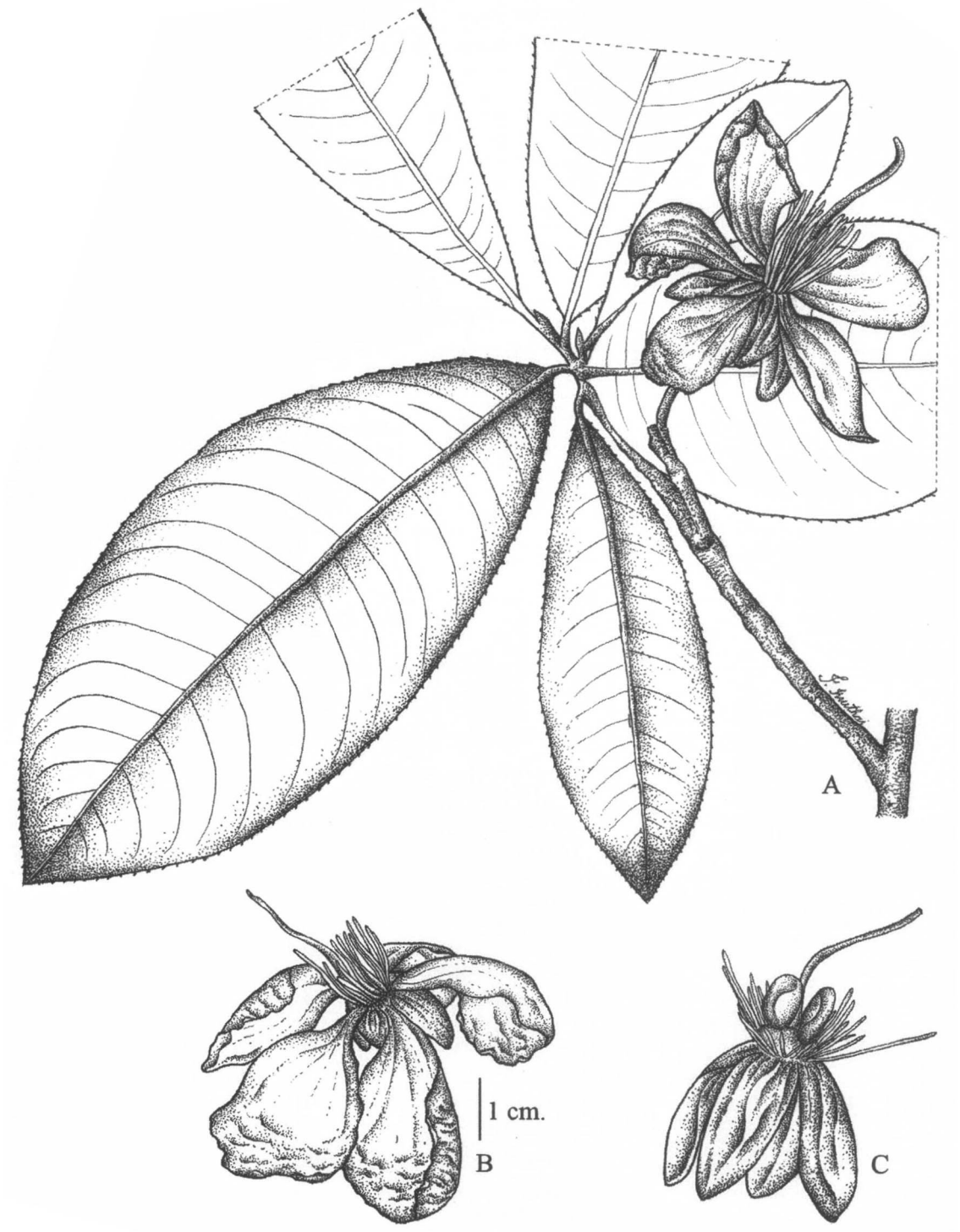

Figure 17. *Ochna integerrima* (Lour.) Merr.: A. Flowering branch; B. Flower; C. Fruit. All drawing from *J. Inuthai* 475.

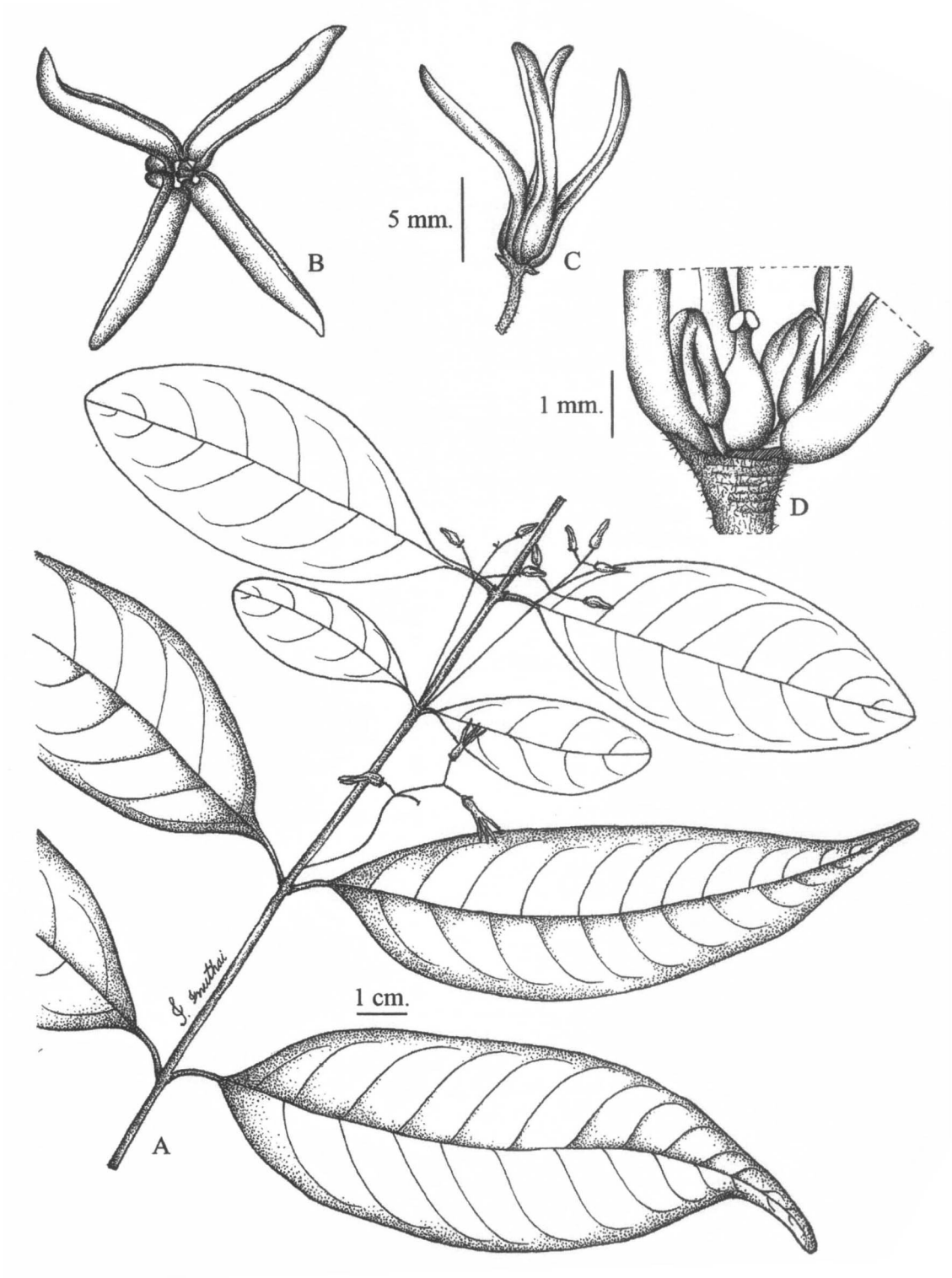

Figure 18. *Chionanthus microstigma* (Gagnep.) P.S. Green: A. Flowering branch; B.–C. Flower, top and side view; D. Lower part of flower. All drawing from *J. Inuthai* 545.

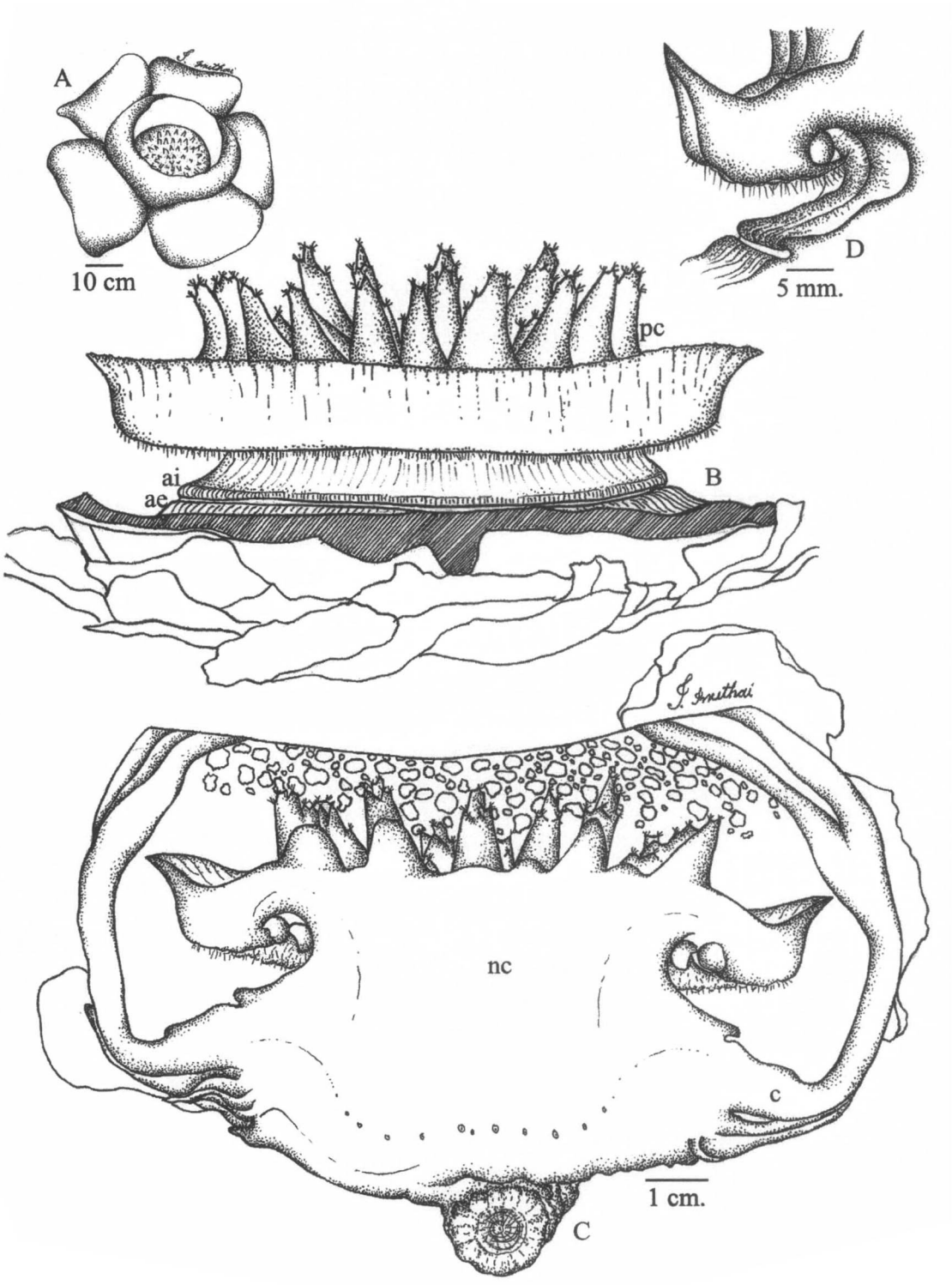

Figure 19. *Raffersia kerrii* Meijer: A. Plant; B. Column with disk on the top: pc. procession apex of disk, ai. annulus interior, ae. annulus exterior; C. Longitudinal section of staminate flower bud: c. cupula, perigone tube, nc. neck of column; D. Anther in a cavity. All drawing from *J. Inuthai* 640.

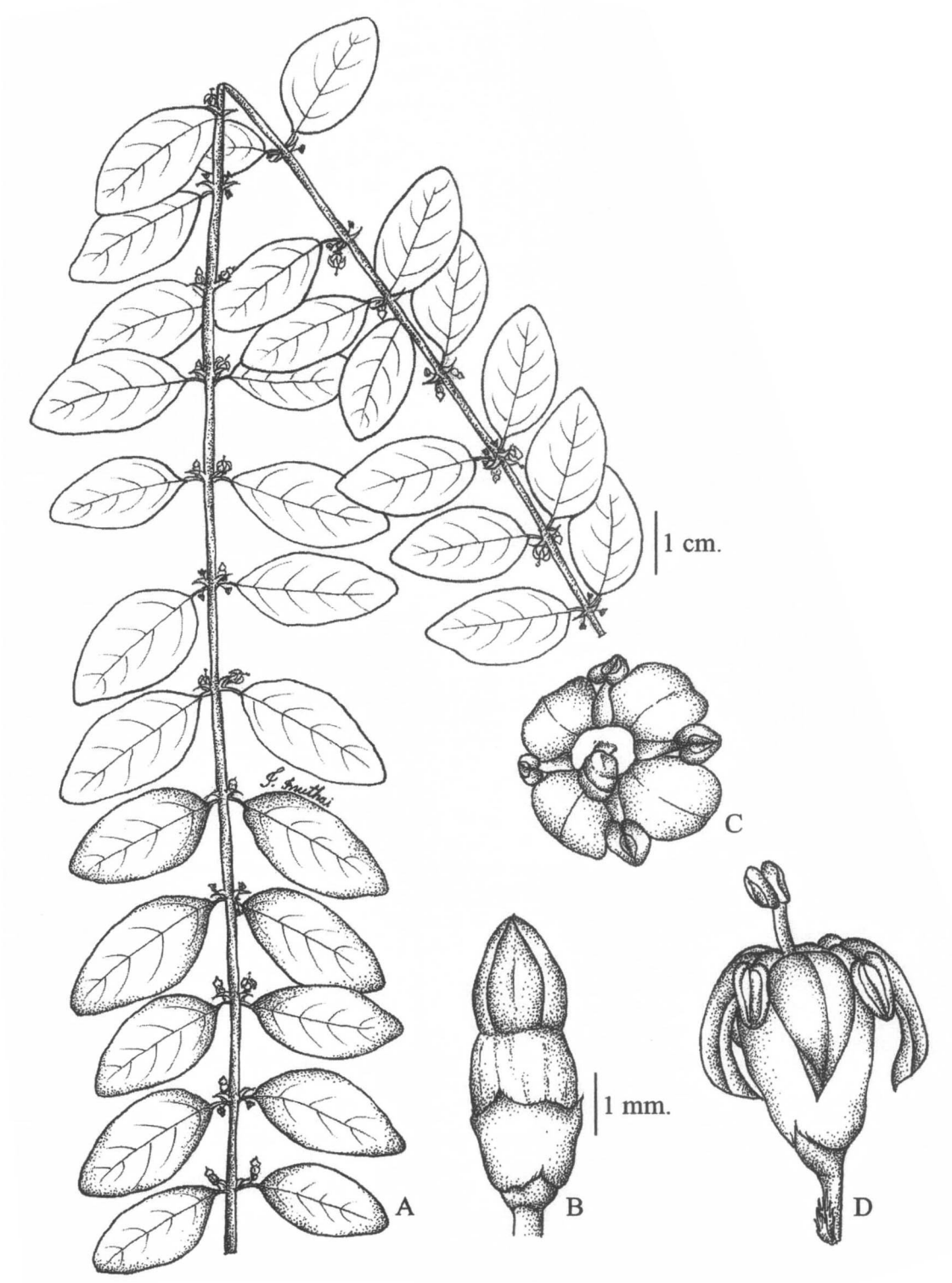

Figure 20. *Canthium horridum* Blume: A. Flowering branch; B. Flower bud; C.–D. Flower, top and side view. A. drawing from *J. Inuthai* 505. B.–D. drawing from *J. Inuthai* 489.

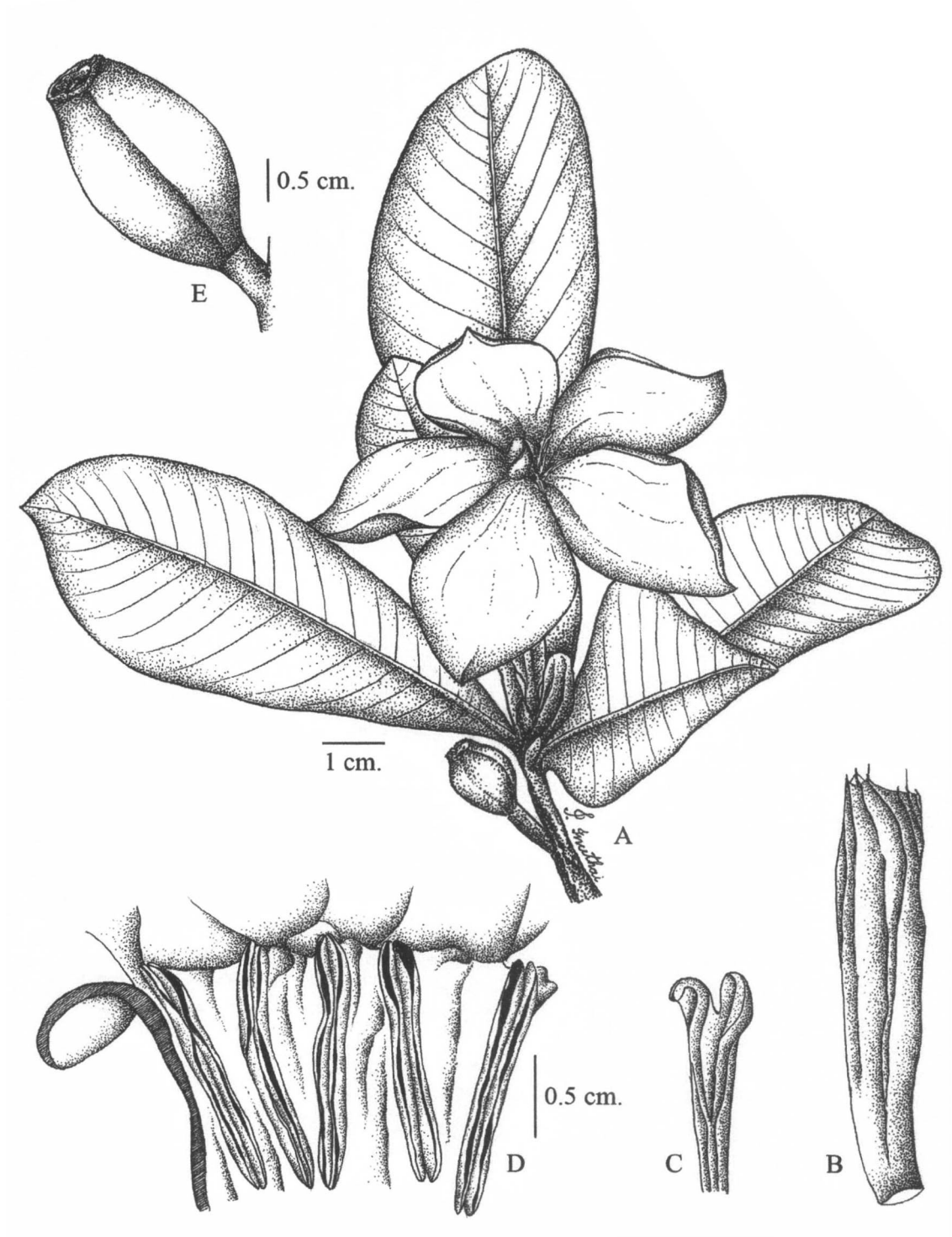

Figure 21. *Gardenia coronaria* Buch.-Ham.: A. Flowering branch; B. Calyx tube; C. stigma; D. Flower cutting open to show stamens; E. Fruit. All drawing from *J. Inuthai* 481.

