

MELIACEAE

CHAMLONG PHENGLAI*, THAWATCHAI WONGPRASERT*,
THEERAWAT BOONTHAVIKOON* & CAROLINE M. PANNELL**

Trees, shrubs or suckering shrublets; stem often with buttresses, white latex sometimes present; hairs simple, or stellate, rarely 2-armed (hair appressed to plant surface and fixed in the middle or near one end, leaving both ends of hair free) or basally bifid, sometimes with scales, stellate or peltate, or mixtures of these, sometimes with dendritic hairs, rarely with small glands; monopodial or sympodial; dioecious, polygamous, monoecious or with all flowers bisexual; bud naked or scales sometimes present; exstipulate. *Leaves* spirally arranged, often clustered near branch tips, rarely decussate (*Dysoxylum acutangulum*), usually once pinnate, rarely 2 or 3-pinnate (*Melia*), sometimes with a terminal bud or young shoot with curled new leaflets at leaf apex between the most distal pair of leaflets ‘pseudogemmula’ (*Chisocheton* only), rarely unifoliolate or simple; leaflets usually entire, rarely lobed or serrate, leaflet below sometimes papillate, giving it a glaucous appearance (*Walsura*, *Heynea*). *Inflorescence* a raceme, panicle or thyrse, often with several orders of branching, usually borne towards ends of twigs, terminal in *Toona calcicola*, sometimes cauliflorous or ramiflorous (*Epicharis*, *Lansium domesticum* and *Goniocheton lenticellatum*), sometimes branches concentrated near distal end of inflorescence (*Heynea* and *Walsura*), or flowers clustered at end of a long axis, giving the appearance of a rope terminating in one or more clusters of flowers (a few species of *Chisocheton*, sometimes in *Aphanamixis*). *Flowers* bisexual or unisexual with well-developed rudiments of opposite sex. *Calyx* (2–)3–5(–7), usually more or less lobed, sometimes truncate or barely lobed (*Chisocheton*) or closed in bud, splitting open at anthesis, falling to leave a circumscissile scar in fruit (*Epicharis*). *Petals* 3–6 in 1 (or 2) whorls, sometimes adhering to lower ½ of staminal tube. *Stamens* free or more usually united forming a tube with or without lobes. *Anthers* 3–10(–16) in 1(or 2) whorls, inserted at tips of filaments, on margin of tube or within tube. *Disk* tubular and extending beyond ovary, annular or cushion-like around ovary base, or absent. *Ovary* superior, densely hairy or scaly or glabrous outside, (1)2–5(–10)-locular, each with 1–many ovules, placentation usually axile. *Fruit* a loculicidal or septifragal capsule, a berry or drupe. *Seed* either winged and attached to a large woody columella (*Chukrasia*, *Khaya*, *Swietenia*, *Toona*), or unwinged and then usually with a fleshy aril or sarcotesta, rarely with a woody outer layer (*Xylocarpus*). Ripe dehiscent capsules of *Aglaiia* sections *Amoora* and *Neoaglaiia*, *Aphanamixis*, *Chisocheton*, *Didymocheton*, *Dysoxylum*, *Epicharis*, *Goniocheton*, and *Prasoxylon* bright orange, red or pink; dehiscent fruits usually exhibit contrasting colours between outer and inner pericarp and seed, with its brightly coloured red or orange or rarely white aril or sarcotesta.

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The family comprises 58 genera with about 740 species, widely distributed, mainly in the tropics and subtropics. There are 24 genera and 95 species in Thailand. Two varieties are recognized in *Azadirachta indica*. One variety is known only from cultivation. Three species of *Chisocheton* represented by only one of 2 or more subspecies.

CLASSIFICATION

Two subfamilies are recognized: Cedreloideae [comprising in Thailand *Chukrasia*, *Toona*, *Xylocarpus* and the introduced and widely cultivated *Khaya* and *Swietenia*] with the buds surrounded by a cluster of small scales, fruits woody septifragal capsules with a central columella and seeds dry, winged or corky, and Melioideae [comprising in Thailand *Aglaiia*, *Aphanamixis*, *Azadirachta*, *Chisocheton*, *Cipadessa*, *Didymocheton*, *Dysoxylum*, *Epicharis*, *Goniocheton*, *Heynea*, *Lansium*, *Melia*, *Munronia*, *Prasoxylon*, *Pseudoclausena*, *Reinwardtiidendron*, *Sandoricum* and *Walsura*] with bud scales absent, fruits capsules, berries or drupes and seeds neither corky nor winged, often with a fleshy seed coat.

RECENT CHANGES IN GENERA AND SPECIES DELIMITATIONS

Most of the generic and species delimitations are unchanged since Mabberley & Pannell, *Meliaceae* in *Flora Peninsular Malaysia* series 2, vol. 4 (2013). Molecular analysis has, since then, however, resulted in the splitting of:

Dysoxylum into six genera of which five occur in Thailand (*Didymocheton*, *Dysoxylum*, *Epicharis*, *Goniocheton*, *Prasoxylon*) (Holzmeyer et al. 2021, *Taxon* 70: 1248–1272) and

Aglaiia elaeagnoidea into three separate species, of which only *Aglaiia wallichii* occurs in Thailand (Joyce et al. 2023, *Blumea* 68: 26–38). All specimens formerly assigned to *A. elaeagnoidea* in Thailand are therefore now referred to *A. wallichii*. The western limit of *Aglaiia elaeagnoidea* s.s. is in Borneo.

PHYTOCHEMISTRY

The *Meliaceae* is characterised by the presence of secondary compounds, the best know of which is neem from *Azadirachta indica*. A class of bioactive chemicals known as flavaglins are unique to *Aglaiia*, while some species of *Dysoxylum* and *Prasoxylon* contain poisons and other bioactive compounds. Extracts from these genera are being explored for their anti-leukaemic and other medicinal and pesticide properties.

SPOT CHARACTERS FOR GENERA

Unbranched or sparsely branched pachycaul treelets: *Aglaiia* (in part), *Aphanamixis* (in part), *Chisocheton* (in part)

Shrublets: *Munronia*, *Turraea*

Halophytes: *Aglaiia cucullata*, *Xylocarpus*

Peat swamp forest: *Aglaiia rubiginosa*, *Chisocheton amabilis*

Bark with white latex: *Aglaiia* (in part), *Chisocheton* (in part)

Slash strongly garlic-scented, like that of kulim, *Scorodocarpus borneensis* (Baill.) Becc.: *Didymocheton mollissimus*, *Prasoxylon alliaceum* and the seeds and shoot-tips of *Azadirachta excelsa*

Indumentum of or with stellate hairs: *Aglaiia* (in part), *Melia*, *Munronia*

Indumentum of stellate or peltate scales: *Aglaiia* (in part)

- Indumentum of simple hairs interspersed with medifixed hairs: *Goniocheton*, *Munronia*, *Prasoxylon* and *Walsura* (in part)
- Base of petioles with paired orbicular glands (*Azadirachta*, *Melia*) [field character]
- Base of petioles with a pair of linear glands below paired orbicular glands (*Azadirachta*) [field character]
- Leaves opposite: *Dysoxylum acutangulum*
- Leaves simple or unifoliolate: *Aglaiia meliosmoides*, *Aglaiia simplicifolia*, *Munronia humilis*, *Turraea pubescens*
- Leaves trifoliolate: *Aglaiia* (in part), *Reinwardtiidendron*, *Munronia pinnata*, *Sandoricum*
- Leaves imparipinnate: *Aglaiia* (most species), *Aphanamixis*, *Azadirachta*, *Chisocheton* (in part), *Cipadessa*, *Didymocheton*, *Dysoxylum* (in part), *Epicharis*, *Goniocheton* (in part), *Heynea*, *Munronia pinnata*, *Pseudoclausena*, *Walsura*
- Leaves paripinnate (sometimes a lateral leaflet pseudoterminal): *Azadirachta*, *Cedrela*, *Chisocheton* (in part), *Chukrasia*, *Dysoxylum* (in part), *Goniocheton* (in part), *Khaya*, *Prasoxylon*, *Reinwardtiidendron*, *Swietenia*, *Toona*, *Xylocarpus*
- Leaves bipinnate: *Melia*
- Leaves with terminal bud (= pseudogemma): *Chisocheton* (in part)
- Terminal leaflet often smaller than lateral leaflets and with a basal pouch: *Aglaiia cucullata*
- Leaflet margin serrate: *Azadirachta indica*, *Melia azedarach* (sometimes), *Munronia*, *Toona sinensis*, *Turraea*
- Inflorescences on bole: *Epicharis* (in part), *Lansium*
- Inflorescences on branches: *Dysoxylum cyrtobotryum* (in part), *Epicharis* (in part), *Goniocheton* (in part), *Lansium* (in part)
- Female inflorescences resembling a long rope, terminating in one or more clusters of flowers: *Aphanamixis*, *Chisocheton* (in part)
- Flowers subglobose and a distinct yellow: *Aglaiia* (most species), *Aphanamixis*, *Reinwardtiidendron*
- Calyx deeply lobed: *Aphanamixis*, *Didymocheton*, *Lansium*, *Reinwardtiidendron*
- Calyx undivided in bud, abscising in fruit, leaving a circumscissile scar: *Epicharis*
- Petals 3: *Aglaiia* (in part), *Aphanamixis*
- Petals reflexed at anthesis: *Azadirachta*, *Chisocheton*, *Didymocheton*, *Dysoxylum*, *Epicharis*, *Goniocheton*, *Melia*, *Prasoxylon* and *Sandoricum*
- Filaments free: *Toona*, *Walsura robusta*
- Stamens and staminodes arising from an androgynophore: *Toona*
- Staminal tube short, filaments flattened, apex forked with anther inserted at base of fork: *Heynea*, *Pseudoclausena*, *Walsura*
- Stamens free or almost so: *Cipadessa*, *Toona*
- Staminal tube subglobose: *Aglaiia*, *Aphanamixis*, *Lansium*, *Reinwardtiidendron*
- Staminal tube cylindrical or urceolate: *Azadirachta*, *Chisocheton* (in part), *Chukrasia*, *Didymocheton*, *Dysoxylum*, *Epicharis*, *Goniocheton*, *Melia*, *Prasoxylon*, *Sandoricum* and *Xylocarpus*
- Staminal tube long and narrow: *Chisocheton* (in part), *Munronia*, *Turraea*
- Apex of staminal tube undulate or lobed with lanceolate truncate or bilobed lobes. The lobes often reflexed at anthesis to expose the anthers: *Azadirachta*, *Chisocheton*, *Didymocheton*, *Dysoxylum*, *Epicharis*, *Goniocheton*, *Melia*, *Munronia*, *Prasoxylon* and *Turraea*
- Anthers in 2 or more whorls: *Reinwardtiidendron*, *Walsura* (in part)
- Anthers more or less equal in number to the petals: *Aglaiia* (in part), *Aphanamixis sumatrana*, *Chisocheton* (in part)

- Anthers double or more the number of petals: all other genera and *Aglaia* section *Amoora*, *Aphanamixis polystachya*
- Anthers hairy: *Aglaia* (in part), *Chisocheton amabilis*, *C. cumingianus*, *C. dysoxylifolius* and *Reinwardtiidendron*
- Anthers locellate (divided transversely into individual compartments): *Chisocheton*
- Disk tubular: *Chisocheton* (in part), *Didymocheton*, *Dysoxylum*, *Epicharis*, *Goniocheton*, *Munronia*, *Prasoxylum*, *Sandoricum*
- Disk annular or cushion-like, often obscure: *Azadirachta*, *Chisocheton* (in part), *Heynea*, *Melia*, *Swietenia*, *Walsura*
- Disk absent: *Aglaia*, *Aphanamixis*, *Chisocheton* (in part), *Lansium*, *Pseudoclausena*, *Reinwardtiidendron*, *Toona*
- Style-head expanded to form a ‘receptaculum pollinis’: *Turraea*
- Fruit a septicidally dehiscent capsule: *Chukrasia*, *Khaya*, *Swietenia*, *Toona*
- Fruit a loculicidally dehiscent capsule: *Aglaia* (sect. *Amoora*, sect. *Neoaglaia*), *Aphanamixis*, *Chisocheton*, *Didymocheton*, *Dysoxylum*, *Epicharis*, *Goniocheton*, *Heynea*, *Munronia*, *Prasoxylum*
- Fruit a berry: *Aglaia* (sect. *Aglaia*), *Lansium*, *Pseudoclausena*, *Reinwardtiidendron*, *Walsura*
- Fruit a drupe: *Azadirachta*, *Cipadessa*, *Melia*, *Sandoricum*
- Seeds with an aril or sarcotesta: *Aglaia*, *Aphanamixis*, *Chisocheton*, *Didymocheton*, *Dysoxylum*, *Epicharis*, *Goniocheton*, *Heynea*, *Lansium*, *Munronia*, *Prasoxylum*, *Pseudoclausena*, *Reinwardtiidendron*, *Walsura*
- Seeds one or two per locule: subfamily Melioideae
- Seeds winged, numerous *Chukrasia*, *Khaya*, *Swietenia*, *Toona*
- Seeds corky: *Xylocarpus*

KEY TO THE GENERA

1. Leaves 2-pinnate **14. Melia**
1. Leaves simple or 1-pinnate
2. Leaves simple (unifoliolate).
3. Small tree or suckering shrublet. Flowers white, large (up to 2 cm long) with a long narrow staminal tube. Anthers 10, connective forming an apical filiform appendage. Fruit a 5-locular capsule
4. Indumentum a mixture of simple, 2-armed and/or stellate hairs. Stigma protruding just beyond anthers **15. Munronia humilis**
4. Indumentum of simple hairs. Stigma protruding far beyond anthers **22. Turraea**
3. Treelet. Flowers yellow, subglobose to 2 mm long. Anthers 5, connective without apical appendage. Fruit 1–3-locular indehiscent berry **1. Aglaia** (in part)
2. Leaves trifoliolate to pinnate
5. Leaves all trifoliolate
6. Indumentum of simple hairs **19. Sandoricum**
6. Indumentum of stellate and/or stellate or peltate scales **1. Aglaia** (in part)
5. Leaves imparipinnate or paripinnate
7. Leaves with pseudogemmula **4. Chisocheton** (in part)
7. Leaves without pseudogemmula
8. Leaves/leaflets with peltate or stellate scales and/or stellate hairs (sometimes very sparse) or mixture of simple, 2-armed and stellate hairs
9. Shrublet. Flowers white, large (up to 2 cm long) with a long narrow staminal tube. Fruit a 5-locular capsule **15. Munronia pinnata**
9. Small to large tree. Flower very small (up to 4 mm in diam.), subglobose, yellow. Fruit a berry or 3(or 4)-locular capsule **1. Aglaia** (in part)
8. Leaves/leaflets glabrous or with simple hairs or 2-armed hairs only
10. Bud scales present
11. Leaves with (1–)2–4(–5) leaflets on each side of rachis. Fruits spherical, indehiscent. Seeds corky without wings; in coastal habitats **24. Xylocarpus**

11. Leaves with 4–15 leaflets on each side of rachis. Fruits subglobose, ovoid or obovoid, dehiscent. Seeds winged; in evergreen forest or cultivated
12. Stamens free, inserted on an androgynophore **21. Toona**
12. Stamens fully or partially connate into a staminal tube
13. Flowers 12–16 mm long. Staminal tube entire to crenulate **5. Chukrasia**
13. Flowers smaller, 8–10 mm long. Staminal tube with 8–10 truncate lobes
14. Fruit ovoid, dehiscent from base or base and apex simultaneously **20. Swietenia**
14. Fruit subglobose, dehiscent from apex only **12. Khaya**
10. Bud scales absent
15. Leaves paripinnate
16. Stigma with conspicuous lobes. Fruit a drupe **3. Azadirachta**
16. Stigma unlobed. Fruit a capsule or berry
17. Disk present. Fruit a capsule
18. Inflorescences spicate or racemose
19. Inflorescences borne on branches or trunk (ramiflorous or cauliflorous). Calyx closed, later splitting into irregular lobes and basally circumscissile **9. Epicharis**
19. Inflorescences axillary, supra-axillary or in axils of fallen leaves. Calyx cup-shaped and lobed **8. Dysoxylum**
18. Inflorescences more than one order of branching, usually a thyrs
20. Leaflets 7–10 on each side of rachis, numerous simple hairs below. Petals adnate to staminal tube **7. Didymocheton**
20. Leaflets up to 6 (rarely 8) on each side of rachis, a few simple hairs, sometimes with 2-armed hairs interspersed, or glabrous below. Petals free from staminal tube **16. Prasoxyton**
17. Disk absent. Fruit a berry
21. Anthers in 1 whorl of 10. Fruit on branches and trunk **13. Lansium**
21. Anthers in 2 whorls of 5. Fruit in axillary infructescences **18. Reinwardtiidendron**
15. Leaves imparipinnate (sometimes terminal leaflet represented by a scar)
22. Leaf rachis swollen at insertion of leaflets, papillae below, giving it a glaucous appearance when dry **23. Walsura**
22. Leaf rachis not swollen at insertion of leaflets, with or without papillae below
23. Petals 3. Disk absent **2. Aphanamixis (in part)**
23. Petals 4 or more. Disk present or absent
24. Staminal tube deeply lobed or absent
25. Leaf rachis contracted at point of insertion of petiolules when dry, leaflets papillose below, making it glaucous when dry. Fruit a 1-seeded capsule, 1.5 by 1.2 cm **11. Heynea**
25. Leaf rachis not contracted at point of insertion of petiolules when dry, leaflets not papillose below. Fruit not a 1-seeded capsule, 1.5 by 1.2 cm
26. Basal 1/3 of filaments forming a staminal tube. Fruit a berry **17. Pseudoclausena**
26. Stamens either free or joined only at base. Fruit a 5- or 6-pyrened drupe, 3–5 mm diam. **6. Cipadessa**
24. Staminal tube not deeply lobed
27. Disk absent, Fruit a capsule **2. Aphanamixis (in part)**
27. Disk present. Fruit a capsule or drupe
28. Stigma with conspicuous lobes, Fruit a 1- or 2-seeded drupe **3. Azadirachta**
28. Stigma without lobes. Fruit 1–5-seeded capsule
29. Female inflorescences giving the appearance of a rope terminating in one or more clusters of flowers. Fruits 2–4-locular **4. Chisocheton (in part: *C. penduliflorus*, *C. tomentosus*)**
29. Female inflorescences not giving the appearance of a rope terminating in one or more clusters of flowers. Fruits usually 5-locular **10. Goniocetum**

1. AGLAIA

Lour., Fl. Cochinch. 1: 173. 1790, *nom. conserv.*; Pannell, Kew Bull., Add. Ser. 16: 1–379. 1992; Fl. Males., ser. I, 12 (1): 194–314. 1995; Gardner et al., Forest Trees N. Thailand 119–120, 403–404. 2000; Hua Peng & Pannell, Fl. China 11: 121. 2008; Mabb. in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 209 f. 39. 2011; T. Wongprasert et al., Thai Forest Bull., Bot. 39: 211. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 54. 2013; Gardner et al., Forest Trees S. Thailand 2: 1223–1247, 1450–1457. 2016.

Trees or shrubs, dioecious; bud scales absent; stem often with buttresses; bark smooth, or somewhat rough, usually with rows of lenticels, sometimes flaking in large scales, white latex often present. *Leaves* spiral, usually imparipinnate, rarely simple (*Aglaia meliosmoides*, *A. simplicifolia*); leaflets alternate or subopposite, base usually asymmetrical, margin always entire, sometimes undulate or recurved, stellate hairs, or stellate or peltate scales, rarely completely glabrous. *Inflorescence* axillary or supra-axillary, often on apical shoot, rarely (not in Thailand) ramiflorous or cauliflorous; male a much-branched panicle; female a smaller, unbranched raceme or few to many branches. *Flowers* very small, usually citronella-scented, unisexual with well-developed rudiments of opposite sex; bracts and bracteoles usually small, inconspicuous rarely linear and extending beyond flowers (*A. bracteolata* and *A. rufibarbis*); male flowers terminal on short branchlets of rachis, solitary on short pedicels or in sessile clusters, 1–5(–9) by 1–3.5(–5) mm; female along rachis or branches, on short pedicels, sessile or subsessile, often larger than male. *Calyx* $\frac{1}{4}$ – $\frac{1}{2}$ the length of petals, cup-shaped, shallowly to deeply 3–5(6) lobed, imbricate, lobes unequal. *Petals* 3–5(6), free or united at base, imbricate or quincuncial, subrotund or obovate, free from staminal tube or united at base only, unequal, concave, often hooded at apex, spreading slightly at anthesis to reveal aperture of staminal tube and often apices of anthers. *Staminal tube* cup-shaped, subglobose or obovoid, apex incurved or not, without appendages, margin entire, crenate or shallowly lobed. *Anthers* (3–)5–9(–12), in a single whorl, without appendages, dehiscing by two longitudinal slits, inserted on inner surface of tube, below margin or on margin of staminal tube, sterile anthers in female flowers similar to male but without pollen. *Disk* absent. *Ovary* superior, 1–3(–4)-locular, each locule with 1–2 ovules, placentation axile, style absent, stigma sessile on ovary, small, ovoid, more or less cylindrical or depressed-globose, entire at apex or with 2–3(–4) small lobes, always either included within staminal tube or with apex level with aperture, never protruding. *Infructescences* borne either singly or often several on a shoot, each with few to many fruits. *Fruits* either indehiscent or a dehiscent loculicidal capsule, locules 1–3 (exceptionally 4), each with one seed or rarely two; calyx always persistent and somewhat accrescent at base of fruit. *Seed* usually with aril or sarcotesta nearly or completely enclosing seed; endosperm absent.

130 species from India and Sri Lanka to Samoa and from S. China to Australia (Western Australia, Northern Territory and Queensland). 40 species in Thailand, 1 species, *A. bracteolata*, is endemic.

The hairs and scales and their distribution on the lower leaflet surface, combined with characters of the leaves and leaflets, means that even sterile material of *Aglaia* in Thailand can be identified to species. Simple hairs occur only very rarely inside the flowers of *Aglaia*, never on any exposed part of the plant (microscope).

TAXONOMY

Three sections, sect. *Aglaia*, sect. *Amoora* and sect. *Neoaglaia* are recognised, and can be distinguished as follows:

Sect. *Aglaia*: Flowers: calyx with 5 (or rarely 6) obtuse or acute lobes; petals 5 (or rarely 6), aestivation quincuncial or imbricate (when petals 6); anthers (3–)5. *Fruits* indehiscent, sometimes with one or more longitudinal ridges along which the pericarp splits open under pressure. *Seeds* with translucent, yellow, orange or white aril, flesh gelatinous. 33 species in Thailand: 1. *A. argentea*, 2. *A. bracteolata*, 3. *A. chittagonga*, 4. *A. coriacea*, 5. *A. crassinervia*, 7. *A. edulis*, 8. *A. elliptica*, 10. *A. eximia*, 11. *A. exstipulata*, 12. *A. forbesii*,

13. *A. foveolata*, 14. *A. glabriflora*, 15. *A. grandis*, 16. *A. hiernii*, 17. *A. korthalsii*, 19. *A. leptantha*, 20. *A. leucophylla*, 22. *A. meliosmoides*, 23. *A. odorata*, 24. *A. odoratissima*, 25. *A. oligophylla*, 26. *A. pachyphylla*, 27. *A. palembanica*, 28. *A. perviridis*, 30. *A. ruftbarbis*, 31. *A. rufinervis*, 32. *A. sexipetala*, 33. *A. silvestris*, 34. *A. simplicifolia*, 35. *A. speciosa*, 37. *A. tenuicaulis*, 39. *A. tomentosa*, 40. *A. wallichii*.

Sect. *Amoora*: Flowers: calyx with 3 broadly obtuse lobes; petals 3, aestivation imbricate; anthers 6–12. *Fruits* more than 6 cm long, dehiscent. *Seeds* with opaque aril, which when fresh has red, white or yellow outer skin. 5 species in Thailand: 6. *A. cucullata*, 9. *A. erythrosperma*, 21. *A. macrocarpa*, 29. *A. rubiginosa*, and 36. *A. spectabilis*.

Sect. *Neoaglaia*: (Muellner et al. 2005, Amer. J. Bot. 92: 534–543). Intermediate between the other two sections. *Flowers*: calyx with 3 (or rarely 4) broadly obtuse lobes; petals 3–5 (rarely 6); anthers 6–9. *Fruits* small, 1–2.8(–6) cm long, 1.2–2.3(–3.5) cm wide, dehiscent; when fresh the pericarp usually pink, sometimes carmine-red or yellow in *A. lawii*. *Seeds* with opaque aril, which when fresh has a red or orange outer skin and white flesh of soft consistency. 2 species in Thailand: 18. *A. lawii* and 38. *A. teysmanniana*.

KEY TO THE SPECIES

1. Leaves simple (unifoliolate)
 2. Leaf reticulation somewhat raised or clearly visible on both surfaces **22. *A. meliosmoides***
 2. Leaf reticulation not raised, not at all visible **34. *A. simplicifolia***
1. Leaves trifoliolate or imparipinnate (never paripinnate)
 3. Flowers 3-merous, (sometimes 5-merous in *A. teysmanniana*). Ripe fruits with 3 (rarely 4) locules and dehiscent (if neither flowers nor fruits present, or the characters cannot be seen, follow alternative option)
 4. Terminal leaflet sometimes folded at base forming a pouch; lateral leaflets with markedly asymmetrical base; leaflets markedly asymmetrical and usually curved to one side. Mangrove and estuarine habitats, occasionally on sandy beaches **6. *A. cucullata*** (in part)
 4. Terminal leaflet never folded at base; lateral leaflet base only slightly asymmetrical leaflets not curved. Not in mangrove or estuarine habitats, rarely on sandy beaches
 5. Leaflet lower surface completely and conspicuously covered with reddish brown stellate or peltate scales. Usually in peat swamp forest **29. *A. rubiginosa*** (in part)
 5. Leaflet lower surface not completely covered with reddish brown stellate hairs or scales indumentum usually pale brown. Not in peat swamp forest
 6. Indumentum of stellate hairs only, usually visible with naked eye on leaflet lower surface **38. *A. teysmanniana*** (in part)
 6. Indumentum of peltate scales or stellate hairs or scales, only visible with magnification, sometimes very sparse but always present on apex of shoot
 7. Leaflets 1–3 on each side of rachis. Ripe fruits less than 3 cm diam. **18. *A. lawii*** (in part)
 7. Leaflets (3–)5–10 on each side of rachis. Ripe fruits more than 3 cm diam.
 8. Leaflet margin recurved, upper surface often shiny and lateral veins raised, narrow and wavy on lower surface when dry **9. *A. erythrosperma*** (in part)
 8. Leaflet margin not recurved, upper surface dull when dry, lateral veins may be subprominent, but not narrow and wavy
 9. Midrib sparsely to densely minute dark reddish brown peltate scales (which sometimes resemble minute pits), sometimes interspersed with pale grey peltate scales. Flower obovoid, 2–3.5 by 1.6 mm; staminal tube subglobose, ca 1.5 mm diam., anthers 6. Fruit obovoid, to 7.5 by 7.3 cm; pericarp longitudinally wrinkled and moulded around seeds when dry **21. *A. macrocarpa*** (in part)
 9. Midrib sparsely to densely pale brown stellate scales, occasional to numerous on lower leaflet surface. Flower ellipsoid, 5–7 by 3–6 mm; staminal tube cup-shaped, ca 2.5 mm diam., anthers 6–9. Fruit ellipsoid or subglobose, 8–10 by 6–8 cm; pericarp not longitudinally wrinkled and moulded around seeds when dry **36. *A. spectabilis*** (in part)
 3. Flowers with more than 3 (usually 5) calyx lobes and more than 3 (usually 5) petals. Ripe fruits with 1 or 2 (rarely 3) locules and indehiscent. If neither flowers nor fruits present, or characters cannot be seen, follow this option

10. Leaflet lower surface without or with few hairs or scales; reticulation of intercostal veins subprominent on one or both surfaces when dry
11. Small tree to 5 m, unbranched or with stem divided into 2 or 3 at apex only. Fruits without a longitudinal ridge **4. A. coriacea**
11. Branching bush, small tree or tree to 25 m. Fruits with or without a longitudinal ridge
12. Bush or small tree to 10 m. Petiole, rachis and petiolules flattened on adaxial side, part or all of petiole and rachis and some or all of petiolules with narrow wings (wild and cultivated, often as a hedge) **23. A. odorata**
12. Tree to 25 m. Petiole, rachis and petiolules terete or with a groove on adaxial side, but not flattened and without a narrow wing (wild only) **25. A. oligophylla** (in part)
10. Leaflet lower surface sparsely to densely peltate scales or stellate scales or hairs; if without hairs and/or scales then reticulation of intercostal veins not raised on either surface when dry
13. Indumentum usually composed of white or pale brown hairs or scales or dendritic hairs which nearly or totally conceal the lower leaflet surface
14. Indumentum composed at least partially of dendritic hairs which have a central radius and several whorls of arms radiating from it
15. Inflorescence with conspicuous linear bracteoles subtending and exceeding flowers in length; numerous stellate scales without a central radius on lower leaflet surface **2. A. bracteolata**
15. Inflorescence without conspicuous bracteoles or, if present, not exceeding flowers in length; dendritic hairs numerous on or densely covering lower leaflet surface
16. Lateral leaflets 9–13 on each side of rachis; lower leaflet surface not visible between hairs even when using a hand lens or microscope. Fruit to 8 by 8.5 cm, locules to 3, each with one or two seeds **26. A. pachyphylla** (in part)
16. Lateral leaflets (4–)5–10(–13) on each side of rachis; lower leaflet surface visible between hairs when using a hand lens or microscope. Fruit to 5 by 5.6 cm, locules 3, each with one seed **15. A. grandis**
14. Indumentum composed entirely of stellate or peltate hairs or peltate scales, dendritic hairs absent
17. Lower leaflet surface densely covered with very pale brown peltate scales, with few to numerous brown peltate scales interspersed **1. A. argentea**
17. Lower leaflet surface densely covered with white or reddish-brown stellate scales, with few to numerous stellate hairs interspersed
18. Upper surface of leaflet not shiny and reticulation not raised when dry, lateral veins 10–22(–29) **10. A. eximia**
18. Upper surface of leaflet shiny and reticulation subprominent when dry, lateral veins 20–45 **26. A. pachyphylla** (in part)
13. Indumentum reddish brown or orange brown, or if pale, not totally concealing lower leaflet surface
19. Lower leaflet surface densely covered with reddish brown or orange brown hairs or scales, surface not or barely visible
20. Lower leaflet surface with numerous stellate hairs, interspersed with paler hairs which have one or few ascending arms, surface visible in between hairs **16. A. hiernii** (in part)
20. Lower leaflet surface densely covered with stellate or peltate scales, sometimes interspersed with stellate hairs which have one or few ascending arms, surface not visible **29. A. rubiginosa** (in part)
19. Hairs or scales either absent from lower leaflet surface or, when present, surface readily visible
21. Indumentum mainly consisting of peltate scales, sometimes interspersed with stellate scales (microscope needed, search carefully for peltate scales on all parts of specimen)
22. Indumentum of peltate and stellate scales (or with at least some of scales with a long fimbriate margin)
23. Leaflets 1–2(–3) on each side of rachis, brown or bluish brown when dry, not pale yellowish green when dry **24. A. odoratissima**
23. Leaflets usually more than 2 on each side of rachis, pale brown or yellowish green when dry or with whitish green or orange veins
24. Leaflets pale brown when dry. Fruit usually subglobose, 3-locular with an apical depression, but sometimes seed failing to develop in 1 or 2 of locules **7. A. edulis** (in part)
24. Leaflets yellow or yellowish green when dry. Fruit usually pear-shaped, sometimes subglobose without an apical depression, sometimes with a small beak, 2-locular **20. A. leucophylla** (in part)
22. Indumentum of peltate scales only
25. Scales usually minute and on midrib only, not easily discernible **21. A. macrocarpa** (in part)
25. Scales easily discernible with magnification, sometimes almost absent from leaflets but then visible on apex of shoot
26. Staminal tube with a narrow pin-prick aperture ca 0.3 mm diam., with an entire margin; anthers included

27. Indumentum consisting of reddish brown peltate scales. Leaflets 7–9 on each side of rachis **33. A. silvestris**
27. Indumentum of pale brown or grey peltate scales. Leaflets 1–6 on each side of rachis **19. A. leptantha**
26. Staminal tube with aperture more than 0.3 mm diam., margin shallowly lobed; anthers protruding through aperture of staminal tube
28. Indumentum consisting of reddish brown peltate scales
29. Leaflets uniformly brown when dry, veins neither black nor red and not contrasting in colour with surface in between when dry
30. Leaflets with scales scattered on lower leaflet surface. Pericarp 1–10 mm thick, fibrous and flexible, with an encircling longitudinal ridge **17. A. korthalsii**
30. Leaflets with scales numerous on lower leaflet surface, Pericarp ca 1 mm thick, brittle, without an encircling longitudinal ridge **35. A. speciosa**
29. Leaflet veins usually red, brown or black when dry, leaflet surface either also black or blackish brown, contrasting with or paler in colour than veins
31. Leaflets 5–6 on each side of rachis, with 12–18 lateral veins on each side of midrib. Fruit asymmetrically ellipsoid with one locule **28. A. perviridis**
31. Leaflets 3–5 on each side of rachis, with 4–7 lateral veins on each side of midrib. Fruit symmetrical with two locules **14. A. glabriflora**
28. Indumentum consisting of orange brown, pale brown or almost white peltate scales
32. Leaflets markedly asymmetrical, terminal ones often folded at base forming a pocket **6. A. cucullata** (in part)
32. Leaflets only slightly asymmetrical, terminal ones not folded at base
33. Peltate scales numerous and evenly distributed on leaflet lower surface, sometimes individually visible to naked eyes as tiny shiny dots **3. A. chittagonga**
33. Peltate scales few to numerous but not evenly distributed on leaflet lower surface or, if they are, not individually visible to naked eye
34. Fruits dehiscent **18. A. lawii** (in part)
34. Fruits indehiscent
35. Leaflets brown or greyish-brown when dry; leaflet lower surface always with numerous yellowish brown or orange brown peltate scales, which have an entire or fimbriate margin or almost stellate scales visible only with hand lens **5. A. crassinervia** (in part)
35. Leaflets brown or pale brown when dry; leaflet lower surface with pale brown or orange brown peltate scales with an entire or fimbriate margin on midrib and sometimes few to numerous on that surface
36. Leaflet lower surface often with stellate scales or hairs present; lateral veins 9–15 on each side of midrib. Fruits 3.2–5 by 3.1–4.2 cm, usually subglobose with an apical depression, 3-locular but sometimes seed failing to develop in 1 or 2 of locules; pericarp thick, woody when dry **7. A. edulis** (in part)
36. Leaflet lower surface with stellate hairs and scales absent, but peltate scales often fimbriate; lateral veins 5–8 on each side of midrib. Fruits 1.1–2.5 by 1.3–1.5 cm, obovoid without an apical depression, (1 or) 2-locular, pericarp thin and brittle when dry **40. A. wallichii**
21. Indumentum mainly consisting of stellate hairs or scales, peltate scales few or absent (microscope needed)
37. Leaflet lower surface with a sparse to dense covering of stellate hairs and/or scales; when sparse, some hairs or scales occurring evenly distributed between veins and visible to naked eye
38. Hairs pale yellowish brown, with arms less than 1 mm long **38. A. teysmanniana** (in part)
38. Hairs reddish brown or brown with arms either less than or more than 1 mm long
39. Hairs on lower leaflet surface few or at least with arms not usually overlapping
40. Leaflet lower surface with indumentum of few fimbriate peltate scales, numerous stellate scales and some stellate hairs. Fruits to 4 mm diam.; pericarp glabrous or with few hairs **27. A. palembanica**
40. Leaflet lower surface without peltate scales. Fruits ca 1 cm or more diam.
41. Lateral leaflets fewer than 5 on each side of rachis **39. A. tomentosa** (in part)
41. Lateral leaflets usually more than 5 on each side of rachis
42. Hairs and scales mostly orange brown, usually few and interspersed with orange brown pits on lower surface of leaflets **20. A. leucophylla** (in part)
42. Hairs and scales mostly reddish brown, numerous, often interspersed with reddish brown pits on lower surface of leaflets, stellate hairs compact, distributed evenly on lower leaflet surface, arms of adjacent hairs and scales not overlapping