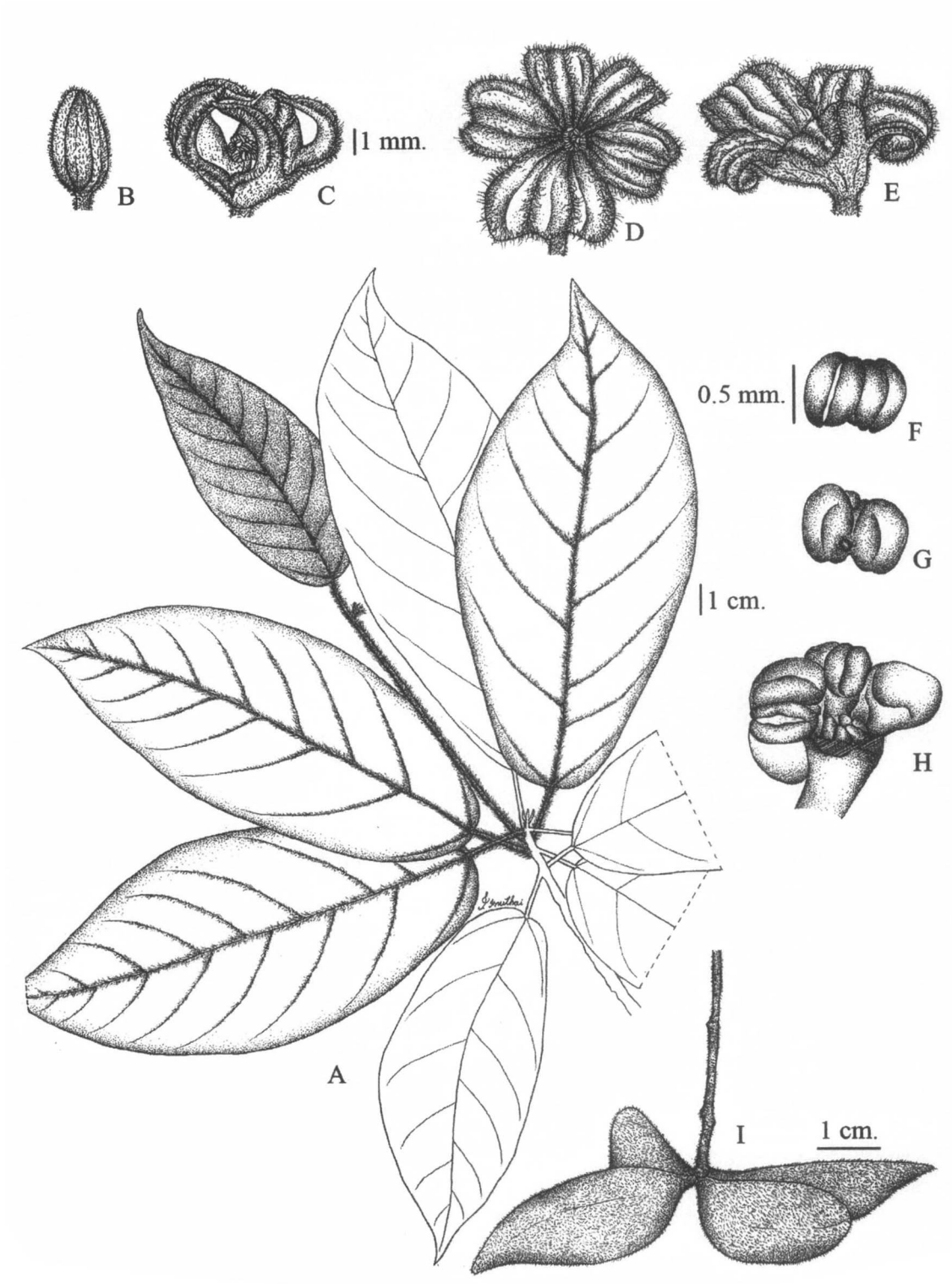

Figure 22. *Sterculia cordata* Blume; A. Leafy branch; B.–C. Staminate bud flower; D.–E. Staminate flower, top and side view; F.–G. Anther; H. Group of anthers; I. Fruit. A. drawing from *J. Inuthai* 513. B.–H. drawing from *J. Inuthai* 502. I drawing from *J. Inuthai* 514.

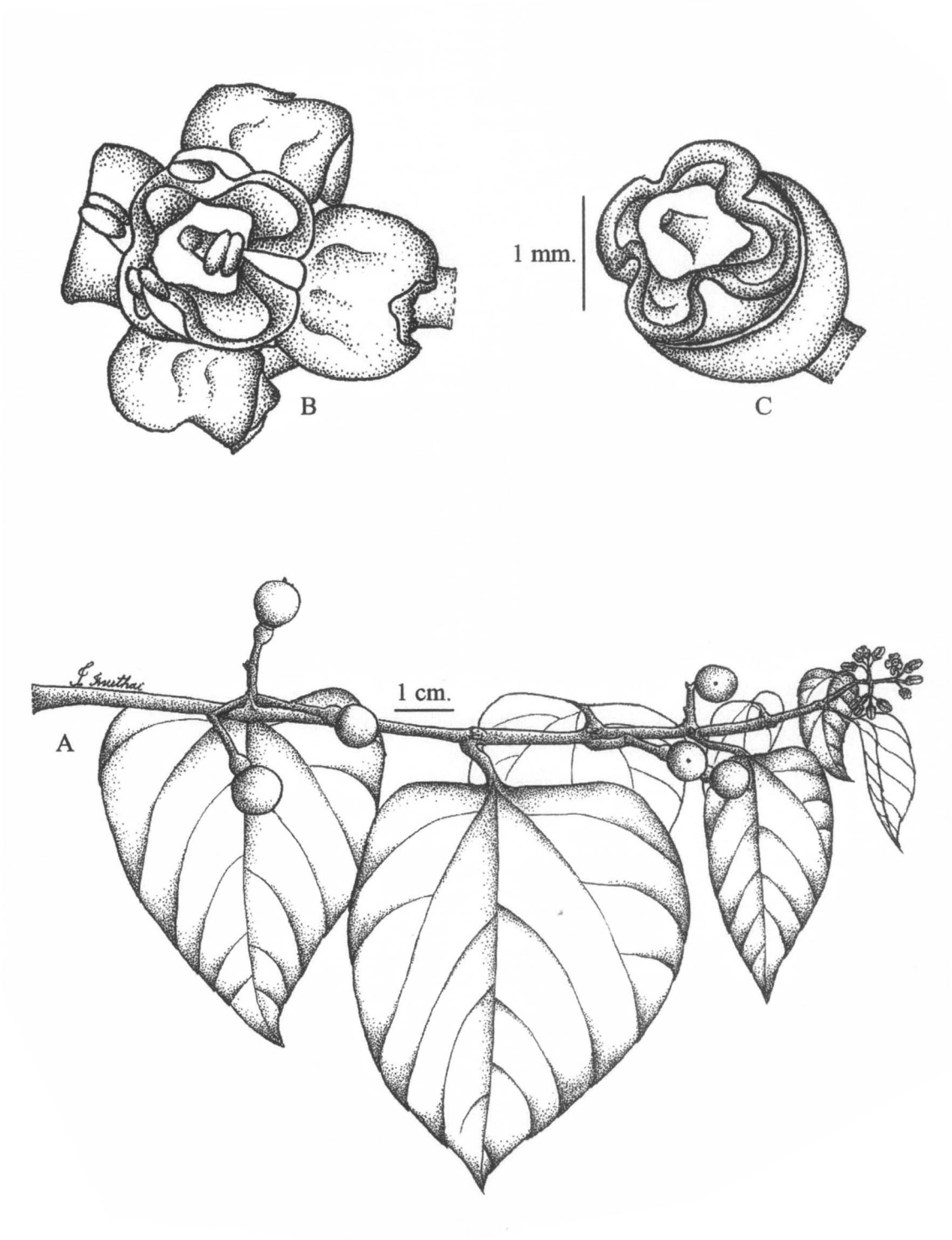

Figure 23. *Cissus nodosa* Blume: A. Flowering and fruiting branch; B. Flower, top view; C. Pistil. All drawing from *J. Inuthai* 464.

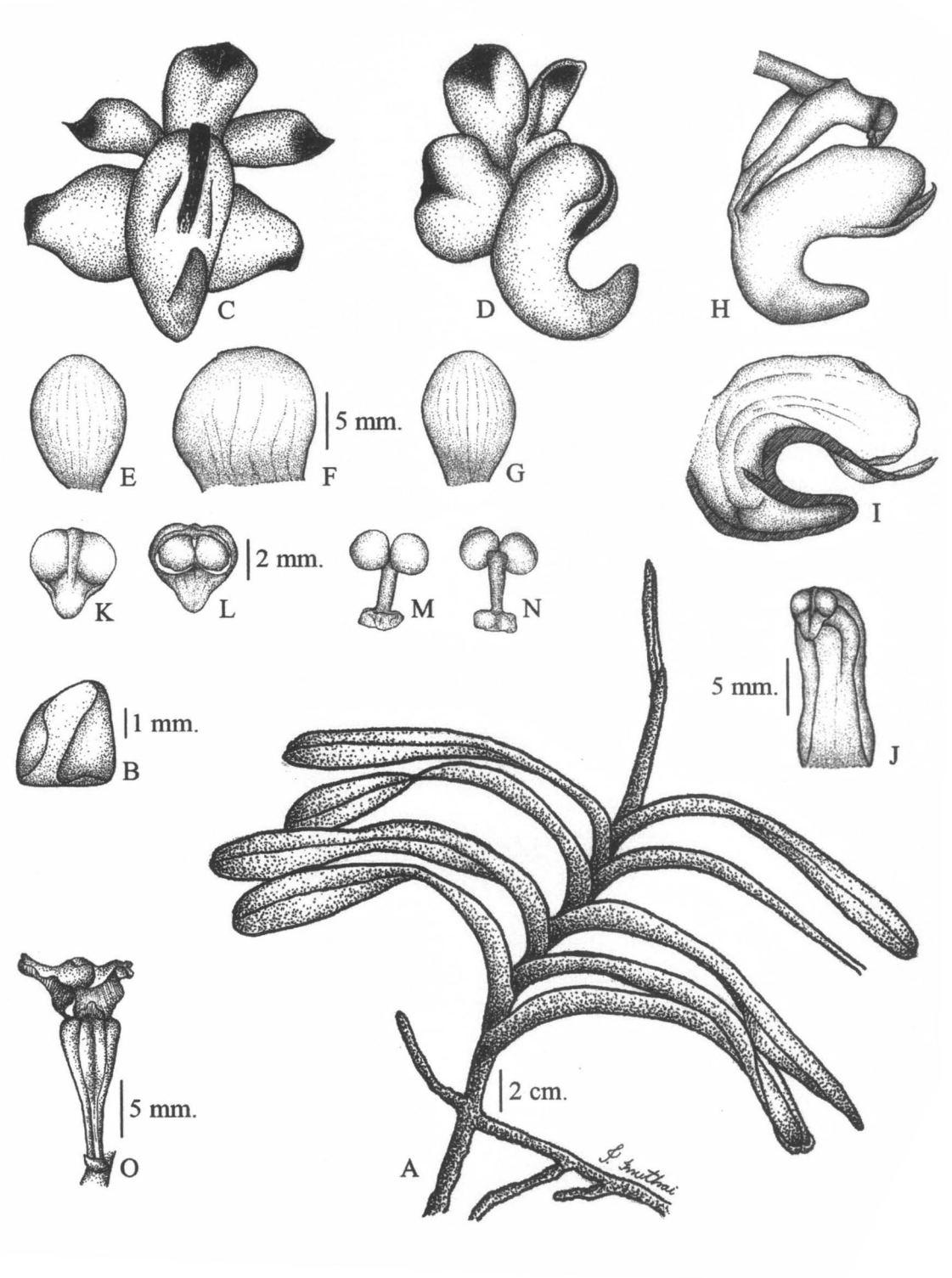

Figure 24. *Aerides odorata* Lour.: A. Plant; B. Bracteole; C.–D. Flower, front and side view; E. Dorsal sepal; F. Lateral sepal; G. Petal; H. Lip; I. Section through lip; J. Column; K.–L. Anther-cap; M.–N. Pollinarium; O. Fruit. A.–N. drawing from *J. Inuthai* 417. O. drawing from *J Inuthai* 552.

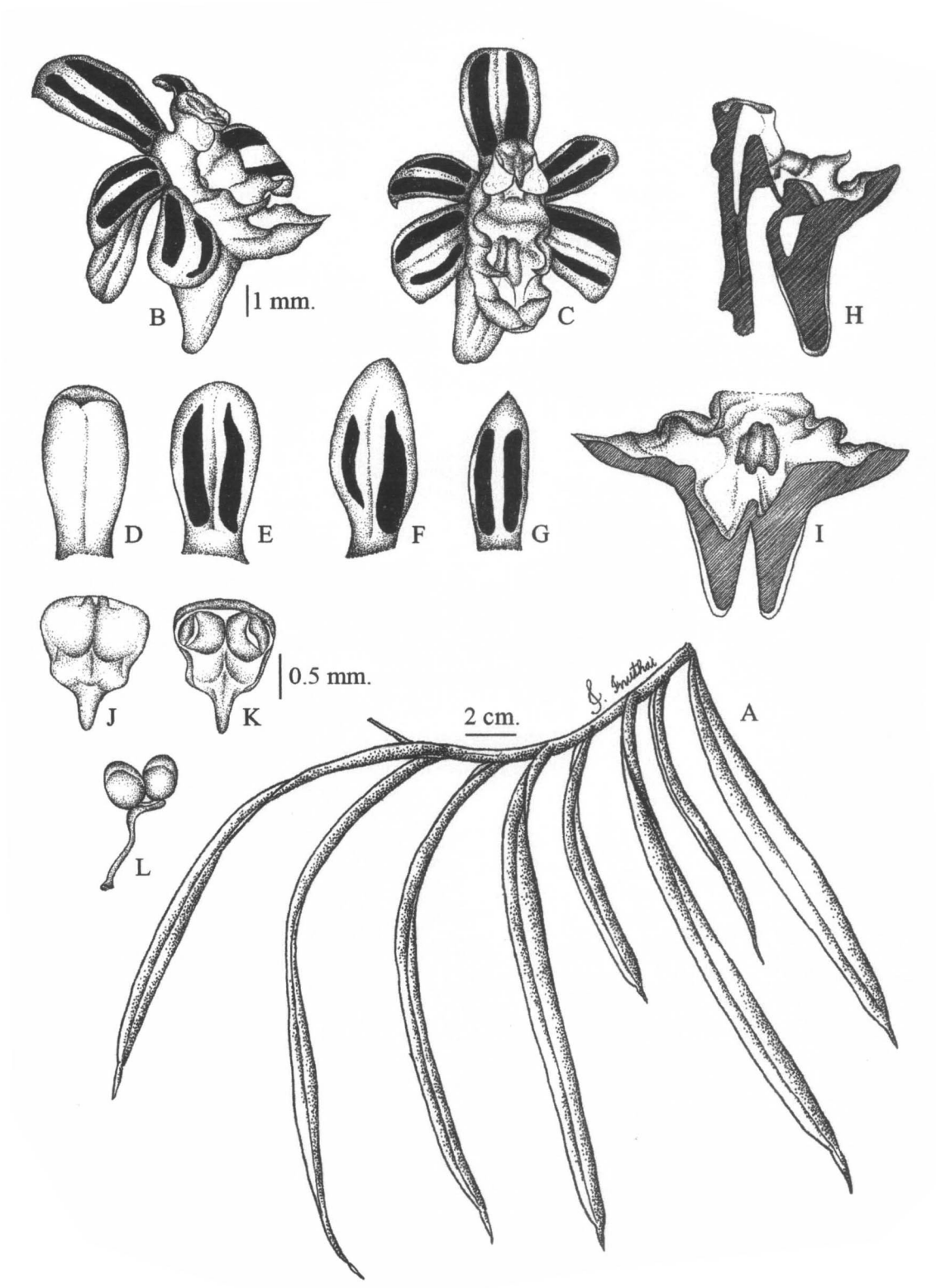

Figure 25. *Cleisostoma subulatum* Blume: A. Plant; B.–C. Flower, side and front view; D.–E. Dorsal sepal; F. Lateral sepal; G. Petal; H. Section through column and lip; I. Backwall callus on lip; J.–K. Anther-cap; L. Pollinarium. All drawing from *J. Inuthai* 633.

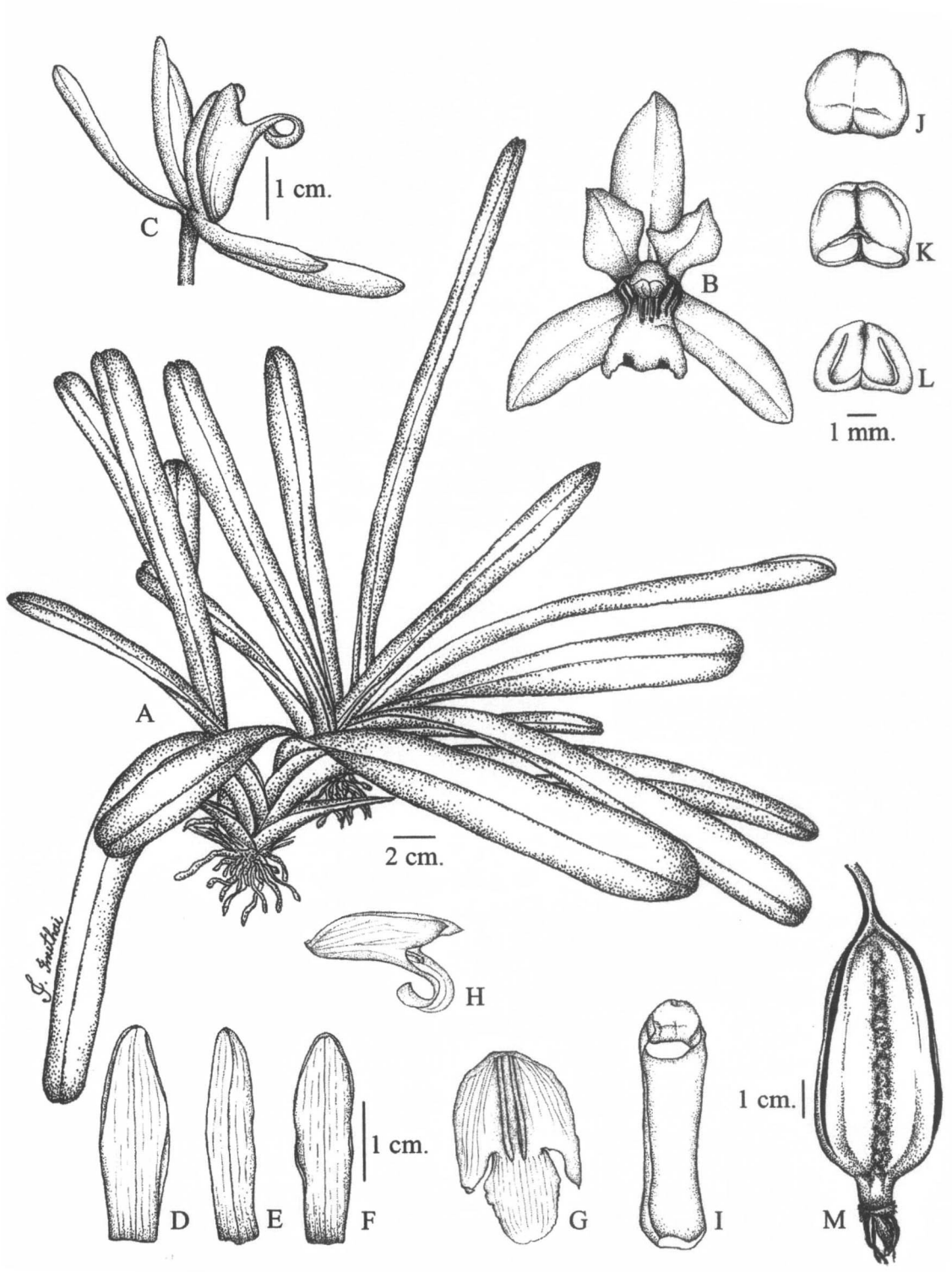

Figure 26. *Cymbidium finlaysonianum* Lindl.: A. Plant; B.–C. Flower, front and side view; D. Dorsal sepal; E. Lateral sepal; F. Petal; G.–H. Lip; I. Column; J.–K. Anther-cap; L. Pollinia; M. Fruit. All drawing from *J. Inuthai* 401.

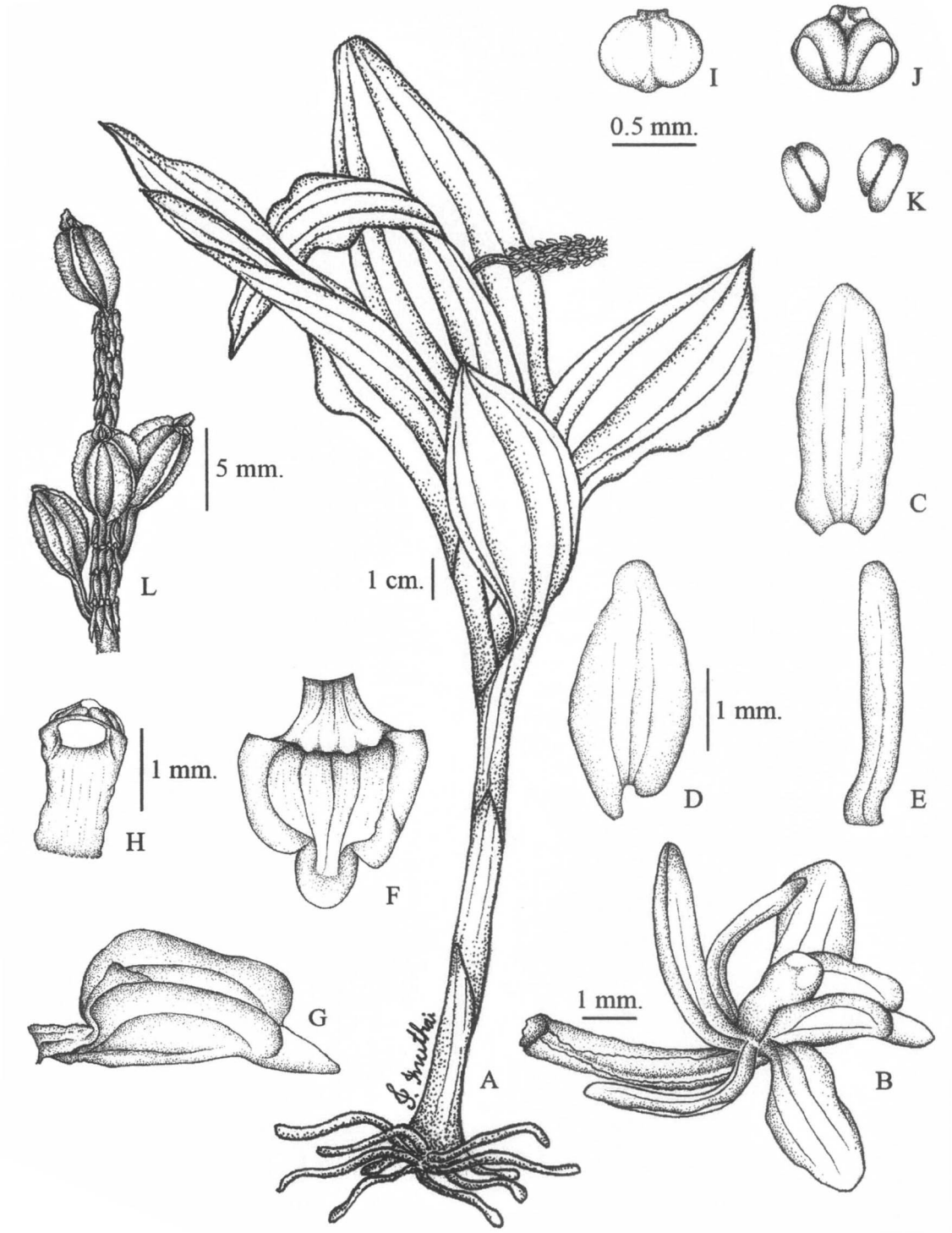

Figure 27. *Dienia ophrydis* (J. König) Seidenf.: A. Plant; B. Flower; C. Dorsal sepal; D. Lateral sepal; E. Petal; F.–G. Lip; H. Column; I.–J. Anther-cap; K. Pollinia; L. Fruiting part of inflorescence. All drawing from *J. Inuthai* 404.

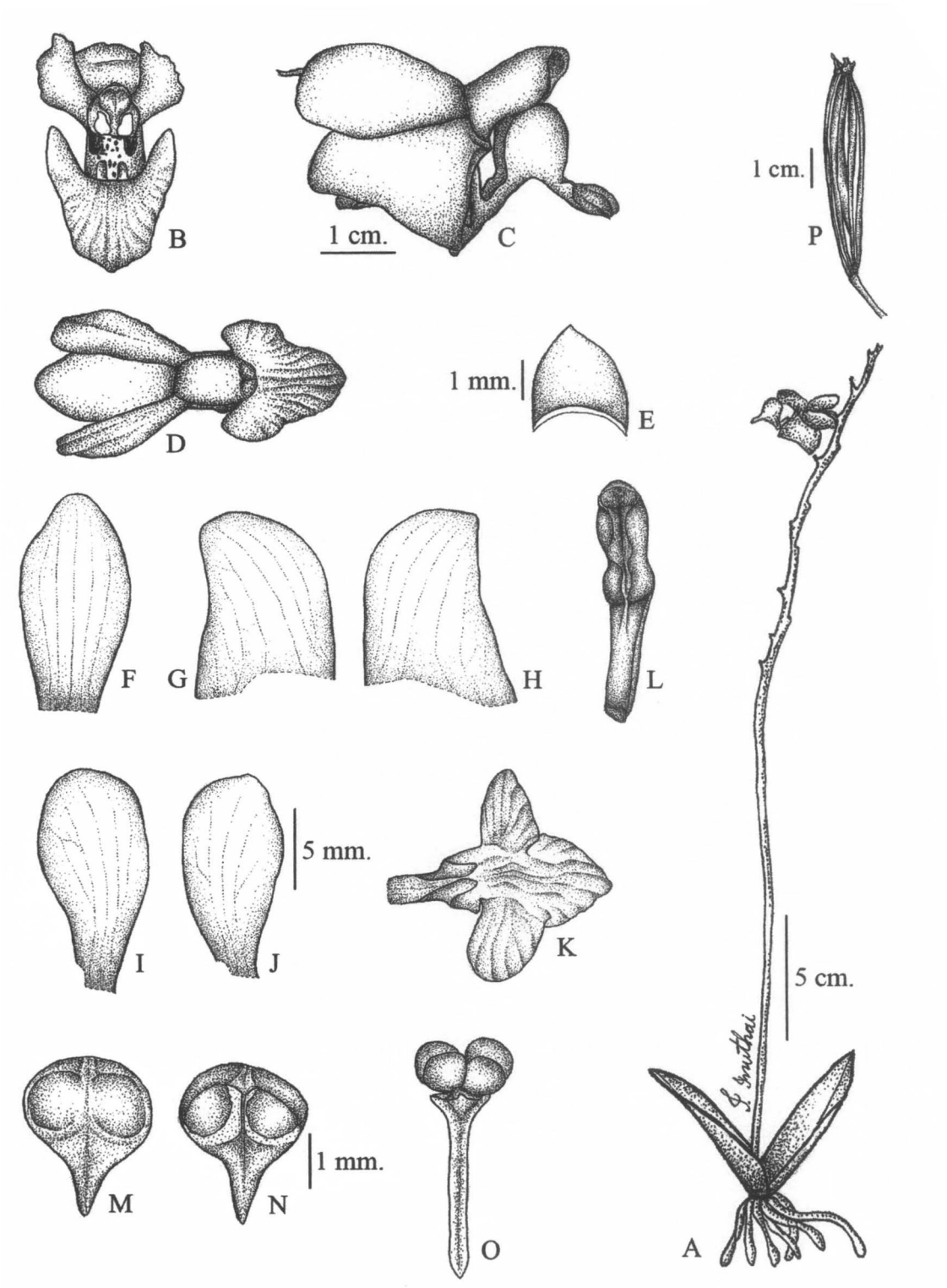

Figure 28. *Doritis pulcherrima* (Lindl.) J.J. Sm.: A. Plant; B., C.–D. Flower, front, side and top view; E. Bracteole; F. Dorsal sepal; G.–H. Lateral sepals; I.–J. Petals; K. Lip; L. Column; M.–N. Anther-cap; O. Pollinarium; P. Fruit. All drawing from *J. Inuthai* 421.

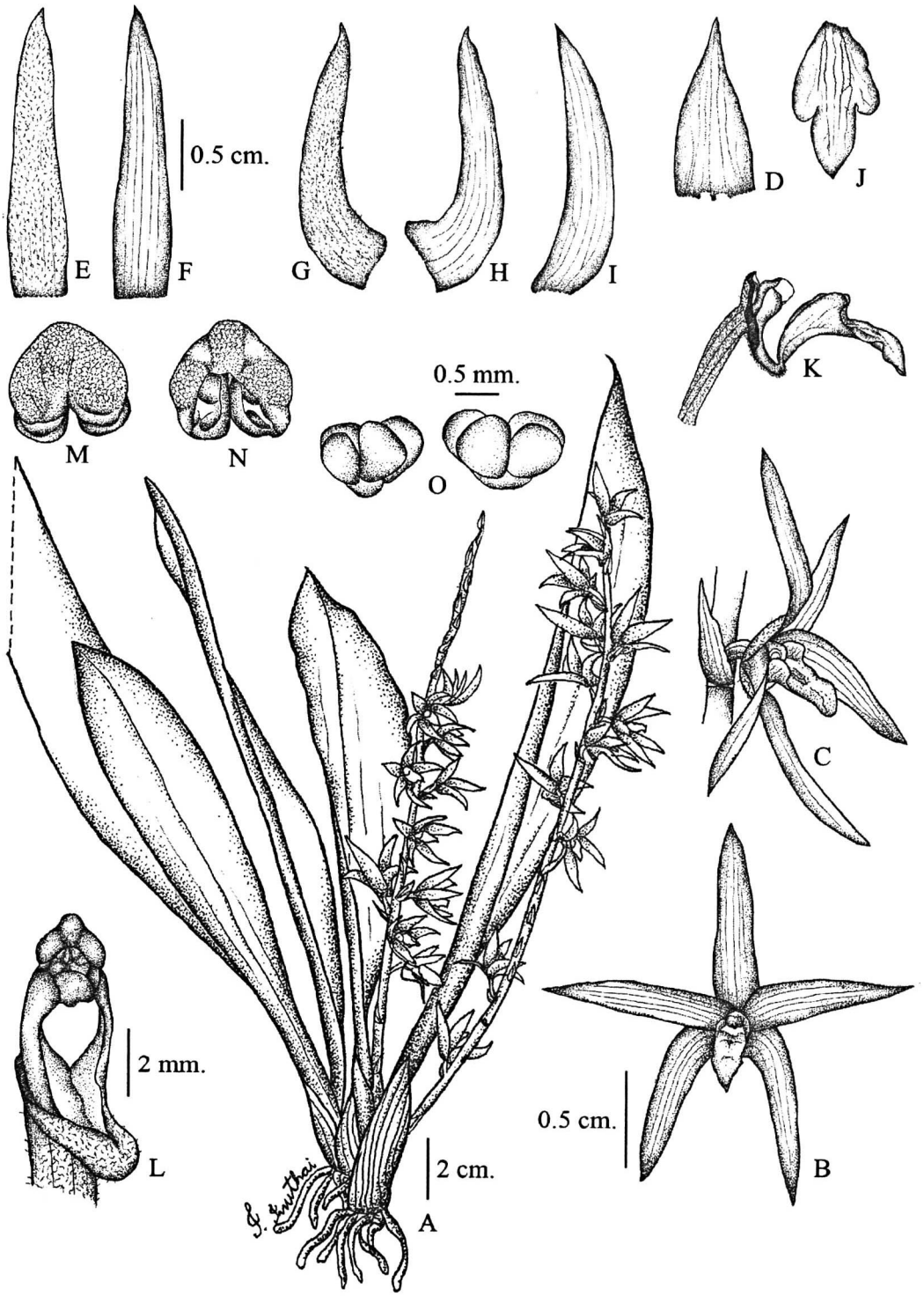

Figure 29. *Eria javanica* (Sw.) Blume: A. Plant; B.–C. Flower, front and side view; D. Bracteole; E.–F. Dorsal sepal; G.–H. Lateral sepal; I. Petal; J. Lip; K. Column and lip; L. Column; M.–N. Anther-cap; O. Pollinia. All drawing from *J. Inuthai* 430.

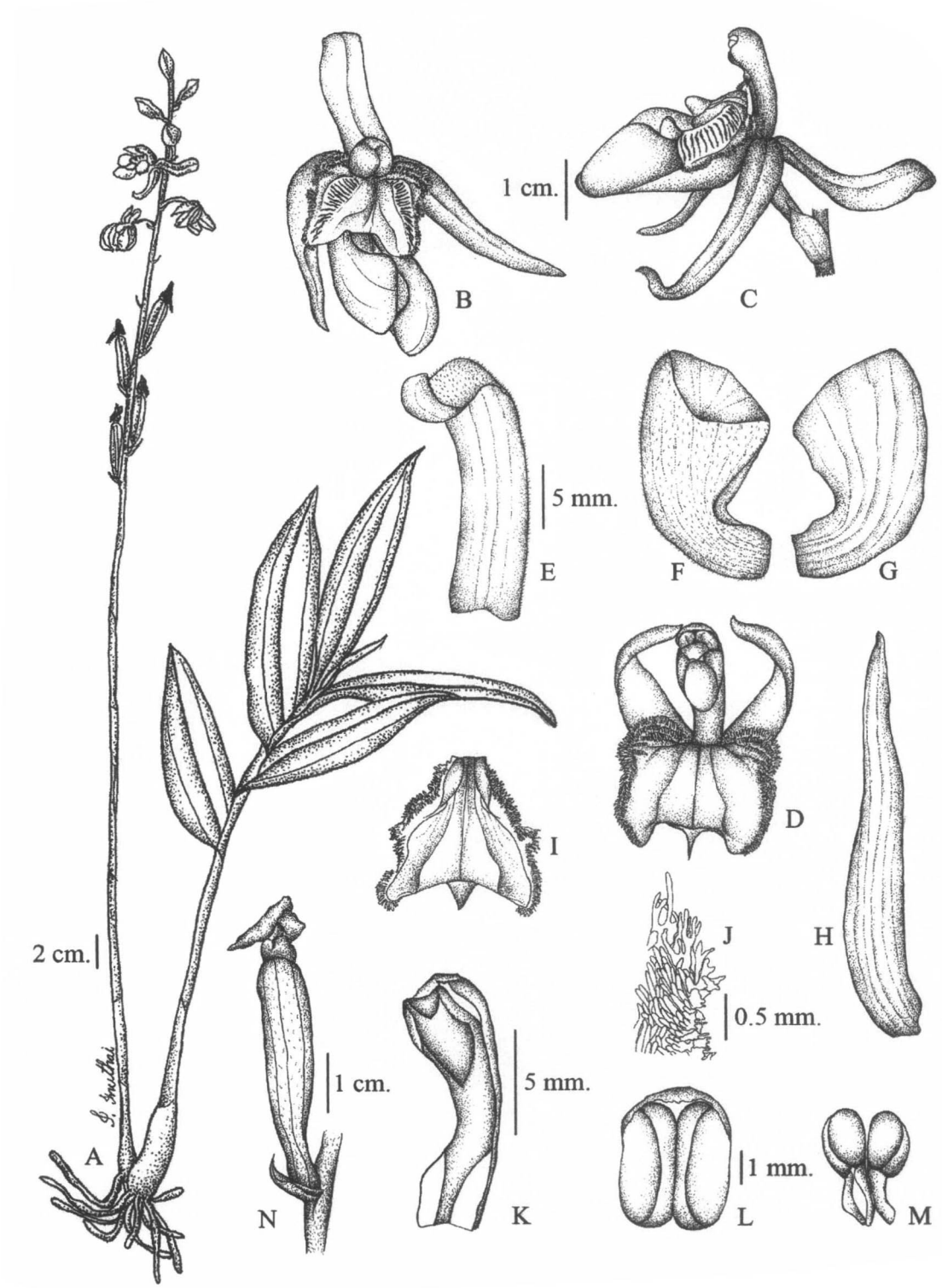

Figure 30. *Plocoglottis quadrifolia* J.J. Sm.: A. Plant; B.–C. Flower, front and side view; D. Flower, dorsal sepal and lateral sepals removed; E. Dorsal sepal; F.–G. Lateral sepal; H. Petal; I. Lip; J. Hairs on lip margin; K. Column; L. Anther-cap; M. Pollinarium; N. Fruit. All drawing from *J. Inuthai* 402.

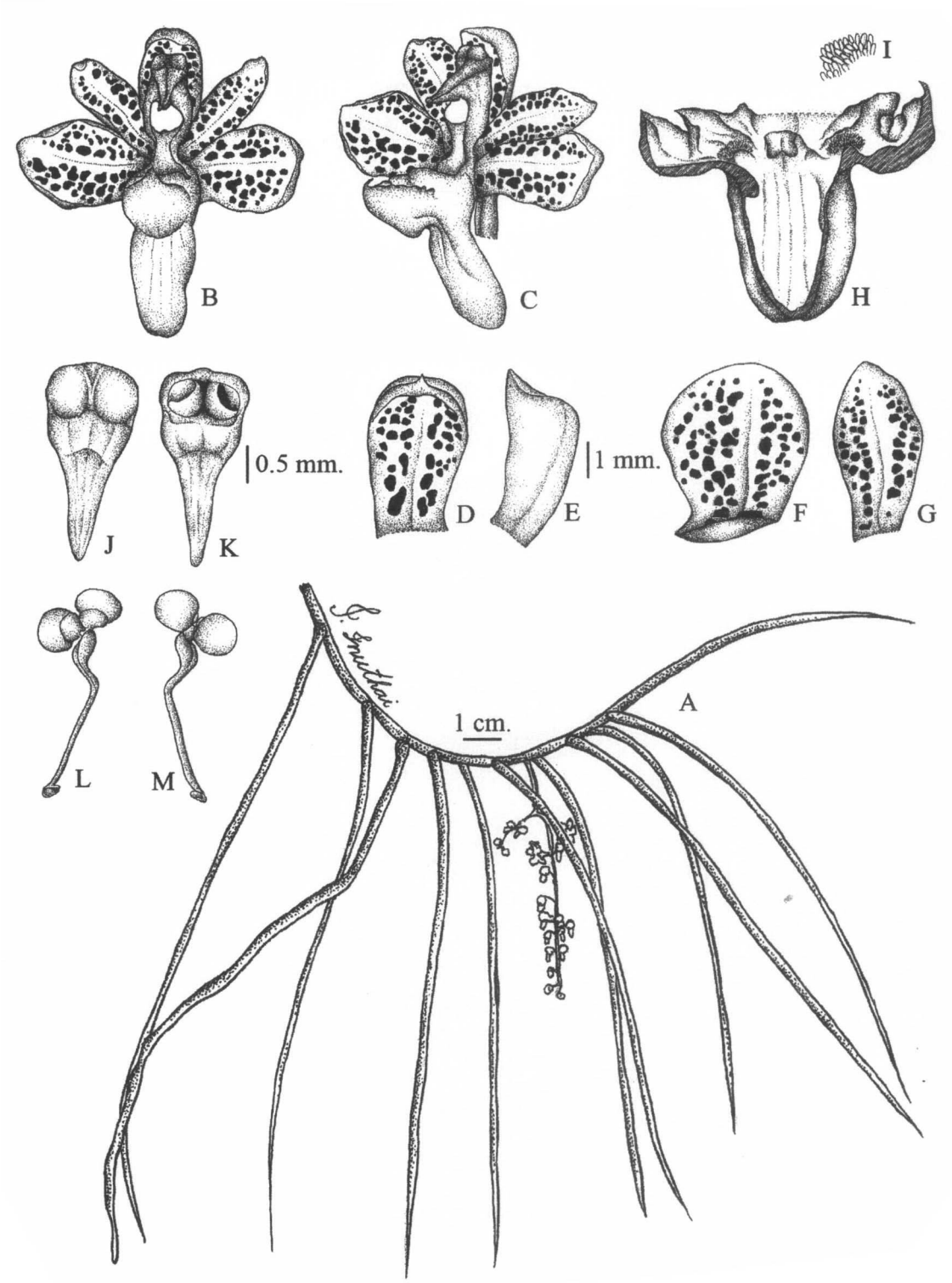

Figure 31. *Rhynchogyna luisifolia* (Ridl.) Seidenf. & Garay: A. Plant; B.–C. flower, front and side view; D.–E. Dorsal sepal; F. Lateral sepal; G. Petal; H. backwall callus; I. Hairs on lip; J.–K. Anther-cap; L.–M. Pollinarium. All drawing from *J. Inuthai* 431.