43. Leaflets to 4 cm wide, darkest brown stellate hairs densely packed with arms that make them visible to naked eyes as brown dots on lower surface of leaflets **11. *A. exstipulata***
43. Leaflets 3–7(–8.5) cm wide and usually more than 4 cm, darkest of stellate hairs less densely packed with arms and therefore not obvious on lower surface of leaflets
44. Leaflets 3–6 on each side of rachis; stellate scales on lower leaflet surface numerous, pits absent or present only on upper surface **32. *A. sexipetala*** (in part)
44. Leaflets 7–9 on each side of rachis; stellate scales on lower leaflet surface few, pits present on both surfaces **31. *A. rufinervis***
39. Hairs on lower leaflet surface numerous and with arms of adjacent hairs overlapping, but leaving surface of leaflet visible. Hairs large and spreading, arms unequal in length usually reddish brown, and numerous on leaflet lower surface, interspersed with smaller paler hairs with fewer arms
45. Lower surface of leaflet with numerous reddish brown or orange brown stellate hairs with arms up to 4 mm long. Inflorescence densely packed with linear hairy bracteoles to 3 cm long **30. *A. rufibarbis***
45. Lower surface of leaflet with numerous reddish brown or orange brown stellate hairs with arms up to 1 mm long. Inflorescence lacking long linear bracteoles **39. *A. tomentosa*** (in part)
46. Branched tree or treelet. Fruits 2-locular **37. *A. tenuicaulis*** (in part)
46. Tree usually unbranched. Fruits 1-locular
37. Leaflet lower surface without or with a few hairs or densely covered with hairs on midrib, sometimes with a few to many stellate scales (visible only with hand lens) unevenly scattered on the rest of that surface
47. Stellate hairs or scales visible with a hand lens, numerous on or densely covering midrib, sometimes also on lateral veins, almost absent elsewhere on leaflet lower surface
48. Intercostal venation subprominent on lower surface and often on upper surface of leaflet when dry, usually without indumentum or with yellowish brown stellate hairs on midrib only **25. *A. oligophylla*** (in part)
48. Intercostal venation inconspicuous or sometimes visible but faint on lower surface when dry, if subprominent, midrib densely dark brown stellate scales
49. Leaflet surfaces with numerous pits
50. Leaves to 75 cm long; petioles to 28 cm long; leaflets 2–10 cm wide, often with dense indumentum of stellate hairs on midrib below when mature; petiolules 0.5–2 cm long. Fruits to 4 cm long **12. *A. forbesii*** (in part)
50. Leaves to 42 cm long; petiole to 8 cm long; leaflets 1.3–4.5 cm wide, without dense indumentum on midrib below when mature; petiolules to 0.8 mm. Fruits to 2.5 cm long **13. *A. foveolata***
49. Leaflet surfaces not or only faintly pitted
51. Small tree to 5 m, unbranched or with stem divided into two or three at apex only **4. *A. coriacea***
51. Much branched tree to 20 m
52. Fruits 3-locular, without or with 3 longitudinal ridges, with a shallow depression at apex **7. *A. edulis*** (in part)
52. Fruits 2-locular with one longitudinal ridge encircling fruit and no apical depression **8. *A. elliptica***
47. Stellate hairs or scales either minute or almost totally absent from midrib below and from the rest of leaflet lower surface
53. Leaflets surface minutely rugulose and pitted, with tiny stellate hairs sometimes frequent on lower surface; lateral veins subprominent, reticulation slightly prominent or visible **36. *A. spectabilis*** (in part)
53. Leaflets surface smooth or rugulose but not pitted, stellate hairs almost absent from lower surface; lateral veins raised and wavy, reticulation faint **9. *A. erythrosperma*** (in part)

1. *Aglaia argentea* Blume, Bijdr. Fl. Ned. Ind.: 170. 1825; Miq., Fl. Ned. Ind., Suppl. 1: 543. 1861; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 70. 1895; Ridl., Fl. Malay Penins. 1: 405. 1922; Backer. & Bakh.f., Fl. Java 2: 129. 1965; Pannell, Tree Fl. Malaya 4: 211. 1989; Kew Bull., Add. Ser. 16: 125, f. 27. 1992; Fl. Males., ser. I, 12(1): 237. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 213. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 68. 2013; Gardner et al., Forest Trees S. Thailand 2: 1227. 2016.— *A. hypoleuca* Miq., Fl. Ned. Ind., Suppl. 1: 197. 1861.— *A. argentea* Blume var. *angustata* Miq., Ann. Mus. Bot. Lugduno-

Batavi 4: 55. 1868.— *A. argentea* Blume var. *borneensis* Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 55. 1868.— *A. argentea* Blume var. *superba* Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 55. 1868.— *A. argentea* Blume var. *hypoleuca* (Miq.) Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 55. 1868.— *A. argentea* Blume var. *curtisii* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 71. 1895. Plate CXXIII: A–B.

Trees (4–)5–15(–25) m tall, 30–80 cm girth, branched; buttresses to 1 m tall; bark rather smooth, brown or greyish green, finely rough, inner bark white, brownish or yellowish; sapwood brownish, very hard; twigs stout, with distinct longitudinal wavy ridges, lenticels sparse, densely brown peltate scales with a darker centre, young shoots dark brown or purplish brown. *Leaves* imparipinnate, 18–40 cm long; petiole 7–14 cm long, swollen near base; leaflets 4–7 on each side of rachis, opposite or subopposite, oblong, lanceolate-oblong, rarely oblanceolate, 6–12 by 2–5.5 cm, apex acuminate to acute, base cuneate or rounded, densely white peltate scales with few to numerous brown peltate scales interspersed below, midrib impressed above, prominent below, lateral veins 10–17 on each side of midrib, obscure on both surfaces, curved upwards becoming indistinct near margin; petiolules 2–5 mm long, densely lepidote. *Inflorescence* 20–30 cm long, densely brown peltate scales. *Flowers* 2–4 by 1.5–2.5 mm. *Calyx* 5, broadly cup-shaped, ca 1 mm long, lobes ca $\frac{3}{4}$ of the length, densely peltate scales outside, glabrous inside, ciliate. *Petals* 5, free, obovate, ca 1 mm long, glabrous, white or yellowish. *Staminal tube* obovoid, ca 1 mm long, glabrous, margin entire or slightly undulate. *Anthers* 5, included. *Ovary* ovoid, up to 0.5 mm long, glabrous, 2(3)-locular, each locule with 1 ovule, stigma ovoid, truncate, glabrous. *Infructescence* erect up to 15 cm long, with indumentum like on twigs. *Fruits* obovoid, 3–3.5 by 2–3 cm, indehiscent, apex rounded, tapering at base; pericarp leathery and woody, green, grey to yellowish grey. *Seeds* completely surrounded by a gelatinous white aril.

Thailand.—PENINSULAR: Ranong, Surat Thani, Phangnga, Nakhon Si Thammarat, Phatthalung, Trang, Satun.

Distribution.—India (Nicobar Islands) Malaysia, Indonesia (type), Philippines, New Guinea, Australia, Solomon Islands.

Ecology.—Tropical evergreen rain forest, sometimes near the sea or by streams; altitude (20–)50–200(–750) m. Flowering: August–December; fruiting: March–April (August).

Vernacular.—Sangkhrat khlong (สังเครียดคคอง), sangkha ma (สังขะมา)(Peninsular).

2. *Aglaia bracteolata* Pannell, Thai Foret Bull., Bot. 53(2): 58. 2025. Fig. 1. Plate CXXIII: C–D.

Trees to 5 m, unbranched or to 20 m, few branches with condensed terminal spiral(s) of leaves; bark light brown or greyish brown, reticulately fissured, thinly cracked to scaly, white sap; twigs about 1 cm across near apex, densely pale brown stellate hairs, interspersed with dendritic hairs which a central radius and arms in a series of 2 or 3 whorls, scars on twigs from fallen leaves, ca 8.5 by 7 mm wide. *Leaves* imparipinnate, to 73 cm long; petiole 18 cm, densely hairs like on twigs; leaflets 10–12 on each side of rachis, oblong or narrowly lanceolate, 6–17.5 by 2–4 cm, acuminate at apex, acute acumen to 7 mm long, narrowly slightly cordate at asymmetrical base, lateral veins 18–21 on each side of midrib, midrib prominent, lateral veins subprominent below, reticulation conspicuous, scales and hairs like on twigs, numerous on midrib below, numerous white stellate scales below; petiolule ca 2(–10) mm long. *Female inflorescences* in axils of several uppermost leaves, to 20 cm long;

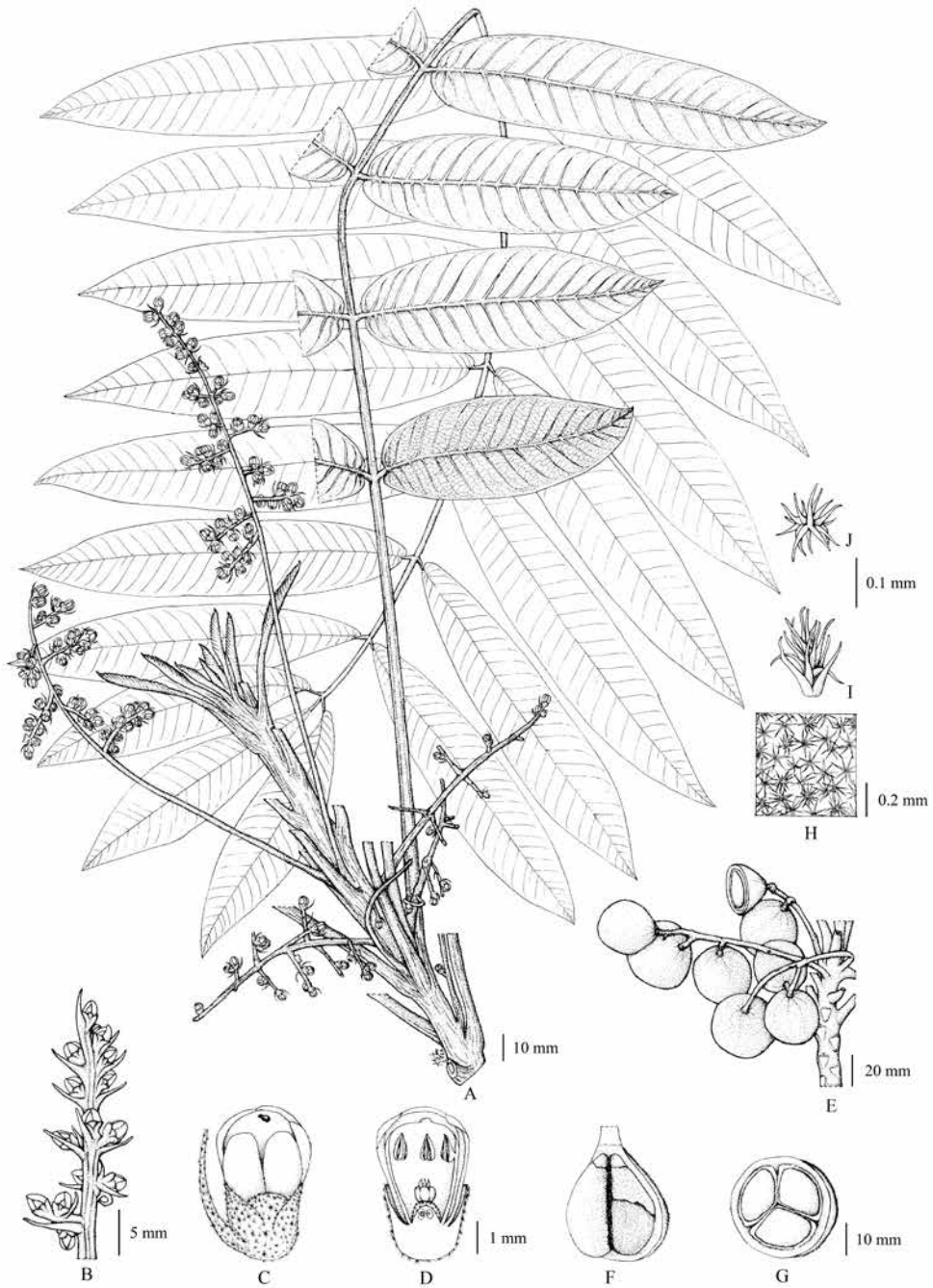


Figure 1. *Aglaia bracteolata* Pannell: A. twig with inflorescences; B. inflorescence; C. flower bud; D. longitudinal section flower; E. infructescences; F. fruit; G. cross-section of fruit; H. indumentum; I. dendritic hair; J. stellate hair. Drawn by Atcharaphan Saengbuaphuan.

peduncle 1–13 cm long; flowers subtended by 1–3 bracteoles, 3.5–5 by 1 mm, narrowly lanceolate at base. *Flowers* 4.5–5 by 3 mm; sessile or with a short pedicel 0.5–1 mm long. *Calyx* cup-shaped, to 2 by 3 mm, divided to about $\frac{2}{3}$ into 5 subrotund lobes, densely pale brown stellate scales. *Petals* 5, narrowly obovate, 5 by 1.5 mm, dull yellow. *Staminal tube* obovoid, 3.5 by 2.5 mm, protruding beyond petals, aperture 1.5 mm in diam., margin entire. *Anthers* 5, ovoid, 1 by 0.5 mm, inserted in uppermost $\frac{1}{3}$ of staminal tube, included. *Ovary* subglobose, ca 1.5 by 1.5 mm, densely pale brown stellate hairs, 3-locular, each containing 2 ovules, stigma ca 1 by 1 mm, with 3 apical lobes. *Infructescence* 20 by 10 cm; peduncle 6 cm long, indumentum like that on twigs. *Fruits* obovoid, (1.6–)2.8–3.6 by (2–)2.7–3.4 cm, indehiscent, shallowly 3-lobed when dry where pericarp moulded around seeds, numerous to densely compact white stellate hairs with many short arms, somewhat glabrescent; pericarp 2–4 mm thick, pinkish dull yellow; locules 3, each with 0 or 1 seed, inner surface brown and glabrous. *Seeds* 1.7–2.4 by 1.3–2 cm and 0.8–1.7 cm thick.

T h a i l a n d.—NORTHERN: Phayao, Lampang; NORTH-EASTERN: Loei (Wat Pa Suan Hom, Nong Hin, PUUDJAA ET AL. 2005, holotype BKF, isotype FHO).

D i s t r i b u t i o n.—Endemic.

E c o l o g y.—Dry evergreen or deciduous forest, on limestone, growing on silty clay or on cliff; altitude 415–656 m.

3. *Aglaia chittagonga* Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 44. 1868; Pannell, Kew Bull., Add. Ser. 16: 140. 1992; Gardner et al., Forest Trees N. Thailand 119, 404. 2000; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 213. 2011; Gardner et al., Forest Trees S. Thailand 2: 1228, 1452. 2016.—*Amoora chittagonga* (Miq.) Hiern in Hook.f., Fl. Brit. India 1: 559. 1875; Craib, Fl. Siam. 1: 259. 1926. Fig. 2.

Trees (7–)10–15 m tall, (30–)45–120 cm girth; bark grey or greenish brown scaly or smooth, inner bark yellowish brown; sapwood white or purplish brown; heartwood reddish brown. *Leaves* imparipinnate, 10–40 cm long; leaflets 2 or 3 on each of rachis, subopposite, oblong, oblong-lanceolate, or ovate-lanceolate, 9–20 by 4–7 cm, apex acute or acuminate, base obtuse, to broadly cuneate, with very pale orange brown peltate scales regularly spaced on leaflet surface below, lateral veins 10–17 on each side of midrib, curved upwards near margin, sometimes anastomosing, often with shorter intercostal in between, midrib depressed above, prominent, lateral veins subprominent and reticulation sometimes visible, not raised below; petiole 6–10.5 cm long. *Inflorescence* axillary or supra-axillary, 10–40 cm long; peduncles 7–15 cm long, slender. *Flowers* 2–3 by 1.5–3 mm; pedicels 2–5 mm long, densely scaly throughout. *Calyx* broadly cup-shaped, 1–1.5 mm long, lobes ca $\frac{1}{2}$ of the length. *Petals* 5, free, oblanceolate, 3–4 mm long, glabrous or occasional scales outside, greenish, white or yellow. *Staminal tube* obovoid, 1.3–2.5 by 2–2.5 mm, glabrous, aperture 0.7–1.2 wide, margin undulate. *Anthers* 7–10, inserted inside tube and just protruding beyond aperture. *Ovary* broadly ovoid, ca 0.5 by 0.5 mm, glabrous, 2(3)-locular, each locule with 1–2 ovules, stigma ovate, 0.2–0.5 mm long, glabrous. *Infructescence* up to 8 cm long. *Fruits* ellipsoid, ca 2.5 by 1.5 cm, indehiscent, densely very pale orange-brown scales, sometimes margin fimbriate outside; locules 2, each containing 0 or 1 seed. *Seed* surrounded by an edible aril.

T h a i l a n d.—NORTHERN: Mae Hong Son; Lampang; SOUTH-WESTERN: Phetchaburi, Prachuap Khiri Khan.

D i s t r i b u t i o n.—Bangladesh (type), Myanmar.



Figure 2. *Aglaia chittagonga* Miq.: Habit with infructescence $\times \frac{1}{2}$ Habit with inflorescence. Half flower $\times 10$. Peltate scale $\times 50$. Drawn by Rosemary Wise. Reproduced with permission of the Board of Trustees, Royal Botanic Gardens, Kew.

E c o l o g y.— From lowland to hill evergreen forest, near streams, limestone bedrock; altitude 25–1,600 m (most commonly 200–1,000 m). Flowering: February–December (most commonly March–July); fruiting: February–December (most commonly May–September).

V e r n a c u l a r.— Sang ka tong (สังกะตัง)(Southwestern).

4. *Aglaia coriacea* Korth. ex Miq. Ann. Mus. Bot. Lugd. Bat. 4: 57. 1868; Pannell, Tr. Fl. Malaya 4: 213. 1989; Kew Bull. Add. Ser. 16: 297. 1992; Fl. Males., ser. I, 12(1): 295. 1995; Fl. Penins. Malaysia, Ser. 2, 4: 68. 2013; Gardner et al., Forest Trees S. Thailand 2: 1228, 1452. 2016.

Small trees to 5 m tall, usually unbranched with up to 10 leaves in a spiral at apex, occasionally with 1 or 2 branches in upper part of the tree; bark brown with green and grey patches, with longitudinal and transverse cracks, inner bark dark pinkish red; sapwood slightly paler than inner bark; heartwood pale pinkish red or yellowish brown; stem apex densely reddish brown stellate hairs with a dense cluster of short arms and a few long arms to 0.5 mm long. *Leaves* imparipinnate, to 120 cm long; petioles to 35 cm long; leaflets coriaceous, midrib and sometimes lateral veins densely reddish brown stellate hairs below; lateral leaflets 3–7 on each side of rachis, subopposite, basal ones only slightly smaller than the rest; lamina oblong or obovate-oblong, 13–43 by 4–9 cm, apex acuminate, acumen obtuse or acute, to 25 mm long, base cuneate or rounded, sometimes asymmetrical, margin recurved, midrib prominent or subprominent below, lateral veins 11–13 on each side of midrib, subprominent below, intercostal venation inconspicuous; petiolules 0.1–3.5 cm long. *Inflorescences* to 6 by 6 cm, axillary or sometimes on upper part of stem below the lowest leaves, densely reddish brown stellate hairs. *Flowers* obovoid, ca 2.5 by 2 mm. *Calyx* reddish brown stellate hairs outside, deeply divided into 5 obtuse lobes. *Petals* 5. *Staminal tube* obovoid, ca 2 mm tall, aperture ca 0.6 mm in diam., shallowly lobed. *Anthers* 5, ovoid, ca 1 mm long. *Ovary* small, depressed globose, stigma narrowly cylindrical, ca 0.6 mm across, 2 small apical lobes. *Infructescences* ca 6 fruits at different stages of ripening clustered at end of a peduncle ca 9 cm long. *Fruits* ellipsoid or subglobose, 2.3–4 by 1.8–3.5 cm, indehiscent; locules 1 or 2 (rarely 3), septa membranous and disintegrating at maturity, yellow or brown; pericarp 0.5–1 mm thick, leathery, inner surface white. *Seeds* 2–3.5 by 1.5–2 cm, inner surfaces flat, aril 0.5–1 mm thick, translucent, white, sweet and juicy.

T h a i l a n d.— PENINSULAR: Surat Thani, Narathiwat.

D i s t r i b u t i o n.— Peninsular Malaysia and Borneo (type).

E c o l o g y.— In primary lowland and hill dipterocarp forest; altitude to 150 m.

5. *Aglaia crassinervia* Kurz ex Hiern in Hook.f., Fl. Brit. India 1: 556. 1875; Pannell, Tree Fl. Malaya 4: 229. 1989; Kew Bull., Add. Ser. 16: 213. 1992; Fl. Males., ser. I, 12(1): 267. 1995; T. Wongprasert et al., Thai Forest Bull., Bot. 39: 213. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 71. 2013; Gardner et al., Forest Trees S. Thailand 2: 1228, 1452. 2016.— *A. cinerea* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 66. 1895; Ridl., Fl. Malay Penins. 1: 404. 1922.— *Chisocheton sumatranus* Baker f., J. Bot. Lond. 62 Suppl.: 18. 1924.— *Aglaia pyricarpa* Baker f., *op. cit.*: 20. 1924. Fig. 3.

Trees 5–15(–24) m tall, 40–10(–200) cm girth; bark grey or greyish brown, rough, lenticellate in vertical lines, inner bark reddish brown with white stripes, creamy yellow,

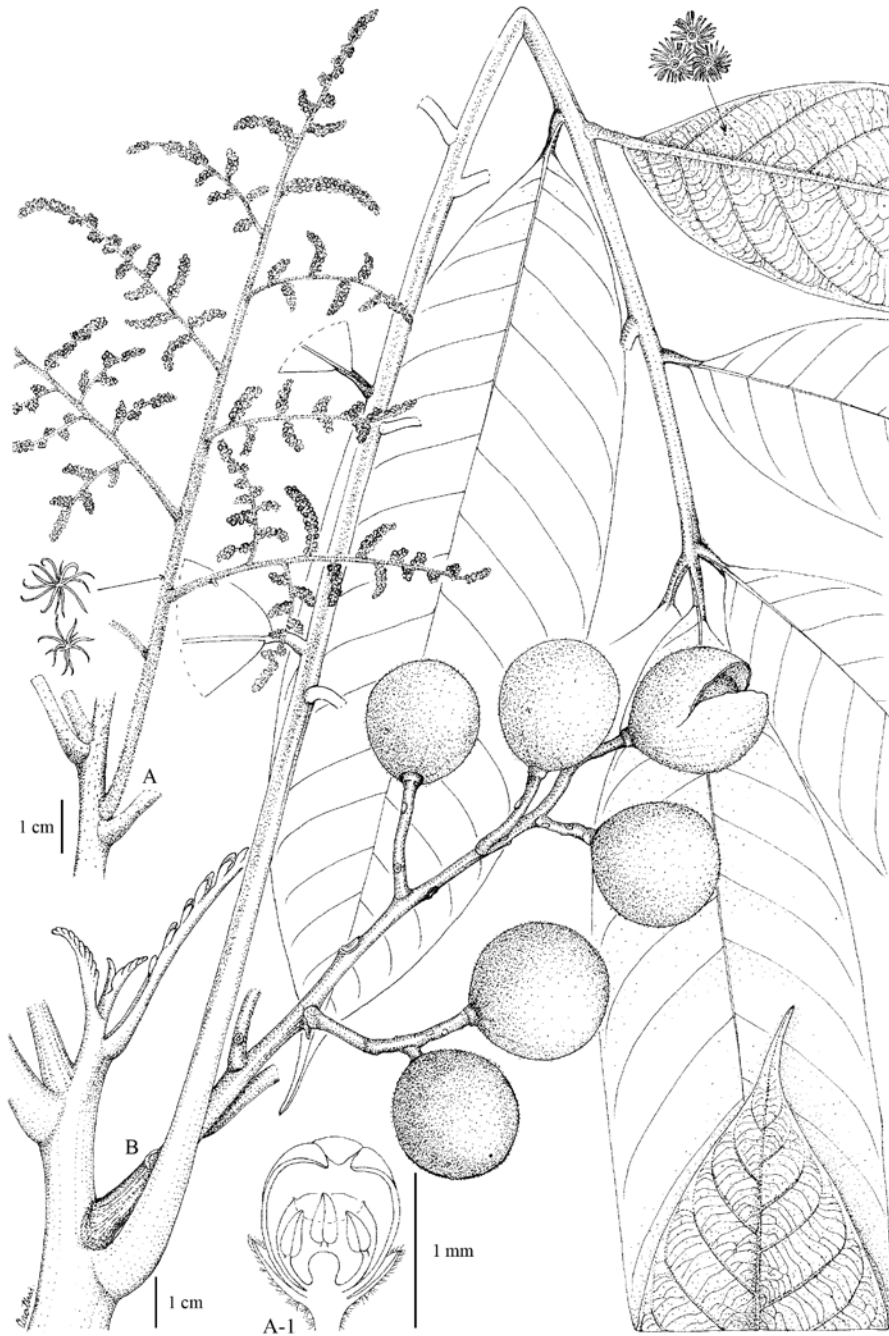


Figure 3. *Aglaia crassinervia* Kurz ex Hiern: A. inflorescences, A-1 longitudinal section of flower (*S. Thawon 418*); B. twig with infructescence (*A.F.G. Kerr 18622*). Drawn by Orathai Kerdkaew.

white latex when cut; young twigs densely covered with yellowish brown or orange-brown peltate scales, entire or fimbriate margin. *Leaves* imparipinnate (7–)10–40 cm long; leaflets (3–)5–7 on each side of rachis, alternate or subopposite, elliptic or occasionally obovate 10–20 by 4–5.5 cm, apex caudate, acuminate to acute, rounded or cuneate at slightly asymmetrical base, subcoriaceous to chartaceous, leaflets often greyish green when dry, usually rugulose and numerous pits above, usually pitted and numerous scales like on twigs below, midrib depressed above, prominent below, lateral veins 8–17 on each side of midrib, curved upwards, more or less anastomosing, reticulation faintly visible on both surfaces; petiole to 20 cm long; petiolules 0.5–1.5 cm long, wrinkled when dry, petiole, petiolules and rachis dense indumentum like that on twigs. *Inflorescence* axillary, 10–40 cm long, lateral branches many, dense indumentum like that on twigs throughout. *Flowers* to 2 mm long, fragrant; pedicels ca 1 mm long. *Calyx* broadly cup-shaped, ca 1 mm long, divided for about ½ of the length into 5 lobes, densely peltate scales outside, glabrous inside. *Petals* 5, free, obovate, 1.5–2 by 1 mm, glabrous, yellowish. *Staminal tube* subglobose, aperture 0.4–0.5 mm in diam. *Anthers* 5, inserted below middle of staminal tube. *Ovary* depressed globose, ca 1 by 1 mm, densely scales like on twigs, 1–2 locular, each locule with 1 ovule, stigma ovoid or depressed globose, central depression at apex. *Infructescence* up to 30 cm long. *Fruits* subglobose, (2.5–)3.5–4 cm in diam., indehiscent; pericarp thin, woody, dense indumentum like that on twigs. *Seeds* ellipsoid, 1.5–2(–3) by 1–1.8 cm, thin gelatinous aril.

T h a i l a n d.— PENINSULAR: Surat Thani, Phangnga, Krabi, Nakhon Si Thammarat, Phatthalung, Satun, Songkhla, Yala, Narathiwat.

D i s t r i b u t i o n.— Myanmar (type), Peninsular Malaysia, Indonesia, Philippines.

E c o l o g y.— Tropical evergreen rain forest, on sandstone bedrock; altitude 50–800 m (most commonly 80–400 m). Flowering: June–July; fruiting: February–August (most commonly May–August).

V e r n a c u l a r.— Sang khriat (สังเครียัด), sang ka tong (สังกะตัง)(Peninsular).

6. *Aglaia cucullata* (Roxb.) Pellegr. in Lecomte, Fl. Indo-Chine 1: 771. 1911; Pannell, Tree Fl. Malaya 4: 214. 1989; Kew Bull., Add. Ser. 16: 58, f. 3. 1992; Fl. Males., ser. I, 12(1): 213. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 213. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 73. 2013; Gardner et al., Forest Trees S. Thailand 2: 1230, 1452. 2016.— *Amoora cucullata* Roxb., Pl. Corom. 3: 54, t. 258. 1820; Hiern in Hook.f., Fl. Brit. India 1: 560. 1875; Pierre, Fl. Forest Cochinch. Fasc. 22: t. 344. 1896; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 55. 1895; Ridl., Fl. Malay Penins. 1: 399. 1922; Craib, Fl. Siam. 1: 260. 1926; Backer & Bakh.f., Fl. Java 2: 126. 1965.— *Aglaia tripetala* Merr., J. Straits Branch Roy. Asiat. Soc. 76: 88. 1917. Plate CXXIV: A–C.

Trees 6–15(–30) m tall, 50–70(–100) cm girth; sometimes with plank buttresses upwards up to 3 m, sometimes with pneumatophores up to 7 m away from bole and up to 60 cm tall; bark grey, inner bark reddish; sapwood yellowish or pinkish brown, white latex; twigs, longitudinally wrinkled, densely pale brown or orange-brown peltate scales which darker in centre and a paler, sometimes fimbriate margin. *Leaves* imparipinnate, 15–40 cm long; petiole 5–11 cm long, slender, swollen near base, scaly then glabrescent; leaflets 2–5 on each side of rachis, opposite or subopposite, oblong, ovate to obovate, usually curved to one side, 10–15 by 3–4.5 cm, apex acute or obtuse, base markedly asymmetrical (except the terminal one), margin slightly recurved, coriaceous, terminal one usually reduced to small

size and folded at base to form a pouch above, below rugulose and faintly pitted, with a few peltate scales on midrib and lateral veins like on twigs, sometimes scattered on surface in between, midrib impressed above, prominent below, lateral veins 8–13 on each side of midrib, curved upwards, more or less anastomosing, reticulation visible on both surfaces; petiolules to 4 cm long. *Inflorescence* axillary or supra-axillary, (10–)30–40 cm long, pale brown peltate scales, glabrescent; peduncle 5–10 cm long. *Flowers* with pedicels 1–2 mm long, pale brownish peltate scales, glabrescent. *Calyx* broadly cup-shaped, ca 1 mm long, divided into 3 or 4 lobes to ca 1/3 of the length, peltate scales outside, glabrous inside, ciliate. *Petals* 3, free, obovate, 1.5–2.5 mm long, glabrous, yellow or orange. *Staminal tube* slightly obconical, ca 2 by 1.7 mm, aperture up to 1.5 mm in diam., shallowly 6-lobed. *Anthers* 6, inserted below middle of staminal tube, slightly protruding. *Ovary* subglobose or ovoid, up to 1 mm long, densely peltate or stellate scales or stellate hairs, (2)3(4)-locular, each locule with 1 or 2 ovules, stigma ovoid with (2 or) 3 small apical lobes or columnar with truncate apex. *Infructescence* erect, few fruits; peduncle 3–5 cm long, densely peltate scales, glabrescent. *Fruits* obovoid or subglobose capsules, dehiscent, 4–5.5(–7) by 4–5(–6) cm, yellow or brown, prominently 2 or 3 longitudinally lobed; pericarp leathery, thin, brittle and moulded around seeds when dry. *Seeds* ellipsoid, ca 3.5 by 3 cm, with yellowish or reddish brown aril.

T h a i l a n d.— PENINSULAR: Ranong, Nakhon Si Thammarat, Trang.

D i s t r i b u t i o n.— Bangladesh, India (type), Vietnam, Malaysia, Singapore, Indonesia, Philippines, New Guinea.

E c o l o g y.— In back mangrove and estuarine forest, sometimes on sandy beaches; altitude 0–50 m. Flowering: February–December (most commonly November–December); fruiting: February–April.

V e r n a c u l a r.— Niang nok hook (เหนียงนกฮูก)(Peninsular).

7. *Aglaia edulis* (Roxb.) Wall., Calc. Gard. Rep.: 26. 1840; Hiern in Hook.f., Fl. Brit. India 1: 556. 1875; Pannell, Kew Bull., Add. Ser. 16: 229. 1992; Fl. Males., ser. I, 12(1): 272. 1995; Hua Peng & Pannell, Fl. China 11: 124. 2008; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 214. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 76. 2013; Gardner et al., Forest Trees S. Thailand 2: 1231, 1452. 2016.— *Milnea edulis* Roxb., Hort. Bengal: 18. 1814, *nom. nud.*; Roxb., Fl. Ind., ed. Carey & Wallich 2: 430. 1824.— *Nyalelia racemosa* Dennst. in Schlüssel, Hort. Malab.: 14, 23, 30. 1818; Hiern in Hook.f., Fl. Brit. India 1: 554. 1875.— *Aglaia sulingi* Blume, Bijdr. Fl. Ned. Ind.: 170. 1825; Backer & Bakh.f., Fl. Java 2: 128. 1965.— *A. latifolia* Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 42. 1868; Backer & Bakh.f., Fl. Java 2: 129. 1965.— *A. khasiana* Hiern in Hook.f., Fl. Brit. India 1: 554. 1875.— *A. pirifera* Hance, J. Bot. 6: 331. 1877; Craib, Fl. Siam. 1: 258. 1926.— *Milnea cambodiana* Pierre, Fl. Forest Cochinch. Fasc. 21: t. 334. 1895.— *Aglaia acida* Koord. & Valetton in Meded. Lands Plantentuin 16: 143. 1896; Backer & Bakh.f., Fl. Java 2: 128. 1965. Fig. 4.