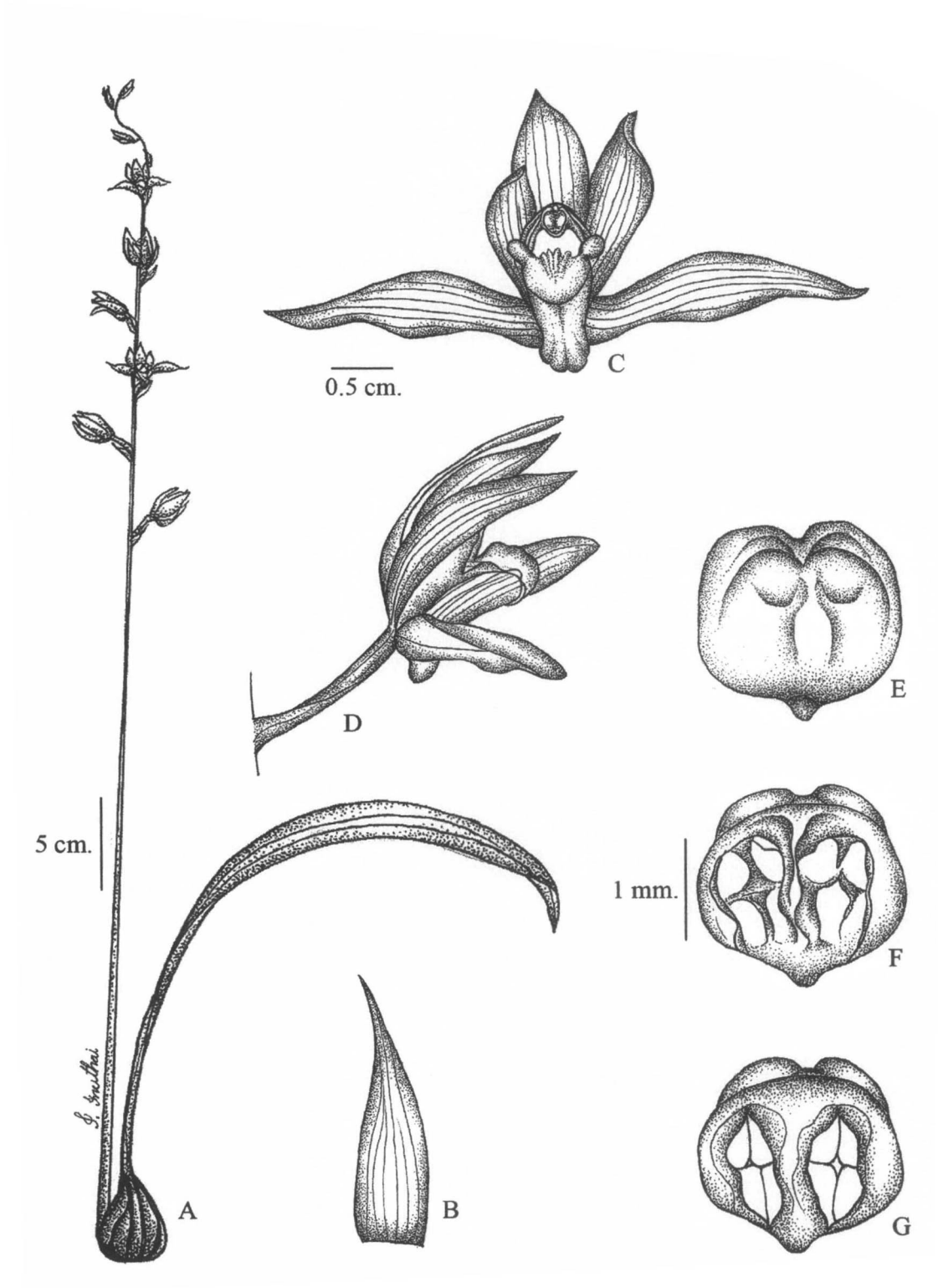

Figure 32. *Tainia penangiana* Hook.f.: A. Plant; B. Bracteole; C.–D. Flower, front and side view; E.–F. Anther-cap; G. Anther-cap with pollinia. All drawing from *J. Inuthai* 628.

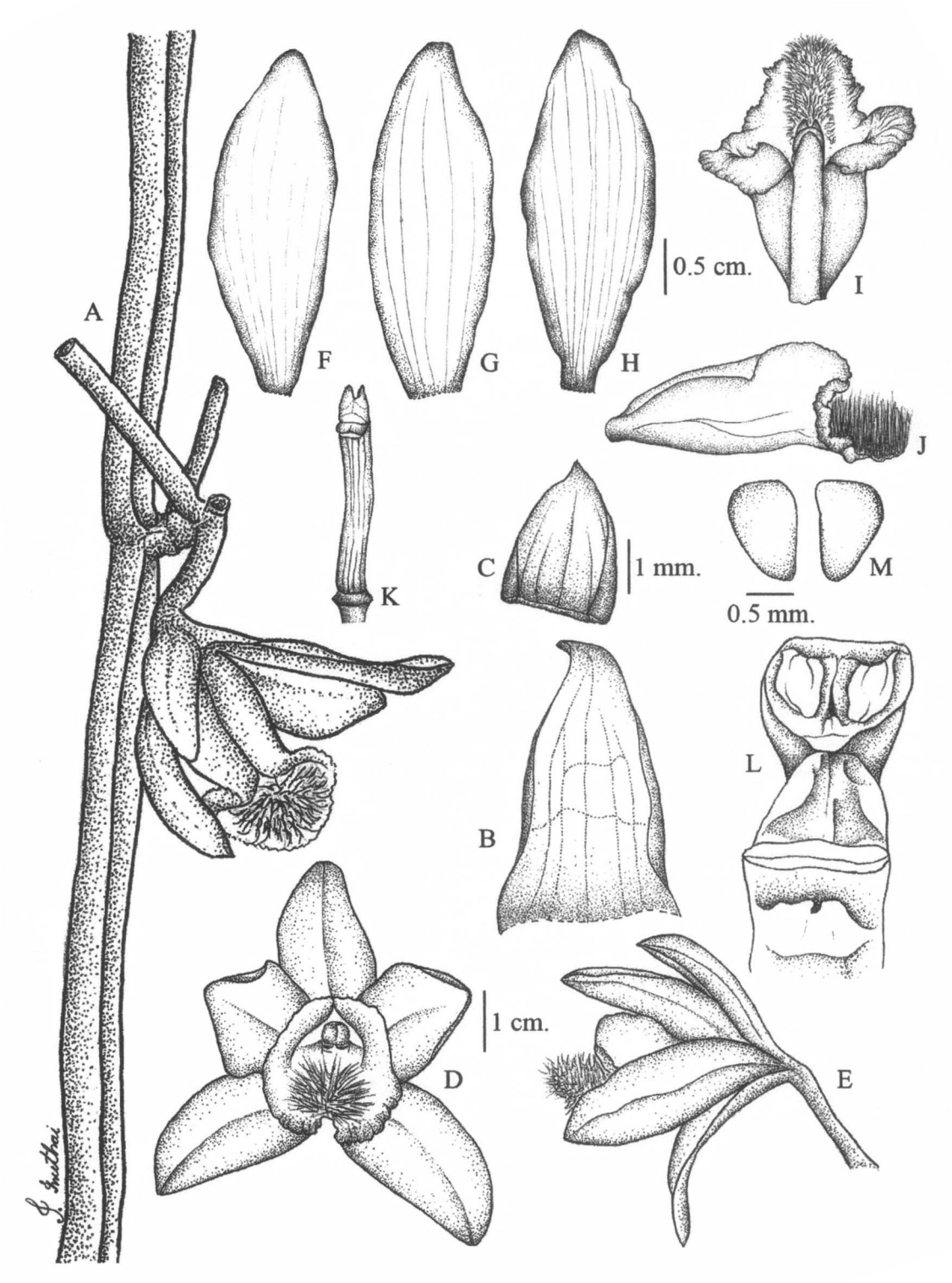

Figure 33. *Vanilla aphylla* Blume: A. Plant; B. Leaf; C. Bracteole; D.–E. Flower, front and side view; F. Dorsal sepal; G. Lateral sepal; H. Petal; I.–J. Lip; K. Column; L. Top of column; M. Pollinia. All drawing from *J. Inuthai* 414.

Phenology

The periods of flowering and fruiting fluctuate all year round (Fig. 34). Several species flower in rainy season. Other species flower in dry season. The most abundant flowering and fruiting month was August (35 species), followed by November (33 species) and December and January (32 species per month). Whilst the lowest amount of flowering and fruiting month was May (14 species). List of flowering and fruiting periods of vascular species is shown in Appendix 1.

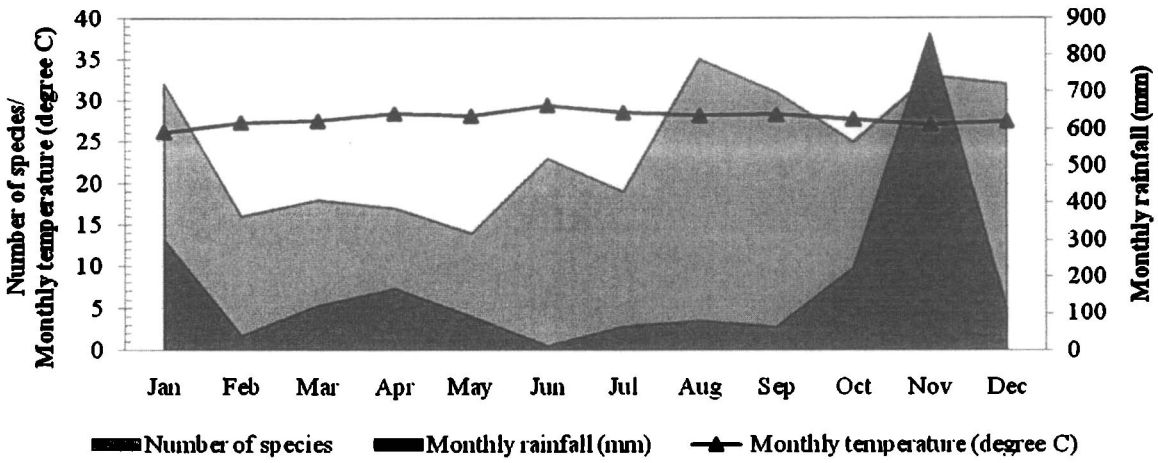

Figure 34. Flowering and fruiting phenology of flowering plants including with monthly temperature and monthly rainfall in 2009 on Khao Reng granitic hill.

Plants with flowering time in dry season are *Homalium dasyanthum* (Turcz.) W. Theob., *Ochna integerrima* (Lour.) Merr., *Streblus taxoides* Kurz, *Fagraea auriculata* Jack, *Hoya micrantha* Hook.f., *Secamone elliptica* R. Br., as well as many orchids, e.g., *Aerides odorata* Lour., *Dienia ophrydis* (J. König) Seidenf., *Doritis pulcherrima* Lindl., etc. Plants with flowering time in rainy season are *Paraboea minor* (Barnett) B.L. Burtt, *Cleisostoma subulatum* Blume, *Eria javanica* (Sw.) Blume, *Rhynchogyna luisifolia* (Ridl.) Seidenf. & Garay, *Globba pendula* Roxb. In the other hand, some species produce flowers and fruits all year round, e.g., *Cladogynos orientalis* Zipp. ex Span., *Gardenia coronaria* Buch.-Ham., *Helicteres hirsuta* Lour., *Cymbidium finlaysonianum* Lindl., *Memecylon edule* Roxb., *M. fruticosum* King, *Wrightia pubescens* subsp. *lanitii* (Blanco) Ngan, etc.

Geographical distribution

Vascular plants in this current study can be categorized into ten phytogographical elements (Fig. 35).

1. ***Paleotropics***: Species occurring in the tropics of the Old World, from Africa and Asia through Malesia to the Pacific Islands.
2. ***Pantropics and subtropics***: Species occurring throughout the tropical and the subtropical regions of the world.
3. ***Indo-chinese***: Species distributed in mainland Asia: including Bangladesh, India to the Himalayas, Indochina, Myanmar, Andaman Islands, Thailand and the southern China.
4. ***Malesian***: Species occurring in the southern part of the Malay Peninsula, including Malaysian Archipelago, Indonesia, Philippines, New Guinea and the Solomon Islands.
5. ***Indo-chinese and Malesian***: Species distributed in mainland Asia including species occurring in Malesia.
6. ***Indian and Indo-chinese***: Species distributed in mainland Asia including Indostan, tropical foothills of the Himalayas, India and Sri Lanka.
7. ***Indian, Indo-chinese and Malesian***: Species distributed in mainland Asia including species occurring in India and Malesia.
8. ***Indian, Indo-chinese, Malesian and Australian***: Species distributed in mainland Asia including species occurring in India, Malesia and Australia.
9. ***Indo-chinese, Malesian and Australian***: Species distributed in mainland Asia including species occurring in Malesia and Australia.
10. ***Known only from Thailand***: Species distributed in Thailand, especially in the study area in Songkhla province.

Of the 83 species recorded in the present study could be divided into ten geographical distribution types. The most common phytogeographical elements are Indo-chinese and Malesian (28 species or 33.74%), followed by Indian, Indo-chinese and Malesian (14 species or 16.87%) and Indian, Indo-chinese, Malesian and Australian (12 species or 14.46%). There are seven species (8.43%) only known from Thailand. Among these, six species are only known from the present study and only one species, *Paraboea minor* (Barnett) B.L. Burtt is recorded as endemic to Thailand. List of vascular plants in ten geographical distribution types is shown in Appendix 2.

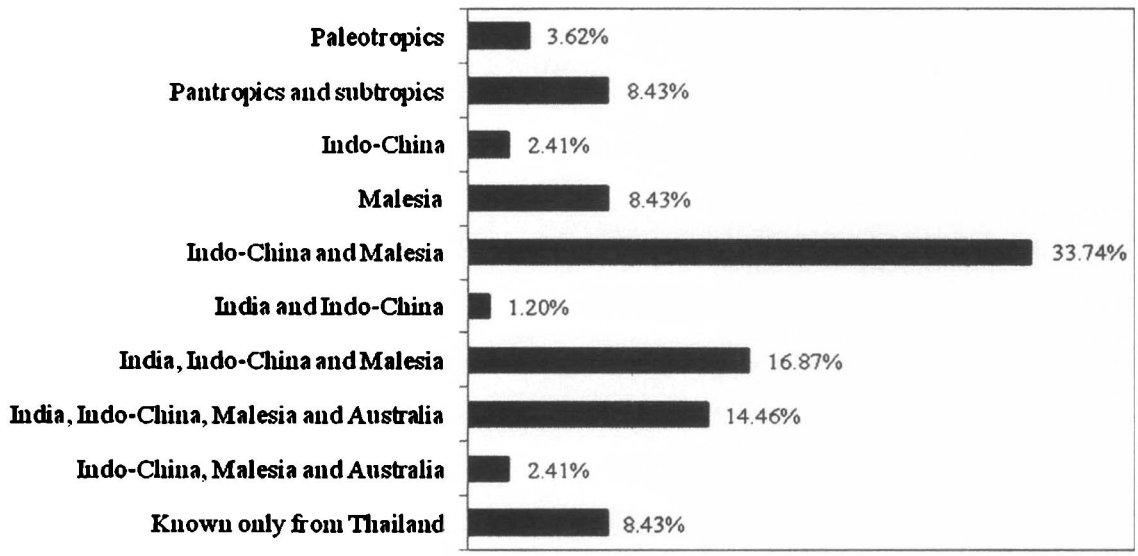

Figure 35. Bar chart showing the percentage of vascular plants on Khao Reng hill, which found in each geographical distribution types.

PART II: VEGETATION STUDY

Schematic diagram of vegetation profiles

There are many rock platforms scattered throughout this granitic inselberg. Sizes and shapes of those rock platforms vary enormously. The illustration of the vegetation profiles were carried out on a large rock platform which ranges from the foothill upwards on the top of the hill. Three plots along the rock platform were selected to draw the profiles. Thus, these profiles exhibit an overall image of the ecological distributions of plant species in varying microhabitat types on the rocky slope of inselberg. However, this inselberg is not high enough to show the change in plant species composition along an elevation gradient. Even though, other rock platforms were not illustrated, all of them were observed.

All of profiles have many similar characters, although each of them bears different plant species. Schematic diagram of vegetation profile on a plot **A** shows four microhabitat types, i.e., the rock-platform fringe, the shallow depression, the deep depression and the rock crevices and clefts. Some plant species could only be found in this plot such as *Bombax anceps* Pierre, *Asplenium pellucidum* Lam. While, five microhabitat types, i.e., the rock-platform fringe, the rock crevices and clefts, the shallow depression, the deep depression and the exposed rock slope are presented in vegetation profile of the plot **B**. Some plant species, i.e., *Cladogynos orientalis* Zipp. ex Span., *Gardenia coronaria* Buch.-Ham. and *Fagraea auriculata* Jack could only be seen on this plot. Vegetation profile on a plot **C** shows five similar microhabitat types as a plot **B**. However, this plot lies on a rock platform which is narrower than the other, so it closes to the edge of the forest which produces more shade and humidity. Therefore, it is composed of many different species when compared that with two previous profiles. Some plant species could only be encountered on this plot such as *Eria javanica* Blume, *Coelorachis helferi* (Hook.f.) Henrard, *Drynaria bonii* H. Christ. There are some common plant species that were found in the most of rock platform on this hill, e.g., *Aerides odorata* Lour., *Paraboea minor* (Barnett) B.L. Burtt, *Memecylon edule* Roxb., *Pyrrosia adnascens* (Sw.) Ching, etc.

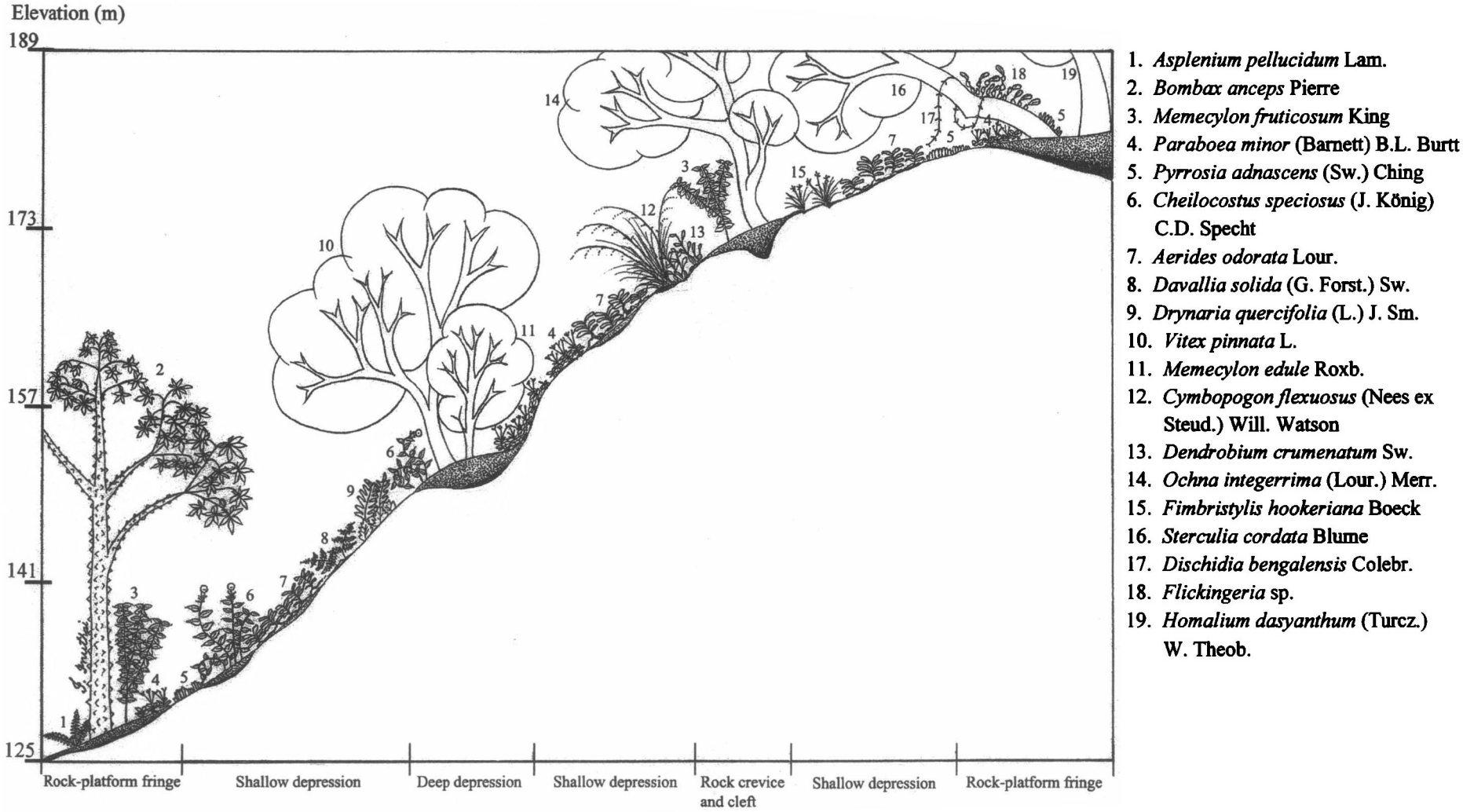

Figure 36. Schematic diagram of vegetation profile on a plot A at Khao Reng hill.

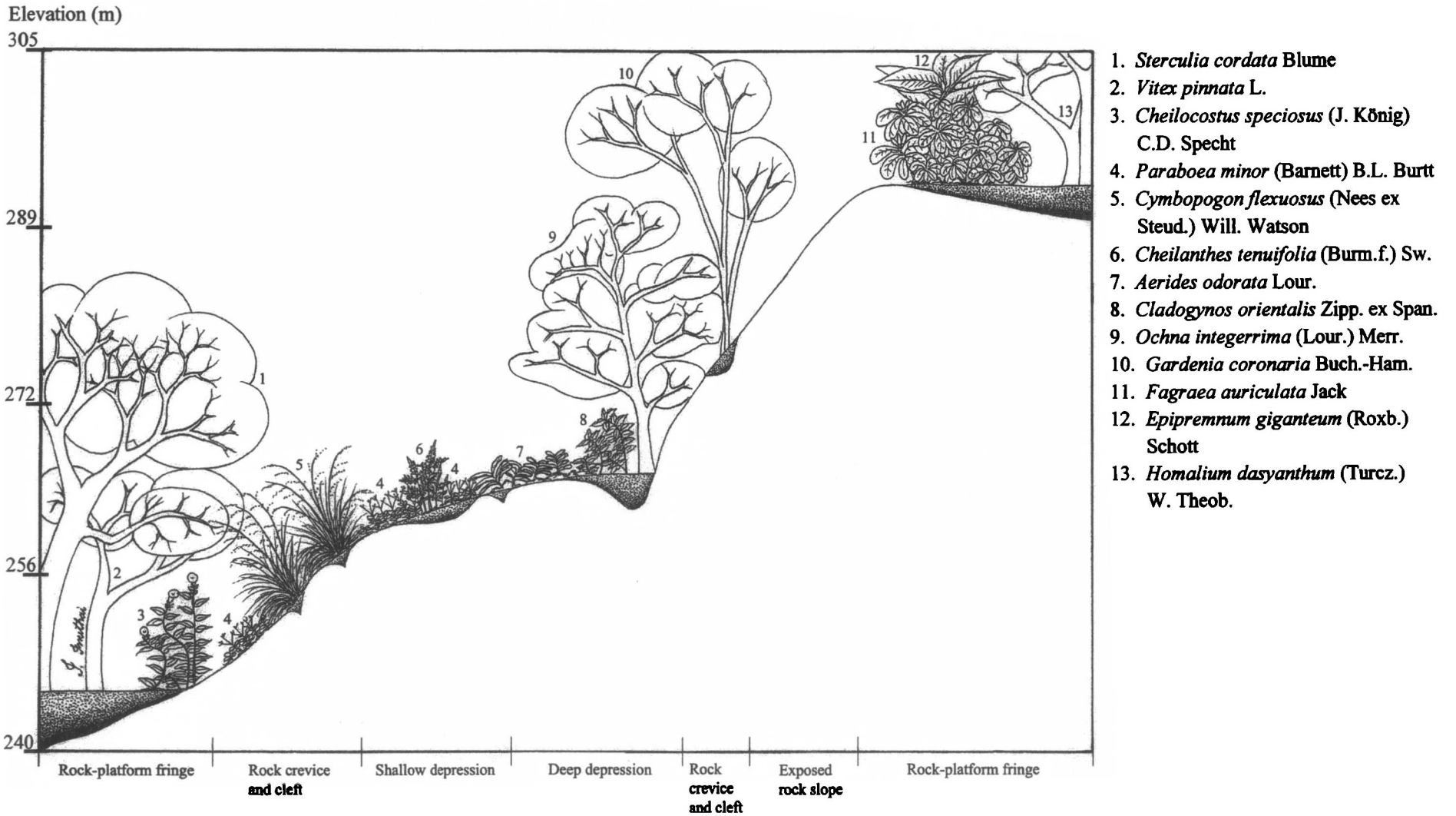

Figure 37. Schematic diagram of vegetation profile on a plot **B** at Khao Reng hill.

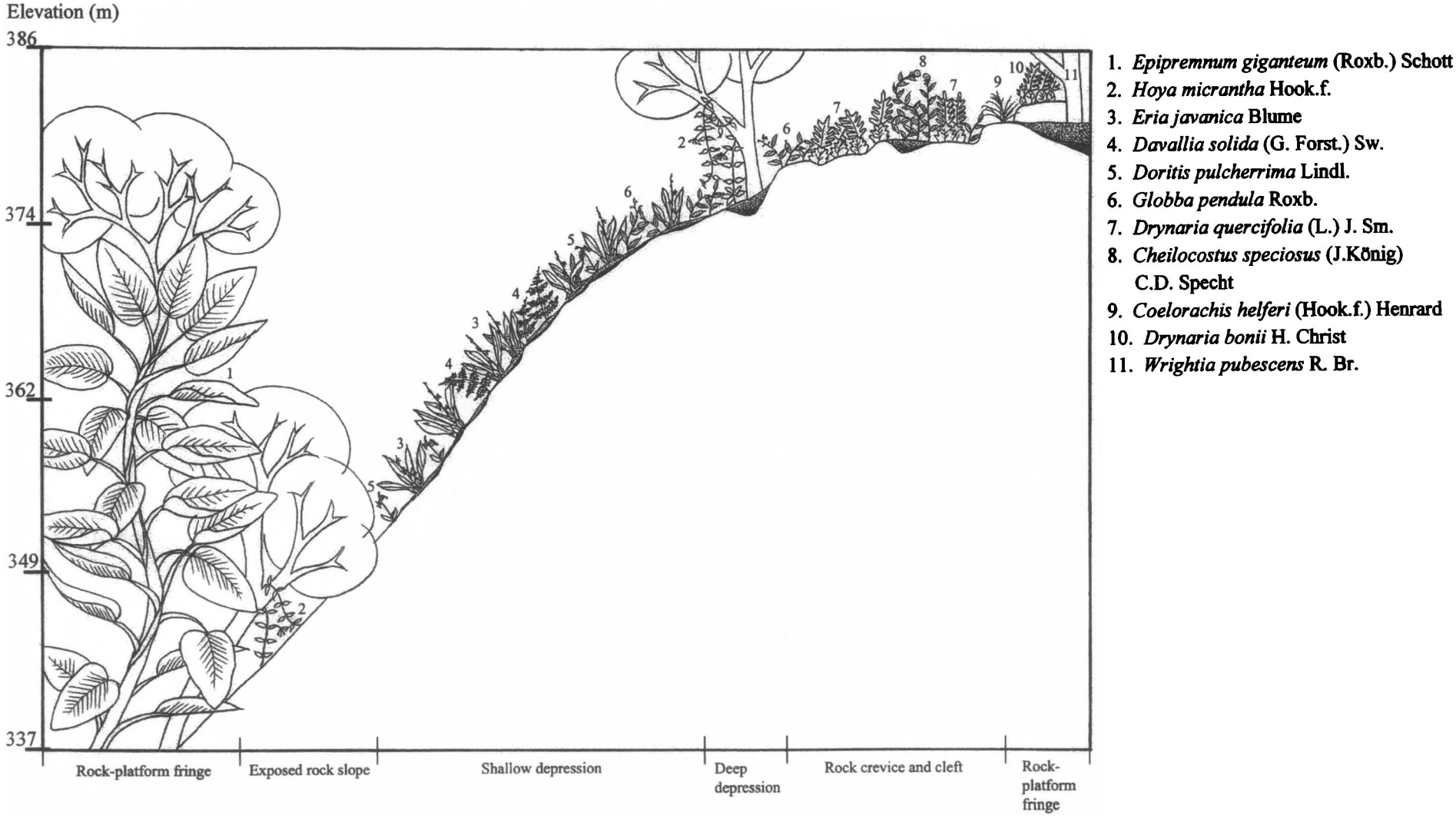

Figure 38. Schematic diagram of vegetation profile on a plot **C** at Khao Reng hill.

CHAPTER 4

DISCUSSION AND CONCLUSION

Microhabitat types and species compositions

Khao Reng granitic inselberg is a mosaic of gentle slopes to steep slopes, depressions, crevices and clefts, rock-falls and shady flat rocky slopes. As present on the profiles, each of these microhabitats was occupied by a distinct plant community, distributed according to substrate characteristic, soil structure, depth and moisture.

Concerning comparison of plant species richness in each of microhabitat types, the highest of species richness was found along the rock-platform fringes (50 species) (Fig. 5, 6). In the present study, "rock-platform fringe" is termed by the zone between the rock platforms and the forest habitats, so as to indicate the boundary between the rock platform and the adjacent tropical semi-evergreen rain forest. These fringes form the ecotone between those two major habitats. A review of many definitions of an ecotone might be "a zone where directional spatial change in vegetation is more rapid than on either side of the zone" (Kelvin, 2000). Ecotone has been used to refer to all types of transitions between different entities across spatial scales (such as biomes, landscapes, ecosystems, patches, plant communities) (Muñoz-Reinoso, 2009). Despite their difference, the two major habitats contain many similar species including, e.g., *Cymbidium finlaysonianum* Lindl., *Vitex pinnata* L., *Ochna integerrima* (Lour.) Merr., *Catunaregam* sp., etc. Many orchids, shrubs and trees can grow in these areas, probably due to the fact that ecotone has a high diversity of ecological niches, due to the varying conditions of soil depth and light intensity (Porembski, 2003). The abundance of epiphytic orchids and ferns is likely due to the high light availability and humidity along the fringe. Moreover, the highest of species richness in this area possibly caused by species common to the rock platforms and the forest mixes with species common to the fringe. The results showed a highly diverse and unique community within this boundary environment. Furthermore, the species in these rock-platforms fringes possibly play important role as buffer elements between

the different plant groups in the two habitats. More detailed study of the physiological and ecological roles of plant elements in these microhabitat types are required.

Shallow depressions and rock crevices and clefts, which are widely scattered all over the granitic inselberg, are the favorite ones that contained many plant species. Typical plant mats on shallow depressions are generally composed of grasses, ferns and epiphytic orchids. Rock crevices allow many herbaceous plants to grow and clefts which are broader and deeper, offer establishment sites for some shrub and tree species. As deep depressions, these depressions containing deeper soils and organic matter are colonized by various species of shrubs and trees. Meanwhile, rock-falls and shady flat rocky slopes support eight and six species, respectively. The results may be due to only few soil pockets occur in these habitats. However, there are some species that grow only in shady flat rocky slopes such as *Parahemionitis cordata* (Hook. & Grev.) Fraser-Jenk., *Cleisostoma subulatum* Blume and *Tainia penangiana* Hook.f. In this study, exposed rock slopes with no cracks do not support any vegetation because of inadequate soil organic matter accumulation.

Edaphic and topographic factors, including the substrate thickness as well as the inclination of the platforms, are likely to have the most direct effect on the species composition of the microhabitats on the granitic rock platforms of Khao Reng Hill. In addition, water and nutrient availability depend on soil depth (Müller, 2007). The degree of inclination of rock faces is an important determinant responsible for the distribution of habitat types (Porembski *et al.*, 1993). At Khao Reng hill, steep slopes with inclinations of 45-60 degrees bear mats of *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson in crevices and clefts that facilitate long-term establishment. In the middle of the rock platforms, there are open areas that are exposed to the sunlight. Here the soil is not thick enough to support big trees, however, many small herbaceous species, such as *Paraboea minor* (Barnett) B.L. Burtt, *Cissus nodosa* Blume were found. The results showed that the inselberg flora is strongly influenced by environmental constraints. In other words, niche differentiation is a major determinant of species assemblages.

Adaptation traits

Inselbergs are, in most cases, xeric habitats as there are always long dry periods with high temperatures. So, little moisture is available for plant growth and there is little soil or substrate to hold any moisture. Perhaps therefore, plants of these areas are typically herbaceous. Plants that grow in this environment have been exposed to the water stress for a period of time in a year.

According to Chandler & Bartels (2003), those plants resist drought stress using two different processes: drought avoidance and drought adaptation. Drought avoiding species avoid drought by growing or living during the rainy season when sufficient water is available. This strategy has been adopted by annual plants. Drought adapted plants decrease transpiration and improve water uptake and have adopted several appropriate strategies. A thick waxy cuticle in some trees is one strategy that protects water loss, e.g., *Memecylon edule* Roxb., *Fagraea auriculata* Jack, *Gardenia coronaria* Buch.-Ham., etc. Some plant species are mainly grow in dense mats on the surface of rock with shallow rock system, e.g., *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson, *Fimbristylis hookeriana* Boeckeler, *Aerides odorata* Lour., *Paraboea minor* (Barnett) B.L. Burtt, *Davallia solida* (G. Forst.) Sw., etc. These mats not only store rainwater and nutrients that would otherwise be rapidly lost by runoff, but also avoid overheating of plant tissues. In addition, these mat formations may have substantial advantages: the establishment of a single individual is adequate to build up large populations in isolated localities and long-term persistence after successful colonization because the considerable age of clonal populations (Porembski *et al.*, 1998). Many species, like the orchids, have developed structures to conserve water. Succulence in leaves and pseudobulbs of some orchids are particularly prominent, e.g., *Eria javanica* (Sw.) Blume, *Flickingeria* sp., *Plocoglottis quadrifolia* J.J. Sm., *Tainia penangiana* Hook.f., *Cymbidium finlaysonianum* Lindl., etc. Moreover, the adventitious roots of some epiphytic orchids such as *Eria javanica* (Sw.) Blume hold a velamen radicum which might be of functional importance for the rapid capillary uptake of rain water (Porembski & Barthlott, 2000). These characteristics are not strictly restricted to inselbergs, they can be found elsewhere under similar ecological condition as well (Porembski *et al.*,

1993; Porembski *et al.*, 1997). However, drought can influence the composition of plant communities (Smith, 1992), especially on this inselberg.

Flowering and fruiting phenology

Flowering is an important aspect of the life history of angiosperm species, with both ecological and evolutionary consequences (Morales *et al.*, 2005). This present study was not precisely concentrate on flowering and fruiting phenology, however, flowering and fruiting patterns on this hill were observed. The result showed that the plant generally flowered and fruited several times during the year (Fig. 34). Nevertheless, it could be divided into two peaks in each period (dry period and wet period). In dry season, flowering and fruiting tended to peak during the mid-season. The result is probably due to high temperatures in dry period, especially on rock platform can increase the rate of reproductive development, which shortens the time for photosynthesis to contribute to fruit or seed production. Whilst, flowering and fruiting peaked in November that had the highest monthly rainfall during the wet season. The results may be because of the increased humidity. Flowering rate of plants under high humidity were greater than rate of those plants under low humidity (Lee *et al.*, 1972). According to Lieberman (1982), fruiting peaked during the wet season, perhaps caused by increased moisture levels necessary for fruit production. In addition, species with longer fruiting duration, flower in dry period and take full advantage of wet period for fruit development (Singh & Kushwaha, 2006). The result showed that flowering and fruiting dropped during seasonal change. Considering the temperature, monthly temperature is quite stable, thus it could not show any significant effect on flowering and fruiting patterns. The results support the hypothesis that ecological factors shape patterns of flowering and fruiting phenology, however, the main factors might not defined here. From this present observation, species flowering in different seasons exhibited varying fruiting durations. Fruit formation continued through 2-3 months following the peak flowering time in different species. However, the time required for fruit maturation varied greatly with species.

Phytogeographical affinities

From literature reviews, flora of Thailand can be divided into two floristic regions, i.e., the sub-continental Southeast Asian region (Indo-chinese region) and the Malesian region. Khao Reng inselberg is located in the southern part of Thailand. It is a part of Thailandian Province in Indo-chinese region as categorized by Takhtajan (1988). Concerning the bio-geographical regions, this area is close to the Kangar-Pattani demarcation line (*sensu* Whitmore 1975) which is an imaginary line drawn from Kangar on the northwestern coast of peninsular Malaysia to the eastern coast of peninsular Thailand in Pattani. Five hundred and seventy five genera were estimated in such area.

Base on geographical distribution of plant species on this hill, those taxa can be categorized into ten phytogeographical elements (Fig. 35). Indo-chinese and Malesian species (33.74%) make up the largest part of the inventory. This highest percentage conformed that plants in this area integrated both Indo-chinese and Malesian elements. The other important elements are Indian, Indo-chinese and Malesian elements (16.87%) and Indian, Indo-chinese, Malesian and Australian elements (14.46%). Most of the Pantropics and Subtropics elements are Pterophytes (5 species). There were two species, i.e., *Drynaria bonii* H. Christ and *Fimbristylis hookeriana* Boeckeler are restricted to Indo-chinese region. Whilst, there were seven species, i.e., *Mesua kunstleri* (King) Kosterm, *Memecylon fruticosum* King, *Rafflesia kerrii* Meijer, *Sterculia cordata* Blume, *Cissus nodosa* Blume, *Plocoglottis quadrifolia* J.J. Sm. and *Globba pendula* Roxb. are confined to Malesia region. Only one species, *Paraboea minor* (Barnett) B.L. Burtt is recorded as endemic to Thailand (Songkhla province). As a result, Thailand shares its flora with the neighboring countries.

Comparison to previous study, Sae Wai (2009) observed vascular plants on the cliffs and rocky ridges of Sankalakhiri range, Betong district, Yala province which is located under the Kangar-Pattani demarcation line. Plant species in those areas are more similar to the Malesian elements. While Khao Reng hill is located above that demarcation line, overviews of plant species are more similar to the sub-continental Southeast Asian elements. This information supports that the Kangar-Pattani demarcation line is an important phytogeographical transition in this region.

Distribution of some selected plant species in Thailand

Many plant species that were found in this area are interesting, e.g., in term of rarity, endemism, distribution range, etc. *Fagraea auriculata* Jack is considered as a threatened plant which is listed in A Preliminary Check-list of Threatened Plants in Thailand (Pooma *et al.*, 2005). It was found only one individual near a rock-platform fringe on this inselberg. This species is distributed throughout Indochina, South Myanmar, Peninsular Malaysia, Java, Bali, Borneo, Philippines, Moluccas and Japan. However, this is the first time that this species was collected in Songkhla province (in the study area).

Only one endemic species to Thailand (only found in Songkhla) was found in this study area. It is *Paraboea minor* (Barnett) B.L. Burtt which is also considered as a vulnerable plant in Thailand Red Data: Plants. This specie was established abundantly on rock platforms. It usually grows in a mat formation, in rock crevices and clefts, on shallow depressions and sometimes on deep depressions. It was previously collected from Toan Ngachang in Songkhla province, at the elevation 50-500 m in tropical rain forest (Santisuk *et al.*, 2006).

Regarding distribution of *Bombax anceps* Pierre, it is distributed throughout China, Cambodia, Myanmar and Peninsular Malaysia including with Northern, South-Western, Central and South-Eastern of Thailand. However, there is no recorded in Southern of Thailand before. The result is probably due to lack of data collection.

Thus, at least before all of plant species are going to quickly disappear from their nature habitats of this unique area, these plants should be observed and collected. This study not only gains more information of vascular plants on Khao Reng inselberg, but also completes ecological data in terms of both abundance and distribution. All of these important historical evidences were deposited as voucher specimens at Herbarium.

Comparison with previous investigations in terms of species richness and life forms

When the habitat types of Khao Reng Hill and adjacent areas are taken into account, two major habitat types, where more accumulation of litter has occurred,

were recognized. They are the rock platforms and the forest (tropical semi-evergreen rain forest) habitats. The present study would concentrate on the rock platform, however, many plant species could be found in both habitats (see also Table 1).