Tree (2–)5–20(–25) m tall, (20–)60–100(–120) cm girth; bark grey to greyish brown, inner bark reddish; sapwood white; heartwood brown to reddish brown; twigs greyish brown, longitudinally wrinkled, densely reddish brown, pale brown or orange-brown stellate hairs and scales or peltate scales with irregular or fimbriate margin. *Leaves* imparipinnate, 10–25 cm long; petiole, 3–10 cm long, slightly swollen near base; leaflets 2–4(5) on each side of rachis, opposite or subopposite, usually elliptic, sometimes obovate, 6–25(–27)

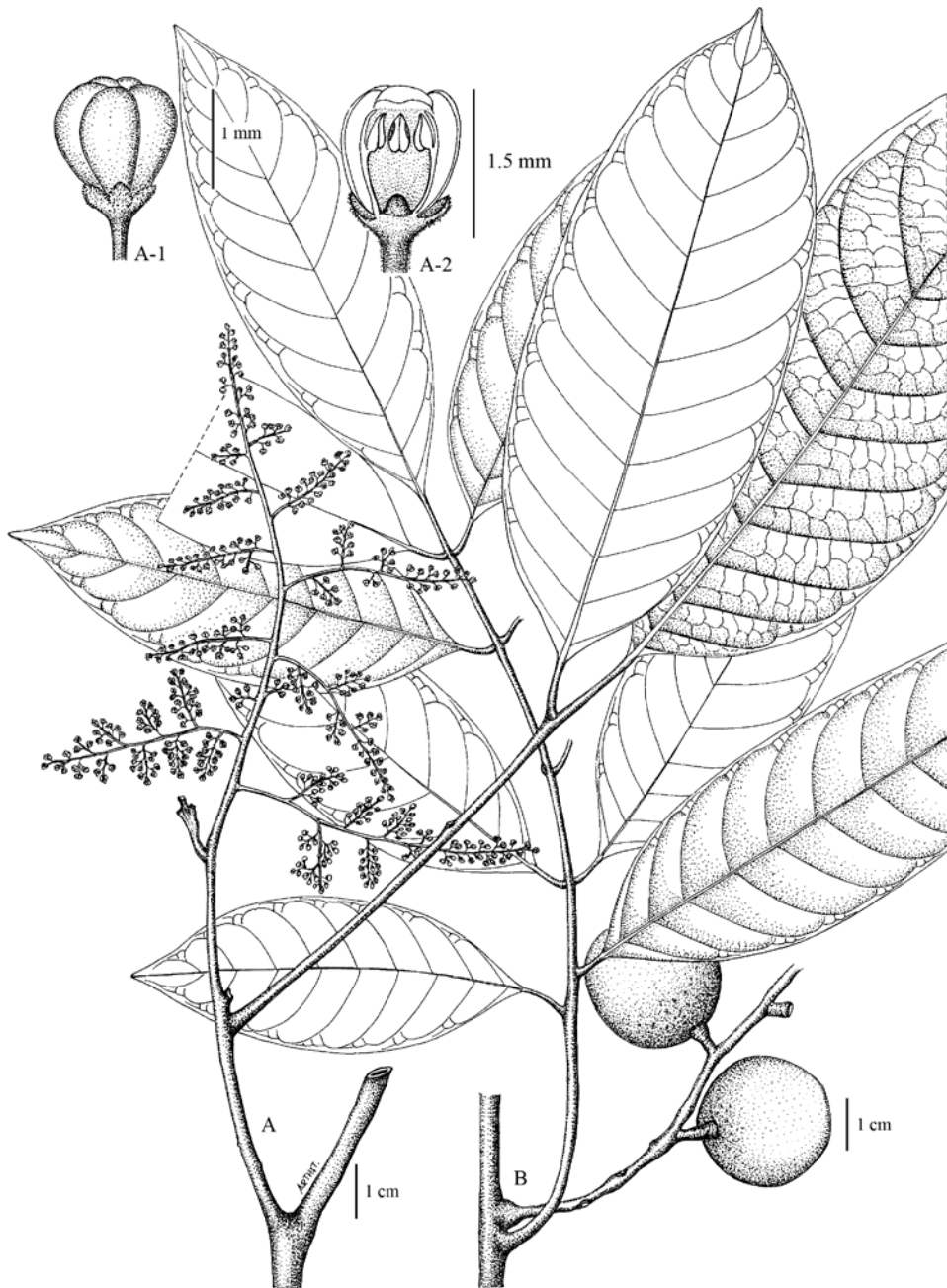


Figure 4. *Aglaia edulis* (Roxb.) Wall.: A. inflorescences, A-1 flower, A-2 longitudinal section of male flower (*S. Phusomsaeng 178*); B. twig with infructescence (*S. Phusomsaeng 229*). Drawn by Arthit Khamkamnoed.

by 3–8(–12) cm, acuminate at apex, rounded or cuneate at slightly asymmetrical base, coriaceous to subcoriaceous, often pale brown or yellowish brown when dry, midrib below and occasionally the rest of lower surface with few to numerous hairs or scales like on twigs, sometimes with numerous reddish brown pits on both surfaces, midrib depressed and glabrescent above, prominent and densely scaly below, lateral veins 9–15 on each side of midrib, curved upwards, not or just anastomosing near margin, reticulation subprominent or faint but visible below; petiolules 0.5–1.5 cm long, stellate hairs and scales throughout, glabrescent. *Inflorescence* axillary or supra-axillary, 12–20 cm long; peduncles 4–10 cm long. *Flowers* fragrant; pedicels ca 0.5 mm long, densely hairy, glabrescent. *Calyx* broadly cup-shaped, ca 0.5 mm long, divided into 5 lobes. ca ½ of the length, stellate hairs or scales outside, glabrous inside, ciliate. *Petals* 5, free, slightly obovate, ca 1.5 mm long, glabrous, yellow to reddish brown. *Staminal tube* cup-shaped, 0.5–1 by ca 1.3 mm, aperture 0.6–1 mm in diam., margin lobed, glabrous. *Anthers* 5, inserted below margin of staminal tube. *Ovary* ovoid, ca 0.2 mm long, densely stellate scales, 3-locular, each locule with 1 or 2 ovules, stigma ovoid or depressed globose. *Infructescence* 4–15 cm long, erect or slightly recurved, densely peltate scales and stellate hairs throughout. *Fruits* subglobose, 3.2–5 by 3.1–4.2 cm, shallow depression at apex, indehiscent, locules 3, brown, greenish or yellowish brown, densely peltate scales or stellate hairs. *Seeds* 0 or 1 per locule, 1.5–2 by 1–2 by 0.5–1 cm, white or brownish aril.

T h a i l a n d.— NORTHERN: Nan, Sukhothai; NORTH-EASTERN: Loei; EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Phetchaburi, Prachuap Khiri Khan; CENTRAL: Nakhon Nayok; SOUTH-EASTERN: Chachoengsao, Chanthaburi, Trat; PENINSULAR: Ranong, Surat Thani, Krabi, Nakhon Si Thammarat, Trang, Satun, Yala, Narathiwat.

D i s t r i b u t i o n.— Bangladesh (type), Bhutan, China, Myanmar, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, Samoa.

E c o l o g y.— In evergreen or mixed deciduous forest, near streams, on granite or limestone bedrock; altitude 30–480 m. Flowering: February–October (commonly April–September); fruiting: January–December (commonly April–June).

V e r n a c u l a r.— Khi phueng (ขี้ผึ้ง)(Eastern); sang khriat sai (สังเคரியดสาย), sang khriat ai kong (สังเคரியดอ้ายก้อน), khang khao (ค่างขาว)(Peninsular).

U s e s.— Aril edible.

8. *Aglaia elliptica* Blume, Bijdr. Fl. Ned. Ind.: 171. 1825; Backer & Bakh.f., Fl. Java 2: 126. 1965; Pannell, Tree Fl. Malaya 4: 214. 1989; Kew Bull., Add. Ser. 16: 275. 1992; Fl. Males., ser. I, 12(1): 288. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 214. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 80. 2013; Gardner et al., Forest Trees S. Thailand 2: 1232, 1453, f. 1613. 2016.— *A. marginata* Craib, Bull. Misc. Inform. Kew 1926: 343. 1926; Craib, Fl. Siam. 1: 255. 1926. Plate CXXIV: D–E.

Trees (3)5–20(–25) m tall, 70–120 cm girth; bark dark reddish brown or greenish brown, finely cracked, inner bark red or white; twigs yellow lenticellate, densely reddish brown or yellowish brown stellate hairs or scales, glabrescent. *Leaves* imparipinnate, 10–25 cm long; leaflets 3–6 on each side of rachis, subopposite or almost alternate, usually elliptic or oblanceolate, rarely oblong, 7–19 by 2.5–7 cm, apex acuminate, shortly caudate to acute, cuneate or rounded at slightly asymmetrical base, chartaceous to subcoriaceous, sparsely hairy then glabrous above, dull when dry, midrib and sometimes lateral veins below densely hairs or scales like that of twigs, sparsely so on the rest of that surface, not prominently

pitted, midrib prominent below, depressed above, lateral veins 7–15 on each side of midrib, distinctly curved upwards, nearly or quite anastomosing near margin, hardly visible above, reticulation, hardly visible below; petiole 4–10 cm long, swollen near base, densely stellate hairy, glabrescent. *Inflorescence* axillary or supra-axillary, 20–40 cm long, many lateral branches; peduncles 4–7 cm long. *Flowers* fragrant; pedicels ca 1 mm long, stellate hairy or glabrescent. *Calyx* broadly cup-shaped, ca 1 mm long, divided into 5 lobes ca ½ of the length, outside densely brown stellate hairs or scales, glabrous inside, ciliate. *Petals* 5, free, subobovate, ca 1 mm long, glabrous, yellowish to yellow. *Staminal tube* shallowly cup-shaped, 0.5–0.7 by ca 1 mm, margin deeply 5 lobed, glabrous. *Anthers* 5, inserted about middle of staminal tube, ca 0.5 mm long, protruding and filling aperture. *Ovary* subglobose, ca 0.2 mm long, densely stellate scales, locules 2, each locule with 1 ovule, stigma ovoid or depressed globose with 2 small apical lobes or a central depression. *Infructescence* often pendulous, 10–30 cm long, densely stellate hairy, glabrescent. *Fruits* subglobose, indehiscent, ca 3 cm in diam., densely hairs and scales like on twigs, longitudinal ridge encircling fruits. *Seed* usually 2, ellipsoid, to 2.8 by 1.8 by 1.1 cm, aril 1–3 mm thick, sometimes not quite complete on antiraphe side, pinkish orange, translucent, sweet or acidic tasting.

T h a i l a n d.— SOUTH-WESTERN: Kanchanaburi, Phetchaburi; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Krabi, Nakhon Si Thammarat, Trang, Satun, Pattani (Khao Kalakiri, Type of *Aglaia marginata*, Kerr 7809, lectotype K, isolectotypes BK, BM, C, NY, P), Yala.

D i s t r i b u t i o n.—Myanmar, Malaysia, Indonesia (type), Philippines.

E c o l o g y.—In tropical evergreen forest to dry evergreen forest, near streams, on limestone or granite or sandstone bedrock; altitude 30–1,400 m (commonly 50–800 m). Flowering: February–November (commonly April–July); fruiting January–December (commonly March–July).

V e r n a c u l a r.— Sang khriat (สังเครีียด), sang khong (สังคัง), sang khriat cho (สังเครีียดช่อ)(Peninsular).

9. *Aglaia erythrosperma* Pannell, Kew Bull., Add. Ser. 16: 76. 1992; Fl. Males., ser. I, 12(1): 219. 1995; T. Wongprasert et al., Thai Forest Bull., Bot. 39: 215. 2011. Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 80. 2013; Gardner et al., Forest Trees S. Thailand 2: 1226, 1451. 2016.

Trees 10–25 m tall, 100–140 cm girth; bark lenticellate, longitudinally cracked, greyish to pinkish brown, inner bark dark orange with white stripes; sapwood pink or pinkish brown; twigs stout, densely reddish brown stellate scales. *Leaves* imparipinnate, 19–35 cm long; petiole 9–25 cm long, flat and swollen near base; leaflets 3–6 on each side of rachis, opposite or subopposite, elliptic, elliptic-oblong to oblong, 8–20 by 4–7.5 cm, apex acute, obtuse or acuminate, rounded at slightly asymmetrical base, margin recurved, coriaceous, surface smooth or slightly rugulose, greenish brown, shiny above, below dull when dry, few to numerous pale brown stellate scales like on twigs on midrib and lateral veins, sparsely so on surface in between, midrib prominent below, flat to subdepressed above, lateral veins 7–15 on each side of midrib, usually raised, longitudinally narrowly ridged and wavy below, reticulation hardly visible; petiolules 2–3 cm long, glabrous or glabrescent. *Inflorescence* axillary or supra-axillary, up to 20 cm long, lateral branches many. *Flowers* obovoid, .ca 4.5 by 3.5 mm; pedicels 1–2 mm long, densely stellate scales like on twigs. *Calyx* broadly cup-shaped, ca 1 mm long, divided into 3 lobes, ca ⅓ of the length, densely stellate scales outside, glabrous inside. *Petals* 3, free, subobovate, 4–5 mm long, yellowish, sparsely to

densely stellate scaly outside, glabrous inside. *Staminal tube* obovoid, up to 4.2 mm long, simple hairs on inner surface of tube and anthers, margin entire or slightly undulate. *Anthers* 6(–8), inserted above middle of tube, slightly protruding. *Ovary* depressed globose, stellate scales, 3-locular, each locule with 1 ovule; stigma ovoid with 6 longitudinal impressions. *Infructescence* erect to slightly curved, 10–25 cm long, densely reddish brown stellate scales. *Fruits* subglobose, to 10 cm diam., bright orange or red, outside densely reddish brown stellate hairs, locules 3, each locule with 1 seed, dehiscent when ripe; pericarp to 1.5 cm thick, inner pericarp white. *Seeds* to 5 by 3.5 by 2 cm, completely surrounded by a bright shiny orange-red aril, which easily detached from the rest of seed; testa shiny reddish-brown.

T h a i l a n d.— SOUTH-WESTERN: Kanchanaburi, Phetchaburi; PENINSULAR: Chumphon, Ranong, Nakhon Si Thammarat, Songkhla.

D i s t r i b u t i o n.— Vietnam, Malaysia (type), Indonesia.

E c o l o g y.— In tropical evergreen forest or mixed deciduous forest, along ridges, on granite or sandstone bedrock; altitude 20–1,000 m (commonly 200–500 m). Flowering: February–March; fruiting: March–May.

10. *Aglaia eximia* Miq., Fl. Ned. Ind. Suppl. 1: 197, 506. 1861; Pannell, Tree Fl. Malaya 4: 215. 1989; Kew Bull., Add. Ser. 16: 121. 1992; Fl. Males., ser. I, 12(1): 236. 1995; T. Wongprasert et al., Thai Forest Bull., Bot. 39: 215. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 84. 2013; Gardner et al., Forest Trees S. Thailand 2: 1233, 1453, f. 1614. 2016.— *A. argentea* Blume var. *eximina* (Miq.) Miq., Ann. Mus. Bot. Lugd.-Bat. 4: 55. 1868; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 70. 1895; Ridl., Fl. Malay Penins. 1: 405. 1922.— *A. argentea* Blume var. *curtisii* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 71. 1895. Fig. 5.

Trees (3–)5–20(–25) m tall, (20–)60–100 cm girth; bark smooth, greyishbrown with some lenticels in longitudinal rows, inner bark brown or pale brown; sapwood pale yellow or pale brown, sometimes tinged with pink, white latex. *Leaves* imparipinnate, 50–100 cm long; leaflets 5–10 on each side of rachis, opposite or subopposite, oblong, oblanceolate or lanceolate-oblong, 10–30 by 5–8.5 cm, apex acuminate or acute, usually rounded and subcordate at asymmetrical base, chartaceous, below thickly white, pale brown stellate scales, often with some brown stellate hairs interspersed, glabrous, midrib prominently ridged below, depressed above, lateral veins 10–25(–29) on each side of midrib, curved upwards, anastomosing near margin, venation hardly visible; petiole 20–60 cm long, slender and swollen near base, densely brown stellate scaly; petiolules 0.5–1 cm long, wrinkled when dry, densely brown stellate scaly. *Inflorescence* axillary or supra-axillary, 15–30 cm long; peduncle to 10 cm long, peduncle, rachis and pedicels with stellate scales. *Flowers* up to 2 mm in diam. *Calyx* broadly cup-shaped ca 1.5 mm long, divided into 5 lobes ca $\frac{3}{4}$ of the length, stellate hairs outside, glabrous inside, ciliate. *Petals* 5, free, ovate, ca 2 mm long, glabrous, yellowish. *Staminal tube* cup-shaped or ellipsoid, ca 1 mm long, margin incurved, glabrous, aperture up to 0.5 mm in diam., margin entire or slightly undulate. *Anthers* 5, inserted about middle of tube, usually included, sometimes protruding. *Ovary* depressed-globose, ca 0.5 mm long, densely scaly, 1–3-locular, each locule with 1(2) ovules, stigma, cylindrical or ovoid, truncate at apex, glabrous. *Infructescence* erect, up to 10 cm long, pale brown stellate scales. *Fruits* ellipsoid or obovoid, 2.5–3 by 1.5–2 cm, indehiscent, slightly longitudinally lobed, densely pale brown stellate scaly. *Seeds* 1–3, 1.5–1.7 by ca 2 by 0.5–0.7 cm, aril thin, white, pale yellow or pink.

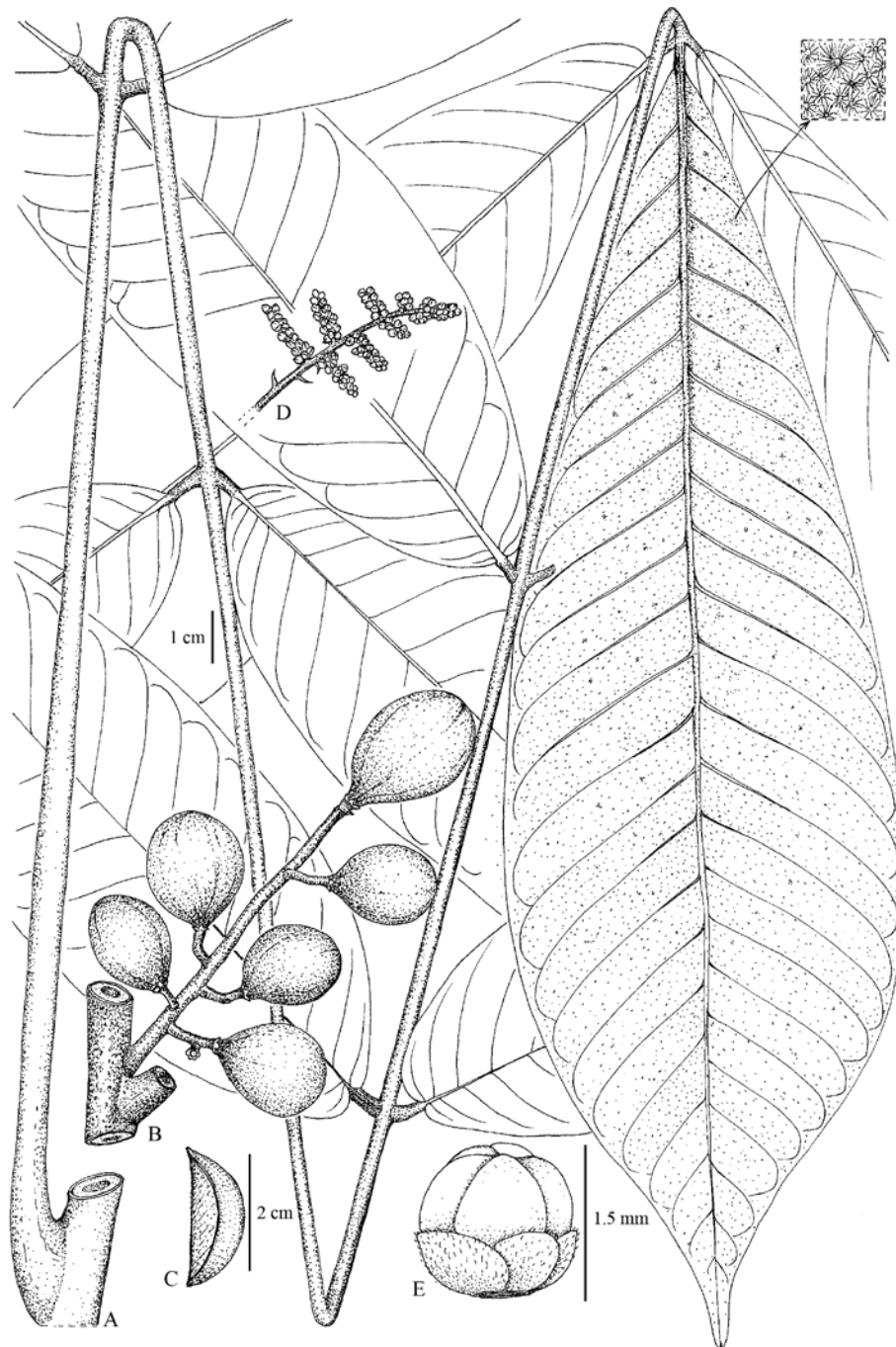


Figure 5. *Aglaia eximia* Miq.: A twig (B. Hansen et al. 11980); B. infructescence; C. seed (D.J. Middleton et al. 466); D. part of inflorescence; E. flower; F. longitudinal section of flower (J.F. Maxwell 86-730). Drawn by Orathai Kerdkaew.

T h a i l a n d.— SOUTH-WESTERN: Kanchanaburi, Prachuap Khiri Khan; PENINSULAR: Ranong, Phangnga, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla.

D i s t r i b u t i o n.— Myanmar, Vietnam, Malaysia, Indonesia (type), Philippines.

E c o l o g y.— Common in evergreen forest near streams, on limestone or granite bedrock, also in mixed deciduous forest; altitude 30–900 m (commonly 100–250 m). Flowering: March–October (most commonly July–October); fruiting: January–December (commonly July–November).

V e r n a c u l a r.— Sang krot (สังกรต), sang khriat (สังเครียต), sang khriat ko (สังเครียตโก), langsat hin (กลางสาดหิน)(Peninsular).

11. *Aglaia exstipulata* (Griff.) Theob. in Mason, Burma, ed. 3(2): 583. 1883; Balak., J. Bombay Nat. Hist. Soc. 67: 57. 1970; Pannell, Tree Fl. Malaya 4: 215. 1989; Kew Bull., Add. Ser. 16: 320. 1992; Fl. Males., ser. I, 12(1): 303. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 215. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 85. 2013; Gardner et al., Forest Trees S. Thailand 2: 1234, 1453, f. 1615. 2016.— *Euphoria exstipulata* Griff., Notul Pl. As. 4: 547. 1854; Ridl., Fl. Malay Penins. 1: 409. 1922.— *A. minutiflora* Bedd. var. *griffithii* Hiern in Hook.f., Fl. Brit. India 1: 557. 1875.— *A. griffithii* (Hiern) Kurz, J. Asiat. Soc. Bengal 44(2): 146. 1875.

Trees (3–)10–20(–27) m tall, (30–)70–150(–180) cm girth; bark dark brown, greyish brown, lenticels in longitudinal rows, inner bark creamy, white latex; twigs dark brown, densely reddish brown stellate hairs. *Leaves* imparipinnate, (5–)30–90 cm long; petiole 3–7.5 cm long, slender and swollen near base; leaflets 5–11 on each side of rachis, subopposite, elliptic-oblong, oblong-lanceolate or ovate-oblong, 7–15 by 2.5–3.5(–4) cm, apex acuminate, caudate to acute, cuneate at slightly asymmetrical base, margin sometimes recurved, undulate, chartaceous to subcoriaceous, midrib prominent, depressed above, lateral veins 10–15 on each side of midrib, subprominent below, curved upwards near margin, not anastomosing, hairs like on twigs on depressed midrib above, densely covering midrib, numerous and evenly distributed on the rest below and with smaller, paler, fewer-rayed stellate hairs, interspersed; petiolules 0.5–1.5 cm long, densely reddish brown stellate hairy. *Inflorescence* axillary or supra-axillary, 15–30 cm long; peduncles 5–10 cm long. *Flowers* fragrant; pedicels ca 2 mm long, reddish brown stellate hairy. *Calyx* 5, broadly cup-shaped, ca 0.5 mm long, divided into 5 lobes ca ½ of the length, reddish brown stellate hairs outside, glabrous inside. *Petals* 5, free, ovate, ca 1 mm long, glabrous, white, yellowish to reddish. *Staminal tube* cup-shaped, ca 1 mm, long, glabrous, deeply divided into 5 lobes in male, apical margin incurved, with a small aperture in female. *Anthers* 5, inserted about middle of tube, pointing upwards towards centre of flower. *Ovary* subovoid, less than 0.5 mm long, 2-locular, each locule with 1 ovule, stigma ovoid. *Infructescence* erect or slightly pendulous, 15–20 cm long, densely reddish brown stellate hairy throughout. *Fruits* ovoid or ellipsoid, 1.5–3 by 1–1.7 cm, indehiscent, densely stellate hairs like on twigs. *Seeds* ellipsoid or subglobose, surrounded by white edible aril.

T h a i l a n d.— PENINSULAR: Nakhon Si Thammarat, Ranong, Phangnga, Krabi, Phatthalung, Trang, Satun.

D i s t r i b u t i o n.— Myanmar (type), Vietnam, Malaysia, Singapore, Indonesia, Brunei.

E c o l o g y.— Tropical evergreen forest, on limestone or granite bedrock; altitude 50–600 m (commonly 150–300 m). Flowering: February–October (most commonly July–October); fruiting: March–December (commonly June–July).

V e r n a c u l a r.— Sang khriat (สังเครี่ด), huat ngo (หวาดเงาะ)(Peninsular).

U s e s.— Aril edible.

12. *Aglaia forbesii* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 68. 1895; Ridl., Fl. Malay Penins. 1: 406. 1922; Pannell, Tree Fl. Malaya 4: 215. 1989; Kew Bull., Add. Ser. 16: 207. 1992; Fl. Males., ser. I, 12(1): 265. 1995; T. Wongprasert et al., Thai Forest Bull., Bot. 39: 215. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 87. 2013 Gardner et al., Forest Trees S. Thailand 2: 1234, 1453, f. 1616. 2016.— *A. humilis* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 69. 1895; Ridl., Fl. Malay Penins. 1: 407. 1992; Pannell, Tree Fl. Malaya 4: 218. 1989.

Trees 8–20 m tall, 50–100 cm girth; bark brown, inner bark yellow, scented; twigs greenish brown or brown, densely reddish brown or greyish brown stellate scales or hairs. *Leaves* imparipinnate, 20–75 cm long; petiole 10–28 cm slender; leaflets 4–7 on each side of rachis, usually alternate, sometimes subopposite, elliptic or oblong, sometimes ovate, 8.5–30 by 2–10 cm, apex acuminate, base rounded or cuneate, asymmetrical, coriaceous, midrib and lateral veins prominent below, depressed above, lateral veins 10–15 on each side of midrib, curved upwards near margin, not anastomosing, reticulation barely visible on both surfaces, often nearly black when dry, numerous pits on both surfaces, numerous stellate scales or stellate hairs on midrib and lateral veins below; petiolules 0.5–2 cm. *Inflorescence* axillary or supra-axillary, near ends of twigs, 20–35 cm long, pubescent; peduncles 6–8.5 cm long. *Flowers* fragrant; pedicels ca 1 mm long, reddish brown hairy. *Calyx* broadly cup-shaped, ca 1.5 mm long, divided into 5 lobes ca $\frac{1}{3}$ of the length, reddish brown stellate scales or hairs outside, glabrous inside. *Petals* 5, free, obovate-oblong, up to 2 mm long, glabrous, yellowish. *Staminal tube* cup-shaped or obovoid, ca 2 mm long, glabrous, margin shallowly 5-lobed or with a pin-prick apical pore. *Anthers* 5, inserted above middle of tube, apex about same level as tube margin. *Ovary* subglobose, ca 2 by 1 mm, 2-locular, each locule with 1 ovule, sparsely hairy, stigma ovoid, ca 1 mm long, dark and shiny, 2 small apical lobes, glabrous. *Infructescence* up to 20 cm long, densely stellate hairy throughout. *Fruits* ovoid or ellipsoid, 2–4 by 1.5–3.5 cm, indehiscent, green to yellow or orange. *Seeds* 1 or 2, ellipsoid, 1.5–3 by 1–2.2 by ca 1.5 cm thick, aril completely covering seed, sweet-sour, translucent, yellow or pink, to 3 mm thick.

T h a i l a n d.— SOUTH-WESTERN: Phetchaburi; PENINSULAR: Phangnga, Trang.

D i s t r i b u t i o n.— Myanmar, Malaysia (type), Indonesia.

E c o l o g y.— Beside streams in evergreen forest, on sandstone bedrock; altitude 100–600 m. Flowering: March–December (commonly March–April); fruiting: May–November (commonly May–August).

V e r n a c u l a r.— Hom (หอม)(Peninsular).

U s e s.— Sweet and sour aril edible.

13. *Aglaia foveolata* Pannell Kew Bull. Add. Ser. 16: 211. 1992; Fl. Malesiana 1, 12(1): 266. 1995; Tr. Fl. Sabah & Sarawak 6: 57. 2007; PROSEA 5, 2: 46. 1995.

Medium-sized trees, 20–25 m tall, to 70 cm diam., branched; buttresses to 76 cm tall, to 30 cm out; bark smooth, reddish brown or greyish brown, with shallow longitudinal fissures, inner bark pale brown or reddish brown; sapwood yellowish brown, white latex; heartwood brown or reddish brown; twigs slender, densely reddish brown stellate hairs or scales or fimbriate peltate scales near apex. *Leaves* imparipinnate, to 42 cm long; petioles to 8 cm long; leaflets yellowish green or brown when dry, numerous pits on both surfaces, scales or hairs like on twigs, few or dense on midrib on both surfaces, absent to numerous on the rest below; lateral leaflets (5–)6–8(–13) on each side of rachis, subopposite; lamina elliptic, narrowly oblong or lanceolate, 5–13.5 by 1.3–4.5 cm, apex acuminate-caudate, acumen obtuse, to 15 mm long, base asymmetrical, cuneate or rounded, margin recurved, midrib prominent below, lateral veins 9–15(–24) on each side of midrib, curved upwards, sometimes with shorter veins in between, subprominent below, intercostal venation sometimes subprominent or faint, visible below; petiolules to 0.8 cm long. *Inflorescences* densely reddish brown indumentum like that on twigs, to 22 cm long and wide. *Flowers* ca 2 by 1.5–2 mm. *Calyx* deeply divided into 5 ovate, obtuse lobes, outside few to densely stellate hairs or scales. *Petals* 5. *Staminal tube* subglobose, 1–1.5 by 1–1.5 mm, aperture 0.3–0.5 mm in diam., wavy margin. *Anthers* 5, ellipsoid, 0.6–0.8 by 0.4 mm. *Ovary* subglobose or depressed globose, ca 0.4 by 0.9 mm, stigma narrowly ovoid or ellipsoid, with longitudinal ridges, subglobose or 2 lobes at apex, ca 0.5–0.3 mm. *Infructescence* ca 35 by 20 cm; peduncle up to 8 cm. *Fruits* subglobose or broadly ellipsoid, to 2.5 cm long, indehiscent, locules 1 or rarely 2, each with 1 seed, subglobose or broadly ellipsoid, to 2.5 cm long, purple, brown, orange or yellow, densely stellate hairs or scales. *Seed* with a translucent, sweet aril.

T h a i l a n d.— SOUTH-WESTERN: Phetchaburi

D i s t r i b u t i o n.— Laos, Vietnam, Sumatra, Peninsular Malaysia (type) and Borneo

E c o l o g y.— Lowland and hill dipterocarp forest; altitude to 1,000 m, including uncommon on mountain ridge in seasonal rainforest.

14. *Aglaia glabriflora* Hiern Fl. Brit. India 1: 555. 1875; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64, 1: 63. 1895; Ridley, Fl. Malay Pen. 1: 404. 1922; Pannell, Tr. Fl. Malaya 4: 217. 1989; Tr. Fl. Sabah & Sarawak 6: 59. 2007.

Medium-sized trees to 30 m tall, to 80 cm girth, branched, sometimes flowering at 3 m tall; small buttresses to 50 cm tall; bark smooth, grey or orange-brown lenticellate, inner bark mid-brown or greenish white, pale red or yellow; sapwood reddish brown or orange-brown, white latex or sap clear, pinkish-orange and watery; heartwood pale orange or brown; twigs numerous to dense reddish brown peltate scales at apex, whole shoot including leaves, inflorescences and infructescences brown or blackish brown when dry. *Leaves* imparipinnate, to 30 cm long; leaflets below with occasional stellate scales; lateral leaflets 3–5 on each side of rachis, opposite, elliptic or ovate, 3.5–10 by 1.5–4 cm, apex acuminate-caudate, acumen obtuse often narrow and parallel-sided, to 15 mm long, base cuneate or subrounded, asymmetrical, margin finely recurved, midrib flattish above, prominent below, lateral veins 4–7 on each side of midrib, usually brown or black when dry, curved upwards, intercostal venation faint; petiolules 0.3–0.8 cm long. *Inflorescences* to 20 cm long. *Flowers* obovoid, 2–2.5 by 1.9–2.1 mm. *Calyx* without hairs or scales. *Petals* 5. *Staminal tube* 1.7–2.3 by 1.5–2 mm. *Anthers* 5, 0.8–1 by 0.5–0.6 mm. *Ovary* ovoid, 0.5–0.9 by 0.4–0.8 mm, densely orange-brown stellate hairs, 2-locular, stigma 0.5–0.9 by 0.4–0.5 mm. *Infructescence* about 10 cm long with few fruits. *Fruits* subglobose to ellipsoid, 1–1.5 by 1–1.5 cm, indehiscent, locules

1 or 2, each with 1 seed; pericarp wrinkled when dry, without longitudinal ridges, densely reddish brown stellate hairs. *Seeds* completely covered with a gelatinous aril.

T h a i l a n d.— PENINSULAR: Songkhla.