Thirty-nine families, 80 genera and 83 species were recorded from Khao Reng granitic inselberg. An overview of this inselberg, it was composed of many ferns and orchids, with few scattered shrubs, trees and climbers. Herbaceous plants (48 species or 57.83%) are the most abundant habits in this area. The result is probably due to herbaceous plants were found in almost microhabitat types, particularly in rock crevices and clefts and on shallow depressions which are widely distributed throughout this inselberg. Unsurprising herbaceous species are conspicuous dominants on granite (Wentworth, 1981; Sarthou *et al.*, 2003). The prominent herb families are Gesneriaceae (*Paraboea minor* (Barnett) B.L. Burtt), Poaceae (*Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson), Orchidaceae (*Aerides odorata* Lour., *Eria javanica* Blume) and Davalliaceae (*Davallia solida* (G. Forst.) Sw.). They commonly grow close together in clumps or mats. Concerning to mat formation, in tropical Africa and Madagascar, Carpet-like mat formed by Cyperaceae and epiphytic orchids (Müller, 2007), while in neotropical inselbergs Bromiliaceae and Velloziaceae are the dominant mats (Porembski *et al.*, 1997). The studies on the United State, South America and Africa inselbergs, the prominent herbs in Poaceae, Cyperaceae and Orchidaceae were reported as well (Barthlott *et al.*, 1993; Porembski *et al.* 1993; Ibisch *et al.*, 1995; Sarthou & Villier, 1998; Sarthou *et al.*, 2003).

Orchidaceae, Rubiaceae, Poaceae, Cyperaceae and Fabaceae are the most important families in the present study. The other typical families of Africa inselbergs (for Ivory Coast: Porembski *et al.* 1993; for Venezuela: Groger & Barthlott, 1996) and the United State inselbergs (for French Guiana: Sarthou & Villier, 1998; Sarthou *et al.*, 2003; for Taxas: Walters & Wyatt, 1982), such as Apocynaceae, Euphorbiaceae and Sterculiaceae were also recorded at Khao Reng inselberg. However, families apart that are of certain importance in regard to species number on inselbergs throughout the tropic (e.g., Poaceae, Cyperaceae, Rubiaceae), there are also region-specific families such as African inselbergs: Fabaceae, Scrophulariaceae and Lentribulariaceae; South American inselbergs:

Melastomataceae, Orchidaceae, Cactaceae and Bromelaiaceae. Unfortunately, information about the floristic composition of tropical Asian inselbergs is very sparse. Nevertheless, Porembski *et al.* (1997) mentioned that consideration of some local floras, it can be assumed that the vegetation of Indian and Ceylonese inselbergs is close to African counterparts at family and genus level. The present work supports this assumption that the floristic composition of Khao Reng inselberg is more similar to Afircan inselbergs vegetation in family level than South American inselbergs.

The largest family in this study is Orchidaceae. This family has been considered to be the largest family of vascular plants. It is very diverse, composed of almost 30,000 species which are distributed all over the world, particularly in the tropic and there are nearly 1,200 species in Thailand (Thaithong, 1999). Two other prominent families in this area are Rubiaceae and Poaceae. Rubiaceae is the one largest plant family of Dicotyledons in Thailand. This family is spread throughout the country, with nearly 110 genera and an estimated 600 species in Thailand Flora (Puff *et al.*, 2005). Poaceae represents the second largest family of Monocotyledons with 700 genera and 10,000 species worldwide, among these 133 genera and 505 species are presented in Thailand Flora (Simpson & Chayamarit, 2010). The expressions of these families are in accord with previous observations from rocky mountains (Sridith, 1989; Boonjaras, 2002; Sea Wai, 2009).

Suggestions for further studies

This current study showed an overview of vascular plants on Khao Reng inselberg. The observation suggests that further understanding of plant community and composition on inselberg including with rock outcrops, rock formations and rock platforms elsewhere in Thailand which is one of the most interesting part of the world, should carry out in order to gain more complete information in terms of diversity, ecology and distribution. These data not only provide important information in local scale, but it will also help to better discern on existing floristic differentiations and the variations in plant species diversity between inselbergs or isolated hills in regional scale. Moreover, flowering and fruiting phenology should be more focused on environmental factors. Physiological

experiments should be undertaken to prove the hypotheses or possibility of any phenomena that were observed in this study.

Conservation aspects

Inselbergs which form in many regions have not attracted much agricultural interest. In Thailand, on the contrary, plants on inselbergs have been critically affected not only by rubber plantations in adjacent areas, but the granitic rock itself has been taken out for constructional purposes. The inselberg is unique landscape features in this area of Thailand. Therefore further study of this unique, relatively undamaged inselberg and effective measures to ensure its conservation form an indispensable core for effective future natural resource management. Furthermore, the need of specific conservation policies for inselbergs vegetation should be pointed out at government level.

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APPENDICES

APPENDIX 1. The periods of flowering and fruiting of vascular plants on Khao Reng hill.

Scientific name	Month*											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Angiosperms												
Dicots												
Acanthaceae												
1. *Pseuderanthemum graciliflorum* Ridl.	*	*	*	*	*	*	*					
2. *Thunbergia fragrans* Roxb.	*										*	*
Apocynaceae												
3. *Wrightia pubescens* subsp. *lanitii* (Blanco) Ngan	*		*	*		*			*	*	*	*
Asclepiadaceae												
4. *Dischidia bengalensis* Colebr.	*							*	*			
5. *Hoya micrantha* Hook.f.			*	*		*		*	*			
6. *Secamone elliptica* R. Br.			*					*				
Asteraceae												
7. *Elephantopus scaber* L.												*
Bombacaceae												
8. *Bombax anceps* Pierre		*						*	*			
Clusiaceae												
9. *Mesua kunstleri* (King) Kosterm										*	*	
Euphorbiaceae												
10. *Bridelia tomentosa* Blume	*											*
11. *Cladogynos orientalis* Zipp. ex Span.	*		*	*	*	*	*	*	*	*	*	*
Fabaceae												
12. *Abrus pulchellus* subsp. *cantoniensis* (Hance) Verdc.	*											
13. *Acacia megaladena* var. *indo-chinensis* I.C. Nielsen								*	*			
14. *Indigofera* sp.												*
15. *Tadehagi triquetrum* (L.) H. Ohashi	*											*
Flacourtiaceae												
16. *Homalium dasyanthum* (Turcz.) W. Theob.		*	*	*		*	*	*				
Gesneriaceae												
17. *Paraboea minor* (Barnett) B.L. Burtt	*							*	*	*	*	*
Hydnocarpaceae												
18. *Hydnocarpus ilicifolia* King						*	*	*	*			
Lamiaceae												
19. *Vitex pinnata* L.	*	*	*			*		*	*	*	*	*
Loganiaceae												
20. *Fagraea auriculata* Jack	*			*	*	*	*	*	*	*	*	
Memecylaceae												
21. *Memecylon edule* Roxb.	*	*	*	*	*	*	*	*	*		*	*
22. *Memecylon fruticosum* King	*		*	*	*	*	*	*	*	*	*	*
Moraceae												
23. *Ficus hispida* L.f.	*											
24. *Streblus taxoides* Kurz		*	*			*	*	*	*			*

Month*: From left to right; Jan = January, Feb = February, Mar = March, Apr = April, May = May, Jun = June, Jul = July, Aug = August, Sep = September, Oct = October, Nov = November, Dec = December

APPENDIX 1. Continued.

Scientific name	Month*											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Myrsinaceae												
25. *Ardisia crenata* var. *crenata* Sims	*											
26. *Maesa ramentacea* (Roxb.) A. DC.	*	*										
Ochnaceae												
27. *Ochna integerrima* (Lour.) Merr.		*	*									
Oleaceae												
28. *Chionanthus microstigma* (Gagnep.) P.S. Green								*	*			
29. *Jasminum simplicifolium* subsp. *funale* (Decne.) Kiew	*											
Rafflesiaceae												
30. *Rafflesia kerrii* Meijer								*	*			
Rubiaceae												
31. *Canthium horridum* Blume				*	*	*		*	*	*	*	*
32. *Catunaregam* sp.												*
33. *Gardenia coronaria* Buch.-Ham.	*		*	*	*	*	*	*		*	*	*
34. *Ixora javanica* (Blume) DC.	*										*	*
35. *Oldenlandia pinifolia* (Wall. ex. G. Don) Kuntze	*											
36. *Pavetta indica* L.				*				*	*			
37. *Prismatomeris tetrandra* subsp. *malayana* (Ridl.) J.T. Johanss.	*			*		*	*	*	*			*
38. *Psydrax* sp.				*								*
Sterculiaceae												
39. *Helicteres hirsute* Lour.	*	*	*	*	*	*	*	*	*	*	*	*
40. *Sterculia cordata* Blume		*				*	*	*				
Vitaceae												
41. *Cissus nodosa* Blume	*							*	*			
Monocots												
Araceae												
42. *Epipremnum giganteum* Schott	*											
43. *Scindapsus scortechinii* Hook.f.			*									
Arecaceae												
44. *Livistona speciosa* Kurz										*	*	*
Costaceae												
45. *Cheilocostus speciosus* (J. König) C.D. Specht							*	*	*	*	*	*
Cyperaceae												
46. *Carex* sp.		*								*	*	
47. *Cyperus dubius* Rottb.		*	*					*	*			*
48. *Fimbristylis hookeriana* Boeckeler	*										*	*
49. *Scleria lithosperma* subsp. *linearis* (Benth.) T. Koyama	*									*	*	*
Orchidaceae												
50. *Aerides odorata* Lour.	*				*	*	*	*	*	*	*	*
51. *Cleisostoma subulatum* Blume										*	*	*
52. *Cymbidium finlaysonianum* Lindl.	*	*			*	*	*	*	*	*	*	*

APPENDIX 1. Continued.

Scientific name	Month*											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Orchidaceae												
53. *Dendrobium crumenatum* Sw.				*	*	*	*	*	*	*	*	
54. *Dienia ophrydis* (J. König) Seidenf.						*				*		
55. *Doritis pulcherrima* Lindl.	*	*			*	*	*	*	*	*	*	*
56. *Eria javanica* (Sw.) Blume					*					*	*	*
57. *Flickingeria* sp.								*				
58. *Plocoglottis quadrifolia* J.J. Sm.				*	*	*	*	*				
59. *Rhynchogyna luisifolia* (Ridl.) Seidenf. & Garay								*	*	*	*	*
60. *Tainia penangiana* Hook.f.	*	*										
61. *Vanilla aphylla* Blume						*					*	
Poaceae												
62. *Coelorachis helferi* (Hook.f.) Henrard											*	*
63. *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson	*	*					*	*	*	*	*	*
64. *Cyrtococcum oxyphyllum* Stapf											*	
65. *Cyrtococcum patens* A. Camus											*	
66. *Elymus* sp.											*	
67. *Melinis repens* (Willd.) Zizka	*		*					*	*	*	*	*
68. *Ottochloa nodosa* (Kunth) Dandy			*	*				*	*			
Stemonaceae												
69. *Stemona tuberose* Lour.			*									
Zingiberaceae												
70. *Globba pendula* Roxb.									*	*	*	

APPENDIX 2. List of vascular plants on Khao Reng hill, which occurring in ten geographical distribution types.

Scientific name	Geographical distribution									
	A	B	C	D	E	F	G	H	I	J
Lycophytes										
Sellaginellaceae										
1. *Selaginella willdenowii* (Desv.) Baker					x					
Pterophyte										
Aspleniaceae										
2. *Asplenium pellucidum* Lam.	x									
Davalliaceae										
3. *Davallia solida* (G. Forst.) Sw.					x					
Dennstaedtiaceae										
4. *Microlepia speluncae* (L.) T. Moore		x								
Lygodiaceae										
5. *Lygodium polystachyum* Wall. ex T. Moore					x					
Polypodiaceae										
6. *Drynaria bonii* H.Christ			x							
7. *Drynaria quercifolia* (L.) J. Sm.								x		
8. *Pyrrosia adnascens* (Sw.) Ching		x								
Pteridaceae										
9. *Adiantum caudatum* L.	x									
10. *Cheilanthes tenuifolia* (Burm.f.) Sw.		x								
11. *Parahemionitis cordata* (Hook. & Grev.) Fraser-Jenk.							x			
12. *Pteris dalhousiae* Hook.					x					
Thelypteridaceae										
13. *Thelypteris opulenta* (Kaulf.) Fosberg							x			
Angiosperms										
Dicots										
Acanthaceae										
14. *Pseuderanthemum graciliflorum* Ridl.					x					
15. *Thunbergia fragrans* Roxb.								x		
Apocynaceae										
16. *Wrightia pubescens* subsp. *lanitii* (Blanco) Ngan									x	
Asclepiadaceae										
17. *Dischidia bengalensis* Colebr.							x			
18. *Hoya micrantha* Hook.f.					x					
19. *Secamone elliptica* R. Br.									x	
Asteraceae										
20. *Elephantopus scaber* L.		x								
Bombacaceae										
21. *Bombax anceps* Pierre					x					
Clusiaceae										
22. *Mesua kunstleri* (King) Kosterm				x						
Euphorbiaceae										
23. *Bridelia tomentosa* Blume								x		
24. *Cladogynos orientalis* Zipp. ex Span.					x					

Geographical distribution*: A = Paleotropic, B = Pantropics and subtropics, C = Indo-China, D = Malesia, E = Indo-China and Malesia, F = India and Indo-China, G = India, Indo-China and Malesia, H = India, Indo-China, Malesia and Austrasia, I = Indo-China, Malesia and Australia and J = Known only from this study.

APPENDIX 2. Continued.

Scientific name	Geographical distribution									
	A	B	C	D	E	F	G	H	I	J
Fabaceae										
25. *Abrus pulchellus* subsp. *cantoniensis* (Hance) Verdc.					x					
26. *Acacia megaladena* var. *indo-chinensis* I.C. Nielsen						x				
27. *Indigofera* sp.										x
28. *Tadehagi triquetrum* (L.) H. Ohashi								x		
Flacourtiaceae										
29. *Homalium dasyanthum* (Turcz.) W. Theob.					x					
Gesneriaceae										
30. *Paraboea minor* (Barnett) B.L. Burtt										x
Hydnocarpaceae										
31. *Hydnocarpus ilicifolia* King					x					
Lamiaceae										
32. *Vitex pinnata* L.							x			
Loganiaceae										
33. *Fagraea auriculata* Jack					x					
Memecylaceae										
34. *Memecylon edule* Roxb.					x					
35. *Memecylon fruticosum* King				x						
Moraceae										
36. *Ficus hispida* L.f.								x		
37. *Streblus taxoides* Kurz							x			
Myrsinaceae										
38. *Ardisia crenata* var. *crenata* Sims							x			
39. *Maesa ramentacea* (Roxb.) A. DC.	x									
Ochnaceae										
40. *Ochna integerrima* (Lour.) Merr.							x			
Oleaceae										
41. *Chionanthus microstigma* (Gagnep.) P.S. Green					x					
42. *Jasminum simplicifolium* subsp. *funale* (Decne.) Kiew					x					
Rafflesiaceae										
43. *Rafflesia kerrii* Meijer				x						
Rubiaceae										
44. *Canthium horridum* Blume					x					
45. *Catunaregam* sp.										x
46. *Gardenia coronaria* Buch.-Ham.					x					
47. *Ixora javanica* (Blume) DC.					x					
48. *Oldenlandia pinifolia* (Wall. ex. G. Don) Kuntze		x								
49. *Pavetta indica* L.								x		
50. *Prismatomeris tetrandra* subsp. *malayana* (Ridl.) J.T. Johanss.					x					
51. *Psydrax* sp.										x
Sterculiaceae										
52. *Helicteres hirsuta* Lour.							x			
53. *Sterculia cordata* Blume				x						
Vitaceae										
54. *Cissus nodosa* Blume				x						

APPENDIX 2. Continued.

Scientific name	Geographical distribution									
	A	B	C	D	E	F	G	H	I	J
Monocots										
Araceae										
55. *Epipremnum giganteum* Schott					x					
56. *Scindapsus scortechinii* Hook.f.					x					
Arecaceae										
57. *Livistona speciosa* Kurz					x					
Costaceae										
58. *Cheilocostus speciosus* (J. König) C.D. Specht								x		
Cyperaceae										
59. *Carex* sp.										x
60. *Cyperus dubius* Rottb.		x								
61. *Fimbristylis hookeriana* Boeckeler			x							
62. *Scleria lithosperma* subsp. *linearis* (Benth.) T. Koyama								x		
Orchidaceae										
63. *Aerides odorata* Lour.							x			
64. *Cleisostoma subulatum* Blume					x					
65. *Cymbidium finlaysonianum* Lindl.					x					
66. *Dendrobium crumenatum* Sw.							x			
67. *Dienia ophrydis* (J. König) Seidenf.								x		
68 .*Doritis pulcherrima* Lindl.							x			
69. *Eria javanica* (Sw.) Blume							x			
70. *Flickingeria* sp.										x
71. *Plocoglottis quadrifolia* J.J. Sm.				x						
72. *Rhynchogyna luisifolia* (Ridl.) Seidenf. & Garay					x					
73. *Tainia penangiana* Hook.f.							x			
74. *Vanilla aphylla* Blume					x					
Poaceae										
75. *Coelorachis helferi* (Hook.f.) Henrard					x					
76. *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson							x			
77. *Cyrtococcum oxyphyllum* Stapf								x		
78. *Cyrtococcum patens* A. Camus					x					
79. *Elymus* sp.										x
80. *Melinis repens* (Willd.) Zizka		x								
81. *Ottochloa nodosa* (Kunth) Dandy								x		
Stemonaceae										
82. *Stemona tuberosa* Lour.								x		
Zingiberaceae										
83. *Globba pendula* Roxb.				x						

COLOUR PLATES

Plate 1. A. The small dome-shape Khao Reng granitic inselberg in Songkhla province; B. Khao Reng inselberg vegetation.

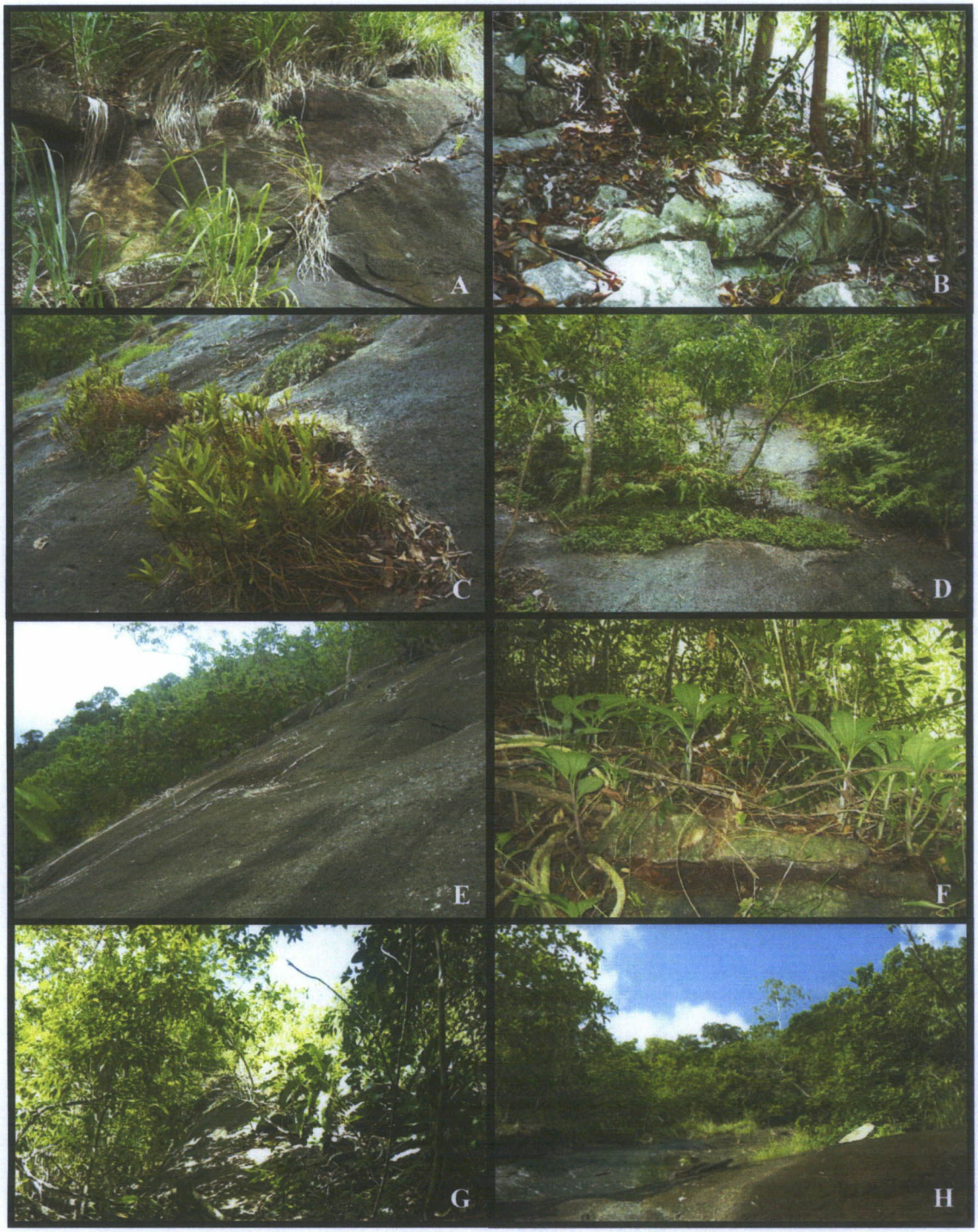

Plate 2. A.–H. Typical microhabitat types on the granitic inselberg of Khao Reng hill: A. Rock crevices and clefts, B. Rock-falls, C. Shallow depressions, D. Deep depressions, E. Exposed rock slopes, F. Shady flat rocky slopes, G.–H. Rock-platform fringes.