D i s t r i b u t i o n.— Peninsular Malaysia (type), Indonesia

E c o l o g y.— Lowland and hill dipterocarp forest.

15. *Aglaia grandis* Korth. ex Miq., Ann. Mus. Bot. Lugd.-Bat. 4: 56. 1868; Pannell, Tree Fl. Malaya 4: 217. 1989; Kew Bull., Add. Ser. 16: 111. 1992; Fl. Males., ser. I, 12(1): 232. 1995; Gardner et al., Forest Trees N. Thailand 120, f. 230, 404. 2000; T. Wongprasert et al., Thai Forest Bull., Bot. 39: 216. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 94. 2013; Gardner et al., Forest Trees S. Thailand 2: 1235, 1454, f. 1617. 2016.— *A. lanuginosa* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 71. 1895; Ridl., Fl. Malay. Penins. 1: 407. 1922.— *Merostela grandis* (Korth. ex Miq.) Pierre, Fl. Forest Cochinch. Fasc. 21: t. 331. 1895.— *M. grandifolia* Pierre, Fl. Forest Cochinch. Fasc. 22: t. 342. 1896.— *Aglaia merostela* Pellegr. in Lecomte, Fl. Indo-Chine 1: 761. 1911; Craib, Fl. Siam. 1: 256. 1926. Fig. 6.

Trees (6–)12–20(–25) m tall, 30–180 cm girth; bark with shallow longitudinal fissures and corky, lenticellate, reddish-brown with scattered grey patches, inner bark dull green; heartwood yellowish brown, white latex; twigs stout, with many leaf scars, densely brown hairs with a central radius and 2–4 whorls of arms radiating from it (dendritic). *Leaves* imparipinnate, 1–1.5 m long; petiole 25–40 cm long, grooved above, much swollen near base; leaflets 5–10 on each side of rachis, subopposite, oblong or oblong-lanceolate, 11–28 by 3.5–7.5 cm, apex acute, obtuse or acuminate, base subcordate or cuneate, coriaceous, below densely dendritic hairs like on twigs, leaflet surface visible between hairs, midrib and lateral veins prominent below, depressed above, lateral veins 14–36(–40) on each side of midrib, straight then curved upwards, anastomosing near margin, reticulation faint, visible on both surfaces; petiolules 1–1.5 cm long, densely dendritic hairy. *Inflorescence* axillary or supra-axillary near end of twig, 80–100 cm long, densely dendritic hairy throughout; peduncles 10–20 cm long; pedicels ca 1 mm long or sessile, brown dendritic hairs. *Calyx* 5, broadly cup-shaped, ca 1 mm long, divided into 5 lobes ca ½ of the length, dendritic hairs outside, glabrous inside, ciliate. *Petals* 5, free, lobes obovate, 1–3 mm long, glabrous, yellowish green, then dark brown. *Staminal tube* obovoid, 1.9–3.3 by 1.5–2.3 mm, glabrous, margin undulate. *Anthers* 5, inserted about middle of tube, apices at level of aperture. *Ovary* ovoid, numerous stellate hairs, ca 0.2 by 0.1 mm, 3-locular, each locule with 1 ovule, stigma black and shiny when dry, cylindrical, narrowed slightly to obtuse, 3-lobed apex. *Infructescence* erect or pendulous, 20–30 cm long, dendritic hairy throughout. *Fruits* ovoid or ellipsoid, 3.5–4.5 by 3–4 cm, indehiscent, pale brown or orange-brown, densely dendritic hairy, locules 3, each with 0 or 1 seed. *Seeds* ellipsoid, longitudinally depressed, surrounded by white gelatinous aril.

T h a i l a n d.— NORTHERN: Chiang Rai, Phayao, Lampang; NORTH-EASTERN: Nong Khai, Buengkan; EASTERN: Si Sa Ket; SOUTH-WESTERN: Kanchanaburi, Phetchaburi, Prachuab Kiri Khan; SOUTH-EASTERN: Sa Kaeo, Chanthaburi, Trat; PENINSULAR: Surat Thani, Phangnga, Phatthalung, Songkhla, Narathiwat.

D i s t r i b u t i o n.— Vietnam, Malaysia, Borneo (type), Sulawesi, Philippines.

E c o l o g y.— In moist evergreen or mixed deciduous forest with bamboo, near streams, on sandstone bedrock; altitude to 1,000 m. Flowering: January–September (commonly June–September); fruiting: January–March.

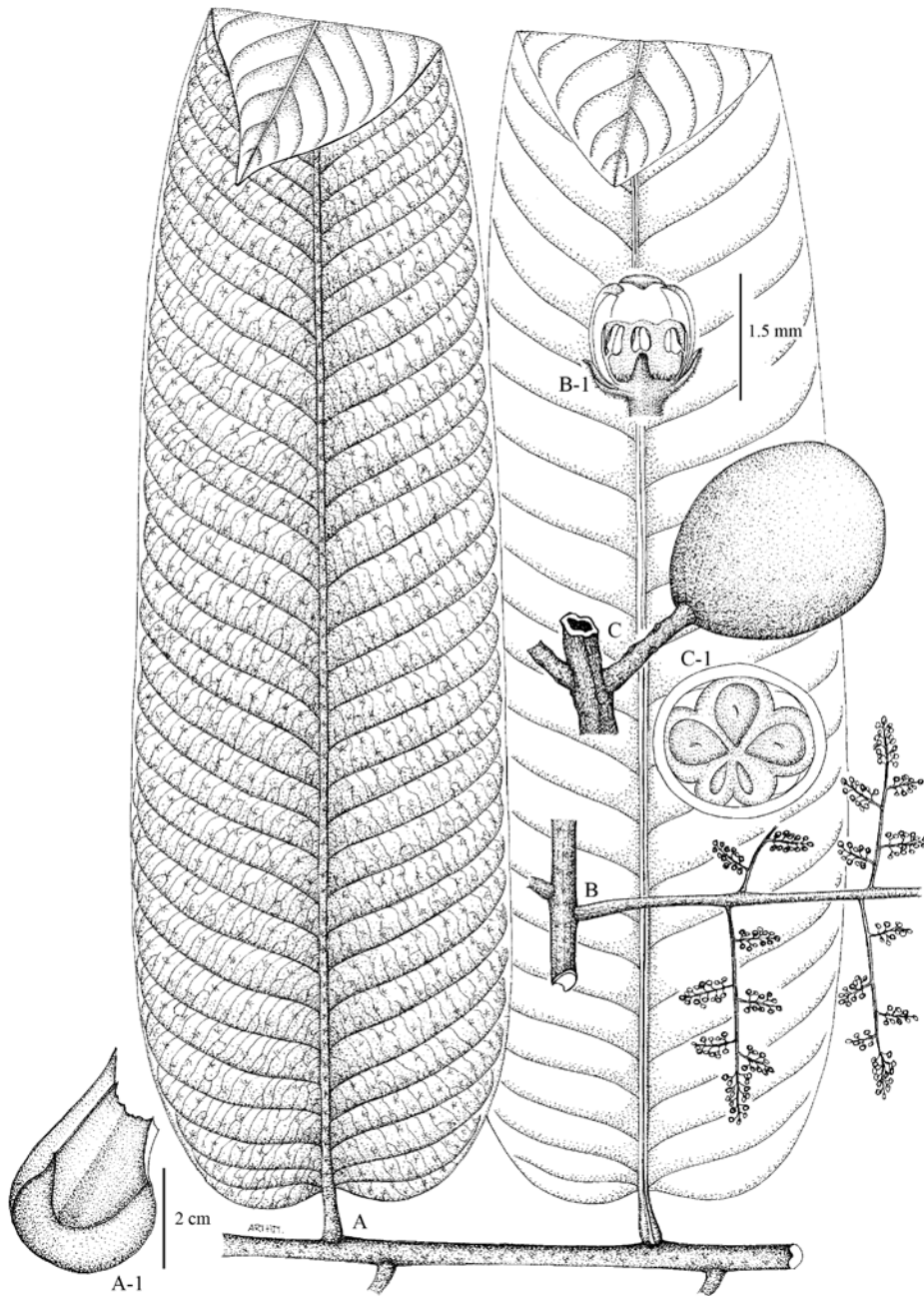


Figure 6. *Aglaia grandis* Korth. ex Miq.: A. twig, A-1 base of petiole (T.D. Pennington 7992); B. part of inflorescence, B-1 longitudinal section of flower (Th. Wongprasert 046-108); C. part of infructescence, C-1 cross section of drupe (C. Niyomdham 1994). Drawn by Arthit Khamkamnoed.

Vernacular.—Khang khao yai (คางคาวใหญ่)(Southeastern).

Uses.—Aril edible.

16. *Aglaia hiernii* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 74. 1895; Ridley, Fl. Malay Pen. 1: 408. 1922; Pannell, Tr. Fl. Malaya 4: 218. 1989; Kew Bull. Add. Ser. 16: 341. 1992; Mabb. & Pannell, Fl. Malesiana 1, 12: 31. 1995; Pannell, Tr. Fl. Sabah and Sarawak 6: 62. 2007; PROSEA 5, 2: 47. 1995; Gardner et al., Forest Trees S. Thailand 2: 1224, 1450. 2016.—*A. curtisii* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 71. 1895; Ridl., Fl. Malay Pen. 1: 408; 1922.

Tree to 15 m tall, to 50(–80) cm girth., branched; bark greenish brown or grey, with fine longitudinal lines of lenticels, inner bark green; sapwood green, pink, pale yellow or white, white latex; twigs fairly stout, densely reddish brown stellate hairs with arms to 1 mm long. *Leaves* imparipinnate, to 70 cm long; petioles to 18 cm long; leaflets yellowish green when young, densely stellate hairs like on twigs on midrib below and numerous on that surface, with arms of adjacent hairs overlapping, interspersed with numerous pale brown stellate scales or hairs with few ascending arms; lateral leaflets (3) 4(5) on each side of rachis, opposite, obovate, elliptic or oblong, 7–30 by 4–11 cm, apex short-caudate, acumen acute, to 15 mm long, base rounded, margin recurved, midrib prominent below, lateral veins 12–25 on each side of midrib, curved upwards near margin, subprominent below, intercostal venation faint; petiolules 1–2.5 cm long. *Inflorescences* densely stellate hairs like on twigs, to 35 cm long and wide; peduncle to 5 cm. *Flowers* subglobose, ca 1 by 1 mm; sessile and tightly packed on terminal branches of inflorescence, *Calyx* divided almost to base into 4 or 5 subrotund lobes, almost or completely glabrous. *Petals* 5. *Staminal tube* shorter than corolla, cup-shaped, apical margin incurved leaving a small aperture. *Anthers* 5, ovoid, inserted just below margin of tube, apices with pale stellate hairs that fill aperture. *Ovary* ca 0.3 mm diam., stigma glabrous, black when dry. *Infructescence* ca 35 cm long, few fruits. *Fruits* obovoid or ellipsoid, ca 5 by 3.5 cm, indehiscent, locules 1 (–3), each with 1 seed; pericarp 2–4 mm thick, woody when dry, stellate hairs or scales outside; pedicel to 0.5 cm long. *Seeds* ca 2.9 by 1.9 by 1.7 cm, aril ca 1.5 mm thick, translucent, pale orange, sweet and edible.

Thailand.—PENINSULAR: Ranong, Phangnga, Krabi.

Distribution.—Peninsular Malaysia (type), Indonesia.

Ecology.—Lowland and hill dipterocarp forest, sometimes on limestone bedrock.

17. *Aglaia korthalsii* Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 42. 1868; Pannell, Tree Fl. Malaya 4: 228. 1989; Kew Bull., Add. Ser. 16: 167. 1992; Fl. Males., ser. I, 12(1): 251. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 216. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 97. 2013; Gardner et al., Forest Trees S. Thailand 2: 1225, 1451. 2016.—*Hearnia aquatica* Pierre, Fl. Forest Cochinch. Fasc. 21: t. 333b. 1895.

Trees 5–20(–30) m tall, 50–120 cm girth; bark dark brown, rough and scaly, inner bark reddish brown; twigs longitudinally wrinkled, densely shiny reddish brown peltate scales which a dark centre and pale, irregular or sometimes shortly fimbriate margin. *Leaves* imparipinnate, to 40 by 48 cm long; petiole 5–12 cm long, slender; leaflets 1–3 on each side of rachis, opposite or subopposite, elliptic or ovate, sometimes obovate, 10–18 by 4–5.5 cm, apex acuminate, base rounded to slightly cuneate, subcoriaceous, scattered to numerous

scales like on twigs at fairly regular intervals below, midrib prominent below, depressed above, lateral veins 9–15(–25) on each side of midrib, curved upwards, anastomosing near margin, lateral veins subprominent below, reticulation hardly visible; petiolules 0.5–1.5 cm long, numerous peltate scales. *Inflorescences* axillary, 10–30 cm long, densely peltate scaly like on twigs; peduncles 2–5 cm long, *Flowers* fragrant; pedicels ca 1 mm long, numerous to densely reddish brown peltate scales. *Calyx* broadly cup-shaped, ca 0.5 mm long, divided into 5 lobes ca $\frac{1}{2}$ – $\frac{3}{4}$ of the length, peltate scaly outside, glabrous inside, ciliate. *Petals* 5, free, subobovate, 1–2 mm long, white or yellowish. *Staminal tube* obovoid or cup-shaped, ca 0.8 by 1.9 mm, margin incurved, shallowly 5-lobed or slightly undulate, glabrous inside. *Anthers* 5, inserted near tube margin, protruding and pointing towards centre of flower. *Ovary* depressed globose, peltate scaly, 2(3)-locular, each locule with 1 ovule, stigma 0.5 by 0.7 mm, depressed globose or obovoid, two small lobes or a central depression at apex. *Infructescence* 3–17 by ca 14 cm, erect or slightly recurved, up to 15 fruits, densely reddish-brown peltate scales throughout. *Fruits* ellipsoid or subglobose, 2–4 by 1–3.5 cm, indehiscent, orange, with a longitudinal ridge encircling fruit, locules 2(3), each with 0 or 1 seed. *Seeds* ellipsoid, 1 or 2, 1.5–2 by 1–1.5 cm, with translucent, yellow aril.

T h a i l a n d.— NORTHERN: Nan; SOUTH-EASTERN: Chanthaburi; SOUTH-WESTERN: Kanchanaburi, Prachuap Khiri Khan; PENINSULAR: Ranong, Krabi, Trang, Yala, Narathiwat.

D i s t r i b u t i o n.— India, Bhutan, Myanmar, Vietnam, Malaysia, Indonesia (type), Philippines.

E c o l o g y.— In lowland evergreen forest, limestone or sandstone bedrock; altitude 0–340 m. Flowering: January–October (commonly January–April); fruiting: January–March.

V e r n a c u l a r.— Ki ya (กี๋ยา)(Peninsular).

U s e s.— Aril edible.

18. *Aglaia lawii* (Wight) C.J. Saldanha ex Ramamoorthy in C.J. Saldanha & Nicolson, Fl. Hassan Dist.: 392. pl. 76. 1976; Pannell, Kew Bull., Add. Ser. 16: 97. 1992; Fl. Males., ser. I, 12(1): 228. 1995; Gardner et al., Forest Trees N. Thailand 119, f. 228. 2000; P.Hua & Pannell, in Fl. China 11: 122. 2008; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 216. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 98. 2013; Gardner et al., Forest Trees S. Thailand 2: 1236, 1454, f. 1618. 2016.— *Nimmonia lawii* Wight, Calcutta J. Nat. Hist. 7: 13. 1847.— *Aglaia oligocarpa* Miq., Ann. Mus. Bot. Lugd.-Bat. 4: 45. 1868. Pannell, Tr. Fl. Malaya 4:221. 1989.— *Amoora lawii* (Wight) Bedd., Fl. Sylv. S. India: t. 133. 1871; Hiern in Hook.f., Fl. Brit. India 1 561. 1875.— *Aglaia andamanica* Hiern in Hook.f., Fl. Brit. India 1: 555. 1875; Craib, Fl. Siam. 1: 254.— *Lansium pedicellatum* Hiern in Hook.f., Fl. Brit. India 1: 558. 1875.— *Amoora canarana* (Turcz) Hiern in Hook.f., Fl., Brit. India 1: 560. 1875.— *Amoora maingayi* Hiern in Hook.f., Fl. Brit. India 1: 562. 1875; Ridl., Fl. Malay Penins. 1: 400. 1922.— *Amoora dysoxyloides* Kurz, J. Asiat. Soc. Bengal 44(2): 200. 1876.— *Aglaia tetrapetala* Pierre, Fl. Forest Cochinch. Fasc. 22: t. 337A. 1897.

Trees 5–20(–30) m tall, (20–)50–100(–200) cm girth; bark reddish brown, yellowish brown or pale pinkish brown smooth or flaking, inner orange or red; sapwood whitish; heartwood brown, white latex; twigs longitudinally ridged, sometimes with numerous elliptic brown lenticels, densely pale brown or whitish peltate scales, irregular or fimbriate margin. *Leaves* imparipinnate, 15–30 cm long; petiole 3–9 cm long; leaflets 1–3(–5) on each side of rachis, opposite or subopposite, lanceolate, oblanceolate or oblong, 4.5–22 by

2–7.5 cm, apex acuminate or acuminate-caudate, base rounded or cuneate, asymmetrical, margin sometimes recurved, coriaceous or subcoriaceous, glabrous or sparsely peltate scaly especially on midrib above, whitish brown peltate scales absent to numerous below, midrib prominent below, flat to depressed above, lateral veins 5–14 on each side of midrib, straight then curved upwards, not anastomosing, sometimes with hairy domatia in axils, reticulation visible; petiolules 2–10(–20) mm long, grooved above, usually with numerous pale brown or whitish peltate scales, glabrescent. *Inflorescence* axillary or supra-axillary, 10–20 cm long; peduncles 2–5 cm long; pedicels 1–2 mm long, peltate scales. *Calyx* broadly cup-shaped, ca 0.5 mm long, divided into 3 or 4 lobes, ca $\frac{2}{3}$ of the length, pale brown peltate scales outside, glabrous inside. *Petals* 3 or 4, joined at base, subobovate, ca 1 mm long, glabrous, whitish yellow to orange. *Staminal tube* obovoid or cup-shaped, 0.5–3.5 by 1–3.5 mm, margin incurved, glabrous, aperture 0.6–1.5 in diam., margin smooth or slightly undulate. *Anthers* 6–9, inserted near base of tube, slightly protruding. *Ovary* ovoid or subglobose, ca 0.5 mm long, glabrous, 3-locular, each locule with 2 ovules, stigma with 3 apical lobes or truncate at apex. *Infructescence* erect or slightly recurved, 10–20 cm long; peduncle 2.5–4 cm, densely pale brown peltate scaly throughout. *Fruits* subglobose, ca 3 cm in diam., dehiscent, locules 3, each with 0 or 1 seed.; pericarp pink or yellow, with 3 longitudinal ridges. *Seed* 1.5–2.5 by 1–1.5 cm, with orange-red aril.

T h a i l a n d.— NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Lampang, Tak, NORTH-EASTERN: Phetchabun, Sakon Nakhon, Mukdahan; EASTERN: Chaiyaphum, Nakhon Ratchasima; SOUTH-WESTERN: Uthai Thani, Kanchanaburi; CENTRAL: Lop Buri, Saraburi, Nakhon Nayok; SOUTH-EASTERN: Sa Kaeo, Chon Buri, Chanthaburi; PENINSULAR: Phangnga, Phatthalung, Yala, Narathiwat.

D i s t r i b u t i o n.— India (type), Bhutan, China, Myanmar, Laos, Vietnam, Malaysia, Indonesia, Philippines, Taiwan, New Guinea, New Britain, Solomon Islands.

E c o l o g y.— Evergreen to mixed deciduous forest, near streams, on granite or sandstone or limestone bedrock; altitude 30–1,500 m (commonly 250–700 m). Flowering: March–December (commonly March–August); fruiting: May–July.

V e r n a c u l a r.— Ta suea (ตาเสือ)(Northern); khang khao (ค้ำขาว)(Eastern); sak ka ma (สักกะมา), sang ka tong (สังกะตัง)(Southwestern); mai hom (ไม้หอม), sang khriat (สังเคียด) (Peninsular).

N o t e.— The two subspecies: subsp. *lawii* and subsp. *oligocarpa* (Miq.) Pannell recognized in Peninsular Malaysia and Borneo are not readily distinguishable in Thailand. All collections from Thailand have therefore been treated as the type subspecies, *A. lawii*.

19. *Aglaia leptantha* Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 51. 1868; Pannell, Kew Bull., Add. Ser. 16: 201. 1992; Fl. Males., ser. I, 12(1): 261. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 217. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 102. 2013; Gardner et al., Forest Trees S. Thailand 2: 1225, 1451. 2016.

Trees 8–20 m tall, 65–150 cm girth; bark reddish brown with greyish green patches; sapwood pale brown, reddish brown, or dark orange-brown; twigs slender, longitudinally wavy ridged, densely pale brown or grey peltate scales with fimbriate margin. *Leaves* imparipinnate, 20–50 cm long; petiole 6–10 cm long, slender; leaflets 4–6 on each side of rachis, lower ones alternate, oblong, oblanceolate, oblong-lanceolate, 7.5–32 by 2.5–10.5 cm, apex caudate and obtuse, base asymmetrical, chartaceous to subcoriaceous, sparsely

peltate scaly below, midrib prominent below, depressed above, lateral veins 6–14 on each side of midrib, curved upwards near margin, more or less anastomosing, peltate scales below then glabrous; petiolules 0.4–1 cm long, with peltate scales. *Inflorescence* axillary or supra-axillary, up to 30 cm long; peduncles 8–10 cm; pedicels ca 0.5 mm long, with peltate scales. *Calyx* cup-shaped, ca 1 mm long, divided into 5 lobes ca ½ of the length, scaly outside. *Petals* 5, free, lanceolate or oblanceolate, ca 1.5 mm long, glabrous, white, yellow or deep orange. *Staminal tube* obovoid, to 3 by 3 mm, longer than petals at anthesis, aperture narrow, ca 0.3 mm in diam., glabrous or a few stellate hairs on anthers and inside of staminal tube. *Anthers* 5, ovoid, inserted below middle of tube, included. *Ovary* slightly depressed globose, ca 1 by 1 mm, densely stellate hairs or scales, 1 or 2 locular, each locule with 1 ovule, stigma ovoid with 2 small apical lobes. *Infructescence* up to 30 cm long; peduncle 3–10 cm long, densely peltate scaly throughout. *Fruits* subglobose or ellipsoid, 1.5–3 by 1.5–2.5 cm, indehiscent, with a longitudinal ridge encircling fruit, densely pale brown peltate scaly; pericarp thin or woody, brown or orange. *Seeds* 1 or 2, ellipsoid, ca 2 by 1 cm, with translucent, gelatinous, edible aril.

T h a i l a n d.— PENINSULAR: Nakhon Si Thammarat, Songkhla, Narathiwat.

D i s t r i b u t i o n.— Myanmar, Cambodia, Malaysia, Singapore, Indonesia (type), Philippines.

E c o l o g y.— In evergreen forest, on sandstone or limestone or granite bedrock; altitude 500–1,100 m. Flowering: August–October; fruiting: October–April.

V e r n a c u l a r.— Sang khriat leuat (สังเคียดเลือด), sang ka tong (สังกะต๋อง)(Peninsular).

U s e s.— Sweet and sour aril edible.

20. *Aglaia leucophylla* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. Bengal, 64: 66. 1895; Ridl., Fl. Malay Penins. 1: 403. 1922; Pannell, Tree Fl. Malaya 4: 218. 1989; Kew Bull., Add. Ser. 16: 266. 1992; Fl. Males., ser. I, 12(1): 271. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 217. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 103. 2013; Gardner et al., Forest Trees S. Thailand 2: 1226, 1451. 2016.— *A. kunstleri* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 69. 1895; Craib, Fl. Siam. 1: 255. 1926.— *A. heteroclita* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 78. 1895; Ridl., Fl. Malay Penins. 1: 410. 1922. Fig. 7.

Trees 5–15(–20) m tall, (35–)70–90 cm girth; sometimes fluted at base or with low narrow buttresses; bark greyish brown, grey or creamy brown, lenticellate, sometimes flaking, inner bark orange or brown, white latex; twigs with shallowly longitudinal wavy ridges, densely golden brown stellate scales or peltate scales. *Leaves* imparipinnate, 25–35 cm long; petiole 10–15 cm long, slender, slightly swollen near base; leaflets 3–7 on each side of rachis, opposite or subopposite, lanceolate or oblanceolate, 9–20 by 3–5 cm, apex caudate or acuminate, base cuneate, asymmetrical, rarely rounded, chartaceous, glabrous on both surfaces or numerous tiny stellate golden brown scales, sometimes interspersed with stellate hairs, sometimes with tiny pits numerous on one or both surfaces, midrib prominent below, depressed above, lateral veins 10–13 on each side of midrib, curved upwards near margin, nearly or quite anastomosing, prominent below, depressed above, reticulation visible below; petiolules 1–3.5 cm long, tiny stellate scales. *Inflorescence* axillary or supra-axillary, 30–60 by 25 cm; peduncles 7–14 cm long. *Flowers* up to 1.5 mm in diam., fragrant; pedicels ca 1 mm long, yellow stellate or peltate scales throughout. *Calyx* broadly cup-shaped, ca 0.5 mm long, divided into 5 lobes ca ½ of the length, golden brown stellate hairy outside, glabrous

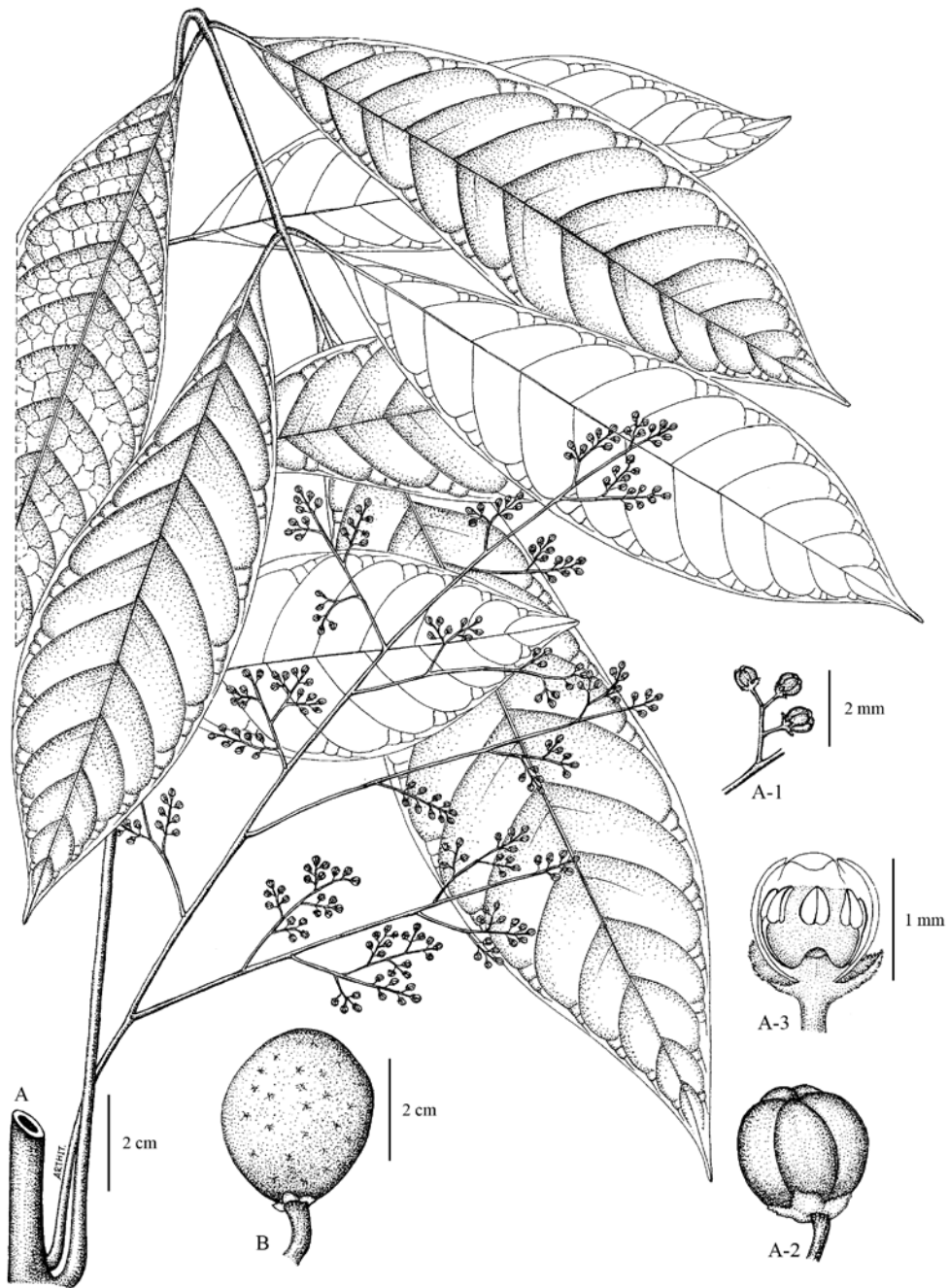


Figure 7. *Aglaia leucophylla* King: A. twig with inflorescences, A-1 part of inflorescence, A-2 flower, A-3 longitudinal section of male flower (B. Sangkachand 1256); B. drupe (C. Niyomdham 5016). Drawn by Arthit Khamkamnoed.

inside. *Petals* 5, free, oblong, ca 1.5 mm long, glabrous, yellowish. *Staminal tube* subglobose or obovoid, ca 0.9 mm long, glabrous, aperture ca 0.3 mm in diam., margin undulate. *Anthers* 5(–7), inserted in middle of tube, their apices at same level as tube margin. *Ovary* depressed globose or broadly ovate, ca 0.5 mm long, densely orange brown stellate hairy, 2-locular, each locule with 1 ovule, stigma ovoid. *Infructescence* slightly recurved, 10–20 by 18 cm long, 3–10 fruits, golden brown stellate scaly throughout. *Fruit* ovoid or subobovoid, ca 3 by 3 cm, indehiscent, yellow, pale orange or brown, densely golden brown stellate scaly, locules 2, each with 1 seed. *Seed* ellipsoid, ca 2.3 by 1 cm, white or pinkish, sweet-sour aril.

Thailand.—SOUTH-EASTERN: Chachoengsao; PENINSULAR: Nakhon Si Thammarat, Songkhla.

Distribution.—Malaysia (type), Brunei, Indonesia, Philippines.

Ecology.—In evergreen forest, near streams, on limestone bedrock; altitude 100–300 m. Flowering: June–December (commonly June–September); fruiting: November–May.

Vernacular.—Ma khuang (มะขวง)(Southeastern); sang ka tong (สังกะตัง)(Peninsular).

Uses.—Aril edible.

21. *Aglaia macrocarpa* (Miq.) Pannell, Kew Bull., Add. Ser. 16: 65. 1992; Fl. Males., ser. I, 12(1): 215. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 217. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 104. 2013; Gardner et al., Forest Trees S. Thailand 2: 1224, 1451. 2016.—*Epicharis macrocarpa* Miq., Fl. Ned. Ind., Suppl. 196, 505. 1861.—*Amoora rubescens* Hiern in Hook.f., Fl. Brit. India 1: 561. 1875; Ridl. Fl. Malay Penins. 1: 399. 1922.—*Aglaia trimera* Ridl. in Kew Bull. 368. 1930.—*A. triplex* Ridl. in Bull. Misc. Inform. Kew 1938: 215. 1938.—*A. rubescens* (Hiern) Pannell, Malaysia Forester 45: 455. 1982; Tree Fl. Malaya 4: 223. 1989.

Trees 3–20(–40) m tall, 80–150 cm girth; bark reddish brown or grey, flaking in large irregular brittle scales, numerous orange or reddish brown lenticels, inner bark dark red or pinkish brown; twigs rather stout, densely minute reddish brown or grey peltate fimbriate scales, glabrescent. *Leaves* imparipinnate, 14–70 cm long, glabrescent; petiole 5–20 cm long, slender, swollen near base, glabrous; leaflets 5–7 on each side of rachis, opposite or subopposite, obovate, ovate-oblong to oblong-lanceolate, 6–13(–25) by 4–4.5(–7) cm, apex acuminate or caudate, rounded or cuneate at asymmetrical base, subcoriaceous to chartaceous, glabrous, both surfaces usually rugulose, sometimes smooth, pinkish brown when dry above, few minute reddish brown peltate scales, sometimes interspersed with pale grey peltate scales on midrib and lateral veins below, midrib prominent below, depressed above, lateral veins 6–11 on each side of midrib, curved upwards, more or less anastomosing near margin, slightly prominent below only; petiolules ca 1 cm long, glabrous. *Inflorescence* axillary or supra-axillary, up to 30 cm long; peduncles up to 10 cm long. *Flowers* 3.4–5 mm long, fragrant; pedicels 1–5 mm long, densely reddish brown peltate scales. *Calyx* broadly cup-shaped, 1–2.5 mm long, divided into 3 lobes ca $\frac{2}{5}$ of the length, dark brown scaly, glabrescent outside, glabrous inside. *Petals* 3, free, linear to oblanceolate, 2–5 mm long, densely scaly outside, glabrous inside, whitish to yellowish. *Staminal tube* subglobose, ca 1.5 mm in diam., glabrous, margin shallowly and irregularly lobed. *Anthers* 6–10, inserted at about middle of tube, the apices level with tube margin, usually with a few simple hairs. *Ovary* depressed globose, up to 2 mm in diam., densely stellate scaly, then glabrous, 3-locular,

each locule with 1 ovule, stigma ovate-oblong, up to 2 mm long, glabrous. *Infructescence* erect, up to 4 fruits; peduncle 3.5–8 cm. *Fruits* obovoid, 5–6 by 4–5.5 cm, dehiscent, with dark reddish brown stellate scales, dehiscing into 3 locules when ripe, each with 0 or 1 seed; pedicel up to 1 cm. *Seed* ca 4.5–5.5 by 2–2.5 by 1.5 cm, completely covered with a red aril.

T h a i l a n d.— PENINSULAR: Phangnga, Phatthalung.

D i s t r i b u t i o n.—Vietnam, Malaysia, Singapore, Indonesia (type), Philippine Islands.

E c o l o g y.—In tropical evergreen to mixed deciduous forest, on limestone bedrock; altitude 50–1,000 m (commonly 50–200 m). Flowering February–August (commonly February–May); fruiting April–May.

V e r n a c u l a r.— Thiam dong (เทียนดง)(Peninsular)

22. *Aglaia meliosmoides* Craib, Bull. Misc. Inform. Kew 1913: 68. 1913; Fl. Siam. 1: 256. 1926; Pannell, Tree Fl. Malaya 4: 219. 1989; Tree Fl. Sabah and Sarawak 6: 75. 2007; Gardner et al., Forest Trees S. Thailand 2: 1243, 1456. 2016.— *A. gagnepainiana* Pellegr., Bull. Soc. Bot. France 93: 320. 1946. Fig. 28.

Shrubs to small trees (1–)5–10 m tall, 20–80 cm girth; bark smooth, greyish brown, lenticellate; sapwood white; twigs densely reddish brown stellate hairy at apex. *Leaves* simple, oblong or oblanceolate, 9–22 by 4–6.5 cm, apex acuminate, acute, rarely broadly acute or retuse, base cuneate, obtuse or subsymmetrical, subcoriaceous, glabrous except along midrib below, midrib prominent below, depressed above, lateral veins 15–20 on each side of midrib, curved upwards, more or less anastomosing near margin, reticulation subprominent on both surfaces; petiole 1–2(–2.5) cm long, sparsely stellate hairy, swollen at both ends. *Inflorescence* axillary near end of twigs, 3–5(–10) cm long, densely tomentose throughout; peduncles 1–2 cm long; pedicels 2–2.5 mm long, hairy. *Calyx* broadly cup-shaped, ca 2 mm long, divided into 5 lobes ca $\frac{2}{3}$ of the length, pubescent outside, glabrous inside. *Petals* 5, free, obovate or elliptic, ca 2 by 1 mm, glabrous, yellowish. *Staminal tube* cup-shaped, 1–2 mm long, glabrous, apical margin toothed or undulate. *Anthers* 4 or 5, included. *Ovary* ovoid, hairy, 2-locular, each locule with 1 ovule, stigma ovoid. *Infructescence* up to 5 cm long, erect, tomentose. *Fruits* obovoid or subglobose, 1.5–2 by 1.2–1.5 cm, indehiscent, densely indumentum like on twigs throughout, red when ripe, with one longitudinal ridge; pedicel 2–4 mm long, densely hairy like on twigs. *Seeds* 1 or 2, 1–1.5 by 0.5 cm; with a gelatinous aril.

T h a i l a n d (type).— NORTHERN: Nan, Lampang, Phrae (Rawng Kwang, Me K'Mi, Type of *Aglaia meliosmoides* Craib, Kerr 2369, lectotype K, isolectotypes BM, E, K); NORTH-EASTERN: Loei, Nong Khai, Buengkan.

D i s t r i b u t i o n.— Laos, Peninsular Malaysia, Singapore, Indonesia, Borneo.

E c o l o g y.— In evergreen forest; on granite or limestone or sandstone bedrock; altitude 20–500 m. Flowering: February–April; fruiting: April–August.

V e r n a c u l a r.— Hom klai (หอมไกล), pra yong (ประยงค์), kra duk ling (กระดุกลิง), hom kloi (หอมค้อย)(Northern).

U s e s.— Aril used as herb.

23. *Aglaia odorata* Lour., Fl. Cochinch. 1: 173. 1790; Hiern in Hook.f., Fl. Brit. India 1: 554. 1875; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 62. 1895; Craib, Fl. Siam. 1: 257. 1926; Backer & Bakh.f., Fl. Java 2: 128. 1965; C.Y.Wu, Fl. Yunnan. 1: 239. 1977; Pannell, Fl. Males., ser. I, 12(1): 383. 1995; P.Hua & Pannell., in Fl. China 11: 124. 2008; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 217. 2011; Gardner et al., Forest Trees S. Thailand 2: 1237, 1454, f. 1619. 2016.— *A. sinensis* Pierre, Fl. Forest Cochinch. Fasc. 21: t. 334. 1895.— *A. chaudocensis* Pierre, Fl. Forest Cochinch. Fasc. 22: t. 339B. 1896; Craib, Fl. Siam. 1: 254.— *A. repouensis* Pierre, Fl. Forest Cochinch. Fasc. 22: t. 340B. 1896.— *A. duperreana* Pierre, Fl. Forest Cochinch. Fasc. 22: t. 341B. 1896.— *A. odorata* Lour. var. *chaudocensis* (Pierre) Pellegr. in Lecomte, Fl. Indo-Chine 1: 757. 1911.— *A. oblanceolata* Craib, Bull. Misc. Inform. Kew 1926: 344. 1926; Craib, Fl. Siam. 1: 253. 1926. Plate CXXIV: F–G.

Shrubs to small trees (1–)4–9 m tall, (8–)30–50 cm girth; bark smooth, grey, brownish or creamy yellow, lenticellate, inner bark yellowish to reddish brown; twigs with yellowish-brown stellate scales densely at apex; older twigs glabrous, sparsely lenticellate. *Leaves* imparipinnate, 4–16 cm long; petiole 2–3.5 cm long; leaflets 1 or 2(3) on each side of rachis, opposite, oblanceolate, obovate or elliptic, (1.5–)7–14(–20) by (1–)2.5–7 cm, apex shortly acuminate, cuneate or attenuate at slightly asymmetrical base, tapering to a very narrow wing on petiolule, subcoriaceous, glabrous, midrib prominent below, depressed above, lateral veins 5–9 on each side of midrib, curved upwards, more or less anastomosing near margin, lateral veins and reticulation subprominent on both surfaces; petiolules 0.5–1 cm long, glabrous. *Inflorescence* axillary, 4–18 cm long, erect; peduncles 2–4 cm long. *Flowers* to 2.5 mm long, fragrant; pedicels 1–2 mm long, glabrous or glabrescent. *Calyx* broadly cup-shaped, ca 1 mm long, divided into 5 lobes ca $\frac{3}{4}$ of the length, glabrous on both sides, ciliate. *Petals* 5, free, slightly obovate-oblong, 1.5–2 mm long, glabrous, yellow. *Staminal tube* ovoid, 1–1.5 mm long, incurved and shallowly 5-lobed at apical margin. *Anthers* 5, inserted in upper half of staminal tube, included or just protruding beyond aperture. *Ovary* ovoid or depressed globose, ca 1 mm long, densely hairy, 2-locular, each locule with 1 ovule, stigma ovoid with two small apical lobes. *Infructescence* erect, 5–8 cm long, glabrous or hairy throughout. *Fruit* ellipsoid, ovoid or obovoid, 1–1.5 by 0.7–1 cm, indehiscent, brownish to orange red, usually with 1 seed. *Seed* ellipsoid, ca 0.5 by 0.3 cm, with translucent white aril.

T h a i l a n d.— NORTHERN: Chiang Mai; NORTH-EASTERN: Loei; EASTERN: Chaiyaphum, Nakhon Ratchasima; SOUTH-WESTERN: Uthai Thani, Kanchanaburi, Prachuap Khiri Khan; CENTRAL: Saraburi, Bangkok (cultivated); SOUTH-EASTERN: Sa Kaeo, Chon Buri (Nakawn Sawan, Me Wong, type of *Aglaia oblanceolata* Craib, *Kerr 6034*, lectotype K, isolectotypes ABD, BK, BM, SING), Rayong; PENINSULAR: Surat Thani, Nakhon Si Thammarat, Trang, Songkhla.

D i s t r i b u t i o n.— China (type), Cambodia, Vietnam, Malaysia (cultivated), Indonesia (cultivated).

E c o l o g y.— Tropical evergreen to dry evergreen forest, on sandy soil to limestone bedrock; altitude 30–1,100 m (most commonly 80–500 m). Flowering all year round (commonly February–September); fruiting: February–May.

V e r n a c u l a r.— Kai thian (ไคเทียน)(Central); ka sum nok (กาสุมนอก)(Southwestern); hom klai (หอมไคล)(Peninsular).

U s e s.— Cultivated, often as a hedge, for its fragrant male flowers and ornamental value; dried flowers used for scented tea; aril edible.

24. *Aglaia odoratissima* Blume, Bidjr. Fl. Ned. Ind.: 171. 1825; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 67. 1895; Ridl., Fl. Malay Penins. 1: 404. 1922; Craib, Fl. Siam. 1: 253. 1926. Corner, Wayside Tree Mal. 1: 457. 1940; Backer et Bakh.f., Fl. Java 2: 128. 1965; Pannell, Tree Fl. Malaya 4: 221. 1989; Kew Bull., Add. Ser. 16: 237. 1992; Fl. Males., ser. I, 12(1): 276. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 219. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 115. 2013; Gardner et al., Forest Trees S. Thailand 2: 1238, 1455, f. 1620. 2016.— *A. paniculata* Kurz, Prelim. Rep. Forest Pegu: 34. 1875; Craib, Fl. Siam. 1: 258. 1926.— *A. cuspidella* Ridl., Bull. Misc. Inform. Kew 1930: 367. 1930.— *A. fraseri* Ridl., Bull. Misc. Inform. Kew 1930: 368. 1930. Fig. 8.

Small to medium-sized trees, 3–15(–20) m tall, 30–100 cm girth; bark rather smooth, greyish, inner bark pink to orange; sapwood white; heartwood brownish; twig apices densely dark brown, fimbriate peltate scales, interspersed with pale yellowish brown stellate hairs. *Leaves* imparipinnate, 10–30 by 5–30 cm; petiole 2–5(–9) cm long, slender; leaflet 1–2(–3) on each side of rachis, opposite or subopposite, obovate or oblanceolate, 4.5–13(–18) by 2–6 cm, apex acuminate, rarely obtuse, rounded or cuneate at base, chartaceous to subcoriaceous, hairs and scales on midrib on both surfaces, few on lateral veins and leaflet below, midrib above flat or slightly depressed, prominent below, lateral veins 5–9(–11) on each side of midrib, subprominent below, curved upwards near margin, reticulation hardly visible; petiolules 0.5–2 cm long, with scales and hairs like on twigs, glabrescent. *Inflorescence* axillary or supra-axillary, 10–40 cm long, densely reddish brown stellate scales; peduncles 2–5 cm long. *Flowers* to 1.5 mm diam., fragrant; pedicels ca 0.5 mm long, hairy, glabrescent. *Calyx* broadly cup-shaped, ca 0.2 mm long, divided into 5 lobes ca ½ of the length, reddish brown stellate scales outside, glabrous inside. *Petals* 5, free, slightly obovate, ca 0.6 mm long, glabrous, yellow. *Staminal tube* shallowly cup-shaped, ca 0.3 mm long, glabrous, apical margin undulate or shallowly 5-lobed. *Anthers* 5, glabrous, inserted in middle of tube, protruding and pointing towards centre of flower. *Ovary* depressed globose, densely stellate hairy, 1 or 2-locular, each locule with 1 or 2 ovules, usually only 1 develops, stigma ovoid. *Infructescence* 10–20 cm long, erect or slightly recurved. *Fruits* globose or ovoid, 1.5–2 by 1–1.5 cm, indehiscent, yellowish brown, orange or orange-red, dense pinkish orange stellate scales turning brown when dry. *Seeds* 1 or 2, ca 1.3 cm long; aril thin, pale pink, white or yellow, translucent, gelatinous, sweet-tasting.

T h a i l a n d.— SOUTH-WESTERN: Kanchanaburi; SOUTH-EASTERN: Trat; PENINSULAR: Ranong, Surat Thani, Phangnga, Krabi, Nakhon Si Thammarat, Phatthalung Trang, Satun, Songkhla, Yala, Narathiwat.

D i s t r i b u t i o n.— India (Nicobar Islands), Myanmar, Malaysia, Indonesia (type), Philippines.

E c o l o g y.— Evergreen to mixed deciduous forest, near streams, on granite bedrock; altitude 50–1,200 m (commonly 200–600 m). Flowering all year round (most commonly February–August); fruiting: January–June.

V e r n a c u l a r.— Nuan paeng (นวลแปง), khi hen (ขี้เหิน), sang khriat (สังเคี๋ยด), sang khriat lueat (สังเคี๋ยดเลื้อด)(Peninsular).

U s e s.— Aril edible, timber can be used for furniture.

25. *Aglaia oligophylla* Miq., Fl. Ned. Ind., Suppl. 1: 507. 1861; Pannell, Tree Fl. Malaya 4: 222. 1989; Kew Bull., Add. Ser. 16: 302. 1992; Fl. Males., ser. I, 12(1): 297. 1995;



Figure 8. *Aglaia odoratissima* Blume: A. twig with inflorescences, A-1 cluster of flowers, A-2 flower, A-3 longitudinal section of flower (A.F.G. Kerr 12452); B. infructescence (Th. Wongprasert 046-18). Drawn by Arthit Khamkamnoed.

T.Wongprasert et al., Thai Forest Bull., Bot. 39: 219. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 116. 2013; Gardner et al., Forest Trees S. Thailand 2: 1239, 1455, f. 1621. 2016.— *A. oligantha* C.DC. in A.C. & C.DC., Monogr. Phan. 1: 603. 1878.— *A. pedicellata* C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 607. 1878.— *A. glaucescens* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 64. 1895.— *A. fusca* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 62. 1895; Pannell, Tree Fl. Malaya 4: 215. 1989.— *A. euphorioides* Pierre, Fl. Forest Cochinch. Fasc. 22: t. 338B. 1896.— *A. quocensis* Pierre, Fl. Forest Cochinch. Fasc. 22: t. 337B. 1896; Craib, Fl. Siam. 1: 259i. 1926.

Trees (3–)5–10(–20) m tall, (16–)30–70 cm girth; bark greyish brown to dark brown, smooth or slightly flaking, inner bark brownish to red; twig apices densely pale yellowish brown stellate hairs or scales. *Leaves* imparipinnate, 10–40 cm long; petiole slender, 2–13 cm long, swollen near base; leaflets 1–5 on each side of rachis, opposite or subopposite, oblong or elliptic-oblong, 6–22 by 3–9 cm, apex acuminate-caudate, acumen obtuse, to 1 cm long, base obtuse, cuneate, slightly asymmetrical, margin recurved or undulate, subcoriaceous or chartaceous, dull green on both surfaces, sparsely hairy then glabrous, midrib prominent below, depressed above, lateral veins 5–10 on each side of midrib, curved upwards near margin, reticulation visible above, subprominent below; petiolules 0.3–1.5 cm, long, brown stellate hairs or scales, glabrescent. *Inflorescence* on twigs or axillary, 8–20 cm long; peduncles 3–5 cm long. *Flowers* depressed globose, to 2 mm long; pedicels ca 2 mm long, densely pale yellowish brown stellate hairy or scaly, glabrescent. *Calyx* broadly cup-shaped, ca 0.5 mm long, divided into 5 lobes ca ½ of the length, stellate scaly outside, glabrous inside, ciliate. *Petals* 5, free, slightly obovate, 1–1.5 mm long, glabrous, yellow. *Staminal tube* depressed globose, ca 1 mm long, glabrous, aperture ca 1.3 mm in diam., margin entire. *Anthers* 5, inserted inside about middle of tube, included or just protruding. *Ovary* depressed globose, densely stellate hairy on lower ⅔, 2 (or rarely 3)-locular, each locule with 1 ovule, stigma narrowly ovoid, with two apical lobes. *Infructescence* 15–20 cm long, erect or slightly recurved, densely stellate hairy or scaly throughout. *Fruits* ellipsoid or globose, ca 1.5–3 cm diam., indehiscent, yellowish brown, densely yellowish brown stellate hairs. *Seeds* 1 or 2, ca 1 cm long, aril translucent gelatinous pinkish red, sweet-tasting.

T h a i l a n d.— EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Phetchaburi. CENTRAL: Nakhon Nayok; SOUTH-EASTERN: Trat; PENINSULAR: Ranong, Surat Thani, Phuket, Krabi, Trang, Satun, Songkhla.

D i s t r i b u t i o n.— Myanmar, Vietnam, Malaysia, Indonesia (type), Philippines.

E c o l o g y.— Near streams in evergreen forest, on limestone or granite bedrock; altitude 0–800 m (commonly 50–200 m). Flowering: February–November (most commonly March–June); fruiting: February–December (commonly April–August).

V e r n a c u l a r.— Ta maeo pa (ตามแมวป่า)(General).

U s e s.— Aril edible.

26. *Aglaia pachyphylla* Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 57. 1868; C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 617. 1878; Pannell, Kew Bull., Add. Ser. 16: 117. 1992; Fl. Males., ser. I, 12(1): 234. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 219. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 118. 2013; Gardner et al., Forest Trees S. Thailand 2: 1240, 1455, f. 1622. 2016.— *A. barbatula* Koord. & Valetton, Bijdr. Boomsort. Java 3: 167. 1896; Backer & Bakh.f., Fl. Java 2: 126. 1965; Pannell, Tree Fl. Malaya 4: 213. 1989. Fig. 9. Plate CXXV: A–B.

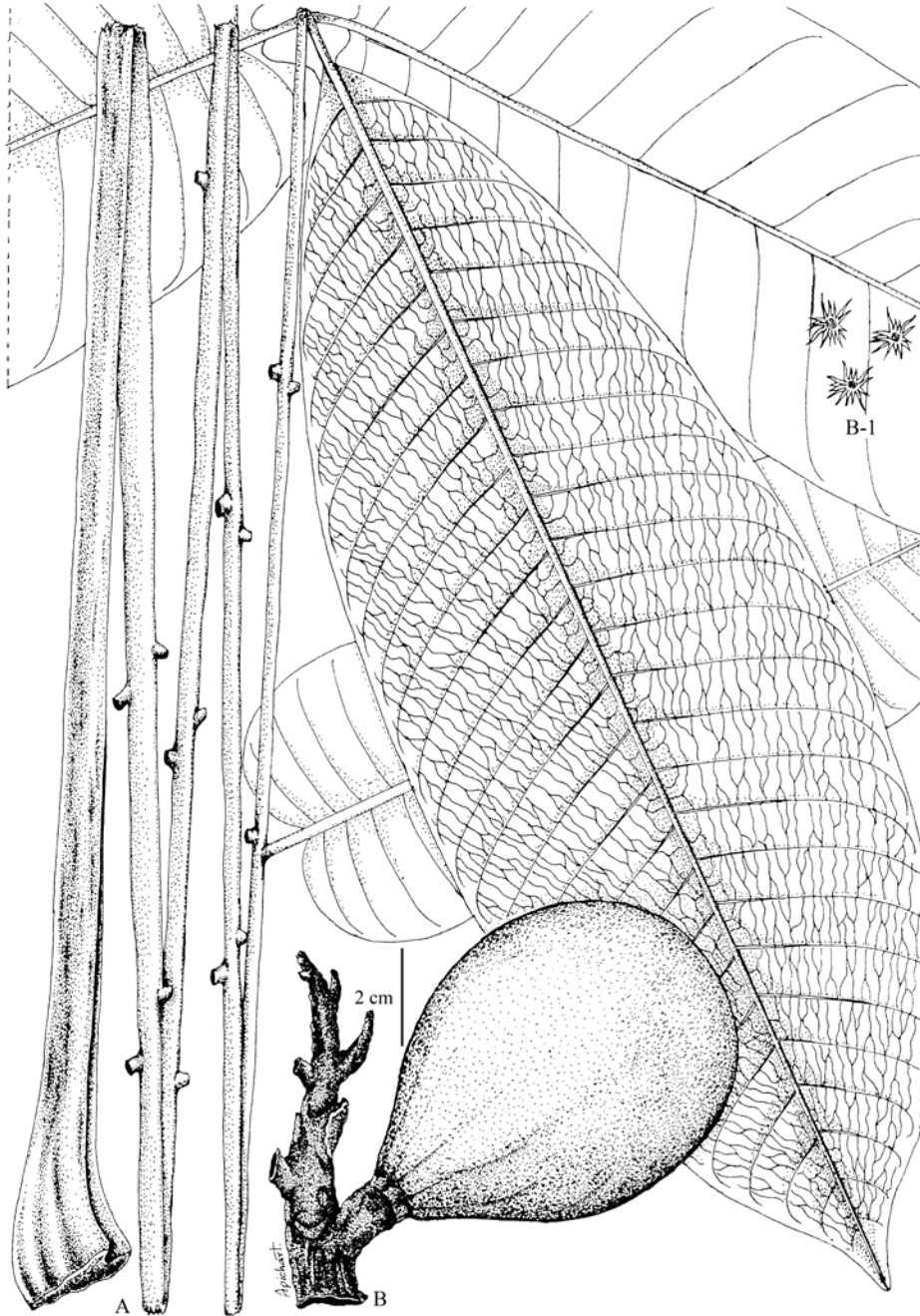


Figure 9. *Aglaia pachyphylla* Miq.: A. twig; B. mature drupe (A.F.G. Kerr 17016), B-1 inflorescences (young drupes), B-2 scales (R. Pooma 1392). Drawn by Apichart Ropsri.

Trees 8–20 m tall, 40–60 cm girth, slender, few-branched; bark brown, greyish brown, longitudinally fissured, inner bark dark brown or pale yellowish brown; sapwood pinkish brown or pale brown, white latex; heartwood brown; twigs stout, dark brown stellate or dendritic hairs, longitudinal wavy ridges, prominent leaf-scars. *Leaves* imparipinnate, 30–125 cm long; petiole 15–30 cm long, grooved above, much swollen near base; leaflets 6–11 on each side of rachis, lower lateral leaflets alternate, oblong, lanceolate or lanceolate-oblong, 11–31(–52) by 4–8(–11) cm, apex acuminate, acumen acute or obtuse, to 1.5 cm long, base rounded, subcordate or cuneate, asymmetrical, coriaceous, below densely pale reddish brown hairs with a central radius and 2–4 whorls of arms radiating from it or densely pale or dark brown stellate hairs or scales, sometimes interspersed with darker hairs, midrib and lateral veins strongly prominent below, depressed above, lateral veins 20–45 on each side of midrib, straight then curved upwards near margin, reticulation subprominent or visible above or on both surfaces; petiolules 0.5–1 cm long. *Inflorescences* axillary or supra-axillary near end of twigs, 10–44 long, densely stellate hairy and scaly throughout; peduncles 5–10 cm long, brown hairs like on twigs. *Flowers* subglobose, to 2 mm diam.; sessile. *Calyx* broadly cup-shaped, ca 1 mm long, divided into 5 lobes ca ½ of the length, stellate hairy outside, glabrous inside. *Petals* 5, free, obovate to elliptic, up to 2 mm long, yellowish. *Staminal tube* subglobose, ca 1 mm long, glabrous, apical margin with 5 lobes. *Anthers* 5, nearly as long as tube with apical tuft of hairs filling aperture. *Ovary* depressed globose, ca 0.5 mm long, 3(–4)-locular, each locule with 1–2 ovules, stigma cylindrical, truncate at apex, glabrous. *Infructescence* 5–20 cm long, stout, scaly, glabrescent. *Fruit* ovoid or subglobose, up to 8 by 8.5 cm, indehiscent, locules 2–4, each with 1 or 2 seeds; pericarp leathery, 3–5 mm, thick. *Seeds* 2(–6), ca 4 cm long, 1.5 cm thick, completely surrounded by a fleshy orange translucent aril.

T h a i l a n d.— SOUTH-WESTERN: Kanchanaburi; Phetchaburi. PENINSULAR: Phatthalung, Yala, Narathiwat.

D i s t r i b u t i o n.— Malaysia, Borneo, Indonesia (type), Philippines.

E c o l o g y.— In evergreen forest, mixed deciduous forest, also in swamp forest, on limestone or sandstone bedrock; altitude 50–700 m. Flowering: May–July; fruiting: February–March.

V e r n a c u l a r.— Ta sua (ตาเสือ)(Southwestern); chom phu samet (ชมพู่เสม็ด) (Peninsular).

27. *Aglaia palembanica* Miq., Fl. Ned. Ind., Suppl. 1: 197, 507. 1861; Hiern in Hook.f., Fl. Brit. India 1: 557. 1875; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 72. 1895; Ridl., Fl. Malay Penins. 1: 409. 1922; Craib, Fl. Siam. 1: 257. 1926; Corner, in Gard. Bull. Singapore, Suppl. 1: 131. 1978; Pannell, Tree Fl. Malaya 4: 223. 1989; Kew Bull., Add. Ser. 16: 323. 1992; Fl. Males., ser. I, 12(1): 304. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 220. 2011; Gardner et al., Forest Trees S. Thailand 2: 1241, 1455, f. 1623. 2016.— *A. palembanica* Miq. var. *longifolia* Craib, Fl. Siam. 1: 258. 1926.

Trees to 6 m tall; bark smooth, reddish brown, lenticellate, or slightly flaking, inner bark yellow to reddish brown, fibrous; heart wood fragrant; young twigs densely brown stellate hairs. *Leaves* imparipinnate, 15–30 cm long; petiole 5–10 cm long, slender; leaflets 4–6 on each side of rachis, subopposite, narrowly elliptic, lanceolate, oblong or oblanceolate, 5–12(–22) by 2.5–3.5(–6) cm, apex caudate to acuminate, acumen acute, to 2.5 cm long, base

rounded or cuneate, asymmetrical, margin slightly undulate, recurved when dry, chartaceous, numerous brown stellate hairs like on twigs, evenly scattered below, interspersed with some paler stellate scales or peltate scales with a long fimbriate margin, midrib prominent below, depressed above, lateral veins 9–15 on each side of midrib, curved upwards near margin, more or less anastomosing, subprominent below, flat above, reticulation hardly visible below; petiolules 0.2–1.4 cm long, densely brown stellate hairs. *Inflorescence* axillary near twig apices, 15–30 cm long, densely brown stellate hairy. *Flowers* ca 1.2 mm long, fragrant, tightly packed on terminal branches of inflorescence. *Calyx* broadly cup-shaped, ca 0.5 mm long, divided into 5 lobes ca ½ of the length, sparsely to densely brown stellate hairy outside, glabrous inside. *Petals* 5, free, elliptic or obovate, 1–1.5 mm long, white, glabrous. *Staminal tube* cup-shaped, ca 1 mm long, glabrous, apical margin incurved. *Anthers* 5, inserted at middle of tube, as long as tube. *Ovary* depressed globose, less than 0.5 mm long, 2-locular, each locule with 1(–2) ovules, stigma ovoid. *Infructescence* erect or pendulous, to 10 cm long, densely brown stellate hairy. *Fruits* ovoid or subglobose, 1.5–3 by 1–1.7(–4) mm, indehiscent, sparsely stellate hairy, glabrescent, dull yellow to dark orange. *Seed* usually 1, ellipsoid, ca 0.6 by 0.4 cm; aril thin.

T h a i l a n d.— PENINSULAR: Ranong, Surat Thani, Songkhla, Pattani (Banang Sta, Type of *Aglaia palembanica* Miq. var. *longifolia* Craib, Kerr 7400, lectotype **K**, isolectotype **ABD**).

D i s t r i b u t i o n.— Malaysia, Indonesia (type), Philippines.

E c o l o g y.— In tropical evergreen forest, near streams, on granite bedrock; altitude 50–200 m. Flowering: February–November (most commonly February–July); fruiting: January–March.

V e r n a c u l a r.— Sang khriat (สังเครียัด)(Peninsular).

28. *Aglaia perviridis* Hiern in Hook.f., Fl. Brit. India 1: 556. 1875; C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 610. 1878; C.Y.Wu, Fl. Yunnan. 1: 239. 1977; Pannell, Kew Bull., Add. Ser. 16: 198. 1992; Fl. Males., ser. I, 12(1): 260. 1995; P.Hua & Pannell, in Fl. China 11: 124. 2008; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 220. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 122. 2013; Gardner et al., Forest Trees S. Thailand 2: 1241, 1455, f. 1624. 2016.— *A. kingiana* Ridl., J. Straits Branch Roy. Asiat. Soc. 82: 175. 1920; Fl. Malay Penins. 1: 404. 1922.— *A. canarensis* Gamble, Bull. Misc. Inform. Kew 1915: 347. 1915. Plate CXXV: C.

Trees (1.5–)5–15(–18) m tall, (24–)40–80(–130) cm girth; bark greyish to dark brown, smooth to slightly fissured or rough, flaking, inner bark orange or red or reddish brown; heartwood white; twigs with numerous to densely small reddish brown peltate scales with a dark central spot and an irregular or fimbriate margin, occasionally with stellate scales, glabrescent, longitudinally wrinkled, lenticellate. *Leaves* imparipinnate, to 54 cm long; petiole to 10 cm long, slender, slightly swollen near base, few to numerous scales like on twigs; leaflets 5 or 6 on each side of rachis, opposite or subopposite, usually ovate, sometimes narrowly elliptic-lanceolate to lanceolate-oblong, 7.5–23 by 2–6 cm, tapering to a caudate parallel sided, obtuse acumen to 2 cm long, usually rounded on one side, cuneate on the other at asymmetrical base, chartaceous, blackish brown or reddish brown when dry, sparsely scaly, then glabrous above, midrib slightly prominent below, depressed above, lateral veins 9–20 on each side of midrib, sometimes with shorter laterals in between, usually

paler and contrasting in colour with leaflet below when dry, subprominent on both surfaces or hardly visible, reticulation hardly visible or slightly raised below; petiolules 1–1.5 cm long, few to numerous scales like on twigs, glabrescent, usually pitted, sometimes rugulose on both surfaces. *Inflorescence* axillary or supra-axillary, 20–30 cm long; peduncles 5–10 cm long. *Flowers* to 2.3 mm long; pedicels ca 2 mm long; few to numerous scales like on twigs, glabrescent. *Calyx* broadly cup-shaped, ca 0.5 mm long, divided to about ½ way into 5 lobes, glabrous. *Petals* 5, free, subobovate, ca 1 mm long, glabrous, yellowish. *Staminal tube* 1–2 mm long, narrower at base below insertion of anthers, aperture 0.4–1 mm across, margin shallowly lobed. *Anthers* 5, inserted in middle half of tube, included or just protruding through aperture. *Ovary* depressed globose, ca 0.2 mm long, glabrous, locule 1, with 1 ovule, stigma ovoid, ca 0.3 mm long, glabrous. *Infructescence* 10–25 cm long, reddish brown scales throughout, glabrescent. *Fruits* asymmetrically ellipsoid, 1.5–2.5(–3.3) by 1.2–2(–2.4) cm, indehiscent, yellow or orange, densely reddish brown scaly. *Seed* 1, ellipsoid, 2–2.5 by 1.5–2 cm, dark reddish brown when dry, with a network of veins, completely surrounded by a thin white or brown aril.

T h a i l a n d.— NORTHERN: Chiang Mai, Chiang Rai, Nan, Phitsanulok; EASTERN: Chaiyaphum. SOUTH-WESTERN: Kanchanaburi, Ratchaburi, Phetchaburi, Prachuap Khiri Khan; SOUTH-EASTERN: Chanthaburi; PENINSULAR: Krabi.

D i s t r i b u t i o n.— India (type), Bangladesh, Bhutan, China, Malaysia.

E c o l o g y.— In mixed deciduous to evergreen forest, on limestone bedrock; altitude 180–1,350 m (commonly 400–900 m). Flowering: April–October (most commonly April–July); fruiting: November–August (most commonly March–July).

29. *Aglaia rubiginosa* (Hiern) Pannell, Malaysian Forester 45: 455. 1982; Tree Fl. Malaya 4: 225. 1989; Kew Bull., Add. Ser. 16: 92. 1992; Fl. Males., ser. I, 12(1): 225. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 220. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 123. 2013; Gardner et al., Forest Trees S. Thailand 2: 1472. 2016.— *Amoora rubiginosa* Hiern in Hook.f., Fl. Brit. India 1: 561. 1875; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 54. 1895; Ridl., Fl. Malay Penins. 1: 398. 1992; Corner, Gard. Bull. Singapore, Suppl. 1: 131, 198. 1978. Fig. 10.

Trees 10–25(–35) m tall, 60–140 cm girth; with an open crown formed by a few ascending branches dividing into as many as 40 smaller banches, each ending in a dense terminal spiral of leaves forming a subcrown; bark pale pinkish brown or greyish brown, flaking in squarish or long narrow scales 2–3 cm wide, inner pale pinkish brown; twigs densely reddish brown stellate hairy or scaly, glabrescent, smooth, large petiole scars. *Leaves* imparipinnate, 50–100 cm long; petiole 20–35 cm long, grooved above, swollen near base; leaflets 7–10 on each side of rachis, lower lateral leaflets alternate, oblong, 5–25 by 2–7 cm, apex acuminate to shortly caudate, acumen acute, to 10 mm long, base rounded or cordate, asymmetrical, margin slightly undulate, strongly recurved, coriaceous, wrinkled and dark when dry, pitted above, densely reddish brown stellate scales below, midrib and lateral veins prominent with longitudinal wavy ridges below, lateral veins 13–18 on each side of midrib, straight then curved near margin, venation barely visible; petiolules 0.5–1 cm long. *Inflorescence* axillary near end of twigs, 30–70 cm long, indumentum like on twigs; peduncles 10–15 cm long. *Flowers* up to 9 by 5 mm; pedicels 2–3 mm long. *Calyx* cup-shaped, 4–5 mm long, divided into 3 lobes ⅓–½ of the length, indumentum like on twigs. *Petals* 3, free, oblong, 4–8 mm long, glabrous, yellow. *Staminal tube* ellipsoid, up to 7 mm

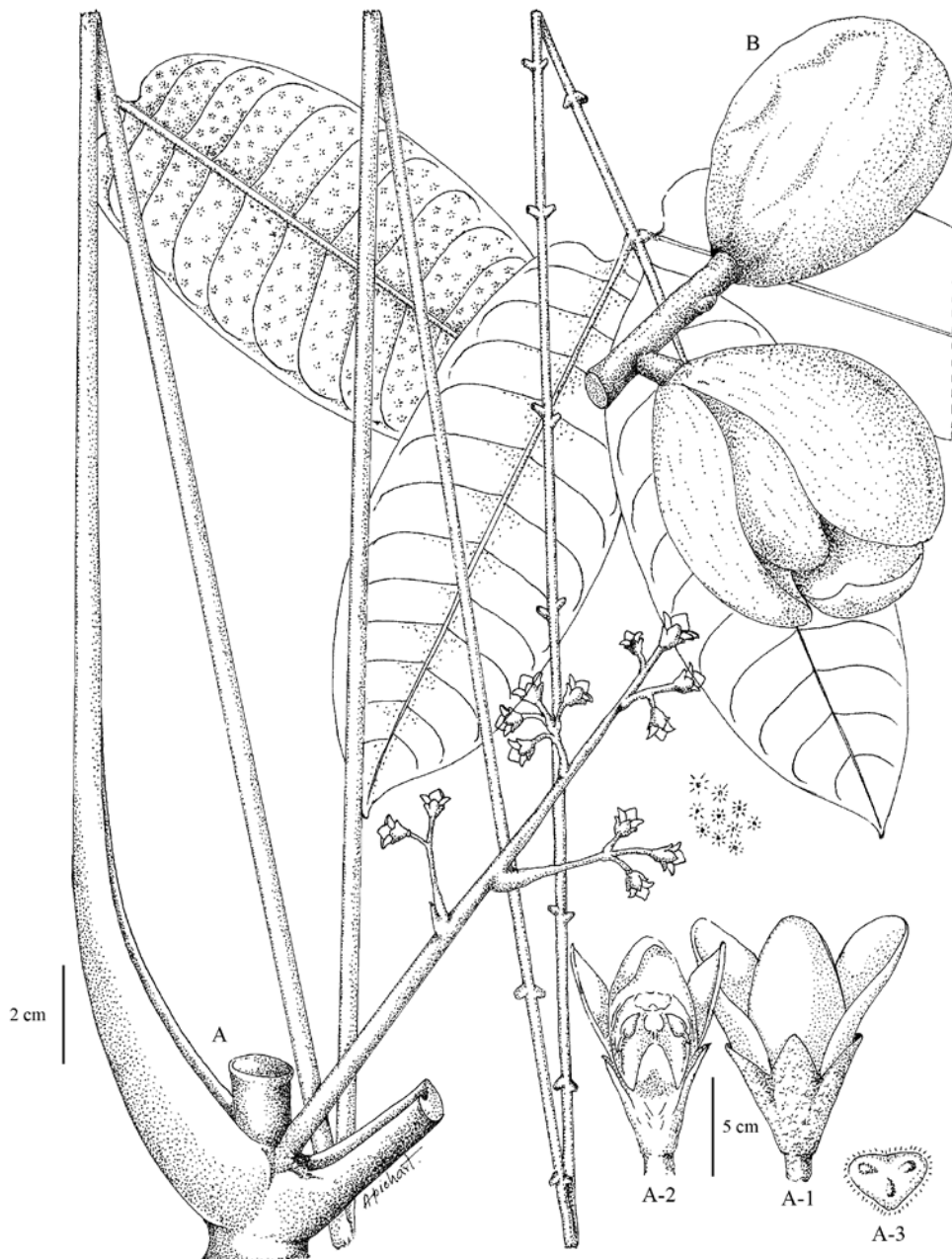


Figure 10. *Aglaia rubiginosa* (Hiern) Pannell: A. twig with inflorescences, A-1 flower, A-2 longitudinal section of flower, A-3 cross section of ovary (*A. Premrasami* 32); B. part of infructescence (*C. Niyomdham* 802). Drawn by Apichart Ropsri.

long, glabrous, aperture to 1.5 mm in diam., margin shallowly 3-lobed. *Anthers* 6, up to $\frac{3}{4}$ the length of tube. *Ovary* obovoid, ca 2 mm long, densely stellate hairy, 3-locular, each locule with 1 ovule, stigma ellipsoid, with 3 apical lobes and 6 longitudinal ridges. *Infructescence* erect or pendulous, 15–20 cm long, densely stellate hairy. *Fruits* ellipsoid or obovoid, 4.5–6 by 3.5–5 cm, densely stellate hairy; pericarp leathery, ca 0.5 cm thick, yellowish brown, dehiscent into 3(4) when mature. *Seeds* 1–3, ellipsoid, 3–3.5 by 2.5–3 cm, aril completely surrounding seed, orange-red.