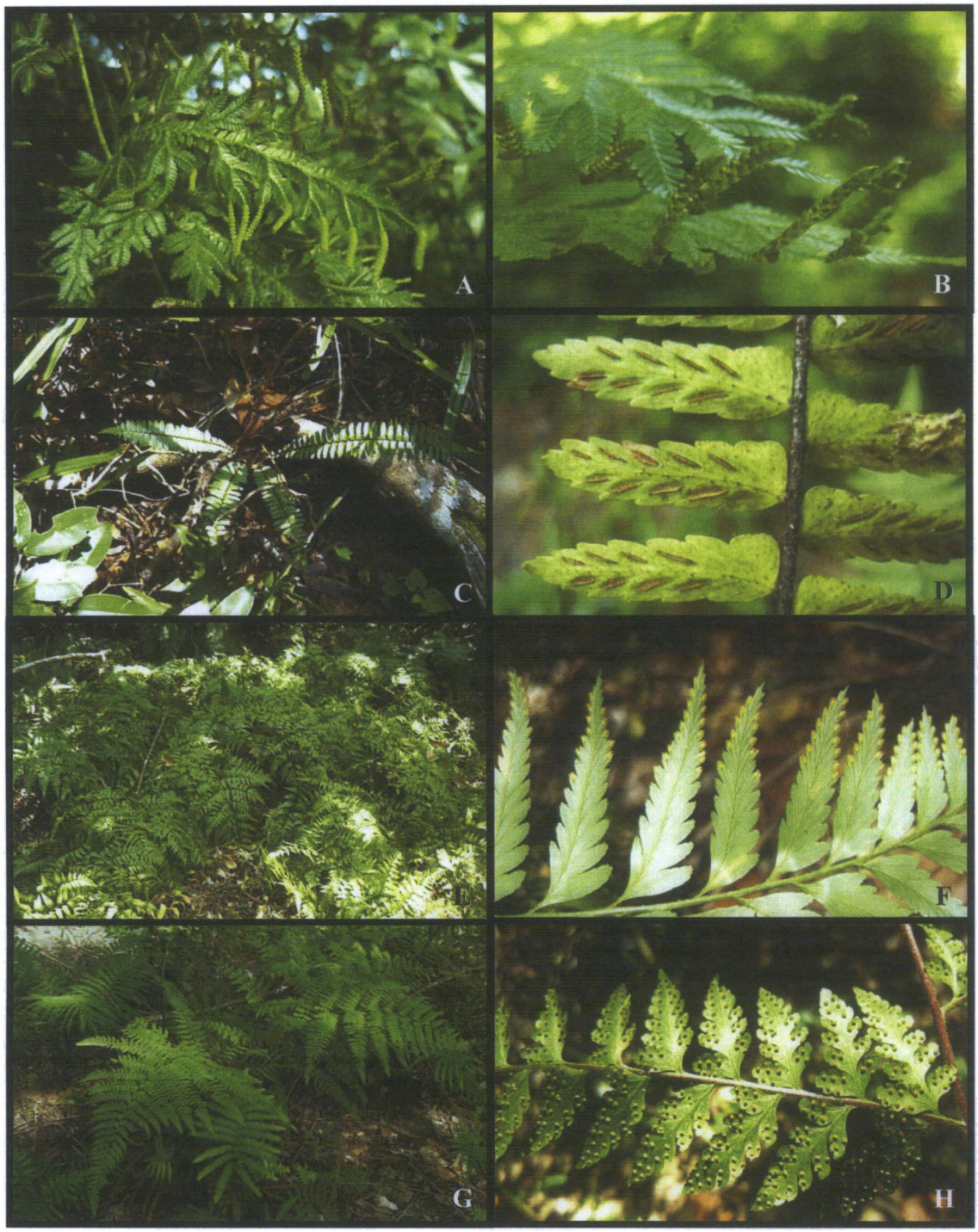

Plate 3. A.–B. *Selaginella willdenowii* (Desv.) Baker: A. Habit, B. Spikes; C.–D. *Asplenium pellucidum* Lam.: C. Habitat and habit, D. Lower surface of fertile pinnae with sori; E.–F. *Davallia solida* (G. Forst.) Sw.: E. Habitat and habit, F. Lower surface of fertile pinnae with sori; G.–H. *Microlepia speluncae* (L.) T. Moore: G. Habitat and habit, H. Lower surface of fertile pinnae with sori.

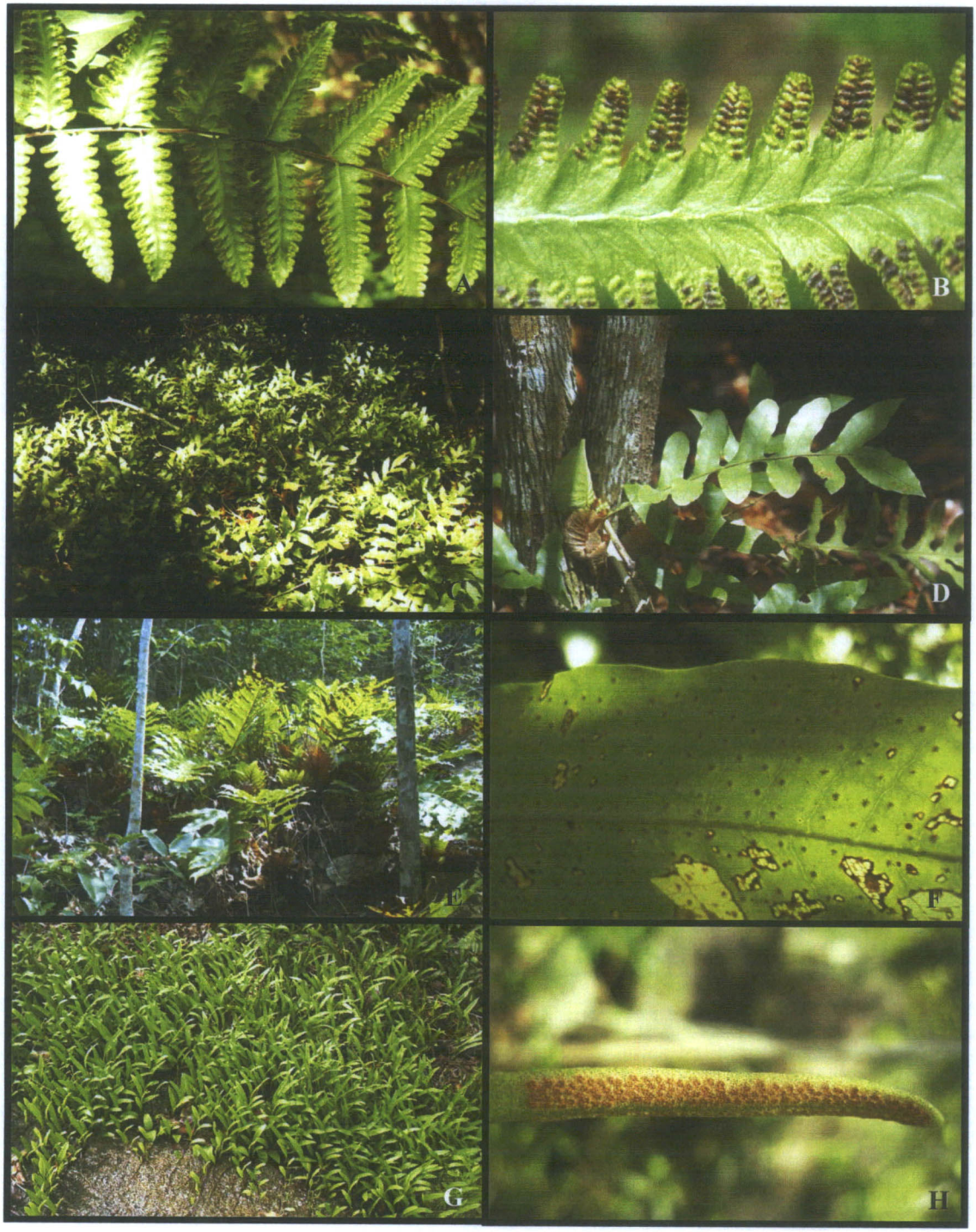

Plate 4. A.–B. *Lygodium polystachyum* Wall. ex T. Moore: A. Frond, B. Sporangia-bearing lobes; C.–D. *Drynaria bonii* H. Christ: C. Habitat, D. Habit; E.–F. *Drynaria quercifolia* (L.) J. Sm.: E. Habitat and habit, F. Lower surface of fertile lobe with sori in a regular row on each side of the main veins; G.–H. *Pyrrosia adnascens* (Sw.) Ching: G. Habitat and habit, H. Lower surface of fertile lamina with sori.

Plate 5. A.–B. *Adiantum caudatum* L.: A. Habitat and habit, B. Lower surface of lamina with sori; C.–D. *Cheilanthes tenuifolia* (Burm.f.) Sw.: C. Habitat, D. Lower surface of fertile pinnae with sori; E. *Parahemionitis cordata* (Hook. & Grev.) Fraser-Jenk.; F–G. *Thelypteris opulenta* (Kaulf.) Fosberg: F. Habitat and habit, G. Lower surface of fertile pinnae with sori.

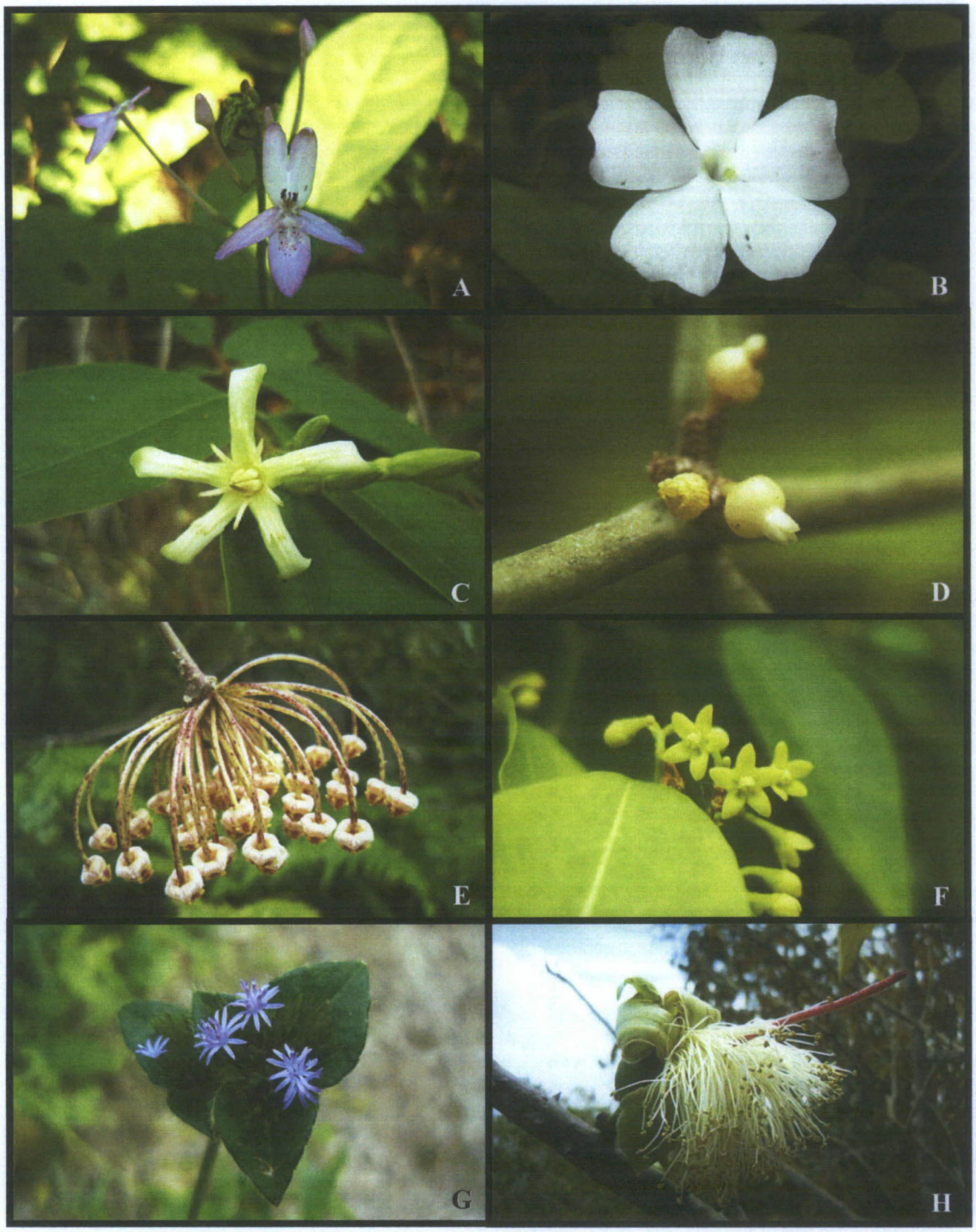

Plate 6. A. *Pseuderanthemum graciliflorum* Ridl.; B. *Thunbergia fragrans* Roxb.; C. *Wrightia pubescens* subsp. *lanitii* (Blanco) Ngan; D. *Dischidia bengalensis* Colebr.; E. *Hoya micrantha* Hook.f.; F. *Secamone elliptica* R. Br.; G. *Elephantopus scaber* L.; H. *Bombax anceps* Pierre

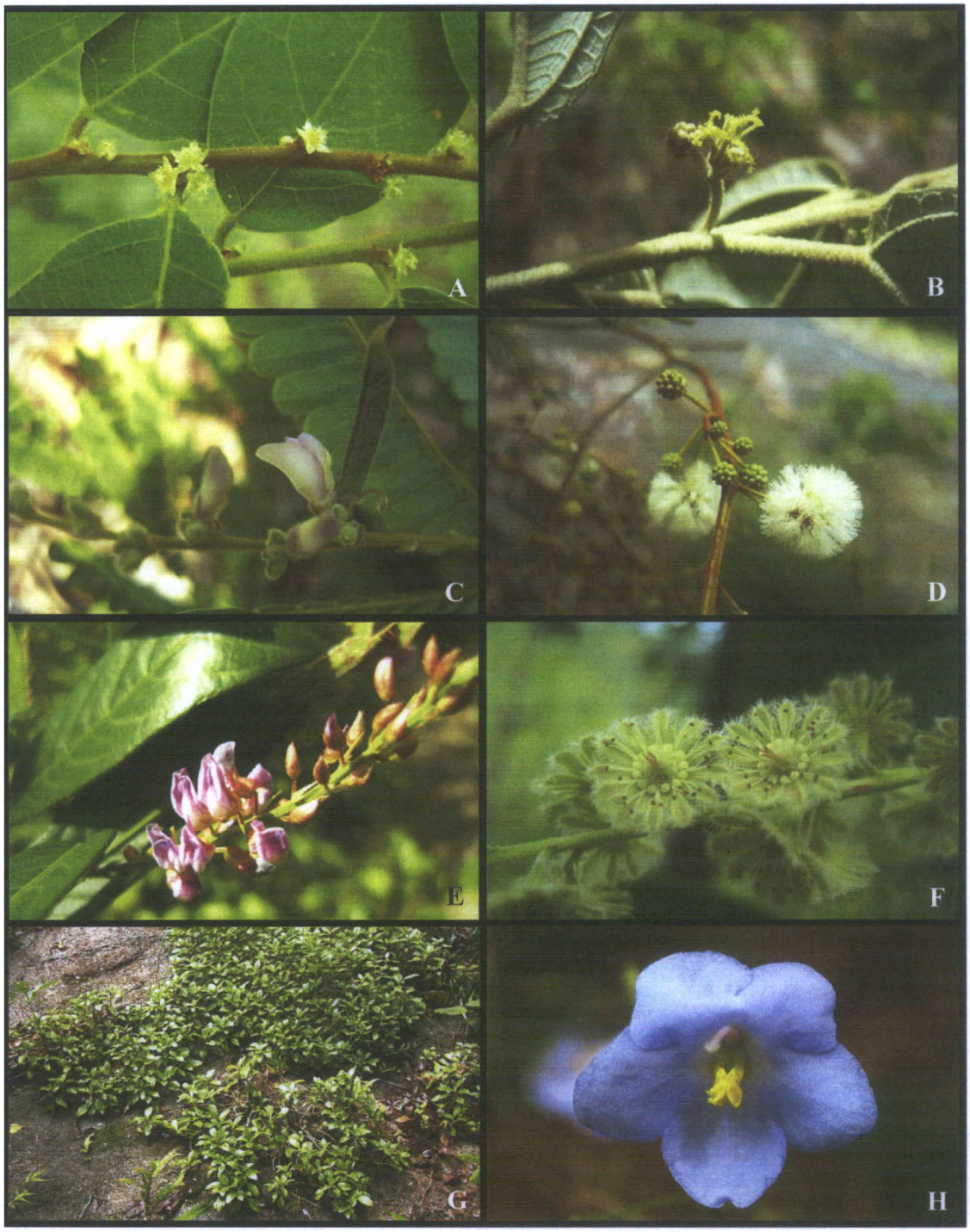

Plate 7. A. *Bridelia tomentosa* Blume; B. *Cladogynos orientalis* Zipp. ex Span., showing pistillate flower (in the front) and staminate flower (behind); C. *Abrus pulchellus* subsp. *cantoniensis* (Hance) Verdc.; D. *Acacia megaladena* var. *indochinensis* I.C. Nielsen; E. *Tadehagi triquetrum* (L.) H. Ohashi; F. *Homalium dasyanthum* (Turcz.) W. Theob.; G.–H. *Paraboea minor* (Barnett) B.L. Burtt: G. Habitat and habit, H. Flower

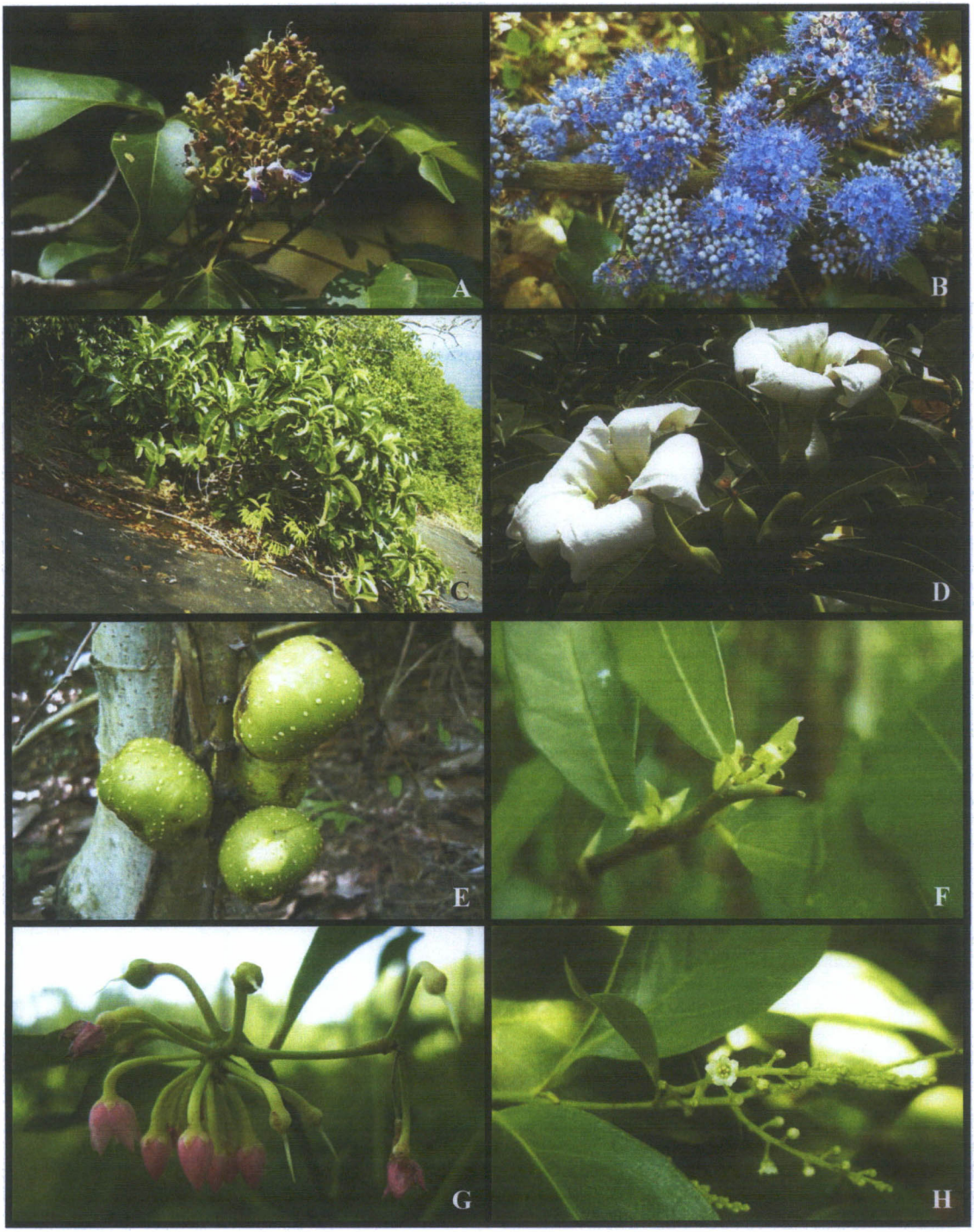

Plate 8. A. *Vitex pinnata* L.; B. *Memecylon edule* Roxb.; C.–D. *Fagraea auriculata* Jack: C. Habitat and habit, D. Flower; E. *Ficus hispida* L.f.; F. *Streblus taxoides* Kurz, showing pistillate flowers; G. *Ardisia crenata* var. *crenata* Sims; H. *Maesa ramentacea* (Roxb.) A. DC.