T h a i l a n d.— NORTHERN: Phitsanulok; PENINSULAR: Narathiwat.

D i s t r i b u t i o n.— Malaysia (type), Singapore, Sumatra, Borneo.

E c o l o g y.— Lowland to peat swamp forest; altitude 0–150 m. Flowering: March–July; fruiting: December–May.

V e r n a c u l a r.— Chom phu samet (ชมพูเสม็ด), samui kaeng (สมุยแกง) (Peninsular).

30. *Aglaia rufibarbis* Ridl., J. Str. Br. Roy. As. Soc. 75: 17. 1917; Fl. Malay Penins. 1: 409. 1922; Pannell Kew Bull. Add. Ser. 16: 344. 1992; Fl. Males., ser. I, 12(1): 312. 1995. Fig. 11.

Small tree to 10 m tall, to 20 cm girth, sparsely branched; bark usually grey and pale brown, sometimes dark brown with dark grey patches, longitudinal cracks, inner bark green, pale yellowish brown or orange-brown, with longitudinal striations; sapwood pale yellowish brown or orange-brown, white latex; twigs densely reddish brown stellate hairs with arms to 4 mm long, hairs sometimes deciduous or the long arms often breaking off leaving a dense cluster of short arms. *Leaves* imparipinnate, to 85 cm long; petioles 10–22 cm long; leaflets with numerous stellate hairs like on twigs on both surfaces, more frequent below, arms of adjacent hairs overlapping, interspersed with smaller paler hairs with fewer arms; lateral leaflets (2)3 or 4 on each side of rachis, opposite; lamina obovate or elliptic, (4–)9–41 by (3–)4.5–14.5 cm, apex acuminate or caudate, acumen obtuse or acute, 5–25 mm long base cuneate or subcordate, asymmetrical, margin recurved, midrib prominent below, lateral veins (7–)8–23 on each side of midrib, curved upwards, not quite anastomosing, prominent below, intercostal venation faint, visible on both surfaces; petiolules 0.2–4 cm long. *Inflorescences* densely stellate hairy; males to 40 by 40 cm; females to 6 by 6 cm, with linear hairy bracteoles up to 3 cm long on rachis and 1.5 cm long on branches. *Flowers* minute, subglobose, to 1.2 mm diam.. *Calyx* deeply divided into 5 narrow, acute lobes, outside numerous stellate hairs. *Petals* 5 (rarely 6), ca 1 mm long. *Staminal tube* nearly as long as corolla, obovoid, a minute apical pore 0.2 mm in diam. *Anthers* broadly ovoid, 0.2–0.25 mm. *Ovary* depressed globose, stigma subglobose, 2 small apical lobes. *Infructescences* to 8 cm long, persistent hairy bracteoles, up to 10 fruits. *Fruits* subglobose, to 3.4 cm in diam., indehiscent, locule 1, with 1 seed, subglobose, densely often deciduous stellate hairs like on twigs; pericarp brittle, readily torn open, ca 1 mm thick, inner surface smooth, white and shiny. *Seed* with no aril.

T h a i l a n d.— PENINSULAR: Yala.

D i s t r i b u t i o n.— Malaysia (type).

E c o l o g y.— Lowland dipterocarp forest; altitude to 250 m.

31. *Aglaia rufinervis* (Blume) Benth., Acta Bot. Neerl. 11: 19. 1962; Backer & Bakh.f., Fl. Java 2: 127. 1965; Pannell, Kew Bull., Add. Ser. 16: 317, f. 96. 1992; Fl. Males., ser. I, 12(1): 302. 1995; T. Wongprasert et al., Thai Forest Bull., Bot. 39: 220. 2011; Pannell, Fl. Penins.

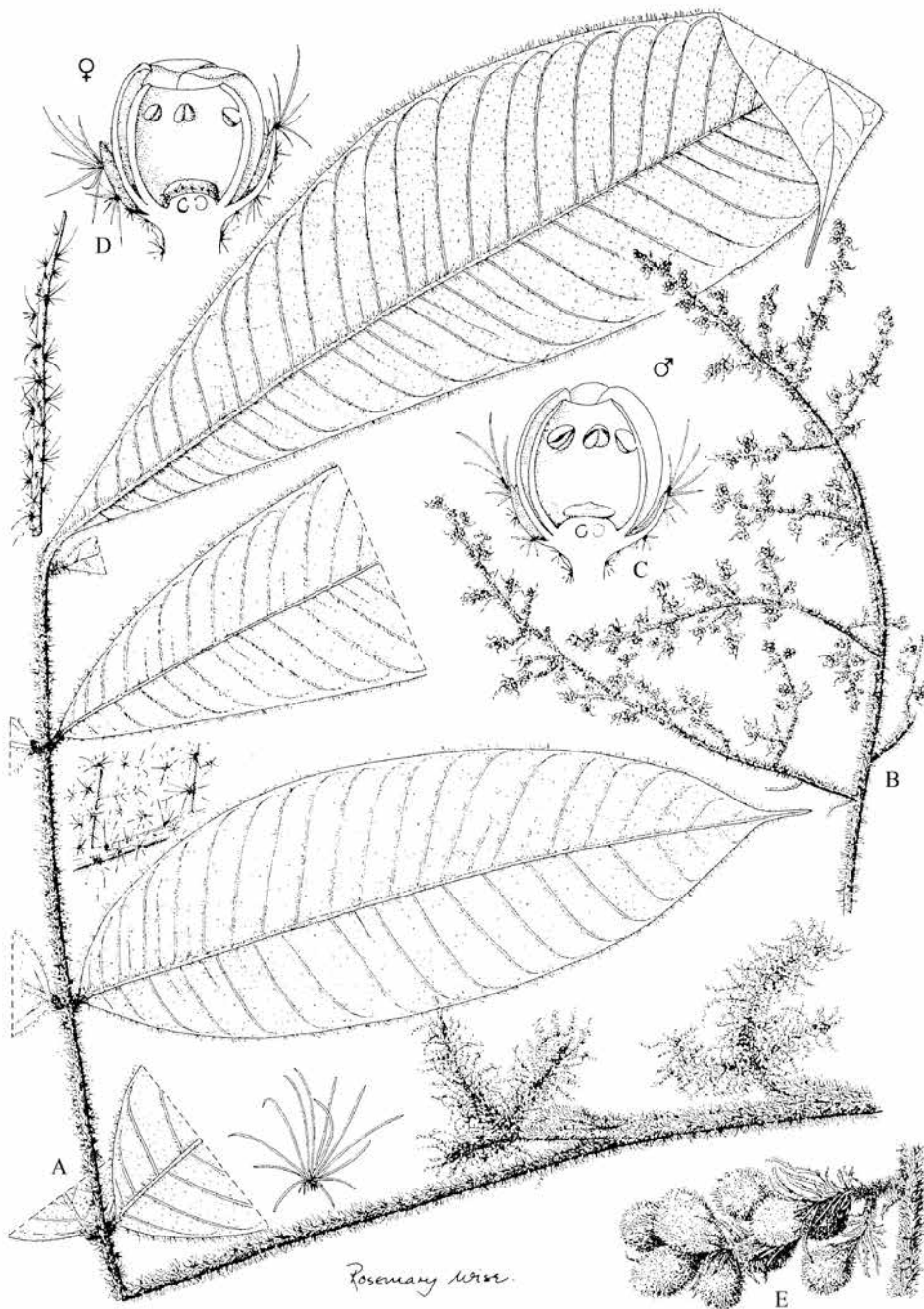


Figure 11. *Aglaia rufibarbis* Ridl.: Habit with female inflorescences $\times \frac{1}{2}$. half flower, female $\times 20$. Male inflorescence $\times \frac{1}{2}$. half flower, male $\times 20$. Infructescence (bottom right) $\times \frac{1}{2}$. Bract from infructescence (upper left) $\times 3$. Detail of lower leaflet surface showing indumentum of stellate hairs $\times \frac{1}{2}$. Stellate hair $\times 4$. Drawn by Rosemary Wise. Courtesy of

Malaysia, Ser. 2, 4: 127. 2013; Gardner et al., Forest Trees S. Thailand 2: 1472. 2016.— *Trichilia rufinervis* Blume, Bijdr. Fl. Ned. Ind.: 164. 1825.— *Aglaia trichostemon* C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 608. 1878; Ridl., Fl. Malay Penins. 1: 407. 1922; Pannell, Tree Fl. Malaya 4: 227. 1989.

Trees (4–)5–10 m tall, 30–80 cm girth; bark smooth, greyish brown or yellowish brown, inner bark pale orange brown; sapwood pale orange brown, white latex; twigs dark brown stellate hairy. *Leaves* imparipinnate, 30–100 cm long; petiole 10–15 cm long; leaflets 7–9 on each side of rachis, lower lateral leaflets alternate or subopposite, oblong or elliptic, 6–20 by 3–7 cm, apex caudate, acute to acuminate, acumen acute, to 1 cm long, base rounded or cuneate, asymmetrical, margin slightly recurved, subcoriaceous, rugulose and pitted above, below with numerous pits and densely reddish brown stellate scales on midrib and few brown or pale brown stellate scales and hairs evenly scattered on surface, midrib and lateral veins prominent below, depressed above, lateral veins 9–18 on each side of midrib, curved upwards near margin, reticulation faintly visible below; petiolules 1.5–3 cm, indumentum like on twigs. *Inflorescence* axillary near ends of twigs, 30–80 cm long, densely reddish brown stellate scaly; peduncles 8–15 cm long. *Flowers* ca 1.2 mm long, fragrant; subsessile or pedicels up ca 0.5 mm long, densely reddish brown stellate scaly. *Calyx* broadly cup-shaped, ca 1 mm long, divided into 5 lobes for ca ½ of the length, orange-brown or reddish brown stellate hairy or scaly outside, glabrous inside. *Petals* 5, free, obovate up to 1.5 mm long, glabrous, white or yellow. *Staminal tube* obovoid, ca 1 mm long, pale yellow stellate hairs on inner side, aperture ca 0.3 mm in diam., shallowly 5-lobed margin. *Anthers* 5, pale yellow stellate hairs, inserted in upper half of tube, just protruding through aperture. *Ovary* ovoid, ca 1 by 1 mm, densely stellate hairy, 1 locule with 1 ovule, stigma ovoid, glabrous. *Infructescence* to 20 cm long, branched, stellate hairs and scales throughout. *Fruits* ovoid or slightly obovoid, ca 1–2 cm diam., dull orange, densely dark brown or orange-brown stellate hairs and scales. *Seeds* ellipsoid, aril translucent, white or yellow.

T h a i l a n d.— SOUTH-WESTERN: Phetchaburi.

D i s t r i b u t i o n.— Malaysia (type), Singapore, Indonesia.

E c o l o g y.— In evergreen forest, usually near streams, on granite bedrock; altitude to 1,200 m. Flowering: July–October; fruiting: January–March.

32. *Aglaia sexipetala* Griff., Not. Pl. Asiat. 4: 505. 1854; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 223. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 132. 2013.— *A. aspera* Teijsm. & Binn., Natuurk. Tijdschr. Ned.-Indie 27: 42. 1864; Backer & Bakh.f., Fl. Java 2: 127. 1965; Pannell, Tree Fl. Malaya 4: 211. 1989; Kew Bull., Add. Ser. 16: 217. 1992; Fl. Males., ser. I, 12(1): 268. 1995; Gardner et al., Forest Trees S. Thailand 2: 1242, 1456, f. 1625. 2016. Fig. 12.

Trees 8–15 m tall, 40–80 cm girth; bark smooth, greyish brown or reddish brown, pale brown lenticels; sapwood yellowish brown, white latex; twigs slender, smooth, dark brown, densely reddish brown stellate hairs and scales. *Leaves* imparipinnate, to 60(–100) cm long; petiole 10–20 cm long; leaflets 3–6 on each side of rachis, lower lateral leaflets alternate, lanceolate-oblong, 7–22 by 3–8.5 cm, apex acuminate, acumen obtuse or acute, 1–1.5 cm long, base rounded, subcordate or cuneate, asymmetrical, margin recurved, somewhat undulate, subcoriaceous, midrib prominent below, few stellate scales and numerous pits above, numerous to densely scales like on twigs or peltate scales with a long fimbriate

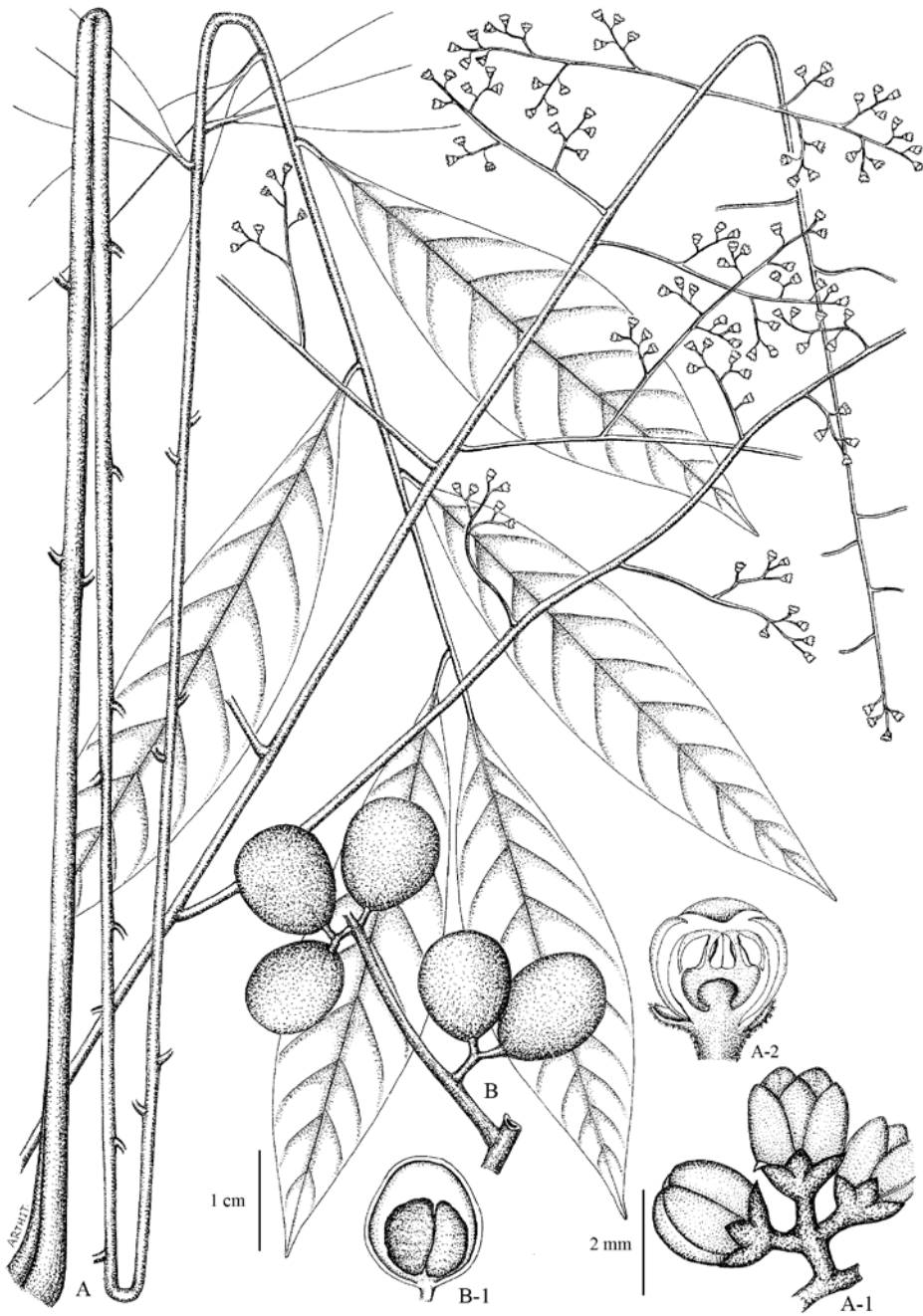


Figure 12. *Aglaia sexipetala* Griff.: A. twig with inflorescences, A-1 flowers, A-2 longitudinal section of flower, (A.F.G. Kerr 12088); B. part of infructescence, B-1 longitudinal of drupe (A.D.E. Elmer 11804). Drawn by Arthit Khamkamnoed.

margin on midrib below, numerous on the rest of leaflet surface below with brown stellate hairs which many short arms interspersed, lateral veins 7–14 on each side of midrib, first ascending then curved upward near margin, faintly visible below, reticulation indistinct both surfaces; petiolules 0.5–1(–3.5) cm long, scaly. *Inflorescence* axillary near end of twigs, 25–40 cm long; peduncles 10–15 cm long, slender. *Flowers* to 1.5 mm diam.; pedicels 2–3 mm long, scaly or hairy or subglabrous. *Calyx* broadly cup-shaped, ca 1 mm long, divided into 5 lobes ca ½ of the length, hairy and scaly outside, glabrous inside. *Petals* 5, free, elliptic-oblong ca 1 mm long, glabrous, yellow. *Staminal tube* cup-shaped, 0.5–1 mm long, glabrous, apical margin incurved or shallowly 5-lobed. *Anthers* 5, inserted above middle of tube, protruding through aperture. *Ovary* ovoid or obovoid, ca 0.5 mm, 2-locular, each locule with 1 ovule, hairy, stigma ovoid, 2 small apical lobes. *Infructescence* up to 20 cm long. *Fruit* subglobose or obovoid, 2–5 by 1.5–4 cm, indehiscent, yellow to reddish brown; pericarp thin, to 2 mm thick, brittle or woody when dry, finely hairy or scaly. *Seeds* 1 or 2, ellipsoid, completely covered with transparent or white aril.

T h a i l a n d.— PENINSULAR: Surat Thani, Phangnga.

D i s t r i b u t i o n.— Malaysia, Indonesia (type), Philippines, New Guinea.

E c o l o g y.— In evergreen forest; altitude 100–400 m. Flowering: January–March; fruiting: October–December.

U s e s.— Aril edible.

33. *Aglaia silvestris* (M.Roem.) Merr., *Interpr. Herb. Amboin.*: 210. 1917; Pannell, *Kew Bull.*, Add. Ser. 16: 193. 1992; *Fl. Males.*, ser. I, 12(1): 259. 1995; T.Wongprasert et al., *Thai Forest Bull.*, Bot. 39: 223. 2011; Pannell, *Fl. Penins. Malaysia*, Ser. 2, 4: 134. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1243, 1456, f. 1626. 2016.— *Lansium silvestre* Roem., *Fam. Nat. Syn. Monogr.* 1: 99. 1846.— *Aglaia ganggo* Miq., *Fl. Ned. Ind.*, Suppl. 1: 506. 1861; King, *J. Asiat. Soc. Bengal*, Pt. 2, Nat. Hist. 64: 65. 1895; Backer & Bakh.f., *Fl. Java* 2: 129. 1965; Pannell, *Tree Fl. Malaya* 4: 216. 1989.— *A. pyramidata* Hance, *J. Bot. (N.S.)* 6: 331. 1877; Craib, *Fl. Siam.* 1: 253. 1926.— *Amoora manni* King ex Brandis, *Indian Trees*: 142. 1906.— *Aglaia baillonii* (Pierre) Pellegr. in Lecomte, *Fl. Indo-Chine* 1: 774. 1911. Fig. 13.

Trees (6–)10–20(–30) m tall, 60–130 cm girth; bark reddish brown or greyish brown, smooth or with longitudinal rows of lenticels, inner bark red with white latex; sapwood brownish; heartwood reddish brown, scented; twigs brown to reddish brown, densely peltate scales which dark brown centre and pale margin. *Leaves* imparipinnate, 20–70 cm long; petiole 8–15 cm, slender, swollen near base; leaflets 6–10 on each side of rachis, alternate to subopposite, lower lateral leaflets alternate, lanceolate or ovate-lanceolate, 8–19 by 3–5.5 cm, apex acuminate, acumen obtuse, to 1.8 cm long, base rounded or cuneate, subcoriaceous to chartaceous, above sometimes with dense scales like on twigs when young, glabrescent, below sparsely to densely similar scales, midrib prominent and lateral veins subprominent below, depressed above, lateral veins 11–21 on each side of midrib, curved upwards near margin, not anastomosing, venation hardly visible; petiolules 0.3–1 cm, densely peltate scales like on twigs. *Inflorescence* axillary or supra-axillary near ends of twigs, 30–50 cm long, densely peltate scales like on twigs; peduncles 5–10 cm, long, slender. *Flowers* to 3.5 by 2.5 mm, fragrant; pedicels 2–3 mm long. *Calyx* broadly cup-shaped, ca 1 mm long, divided into 5 lobes ca ⅓ of the length, ciliate, densely peltate scales like on twigs. *Petals* 5, free, elliptic or ovate, ca 2 mm long,



Figure 13. *Aglaia silvestris* (M. Roem.) Merr.: A. twig with female inflorescences, A-1 female flower (A.F.G. Kerr 9681), A-2 part of male inflorescence; B. part of infructescence (T.G. Hartley 10521). Drawn by Apichart Ropsri.

glabrous, greenish yellow to deep yellow. *Staminal tube* longer than corolla, obovoid, with a minute pore 0.2–0.3 mm across, entire at margin. *Anthers* 5, ovoid, inserted near base, included in tube. *Ovary* depressed globose, ca 1 mm diam., 2(3)-locular, each locule with 1 ovule, stigma ovoid. *Infructescence* up to 30 cm long, pendulous. *Fruits* subglobose to obreniform, ca 2.5 by 1.8 cm, indehiscent, orange; pericarp thin, densely peltate scales like on twigs. *Seeds* ellipsoid, ca 1.5 by 1 cm, aril white, translucent, sweet.

Thailand.—NORTHERN: Phayao; SOUTH-EASTERN: Chanthaburi, Trat; PENINSULAR: Chumphon, Ranong, Phangnga, Trang, Satun, Yala.

Distribution.— Indo-China, Malaysia, Indonesia, Philippines (type), New Guinea, New Britain, Solomon Islands.

Ecology.— In evergreen to mixed deciduous forest, usually near streams, on sandstone or limestone bedrock; altitude 50–1,300 m (most commonly 100–400 m). Flowering all year round (most commonly July–December); fruiting: December–August (commonly March–July).

Vernacular.— Chan cha mot (จันทน์ขมด)(General); sang khriat kho ngong (สังเคียดคอโจ้ง)(Southeastern).

Uses.— Aril edible; wood fragrant.

34. *Aglaia simplicifolia* (Bedd.) Harms in Engl. & Prantl, Nat. Pflanzenfam. 3, 4: 300. 1896; Pannell, Kew Bull., Add. Ser. 16: 306. 1992; Fl. Males., ser. I, 12(1): 298. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 223. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 136. 2013; Gardner et al., Forest Trees S. Thailand 2: 1243, 1456, f. 1627. 2016.— *Beddomea simplicifolia* Bedd., Fl. Sylv. S. India 1: 135. 1871.— *B. simplicifolia* Bedd. var. *racemosa* Bedd., Fl. Sylv. S. India 1: 135. 1871.— *B. racemosa* Ridl., J. Fed. Malay States Mus. 4: 10. 1909. Fig. 14.

Medium-sized trees, 15–20 m tall, 15–20 cm girth, branched; bark smooth, greyish brown; sapwood white; twigs pale greyish or yellowish brown, dense reddish brown stellate hairs at apex. *Leaves* simple, elliptic or obovate, 7–23 by 2.5–6.5 cm, apex acuminate to 2 cm long, base cuneate or rounded, surfaces dull pale green or brown when dry, below with occasional hairs like on twigs, midrib prominent below, somewhat impressed above, hairs like on twigs absent to numerous on midrib below, few to absent on lower leaflet surface, lateral veins 14–22 on each side of midrib, ascending and curved upwards near margin, not or just anastomosing, intercostal venation inconspicuous on both surfaces; petioles 0.5–1.7 cm long. *Inflorescences* 12 by 3 cm; peduncle 3.5 cm. *Male flowers* ca. 1 by 1.5 mm; pedicel 1–2 mm, few to densely stellate hairy. *Calyx* 1.5 mm wide, deeply divided into 5 acute lobes, few stellate hairs. *Petals* 3. *Staminal tube* obovoid, ca 1 by 1 mm, aperture 0.25–0.3 mm, entire. *Anthers* 3, ovoid, 0.5 by 0.5 mm inserted in upper half of tube, included. *Ovary* represented by a tuft of hairs. *Infructescences* to 6 by 5 cm; peduncles 5–10 mm long. *Fruits* subglobose, ca 2.2 by 1.9 cm, indehiscent, red when ripe, with one longitudinal ridge, peduncle, branches, and fruits with dense hairs like on twigs. *Seeds* with a gelatinous aril.

Thailand.— PENINSULAR: Narathiwat.

Distribution.— India (type), Laos, Thailand, Sumatra, Peninsular Malaysia and Borneo.

Ecology.— In lowland forest; altitude to 335 m.

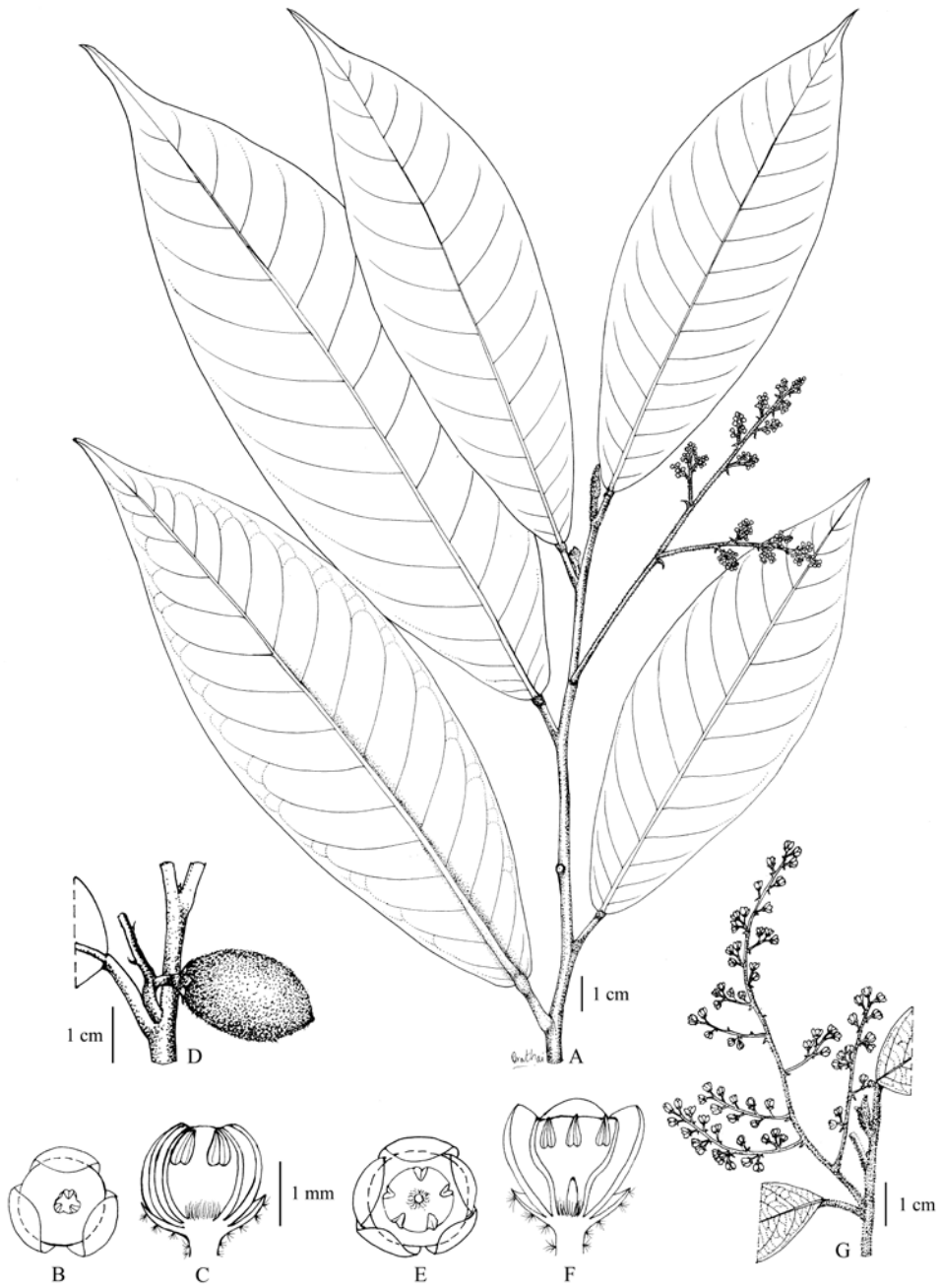


Figure 14. *Aglaia simplicifolia* (Bedd.) Harms: A. twig with inflorescences, A-1 flower, A-2 staminal tube & outer part of stamen (C. Phengklai 74); B. infructescence (A.F.G. Kerr 3628). Drawn by Orathai Kerdkaew.

35. *Aglaia speciosa* Blume, Bijdr. Fl. Ned. Ind.: 171. 1825; Miq., Fl. Ind. Bat. 1: 543. 1859; Ann. Mus. Bot. Lugd.-Bat. 4:46. 1868; Koorders & Valetton, Atlas Baumarten Java 1: t. 162. 1913; Backer & Bakhuizen f., Fl. Java 2: 127. 1965; Pannell, Kew Bull. Add. Ser. 16: 164. 1992; Fl. Malesiana 1, 12(1): 250. 1995; Tree Fl. Sabah & Sarawak 6: 93. 2007; PROSEA 5, 2: 53. 1995; Gardner et al., Forest Trees S. Thailand 2: 1225, 1451. 2016. Fig. 15.

Big trees to 35 m tall, to 60 cm girth, branched; buttresses to 1.3 m tall, to 1 m out; bark grey or pink, inner bark reddish brown or greyish brown, white latex; sapwood pale yellow or white, pinker towards heartwood; twigs with pinkish orange lenticels scattered or in longitudinal rows, densely peltate scales with a dark reddish brown centre and pale, sometimes fimbriate margin. *Leaves* imparipinnate, 25–30 cm long; petioles 4.5–10 cm long; leaflets below with numerous scales like those of twigs, lateral leaflets 1 or 2(–6) on each side of rachis, subopposite, narrowly elliptic or narrowly obovate, 3.2–12 by 2–3.5 cm, apex acuminate, acumen obtuse, to 10 mm long, base rounded or cuneate, margin planar to slightly recurved, midrib impressed above, prominent below, lateral veins 6–12 on each side of midrib, barely prominent below, intercostal venation faint on both surfaces; petiolules 0.5–1 cm long. *Inflorescences* to 22 by 20 cm, densely scales like on twigs. *Flowers* 1.5–2 by 1.7–2 mm. *Calyx* 0.5–1.5 mm long, densely peltate fimbriate scales outside. *Petals* 5. *Staminal tube* cup-shaped, 0.8–1.2 by 1–1.5 mm, aperture more than 0.3 mm diam., margin incurved, shallowly lobed. *Anthers* 5, 0.3–0.5 by 0.3–0.4 mm, protruding through aperture. *Ovary* ovoid, 0.2–0.4 by 0.2–0.5 mm, densely scales like on twigs, 2-locular, stigma subglobose or depressed globose, 0.2–0.5 by 0.4–0.5 mm. *Infructescences* ca 18.5 cm long. *Fruits* obovoid, 2.3–3 by 1.7–2.7 cm, indehiscent, locules 2 (rarely 1), each with 0 or 1 seed, red, orange or brown when ripe; pericarp ca 1 mm thick, brittle, without lines of dehiscence. *Seeds* with a translucent, yellow or orange, edible aril ca 2 mm thick, firmly adhering to testa; seeds after removal of aril ca 1.6 by 1.3 by 0.8 cm.

D i s t r i b u t i o n.— Malaysia, Indonesia (type).

E c o l o g y.— In lowland and hill dipterocarp forest; altitude to 600 m.

T h a i l a n d.— PENINSULAR: Trang, Songkhla.

36. *Aglaia spectabilis* (Miq.) S.S. Jain & Bennet, Indian J. Forest 9(3): 271. 1987; Pannell, Kew Bull., Add. Ser. 16: 79. 1992; Fl. Males., ser. I, 12(1): 221. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 225. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 141. 2013; Gardner et al., Forest Trees S. Thailand 2: 1244, 1456, f. 1629. 2016.— *Amoora spectabilis* Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 37. 1868; Hiern in Hook.f., Fl. Brit. India 1: 561. 1875.— *A. gigantea* Pierre in Laness., Pl. Util. Col. Franc.: 311. 1886; Fl. Forest Cochinch. Fasc. 22: t. 343A. 1896; Craib, Abdn. Uni. Stud. 57: 36. 1912; Craib, Fl. Siam. 1: 260. 1926.— *A. ridleii* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 56. 1895; Ridl., Fl. Malay Penins. 1: 398. 1922.— *A. wallichii* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 56. 1895.— *Aglaia gigantea* (Pierre) Pellegr. in Lecomte, Fl. Indo-Chine 1: 769. 1911.— *A. ridleii* (King) Pannell, Malaysian Forester 45: 455. 1982; Tree Fl. Malaya 4: 223. 1989.— *Amoora stellatosquamosa* C.Y.Wu, Fl. Yunnan. 1: 233. 1977. Fig. 29.— *Aglaia dasyclada* F.C. How & T.C. Chen, Acta Phytotax. Sinica 4: 21, t. 2 (1955).— *Amoora dasyclada* (F.C. How & T.C. Chen) C.Y.Wu, Fl. Yunnan. 1: 234. 1977.— *Amoora duodecimantha* H. Zhu & H. Wang, Acta Bot. Yunnan. 16(1): 25. 1994.

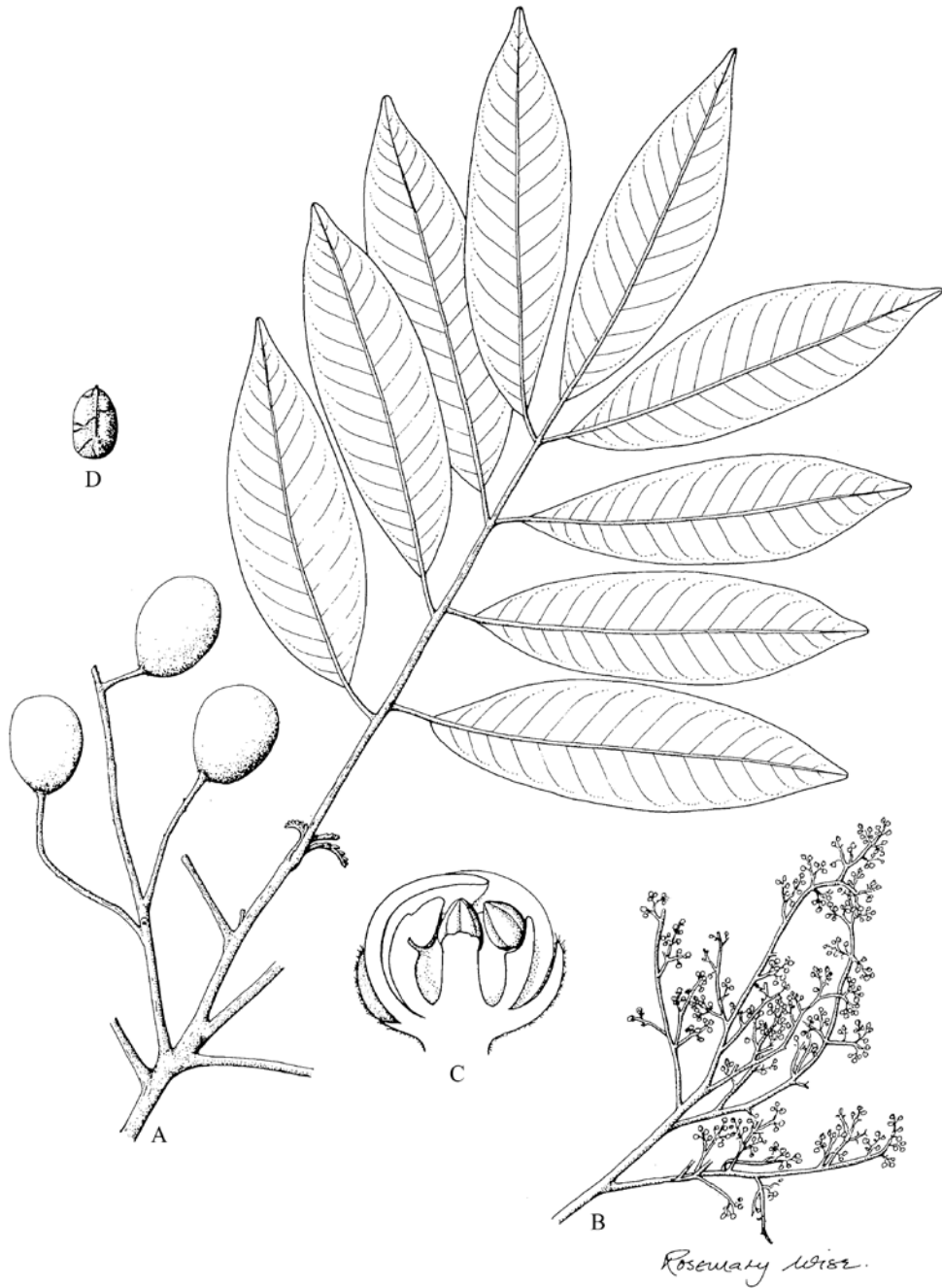


Figure 15. *Aglaia speciosa* Blume: Habit with infructescence $\times \frac{1}{2}$. Seed $\times \frac{1}{2}$. Inflorescence $\times \frac{1}{2}$. Half flower $\times 20$. Drawn by Rosemary Wise. Reproduced with permission of the Board of Trustees, Royal Botanic Gardens, Kew.

Trees (7–)10–25(–40) m tall, 50–150(–240) cm girth; buttresses plank-shaped, to 2 m tall, 3.7 m outwards; bark greyish white or brown, rough, sometimes lenticellate, flaking in large scales up to 30 cm across, inner bark with red and white stripes, white latex; twigs stout, densely yellowish brown stellate hairs or scales, glabrescent. *Leaves* imparipinnate, 50–100 cm long; petiole 15–23 cm long, slender; leaflets 6–10 on each side of rachis, opposite or subopposite, oblong, lanceolate-oblong to obovate, terminal one always obovate or oblanceolate, 8–26 by 2.5–7(–11.5) cm, apex acute or acuminate, acumen acute or obtuse, to 1.5 cm long, rounded at asymmetrical base, subcoriaceous; rugulose, numerous pits above, sometimes pitted, few or occasionally numerous pale brown or orange-brown stellate hairs or scales on midrib, a few or occasionally numerous on lateral veins and lamina below, midrib prominent below, depressed above, lateral veins 9–20 on each side of midrib, straight then curved upwards, reticulation subprominent below; petiolules 8–20 mm, sparsely stellate hairy then glabrous. *Inflorescence* axillary or supra-axillary, 20–80 cm long; peduncles up to 10 cm long. *Flowers* fragrant; pedicels 1–2 mm, long. *Calyx* broadly cup-shaped, ca 1.5 mm long, divided into 3 lobes ca $\frac{2}{3}$ of the length, sparsely stellate hairy outside, glabrescent, glabrous inside. *Petals* 3, free, oblanceolate, ca 3 mm long, yellow to yellowish orange. *Staminal tube* cup-shaped, ca 3 mm long, margin entire. *Anthers* 6–9(–12), protruding beyond aperture, sometimes with a few simple or forked hairs. *Ovary* subglobose, ca 1 mm long, stigma ovoid. *Infructescence* 5–14 cm long, erect, few fruits. *Fruits* subglobose or obovoid capsules, 6–10 by 4–8 cm, dehiscent, locules 3 (or 4); pericarp orange brown, red or yellow, hairy, white latex. *Seed* 0 or 1 per locule, ca 3.5 by 2–2.5 by ca 1.5 cm, aril red when ripe.

T h a i l a n d.— NORTHERN: Chiang Rai, Chiang Mai, Kamphaeng Phet; EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Uthai Thani, Ratchaburi; CENTRAL: Nakhon Nayok; SOUTH-EASTERN: Chanthaburi, Trat; PENINSULAR: Nakhon Si Thammarat, Satun, Narathiwat.

D i s t r i b u t i o n.— India (type), Sikkim, China, Myanmar, Indo-China, Peninsular Malaysia, Indonesia, Philippines, Australia, New Britain, Solomon Islands, Santa Cruz Islands.

E c o l o g y.— In evergreen forest usually near streams, on sandstone bedrock; altitude 130–1,600 m (commonly 100–600 m). Flowering: June–November; fruiting: December–October (commonly March–June).

V e r n a c u l a r.— Mu do (มูโด), ta suea (ตาเสือ)(Peninsular).

N o t e.— Hornbills and pigeons are the only birds in Thailand that can swallow the seeds of this species (Kitamura et al., *J. Trop. Ecology*, 20: 421–427. 2004).

37. *Aglaia tenuicaulis* Hiern in Hook.f., *Fl. Brit. India* 1: 556. 1875; King, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 64: 76. 1895; Ridl., *Fl. Malay Penins.* 1: 408. 1922; Craib, *Fl. Siam.* 1: 259. 1926; Pannell, *Tree Fl. Malaya* 4: 226. 1989; Kew Bull., *Add. Ser.* 16: 313. 1992; *Fl. Males.*, ser. I, 12(1): 301. 1995; T.Wongprasert et al., *Thai Forest Bull.*, Bot. 39: 225. 2011; Pannell, *Fl. Penins. Malaysia*, Ser. 2, 4: 145. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1245, 1457, f. 1630. 2016.

Trees 5–12 m tall, 30–70 cm girth, often unbranched; bark smooth, brown, inner bark creamy with red stripes; sapwood whitish, latex white if present; young shoots and twigs orange brown or brown, densely reddish brown stellate hairs. *Leaves* imparipinnate, 30–120 cm long, densely reddish brown stellate hairy; petiole 20–30 cm long, stellate hairy, swollen near base; leaflets 3–5 on each side of rachis, lower lateral leaflets alternate, oblong

or lanceolate-oblong, 18–32 by 6–11.5(–14) cm, apex acuminate or shortly caudate, acumen obtuse or acute, to 1.5 cm long, base cuneate or rounded, asymmetrical, subcoriaceous, numerous stellate hairs below which sometimes few long arms overlap with adjacent hairs, usually with arms all short, not overlapping, hairy to glabrous above, midrib prominent below, depressed above, lateral veins 16–22 on each side of midrib, curved upwards near margin, more or less anastomosing, reticulation visible below, densely stellate hairy; petiolules 1–1.5 cm long, stellate hairy. *Inflorescence* axillary near terminal, 15–40 cm long, densely stellate hairy throughout; peduncles 5–10 cm long, hairy. *Flowers* ca 1.5 mm diam., fragrant; pedicels ca 1 mm long, stellate hairs. *Calyx* broadly cup-shaped, ca 1 mm long, divided into 5 lobes ca ½ of the length, densely stellate hairy outside. *Petals* 5, free, sub-obovate, ca 1 mm long, glabrous, yellowish. *Staminal tube* ellipsoid, ca 0.5 mm long, margin 5-lobed, few hairs near base inside. *Anthers* 5, inserted above middle of tube, included. *Ovary* depressed globose, ca 0.3 by 0.6 mm, densely hairy, 1–2 locular, each locule with 1 ovule; stigma obovoid, truncate at apex with lobed margin. *Infructescence* up to 10 cm long, branched, erect, stellate hairy throughout. *Fruits* ovoid or ellipsoid, 2–3 by 2–2.5 cm, indehiscent; pericarp thin but hard, densely stellate hairy. *Seeds* ellipsoid, completely surrounded by a translucent, edible, sweet aril.

T h a i l a n d.— PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga.

D i s t r i b u t i o n.— Malaysia (type), Singapore, Indonesia, Philippines.

E c o l o g y.— In evergreen forest, usually near streams, on granite or limestone bedrock; altitude 30–700 m (most commonly 30–120 m). Flowering: March–August; fruiting: August–February.

38. *Aglaia teysmanniana* (Miq.) Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 48. 1868; Pannell, Tree Fl. Malay 4: 226. 1989; Kew Bull., Add. Ser. 16: 108. 1992; Fl. Males., ser. I, 12(1): 231. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 225. 2011; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 148. 2013; Gardner et al., Forest Trees S. Thailand 2: 1246, 1457, f. 1631. 2016.— *Amoora teysmanniana* Miq., Fl. Ned. Ind., Suppl. 1: 196, 503. 1861.— *Aglaia heptandra* Koord. & Valetton, Bijdr. Boomsort. Java 3: 132. 1896; Backer & Bakh.f., Fl. Java 2: 126. 1965.— *Amoora stellata* C.Y.Wu, Fl. Yunnan. 1: 234. 1977.

Shrubs to medium-sized trees (2–)5–15(–20) m tall, (20–)50–80(–120) cm girth; bark brown or grey, smooth or scaly; sapwood brownish; twigs densely pale yellowish brown stellate hairs. *Leaves* imparipinnate, 15–50(–100) cm long; petiole 9–21 cm, swollen near base; leaflets alternate, 2–3 on each side of rachis, oblong, oblanceolate, elliptic or ovate, 5–17.5(–25) by 2.5–7(–9.5) cm, apex acuminate or shortly caudate, acumen obtuse or acute, to 1.5 cm long, cuneate or rounded at asymmetrical base, chartaceous, glabrous, dull green above, pale below, densely pale yellow stellate hairs on midrib and numerous on the rest of leaflet below where often deciduous, midrib prominent below, depressed above, lateral veins 10–23 on each side of midrib, curved upwards, more or less anastomosing near margin, densely stellate hairy, reticulation obscure; petiolules 0.5–2 cm long, densely stellate hairy. *Inflorescence* axillary or supra-axillary near end of twigs, 8–15 cm long; peduncles 3–5 cm long. *Flowers* to 2 mm diam., fragrant; pedicels 3–5 mm long, densely stellate hairy throughout. *Calyx* broadly cup-shaped 1–1.5 mm, divided into 3 or 5 lobes ca ½–⅔ of the length, densely stellate hairy outside. *Petals* 3 or 5, free, subobovate, 2–3 mm long, glabrous or sparsely hairy outside, yellowish. *Staminal tube* cup-shaped, ca 2 mm long, glabrous, margin slightly undulate. *Anthers* 7, inserted below middle of tube, included or just

protruding. *Ovary* subglobose, ca 1 mm diam, densely stellate scaly, 3-locular, each locule with 1 or 2 ovules, stigma with 3 small apical lobes. *Infructescence* erect, 5–25 cm long. *Fruits* ovoid or ellipsoid, 1–2.2 by 1.3–2 cm, dehiscent capsules, locules usually 3, densely stellate hairy, glabrescent, pink when ripe. *Seeds* 1–3, obovoid, 1–1.5 by 0.5–1 cm, with orange or red aril.

T h a i l a n d.— NORTHERN: Lampang, PENINSULAR: Chumphon, Ranong, Surat Thani, Phatthalung, Trang, Narathiwat.

D i s t r i b u t i o n.— China, Vietnam, Malaysia, Indonesia (type), Philippines.

E c o l o g y.— In evergreen to mixed deciduous forest, usually near streams, on granite or sandstone or limestone bedrock; altitude 10–1,200 m (commonly 80–400 m). Flowering: February–June; fruiting: April–January (commonly April–August).

V e r n a c u l a r.— Mot sang rong hai (มดสังร้องไห้)(Peninsular).

U s e s.— Aril edible.

39. *Aglaia tomentosa* Teijsm. & Binn., *Natuurk. Tijdschr. Ned-Indië* 27: 43. 1864; Pannell, *Tree Fl. Malaya* 4: 226. 1989; *Kew Bull., Add. Ser.* 16: 331. 1992; *Fl. Males., ser. I*, 12(1): 306. 1995; T.Wongprasert et al., *Thai Forest Bull., Bot.* 39: 225. 2011; Pannell, *Fl. Penins. Malaysia, Ser. 2*, 4: 149. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1247, 1457, f. 1632. 2016.— *A. minutiflora* Bedd., *Icon. Pl. Ind. Or.* 1: 44, t. 193. 1874; Hiern in Hook.f., *Fl. Brit. India* 1: 557. 1875.— *A. minutiflora* Bedd. var. *travancorica* Hiern in Hook.f., *Fl. Brit. India* 1: 557. 1875.— *A. cordata* Hiern in Hook.f., *Fl. Brit. India* 1: 557. 1875; King, *J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist.* 64: 73. 1895; Ridl., *Fl. Malay Penins.* 1: 409. 1922; Craib, *Fl. Siam.* 1: 255; Pannell, *Tree Fl. Malaya* 4: 214. 1989.— *Milnea harmandiana* Pierre, *Fl. Forest Cochinch. Fasc.* 21: t. 333. 1895.— *Aglaia palembanica* Miq. var. *longifolia* Craib, *Fl. Siam.* 1: 258. 1926.

Shrubs to small trees (2–)5–10(–12) m tall, (20–)40–60 cm girth; bark smooth or flaky, brown, pinkish brown, dark brown or grey, inner bark yellowish or yellowish cream; heartwood pale brown; twigs slender, densely reddish brown or orange-brown stellate hairs with arms to 1 mm long. *Leaves* imparipinnate, 10–80 cm long; petiole 5–30 cm long, densely stellate hairy; leaflets 2–5 on each side of rachis, opposite or sub-opposite, obovate, oblanceolate to oblanceolate-oblong, 7–29 by 3.5–7 cm, apex acuminate or caudate, acumen obtuse or acute, to 3.5 cm long, base cordate or tapering and cuneate, margin often recurved when dry, chartaceous, sparsely stellate hairy, glabrescent above, midrib prominent below, faint above, hairs like on twigs, numerous on to densely covering midrib and veins and numerous on the rest of lower surface, arms of adjacent hairs usually overlapping, with smaller paler hairs which fewer and shorter arms interspersed on surface in between, lateral veins (5–)7–23 on each side of midrib, straight then curved upwards near margin, more or less anastomosing, reticulation faintly visible below; petiolules 0–0.5 cm long, hairy. *Inflorescence* axillary or supra-axillary, 8–30 cm long; peduncles 5–15 cm long. *Flowers* fragrant; pedicels subsessile, densely stellate hairy. *Calyx* broadly cup-shaped, ca 1 mm long, divided into 5 lobes ca ½ of the length, stellate hairy outside, glabrous inside. *Petals* 5, free, ovate, ca 1.5 mm, long, glabrous, white to yellowish or pinkish white. *Staminal tube* cup-shaped, ca 1 mm long, glabrous, margin shallowly 5 lobed. *Anthers* 5, inserted about middle of tube, included. *Ovary* depressed globose, less than 0.5 mm long, densely stellate hairy, with two locules, each locule with 1 ovule; stigma ovoid. *Infructescence* erect or slightly

pendulous, 20–30 cm long. *Fruits* subglobose or ellipsoid, (1–)1.5–2 by 1–2 cm, indehiscent, dense indumentum like that on twigs, brown, orange or yellowish orange. *Seeds* ellipsoid, usually one; aril orange red or brown, gelatinous, translucent, acidic-tasting, completely covering seed.

Thailand.—SOUTH-WESTERN: Kanchanaburi, Phetchaburi; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Yala, Narathiwat.

Distribution.—India, Laos, Vietnam, Malaysia, Singapore, Indonesia (type), Philippines, Australia.

Ecology.—In evergreen or mixed deciduous forest, near streams, on granite or limestone or sandstone bedrock; altitude 0–1,050 m (commonly 100–500 m). Flowering: February–November (commonly June–September); fruiting: April–December (commonly December–May).

Vernacular.—Sang khriat (สังเคียด), nuai fai (หน่วยฝ้าย), huat ngo (หวดเงาะ) (Peninsular).

Uses.—Aril edible.

40. *Aglaia wallichii* Hiern in Hook.f., Fl. Brit. India 1: 555. 1875; C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 606. 1878; Joyce, Crayn, Rossetto, Yap, Thiele & Pannell, Blumea 68: 36 (2023).—*Aglaia roxburghiana* auct. non (Wight & Arn.) Miq. Ann. Mus. Bot. Lugduno-Batavi 4: 41. 1868; Hiern in Hook.f., Fl. Brit. India 1: 555. 1875; Kurz, J. Asiat. Soc. Bengal 44(2): 147. 1875.—*Aglaia elaeagnoidea* auct. non (A.Juss.) Benth. Fl. Austral. 1: 383. 1863; Backer & Bakh.f. Fl. Java 2: 128. 1965; Pannell, Kew Bull., Add. Ser. 16: 143. 1992, p.p.; Fl. Males., ser. I, 12(1): 243. 1995, p.p.; Hua Peng & Pannell, Fl. China 11: 123. 2008; Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 78. 2013; S.Gardner et al.: 1231, 1453, f. 1612. 2016; Joyce, Crayn, Rossetto, Yap, Thiele & Pannell, Blumea 68: 37.—*Aglaia hoanensis* Pierre, Fl. Forest. Cochinch. t.336. 1895; Craib, Fl. Siam. 1: 255. 1926.

Small trees or shrubs (2–)5–15(–20) m tall, (20–)50–60(–120) cm girth; bark with dark brown or grey and rusty brown patches, inner bark pink; sapwood white to creamy; heartwood dark brown; twigs apices densely orange brown peltate scales, entire or a long fimbriate margin, glabrescent. *Leaves* imparipinnate, 5–20(–24) cm long; leaflets (1)2–3 on each side of rachis, opposite or subopposite, elliptic or elliptic-oblong (rarely ovate-oblong) or obovate-lanceolate, 5–11 by 2.5–3.5(–4.5) cm, apex acuminate to slightly caudate, base acute to cuneate or obtuse, chartaceous to subcoriaceous, few to numerous scales on midrib below, midrib flat or slightly depressed above, subprominent below, lateral veins 5–9 on each side of midrib, prominently curved upwards, anastomosing below, depressed above, reticulation visible below; petiole 2.5–5.5 cm long, slender, glabrescent except near slightly swollen and scaly base; petiolules 0.5–2 mm. *Inflorescence* axillary or supra-axillary, 5–15 cm long, lateral branches many, densely orange brown scaly; peduncles 1–3 cm long. *Flowers* to 2 by 3 mm, fragrant; pedicels ca 1 mm long, scaly, glabrescent. *Calyx* 5, subglobose, ca 0.5 mm long, lobes ca 2/3 of the length, densely scaly outside, glabrous inside, ciliate. *Petals* 5, free, subobovate, ca 1.5 mm long, glabrous, yellowish or white. *Staminal tube* depressed globose or ovoid, ca 1 mm long, glabrous, margin undulate. *Anthers* 5, glabrous, inserted about middle of tube, just protruding. *Ovary* ovoid, ca 0.3 mm in diam., glabrous, 2-locular, each locule with 1 ovule, usually one developed; stigma ovoid. *Infructescence* 5–15 cm

long, erect, densely small scales. *Fruits* subglobose, ovoid or ellipsoid, 1.1–2.5 by 1.3–2 cm, indehiscent, densely orange brown peltate scales with a long fimbriate margin, locules 2, each with 0 or 1 seed; pericarp thin and brittle when dry. *Seeds* ellipsoid, 0.5–0.6 by 0.3–0.5 cm; with thin, white, gelatinous, sweet aril.

T h a i l a n d.— NORTHERN: Phitsanulok; NORTH-EASTERN: Loei; EASTERN: Nakhon Ratchasima, Ubon Ratchathani; SOUTH-WESTERN: Uthai Thani, Phetchaburi CENTRAL: Saraburi, Nakhon Nayok; SOUTH-EASTERN: Sa Kaeo, Prachin Buri, Chon Buri, Chanthaburi, Trat; PENINSULAR: Ranong, Surat Thani, Phangnga, Nakhon Si Thammarat, Trang, Satun.

D i s t r i b u t i o n.— Bangladesh (type), Myanmar, China, Laos, Vietnam, Cambodia, Malaysia, Indonesia.

E c o l o g y.— In evergreen or deciduous forest, near streams, on limestone or granite bedrock; altitude 30–1,400 m (most commonly 50–400 m). Flowering: January–November (commonly September–November); fruiting: December–July (commonly March–July).

V e r n a c u l a r.— Daeng khao (แดงขาว), kraduk khiat (กระดุกเขียด), ta maeo (ตาแมว) (Southeastern); sang khiat dam (สังเขียดดำ) (Peninsular); nam phueng (น้ำผึ้ง), chang khru (จิ้งครู) (Eastern).

N o t e.— Gibbons (*Hylobates* spp.) ingest the seeds with their adherent fleshy aril, subsequently voiding the seed cleaned of the flesh (Brockelman, pers. comm.)

2. APHANAMIXIS

Blume, Bijdr. Fl. Ned. Ind.: 165. 1825; T.D. Penn., Blumea 22: 485. 1975; Mabb., Blumea 31: 136. 1985; Mabb. Fl. Males., ser. I, 12(1): 187. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 226. 2011; Mabb. in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 208. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 156. 2013 Gardner et al., Forest Trees S. Thailand 2: 1248–49. 2016.

Trees; hairs simple, rarely (not in Thailand) basally bifid or stellate. *Leaves* imparipinnate; leaflets opposite. *Inflorescence* axillary to supra-axillary. *Flowers* unisexual (trees dioecious) or bisexual; male flowers in panicles, female and bisexual flowers in spikes or racemes, rarely panicles (in Thailand only in spikes or racemes). *Flowers*: male flowers smaller than female. *Calyx* deeply 5-lobed, lobes imbricate. *Petals* 3, imbricate, united with staminal tube basally. *Staminal tube* subglobose to deeply cup-shaped. *Anthers* 3–6, glabrous, inserted within tube. *Disk* absent. *Ovary* 3–4-locular, each locule with (1 or) 2 collateral to superposed ovules, style stout, stigma conical to truncate, 3-angled or ribbed with impressions of anthers. *Fruit* a 2 or 3(4)-valved, loculicidal capsule, each locule 0–1-seeded. *Seeds* arillate; cotyledons plano-convex, collateral, united; radicle small, included.

3 species from Sri Lanka and India to Bhutan, tropical China, Myanmar, Cambodia, Laos and Vietnam, throughout Malesia to the Solomon Islands. 2 species in Thailand.

KEY TO THE SPECIES

1. Treelet or tree to 20 m tall. Leaflets coriaceous or subcoriaceous, more or less markedly asymmetrical, lateral veins curving upwards near margin but not anastomosing. Anthers always more than 3 **1. A. polystachya**
1. Small treelet, often unbranched and flowering when 1 m tall. Leaflets chartaceous, more or less equal at base, lateral veins curving upwards near margin and anastomosing. Anthers always 3 **2. A. sumatrana**

1. *Aphanamixis polystachya* (Wall.) R.Parker in Ind. For. 57: 486. 1931; Pellegr. in Lecomte, Fl. Indo-Chine, Suppl. 1: 714. 1948; C.Y.Wu, Fl. Yunnan. 1: 230. 1977; Mabb., Blumea 31: 137. 1985; Tree Fl. Malaya 4: 230. 1989; Fl. Males., ser. I, 12(1): 188. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 226. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 156. 2013; Gardner et al., Forest Trees S. Thailand 2: 1248, 1457, f. 1633. 2016.— *Aglaia polystachya* Wall. in Roxb. Fl. Ind. 2: 429. 1824.— *A. rohituka* (Roxb.) Wight et Arn. in Wight, Cat.: 24. 1833; Hiern in Hook.f., Fl. Brit. India 1: 559. 1875; Kurz, Forest Fl. Burma 1: 220. 1877; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 53. 1895; Craib, Bull. Misc. Inform. Kew 1911: 27. 1911; Fl. Siam. 1: 260. 1926.— *Amoora polystachya* (Wall.) Wight et Arn. ex Steud., Nomencl. ed. 2, 1: 78. 1840; Craib, Fl. Siam. 1: 260. 1926.— *Aphanamixis grandifolia* Blume, Bijdr. Fl. Ned. Ind.: 165. 1825; Backer & Bakh.f., Fl. Java 3: 654. 1968.— *Aglaia aphanamixis* Pellegr. in Lecomte, Fl. Indo-Chine 1: 767. 1911.— *Dysoxylum cuneatum* Hiern in Hook.f., Fl. Brit. India 1: 549. 1875.— *Aphanamixis cochinchinensis* Pierre, Fl. Forest Cochinch. Fasc. 5: t. 343 B. 1897.— *Dysoxylum cauliflorum* auct. non Hiern: Ridl., Fl. Malay Penins. 1: 396. 1992.— *Aphanamixis sinensis* P.H.How & Chen, Acta Phytotax. Sin. 4: 29, t. 3. 1955. Fig. 16. Plate CXXV: D–F.

Trees 5–20 m tall, 60–120(–200) cm girth, often flowering at 1 m tall; terminal bud linear, ca 1 cm long, hairy; bark rather smooth, finely fissured, greenish brown to reddish brown, occasionally flaking or peeling, inner bark pinkish to reddish, often with white latex; sapwood pinkish or white; heartwood pale to dark red; twigs drooping, lenticellate, subglabrous to tawny puberulous. *Leaves* 20–70(–90) cm long, sometimes terminal leaflet reduced; petiole 10–15 cm long, few appressed simple hairs, glabrescent; leaflets (3–)6–10 on each side of rachis, obovate–oblong or oblong, 5–20(–25) by 2.5–6(–9) cm, apex acuminate, usually curved to one side, cuneate on one side, rounded on the other at asymmetrical base, margin entire or undulate, coriaceous to subcoriaceous, occasional appressed simple hairs or glabrous, midrib prominent below, depressed above, lateral veins (7–)8–14(–17) on each side of midrib, slightly curved upwards near margin, prominent below, reticulation visible or sometimes subprominent when dry; petiolules 0.4–1.5 cm long, terminal one up to 3 cm long. *Inflorescences* often several in leaf axils near shoot apex; up to 50 cm long with 1 order of branching in male; to 80 cm long, spicate in female. *Flowers* 4–9 mm in diam.; sessile. *Calyx* deeply divided into 5 lobes, lobes ca 1 by 1.5–3 mm, ciliate, pubescent outside, glabrous inside. *Petals* 3, ca 3 by 2 mm, glabrous inside, pubescent outside, yellow, cream or yellowish white. *Staminal tube* 1.5–2 by ca 1.5 mm, white, glabrous. *Anthers* (5 or) 6(–8), ellipsoid, 2.4–4 mm long, glabrous, included. *Infructescence* a pendent spike; peduncle to 0.5 cm diam. *Fruit* subglobose, ovoid or obovoid, 2.5–4 by 2–4 cm, yellowish to pinkish white or whitish brown; sessile or on a short pedicel; fruiting calyx broadly ovate, 1–1.5 by 2–3 mm, fringed or undulate margin, pubescent outside, glabrous inside; fruiting stalk stout, 2–3 mm long. *Seeds* 1–3, 1.7–2.2 cm long, glossy dark brown to blackish, covered with a bright red aril.

T h a i l a n d.— NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Nan, Lamphun, Lampang, Phrae, Tak, Kamphaeng Phet. NORTH-EASTERN: Loei, Nong Khai, EASTERN: Chaiyaphum, Nakhon Ratchasima; SOUTH-WESTERN: Uthai Thani, Kanchanaburi, Ratchaburi, Prachuap Khiri Khan; CENTRAL: Lop Buri, Nakhon Nayok; SOUTH-EASTERN: Prachin Buri, Chon Buri, Chanthaburi; PENINSULAR: Chumphon, Ranong, Phangnga, Phuket, Nakhon Si Thammarat, Phatthalung, Trang, Songkhla, Yala, Narathiwat.

D i s t r i b u t i o n.— Sri Lanka, India (type), Bhutan, China, Laos, Vietnam, Malaysia, Singapore, Indonesia, Philippines.

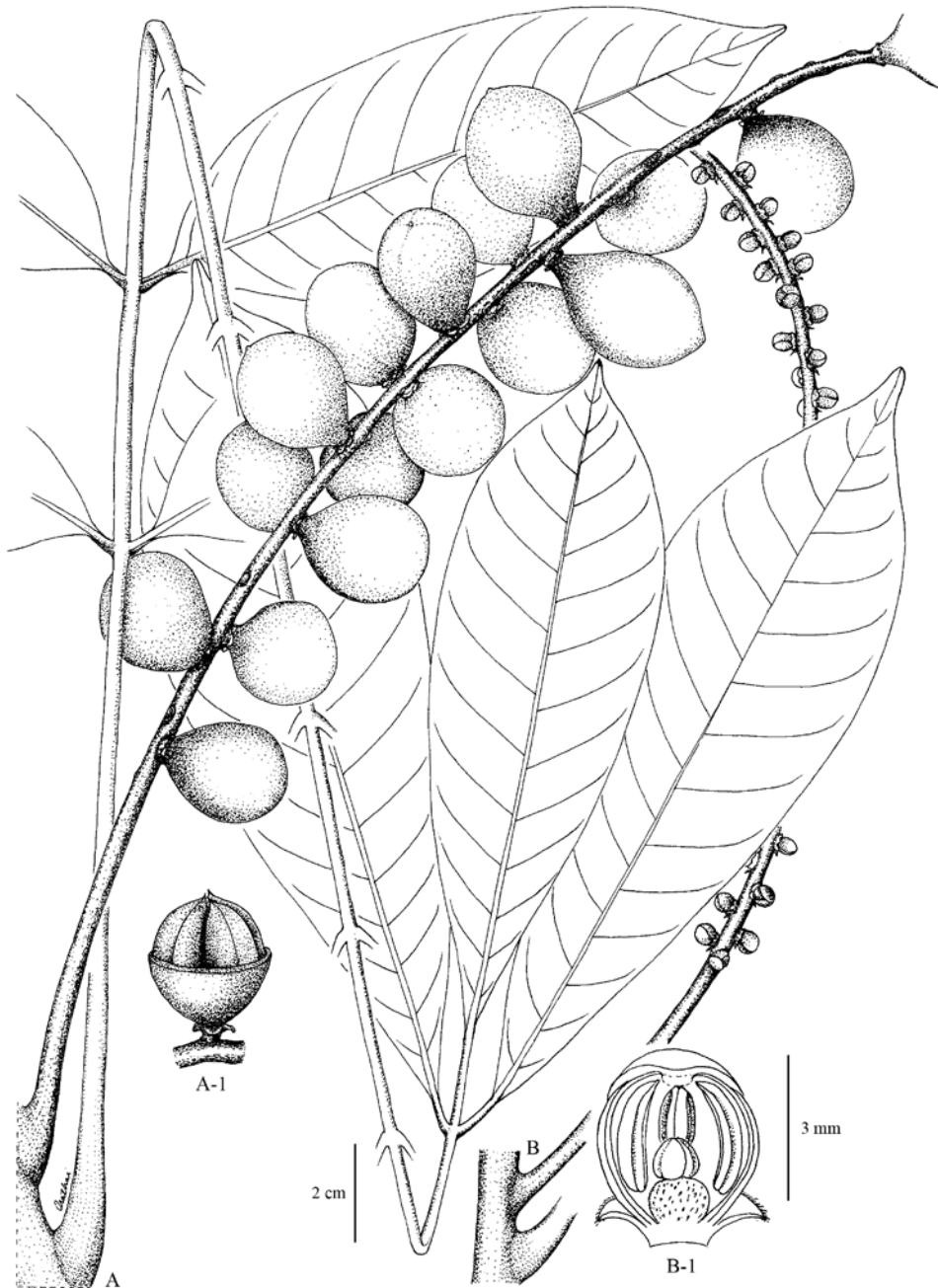


Figure 16. *Aphanamixis polystachya* (Wall.) R.Parker: A. twig with infructescence, A-1 male drupe shown seeds & aril (C.F. van Beusekom & C. Phengkhai 2663); B. female inflorescence, B-1 longitudinal section of female flower, B-2 longitudinal section of male flower (R. Geesink 5068). Drawn by Orathai Kerdkaew.