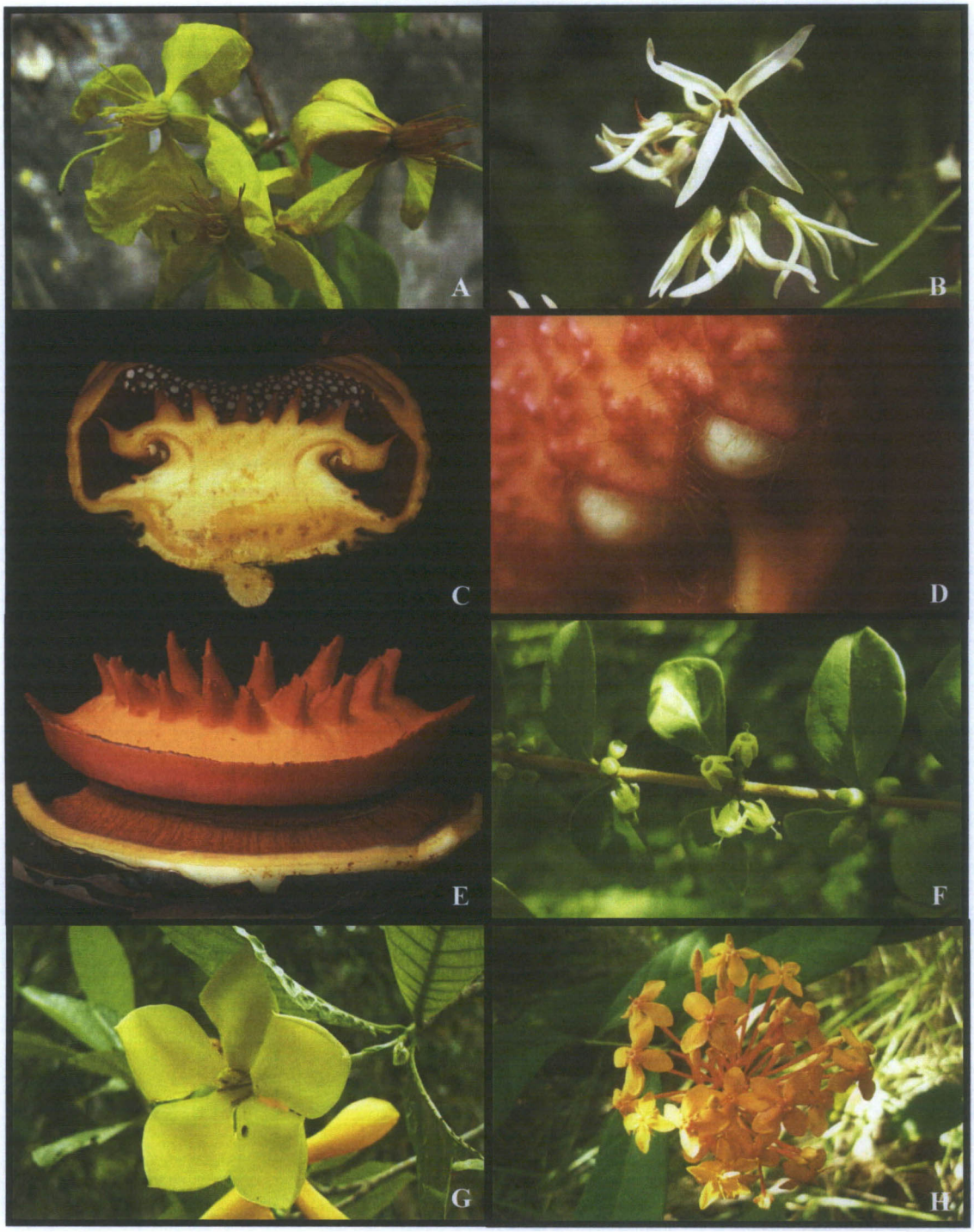

Plate 9. A. *Ochna integerrima* (Lour.) Merr.; B. *Chionanthus microstigma* (Gagnep.) P.S. Green; C.–E. *Rafflesia kerrii* Meijer: C. Transverse section of staminate flowers, D. Anthers in the anther cavities, E. A half of column with the procession apex of disk; F. *Canthium horridum* Blume; G. *Gardenia coronaria* Buch.-Ham.; H. *Ixora javanica* (Blume) DC.

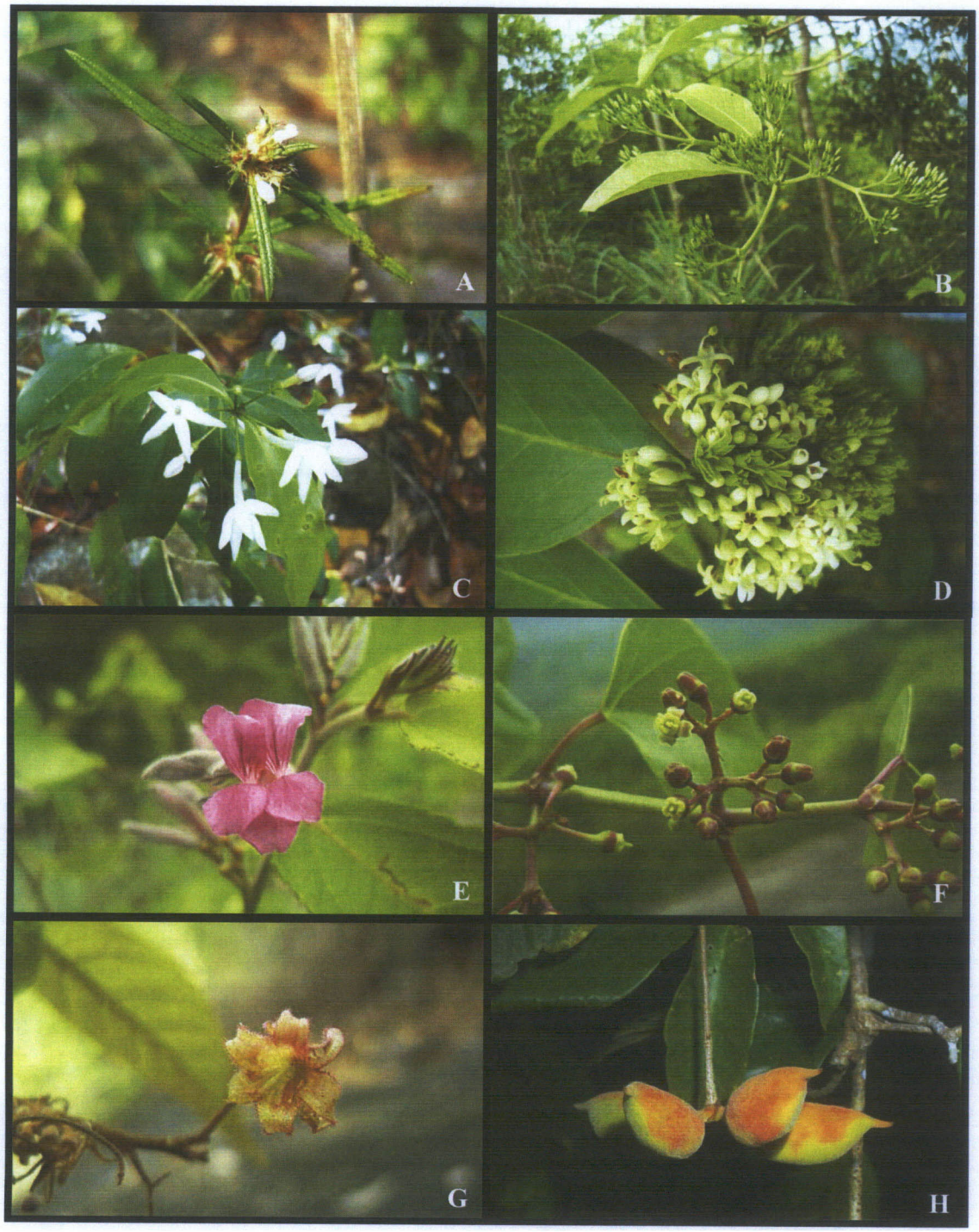

Plate 10. A. *Oldenlandia pinifolia* (Wall. ex. G. Don) Kuntze; B. *Pavetta indica* L.; C. *Prismatomeris tetrandra* subsp. *malayana* (Ridl.) J.T. Johanss.; D. *Psydrax* sp.; E. *Helicteres hirsuta* Lour.; F. *Cissus nodosa* Blume; G.–H. *Sterculia cordata* Blume: G. Staminate flower, H. Fruits.

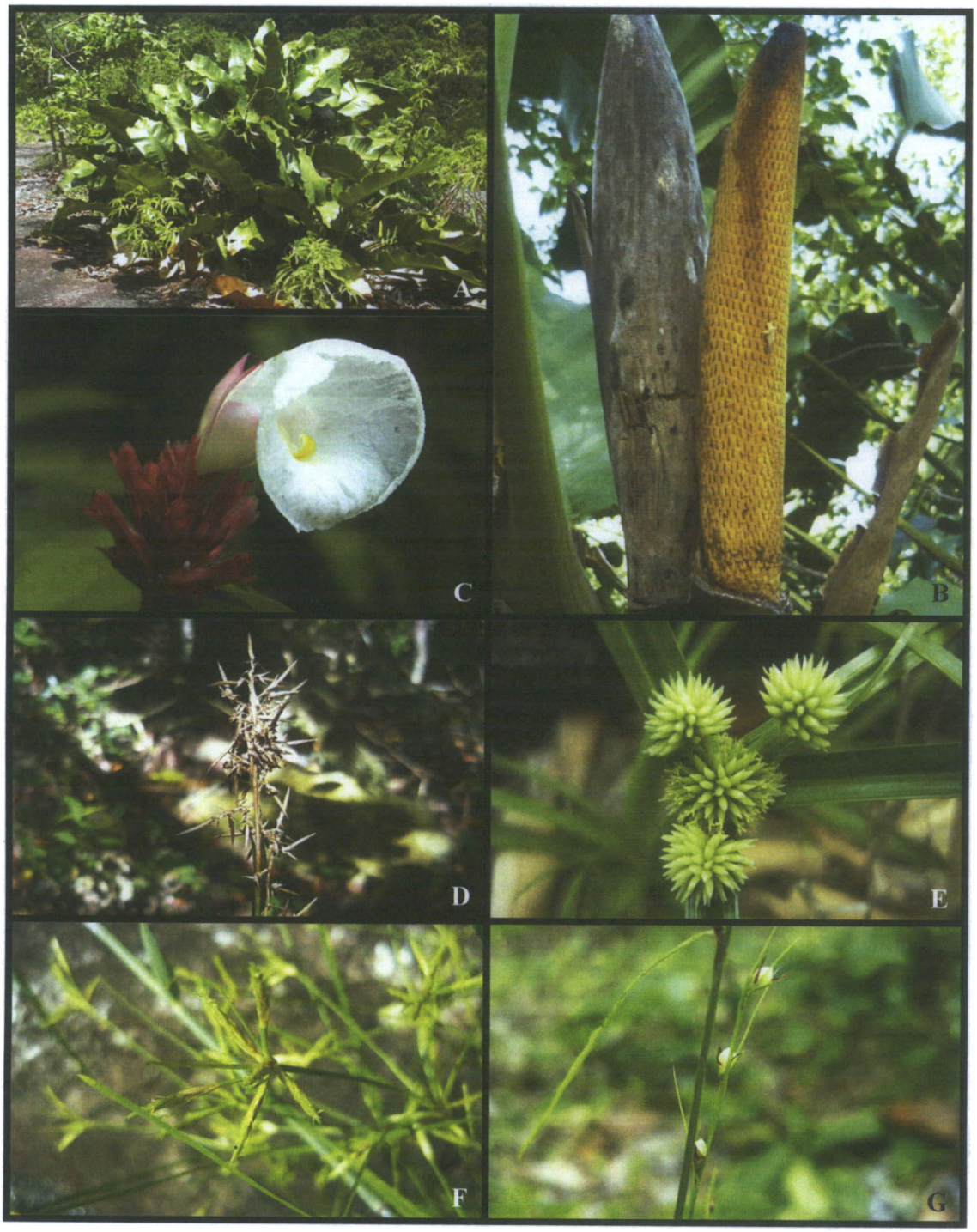

Plate 11. A.–B. *Epipremnum giganteum* Schott: A. Habitat and habit, B. Flower; C. *Cheilocostus speciosus* (J. König) C.D. Specht; D. *Carex* sp.; E. *Cyperus dubius* Rottb.; F. *Fimbristylis hookeriana* Boeckeler; G. *Scleria lithosperma* subsp. *linearis* (Benth.) T. Koyama.

Plate 12. A.–B. *Aerides odorata* Lour.: A. Habit, B. Flowers; C.–D. *Cleisostoma subulatum* Blume: C. Habitat and habit, D. Flowers; E.–F. *Cymbidium finlaysonianum* Lindl.: E. Habitat and habit, F. Flower; G.–H. *Dendrobium crumenatum* Sw.: G. Habitat and habit, H. Flower

Plate 13. A.–B. *Dienia ophrydis* (J. König) Seidenf.: A. Habitat, B. Inflorescence and flowers; C.–D. *Doritis pulcherrima* Lindl.: C. Habitat and habit, D. Flower.; E.–F. *Eria javanica* (Sw.) Blume: E. Habitat and habit, F. Flowers; G.–H. *Flickingeria* sp.: G. Habitat and habit, H. Fruit.

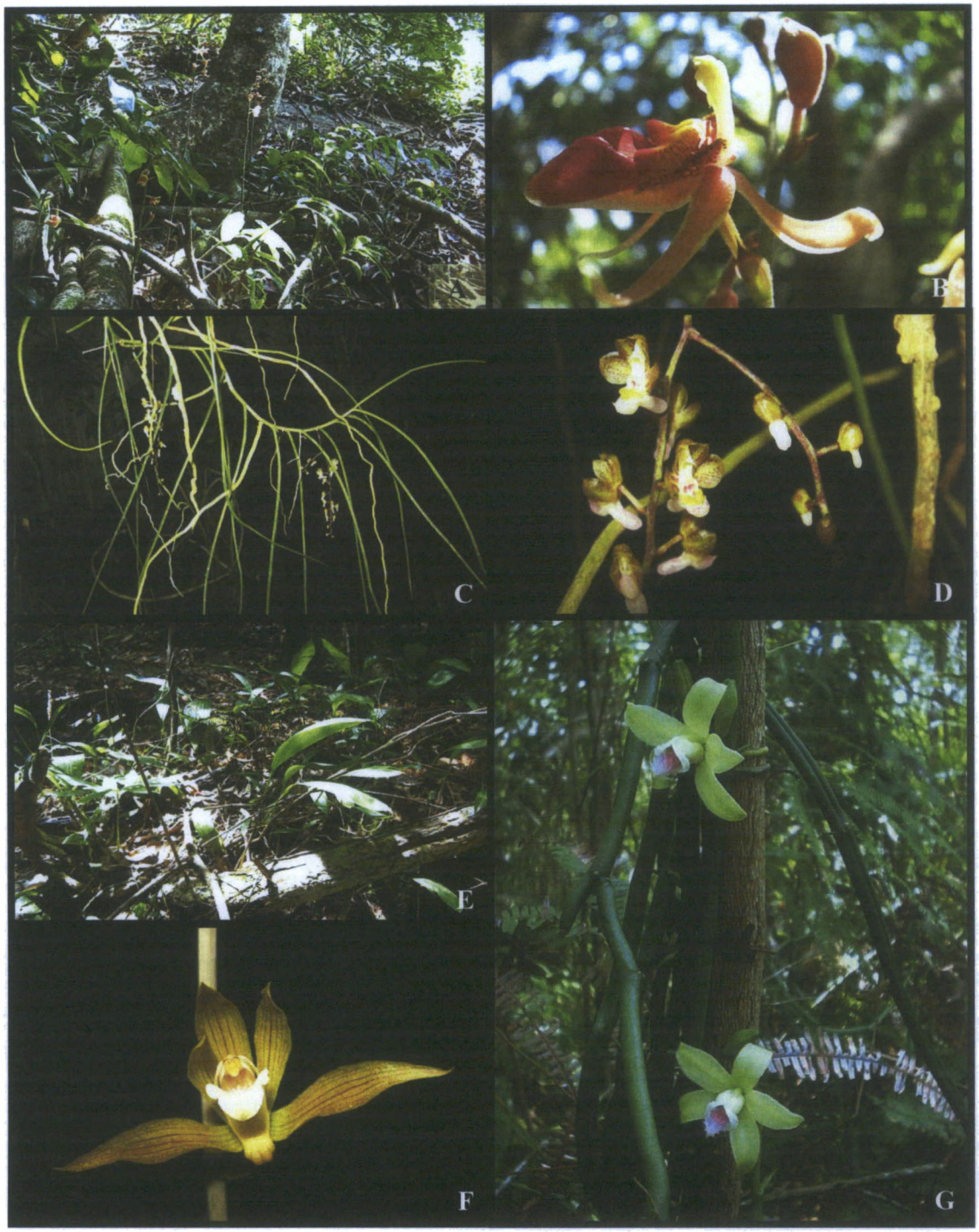

Plate 14. A.–B. *Plocoglottis quadrifolia* J.J. Sm.: A. Habitat and habit, B. Flower; C.–D. *Rhynchogyna luisifolia* (Ridl.) Seidenf. & Garay: C. Habit, D. Inflorescence and flowers; E.–F. *Tainia penangiana* Hook.f.: E. Habitat and habit, F. Flower; G. *Vanilla aphylla* Blume

Plate 15. A. *Coelorachis helferi* (Hook.f.) Henrard; B. *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson; C. *Cyrtococcum oxyphyllum* Stapf; D. *Cyrtococcum patens* A. Camus; E. *Melinis repens* (Willd.) Zizka; F. *Ottochloa nodosa* (Kunth) Dandy.; G. *Stemona tuberosa* Lour.; H. *Globba pendula* Roxb.

SCIENTIFIC NAME INDEX

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- The TRF/BIOTEC Special Program for Biodiversity Research and Training grant BRT T152101 (BRT)
- Centre for Biodiversity of Peninsular Thailand (CBIPT)

List of Publication and Proceedings

- Inuthai, J. and Sridith, K. 2010. The vegetation structure on the granitic inselberg in Songkhla province, Peninsular Thailand. *Thai Forest Bulletin (Botany)* 38: 74-89.