E c o l o g y.— Tropical evergreen to swamp forest, mixed deciduous forest by streams, on limestone or granite bedrock; altitude 10–1,360 m (commonly 100–800 m); Flowering: April–October (commonly April–August); fruiting: August–March (commonly August–March).

V e r n a c u l a r.— Khamin dong (ขมิ้นตัง), mahang kan (มะฮังก่าน), lao hang (เลาหาง), ma-a (มะอ้า)(Northern); ta suea (ตาเสือ)(Central); ta pu (ตาปู่)(Southeastern); tum dong (ตุ้มตัง), sang khriat ko hok (สังเคียดคอโฮก)(Peninsular).

2. *Aphanamixis sumatrana* (Miq.) Ridl., Fl. Malay Penins. 1: 400. 1922; Mabb., Blumea 31: 139. 1985; Pannell, Tree Fl. Malaya 4: 231. 1989; Gardner et al., Forest Trees S. Thailand 2: 1249, 1457, f. 1633. 2016. Mabb., Fl. Males., ser. I, 12(1): 194. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 227. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 1158. 2013.— *Amoora sumatrana* Miq., Ann. Mus. Bot. Lugdono-Batavia 4: 35. 1868.

Trees 1–6 m tall, up to 20 cm girth; terminal bud linear, ca 1 cm long. hairy; bark rather smooth, finely fissured, greenish brown, occasionally peeling, inner bark pinkish to reddish, often with white latex; sapwood pinkish or white; heartwood pale to dark red; twigs drooping, lenticellate. *Leaves* 30–50(–110) cm long; petiole 10–15(–25) cm long, sparsely pubescent, glabrescent; leaflets 4–6 on each side of rachis, **elliptica**, obovate-oblong, or obovate–lanceolate 8–20(–30) by (3–)4–7.5(–10) cm, apex broadly obtuse then minutely shortly acute, sometimes curved to one side, cuneate at somewhat asymmetrical base, margin entire or undulate, chartaceous, dull dark green above, pale below, glabrous or with short patent simple hairs, midrib prominent below, depressed above, lateral veins (11–)15–20 on each side of midrib, curved and anastomosing near margin, distinct on both surfaces, reticulation visible; petiolules 0.5–1.5 cm long, apical one to 6 cm, pubescent. *Inflorescence* supra-axillary, up to 50 cm long in male, to 60(–110) cm long in female. *Flowers* ca 4 mm in diam. *Calyx lobes* ca 1 by 1 mm, few appressed simple hairs outside, glabrous inside. *Petals* ca 5 by 2 mm, a few appressed simple hairs outside, glabrous inside, yellow. *Staminal tube* 1.5–2 by 1.5 mm, white, glabrous. *Anthers* 3, ca 2 mm long, just protruding and filling aperture. *Infructescence* spicate, slightly curved; peduncle ca 10 cm long. *Fruit* subglobose or obovoid, 1.5–4 by 1–4 cm, conspicuously (2–)3 longitudinally valved, woody or leathery, yellowish to pinkish; fruiting calyx somewhat accrescent in fruit. *Seeds* 1–3, glossy dark brown to blackish, covered with a red aril.

T h a i l a n d.— NORTHERN: Chiang Mai, Chiang Rai, Nan, Lampang, Sukhothai; PENINSULAR: Chumphon, Ranong, Narathiwat.

D i s t r i b u t i o n.— Peninsular Malaysia, Sumatra (type), Singapore and Philippines.

E c o l o g y.— Tropical evergreen rain forest; altitude to 600 m.

3. AZADIRACHTA

A.Juss., Bull. Sci. Nat. Géol. 23: 236. 1830; Jacobs, Gard. Bull. Singapore 18: 71. 1961; Backer & Bakh. F., Fl. Java 2:120. 1965; Penn. & Styles, Blumea 22: 464, f.3. 1975; Mabb., Fl. Males., ser. I, 12(1): 337. 1995; Gardner et al., Forest Trees N. Thailand 115, 403, f. 222. 2000; Mabb., Tree Fl. Sabah & Sarawak 6: 111. 2007; in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 198. 2011; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 227. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 159. 2013; Gardner et al., Forest Trees S. Thailand 2: 1250–1, 1458–9, f. 1636–7. 2016.

Trees; hairs simple; buds thinly encrusted with resin. *Leaves* imparipinnate or paripinnate, usually with a pair of linear glands below a pair of orbicular glands near base of petioles, visible in fresh material, rachis not swollen at insertion of leaflets; leaflets opposite or subopposite, pubescent or glabrous. *Inflorescence* thyrsoid, axillary. *Flowers* bisexual and male on the same tree, oblong or salverform. *Calyx* 5-lobed to halfway, lobes imbricate. *Petals* 5, free, imbricate. *Staminal tube* cylindrical, with 10 longitudinal ridges, slightly expanded at apex, margin (8–)10-lobed, lobes obtuse, truncate, emarginate or bifid, recurved at anthesis. *Anthers* (8–)10, glabrous, inserted at base of lobes. *Disk* annular, united with base of ovary. *Ovary* ovoid, glabrous, 3-locular, each locule with 2 collateral ovules, stigma narrowly ovoid, bearing 3 acute, partially fused papillose stigmatic lobes. *Fruit* a 1(2) seeded drupe; endocarp thin, cartilaginous. *Seed* ovoid or ellipsoid, pointed distally; testa thin, membranous with a small adaxial sarcotesta.

2 species in Indomalesia, both of which are in Thailand.

KEY TO THE SPECIES AND VARIETIES

1. Leaflets with entire margin. Ripe drupes not less than 2.5 by 2 cm **1. *A. excelsa***
1. Leaflets with serrate margin. Ripe drupes up to 2 by 1.5 cm
 2. Apical leaflet prominent if present, lateral leaflets strongly asymmetrically curved at base to one side. Staminal tube usually glabrous inside. Drupes dark yellow when ripe. Only in cultivation on roadsides and in plantations **2a. *A. indica* var. *indica***
 2. Apical leaflet usually reduced or absent, lateral leaflets only slightly asymmetrical at base on one side. Staminal tube hairy on upper half inside. Drupes yellow or glossy green when ripe. Probably naturalized rather than native **2b. *A. indica* var. *siamensis***

1. *Azadirachta excelsa* (Jack) Jacobs, Gard. Bull. Singapore 18: 75. 1961; Wong, Mal. For. Rec. 28 cum. tab.: 81. 1976; Mabb., Tree Fl. Malaya 4. f. 4: 233 1989; Fl. Males., ser. I, 12(1): 337. 1995; Gardner et al., Forest Trees S. Thailand 2: 1250, 1458, f. 1636. 2016; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 227. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 160. 2013.—*Melia excelsa* Jack, Malayan. Misc. 11: 12. 1820; Corner, Gard. Bull. Straits. Settl. 10: 263, t. 1, 2 1939.—*Trichilia excelsa* (Jack) Spreng., Syst. Veg. 4(2): 252. 1827.—*Azedarach excelsa* (Jack) Kuntze, Rev. Gen. Pl. 1: 110. 1891. Fig. 17.

Trees 10–40 m tall, 150–300 cm girth, rarely slightly buttressed; bark grey, longitudinally peeling off (smooth in young trees); sapwood white; heartwood pinkish; young twigs with leaf scars, lenticellate, shortly hairy. *Leaves* (20–)30–60 cm long, pubescent, glabrescent; petiole 6–10 cm long, puberulous then glabrous, grooved above; leaflets 7–11 on each side of rachis, elliptic–oblong or oblong-lanceolate, 4–12 by 2–4.5 cm, apex acute, base asymmetrically obtuse, sometimes shortly decurrent on one side, margin entire (serrate or undulate in seedlings), chartaceous to subcoriaceous, puberulous then glabrous on both surfaces, usually curved to one side, midrib prominent below, slightly depressed above, lateral veins 7–11 on each side of midrib, curved upwards near margin, not anastomosing, venation visibly reticulate below; petiolules 2–3 mm long, glabrous. *Inflorescence* axillary near end of twigs, a compound thyrs, 20–40 cm long, erect. *Flowers* fragrant; pedicels ca 5 mm long, pubescent. *Calyx* lobes greenish, ca 1 mm long, pubescent outside. *Petals* oblong, 5–6 by 1.5–2 mm, creamy white, pubescent outside. *Staminal tube* 3.5–4.5 mm long, white or greenish, glabrous outside, some simple hairs in upper part inside, 10-ribbed, each rib terminating in a bifid lobe. *Anthers* 10, sessile, inserted on lobes, slightly exerted. *Ovary* ca 1.5 by 1 mm, glabrous, style ca 3.5 mm long, glabrous, stigma swollen, at level of aperture



Figure 17. *Azadirachta excelsa* (Jack) Jacobs: A. twig with inflorescences, A-1 flower, A-2 longitudinal section of male tube & ovary; B. infructescence (K. Chiratanakorn s.n., BKF 91451). Drawn by Arthit Khamkamnoed.

of staminal tube. *Fruit* an ellipsoid or ovoid drupe, 2.5–3.2 by 2–2.4 cm, glabrous, green, turning yellow at maturity. *Seeds* 1, ca 2.5 by 1.5–1.8 cm, covered with soft aril.

T h a i l a n d.— SOUTH-WESTERN: Kanchanaburi (Cultivated), Prachuap Khiri Khan; PENINSULAR: Ranong, Surat Thani.

D i s t r i b u t i o n.— Malaysia (type), Indonesia, Brunei, Philippines.

E c o l o g y.— In evergreen forest; altitude (5–) 20–100(–250) m.

V e r n a c u l a r.— Sadao thiam (สะเดาเทียม), sadao chang (สะเดาช้าง), thiam (เทียม) (Peninsular).

N o t e.— Young shoots, leaves and flowers are eaten as a vegetable.

2. *Azadirachta indica* A.Juss., *Mém. Mus. Nat.* 19: 221. 1832; C.DC. in A.DC. & C.DC., *Monogr. Phan.* 1: 459. 1878; Craib, *Fl. Siam.* 1: 250. 1926; Backer & Bakh.f., *Fl. Java* 2: 120. 1965; Mabb., *Fl. Males.*, ser. I, 12(1): 341. 1995 (excl. var. *siamensis* Valetton); Gardner et al., *Forest Trees N. Thailand* 115, 2000; *Forest Trees S. Thailand* 2: 1251, 1458, f. 1637. 2016; T.Wongprasert et al., *Thai Forest Bull., Bot.* 39: 227. 2011.— *Melia Azadirachta* L., *Sp. Pl.*: 385. 1753; Hiern in Hook.f., *Fl. Brit. India* 1: 544. 1875; Craib, *Bull. Misc. Inform. Kew* 1911: 27. 1911; *Abdn. Uni. Stud.* 57: 35. 1912; Ridl., *Fl. Malay Penin.* 1: 384. 1922.— *M. indica* (A.Juss.) Brandis, *For. Fl. NW & C India*: 67. 1874.

2a. var. *indica* Fig. 18. Plate CXXXV: G–H.

Trees 5–15 m tall, 60–120 cm girth; bark pale green to dark grey, longitudinally furrowed, inner bark creamy to reddish; sapwood whitish; heartwood reddish brown; young twigs with many oblong lenticels, glabrous. *Leaves* near end of twigs, 20–35 cm long, glabrous or hairy, glabrescent; petiole 6–10 cm, not wrinkled at base when dry, sparsely greyish hairy glabrescent; leaflets 4–7 on each side of rachis, subopposite, apical one not reduced, lanceolate, ovate or strongly curved to one side, 2–8 by 1.5–4 cm, apex caudate, asymmetrical base cuneate on one side, rounded on the other, margin serrate, young leaves reddish, midrib prominent on both surfaces, lateral veins (5–)8–15 on each side of midrib, faint on both surfaces, curved upwards near margin, not anastomosing, venation very faintly reticulate; petiolules 3–5(–7) mm long. *Inflorescence* axillary near ends of twigs, a compound thyrse, 20–30 cm long; pedicels ca 2 mm long, sparsely pubescent; bracts and bracteoles lanceolate, 0.5–1 mm long, pubescent. *Calyx* lobes free or partly united near base, broadly ovate, ca 1 by 1 mm, pubescent outside, margin ciliate. *Petals* 5, free, spatulate or obovate, 3–5 by 1.5 mm, white or yellowish, pubescent on both surfaces, much more along dorsal line. *Staminal tube* 3–5 mm long, creamy, glabrous outside, hairy in upper half inside, 10-ribbed, margin 10 rounded or somewhat lacinate lobes. *Anthers* 10, sessile, on lobes. *Ovary* ovoid, ca 1 by 1 mm, glabrous, 3-locular, style tubular, ca 2 mm, glabrous, stigma 3-lobed, each with pointed apex. *Infructescence* 25–50 cm long; fruiting stalk 1–1.5 cm long. *Fruits* ellipsoid or subobovoid, 1–2 by 0.8–1.5 cm, dark yellow when ripe. *Seed* 1(2), covered with soft aril.

T h a i l a n d.— (All cultivated) NORTHERN: Phrae, Phitsanulok; SOUTH-WESTERN: Prachuap Khiri Khan; CENTRAL: Phra Nakhon Si Ayutthaya; EASTERN: Chaiyaphum; SOUTH-EASTERN: Chon Buri, Rayong; PENINSULAR: Satun, Songkhla.

D i s t r i b u t i o n.— Natural range not known. Widely cultivated in Saudi Arabia, Pakistan, Sri Lanka, India (type), Myanmar, Malaysia, Singapore, Philippines, Australia.

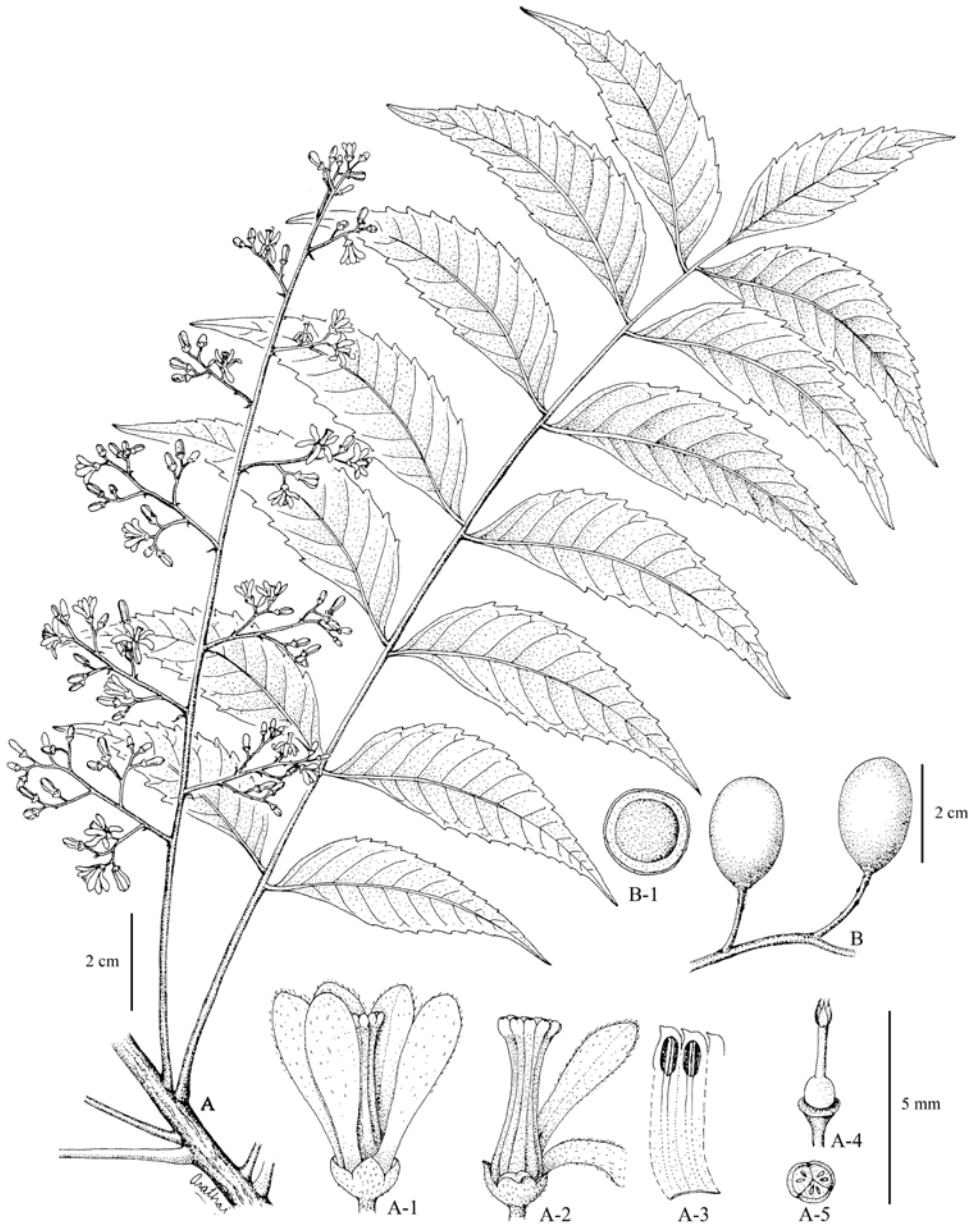


Figure 18. *Azadirachta indica* A.Juss. var. *indica*: A. twig with inflorescences, A-1 flower, A-2 staminal tube, A-3 stamen habit, A-4 pistil, A-5 cross section of ovary (A.F.G. Kerr 5637); B. part of infructescence, B-1 cross section of drupe (C.F. van Beusekom et al 440). Drawn by Orathai Kerdkaew.

E c o l o g y.— Cultivated by roadside and in forest plantations; altitude 50–300 (–800) m.

V e r n a c u l a r.— Sadao india (สะเดาอินเดีย), khwinin (ควินิน)(General); Neem.

U s e s.— Neem oil has been used to treat a wide range of ailments for more than 2000 years in Ayurvedic and Unami medicine. Young shoots and inflorescences are edible.

2b. var. siamensis Valeton in Hochr., Pl. Bogor. Exs.: 66. 1904; Cat. Bogor. Nov.: 21. 1905; Gardner et al., Forest Trees S. Thailand 2: 1251, 145, f. 1637. 2016; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 229. 2011. Fig. 19. Plate CXXV: J.

Trees 5–20 m tall, 80–200 cm girth; bark pale green to dark grey, longitudinally furrowed, inner bark creamy to reddish; sapwood white to yellowish; heartwood reddish brown; young twigs with numerous oblong lenticels, hairy then glabrous. *Leaves* near twigs ends, 11–30 cm long, rachis glabrous; petiole 3.5–10 cm long, glabrous, usually wrinkled at base when dry; leaflets 6 or 7 on each side of rachis, subopposite, apical one usually reduced or absent, ovate or ovate-oblong, 6–9(–12) by 2.5–4.5 cm, apex acuminate to slightly caudate, base obtuse, slightly asymmetrical, margin serrate or irregularly serrate, slightly curved to one side, glabrous, except sparsely hairy along midrib and lateral veins, prominent below, faint above, lateral veins 7–12 on each side of midrib, usually spreading, venation prominently reticulate below; petiolules 3–10 mm long, glabrous. *Inflorescence* axillary near ends of twigs, 8–25(–30) cm long; pedicels ca 1 mm long, glabrous or sparsely hairs; bracts and bracteoles lanceolate, ca 1 mm long. *Calyx* lobes ovate, ca 1.5 by 1 mm. *Petals* obovate-oblong, ca 3 by 1 mm, greenish, white or yellowish, ciliate. *Staminal tube* 3–5 mm long, creamy, hairs on the upper half inside. *Anthers* 10, inserted on lobes, glabrous on lower half, some simple hairs in upper part inside. *Ovary* ca 1 by 0.5 mm, glabrous; style ca 1.5 mm long, glabrous; stigma ovoid, slightly lobed at apex. *Infructescence* 25–40 cm long; fruit stalk 1–3 cm long. *Fruits* ellipsoid, ca 2 by 1 cm, yellow when ripe. *Seed* 1; covered with soft aril.

T h a i l a n d.— NORTHERN: Chiang Mai, Chiang Rai, Phrae; NORTH-EASTERN: Kalasin; EASTERN: Buri Ram, Si Sa Ket; SOUTH-WESTERN: Kanchanaburi, Ratchaburi; CENTRAL: Chai Nat, Lop Buri; SOUTH-EASTERN: Prachin Buri, Chon Buri, Chanthaburi.

D i s t r i b u t i o n.— Indonesia (type, cultivated in Bogor Botanical Gardens).

E c o l o g y.— In mixed deciduous and dry deciduous dipterocarp forests; altitude 50–300(–800) m, probably naturalized rather than native. Often not clearly distinguishable from var. *indica*.

V e r n a c u l a r.— Sadao (สะเดา)(General); saliam (สะเลียม)(Northern).

U s e s.— Leaves, flowers, fruits and seeds eaten. Juice applied to skin kills lice, fruit sprayed on crops as insecticide.

4. CHISOCHETON

Blume, Bijdr.: 168. 1825; Mabb., Bull. Brit. Mus. (Nat. Hist.) Bot. 6: 301. 1979; Mabb., Fl. Males., ser. I, 12(1): 136. 1995; in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 206, f. 38. 2011; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 229. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 162. 2013; Gardner et al., Forest Trees S. Thailand 2: 1252–1260, f. 1640–49. 2016.

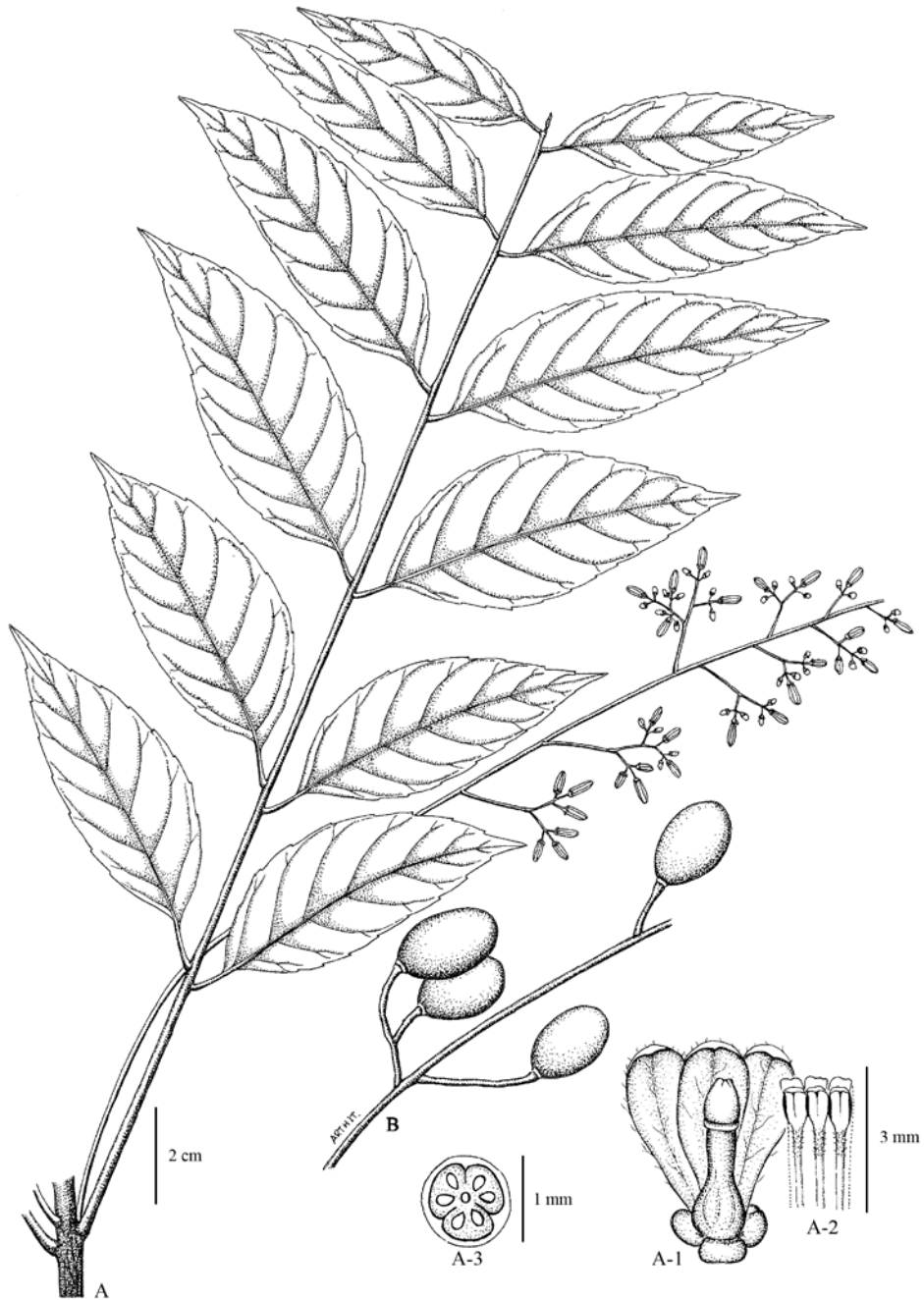


Figure 19. *Azadirachta indica* A.Juss. var. *siamensis* Valetton: A. twig with inflorescences, A-1 flower shown pistil, A-2 stamens, A-3 cross section of ovary; B. part of infructescence. Drawn by Arthit Khamkamnoed.

Evergreen trees, dioecious, usually with simple hairs, (outside Thailand rarely with 4-armed stellate hairs); bud scales absent. *Leaves* imparipinnate, mostly appearing paripinnate by presence of a young shoot of curled new leaflets (pseudogemmules) at end of elongating rachis; leaflets 2–28 on each side of rachis, usually opposite, margin entire. *Inflorescence* thyrsoid or like a long rope with a congested terminal raceme, axillary to supra-axillary, or ramiflorous. *Flowers* unisexual, sometimes with elongated receptacle (pseudopedicel); bracts and bracteoles small, narrowly triangular, usually caducous. *Calyx* more or less cup-shaped, usually with almost entire margin, or obscurely 3–6-lobed. *Petals* 4–6, free, in 1 (or 2) whorls, imbricate, quincuncial or valvate. *Staminal tube* cylindrical, sometimes expanded at mouth, margin entire, crenate or with (3)4–10(–15) truncate or narrowly lanceolate, or emarginate, or 2 (or 3)-fid lobes. *Anthers* (3)4–10(–13), usually inserted within tube, alternating with lobes, usually locellate (i.e. divided into secondary, smaller, transverse compartments). *Disk* usually absent, less often below ovary, annular or discoid, occasionally lobed. *Ovary* 2–5-locular, each locule with 1(2) ovule, stigma capitate, discoid, clavate or shortly cylindrical, usually glabrous. *Fruit* a 2–5-locular capsule, each valve with 1(–2) seeds; pericarp usually leathery or almost completely lignified. *Seeds* obovoid-spheroid to scutelliform or orange-segment-shaped, arillate or sarcotestal.

About 53 species from India (Assam) and tropical China throughout Malesia south-eastwards to northern Australia (Queensland) and Vanuatu. 11 species in Thailand.

KEY TO THE SPECIES AND SUBSPECIES

1. Reticulation prominent or subprominent on both leaflet surfaces when dry
 2. Leaflets sessile to subsessile, reticulation markedly depressed above and prominent below, strongly reticulate-areolate. All parts of plant numerous or densely reddish brown simple irritant hairs. Fruits usually 5-locular, subglobose. Seeds 3–5 **11. *C. tomentosus***
 2. Leaflets with petiolules, reticulation subprominent below, not strongly reticulate-areolate, irritant hairs absent. All parts of plant either glabrous or numerous simple non-irritant hairs. Fruits 2–4 locular, subglobose or with stipe and beak. Seeds 1–4
 3. Staminal tube with long, finger-like lobes. Anthers glabrous. Infructescence branched with more than one order of branching. Peninsular Floristic Region evergreen forest only **8. *C. patens***
 3. Staminal tube with short truncate lobes. Anthers hairy or glabrous. Infructescence a raceme with short side branches. Sometimes occurring north and east of Peninsular Floristic Region
 4. Anthers glabrous. Fruits subglobose, with a distinct stipe and minute beak, 2-locular. Peninsular Floristic Region evergreen forest only **5. *C. erythrocarpus***
 4. Anthers hairy. Fruits subglobose, without stipe or beak, 3–4-locular. Peat swamp forest in Peninsular; or evergreen or deciduous forest in Northern and Southeastern Floristic Regions
 5. Petals 5 or 6. Fruits to 4 cm diam. Peat swamp forest in Peninsular Floristic Region only **1. *C. amabilis***
 5. Petals 4. Fruits larger, to 6 by 7 cm diam. Evergreen or deciduous forest in Northern and Southeastern Floristic Regions, absent from peat swamp forest and Peninsular Floristic Region **3. *C. cumingianus* subsp. *balansae***
1. Reticulation not or barely raised on either leaflet surface when dry, may be visible on one or both surfaces
 6. Basal leaves markedly smaller than more distal leaves, lateral veins on largest leaflets 18 or more on each side of midrib. Fruits to 8 cm diam., with 4 locules **7. *C. macrophyllus* subsp. *fulvescens***
 6. Basal leaves smaller than more distal leaves, but less markedly so, lateral veins on largest leaflets fewer than 18 on each side of midrib. Fruits less than 8 cm diam., with 2 or 3 locules
 7. Female inflorescence a spike or raceme, 1–7 m long, resembling a long rope, terminating in one or more clusters of flowers either inserted onto rachis or congested in a single terminal mass in which flowers sessile on short branches
 8. Leaflets not hairy, reticulation not prominent. Fruits to 7 cm diam., subglobose to obovoid, weakly rostrate with a short stipe **4. *C. dysoxylifolius***
 8. Leaflets somewhat hairy, reticulation barely prominent. Fruits 3.5–5 by 1–2 cm, spindle shaped **9. *C. penduliflorus***

7. Female inflorescence less than 1 m long, more than one order of branching. Flowers not sessile on unbranched rachis nor on short branches in a single congested mass at distal end, or inflorescences male, shorter and with several orders of branching
9. Small (to 12 m) pachycaul tree. Flower buds spindle-shaped, narrow at base, expanding to accommodate anthers and narrowed again at apex **9. *C. penduliflorus***
9. Taller (to 25 m, or exceptionally to 40 m) branched tree. Flower buds not spindle shaped
10. Fruits reported to be large, apple-like or pyriform with 3 locules. Northern Floristic Region only **6. *C. grandiflorus***
10. Fruits 2-locular, with 2 seeds. Peninsular Floristic Region only
11. Leaves to 150 cm long; leaflets up to 17 on each side of rachis, leaflet below with few to numerous regularly spaced appressed white hairs. Calyx often accrescent, persistent in fruit. Fruit subglobose, to 4.5 cm in diam., narrowed abruptly to a stipe 1.5–2 cm long, without a beak; with a 1–1.5 cm thick pericarp. Seeds flattened, partly with orange aril **2. *C. ceramicus***
11. Leaves to 50 cm long; leaflets up to 11 on each side of rachis, leaflet below with few to numerous patent or a few prostrate hairs. Calyx absent in fruit. Fruits spindle shaped, tapering to base and to an apical point (or rarely subglobose without a stipe) up to 8 cm long, including 1.5 cm beak and 1.1 cm stipe, usually with one longitudinal ridge. Seeds with thin aril or sarcotesta **10. *C. pentandrus* subsp. *paucijugus***

1. *Chisocheton amabilis* (Miq.) C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 537. 1878; Merr., J. Straits Branch Roy. Asiatic Soc., spec. no.: 319. 1921; Corner, Gard. Bull. Singapore, Suppl. 1: 198. 1978; Mabb., Bull. Brit. Mus. (Nat. Hist.) Bot. 6.4: 344. 1979; Tree Fl. Malaya 4: 234. 1989; Fl. Males., ser. I, 12(1): 163. 1995; T. Wongprasert et al., Thai Forest Bull., Bot. 39: 230. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 164. 2013.— *Schizochiton amabilis* Miq., Ann. Mus. Bot. Lugdono-Batavia 4: 26. 1868.— *Chisocheton illustris* Ridl., Bull. Misc. Inform. Kew 1930: 366. 1930.— *C. brachyanthus* (non Merr.) Anderson, Gard. Bull. Singapore 20: 115. 1963. Fig. 20.

Trees 8–10(–20) m tall, 40–80 cm girth; bark smooth or finely fissured, dark or greenish-grey, inner bark creamy to pinkish; sapwood whitish; heartwood reddish brown; twigs 3–7 mm in diam., drying reddish. *Leaves* (20–)30–40(–95) cm long, pseudogemmulate, pseudogemmula fulvous-tomentose; petiole 5–10(–15) cm long; leaflets (4–)7–20 on each side of rachis, opposite to subopposite, oblong or elliptic-oblong, 6–17 by 3.5–6 cm, tapering to an obtuse acumen to 15 mm long, rounded or cuneate at asymmetrical base, subcoriaceous, with a few long stiff simple hairs on midrib and near margin of leaflet below, numerous dark red and sometimes black dots below, lateral veins 6–10 on each side of midrib, midrib depressed above, prominent below, lateral veins slightly depressed above, prominent below, reticulation subprominent on both surfaces when dry; petiolules 3–5 mm, with a few spiky simple hairs. *Inflorescence* 15–30 cm long, axillary or supra-axillary, near ends of twigs, pendent; branched once, with flowers inserted on side-branches; peduncles 5–11 cm, a few stiff simple hairs on all stems, calyx and corolla, glabrescent. *Flowers* fragrant; pedicels ca 2 mm long. *Calyx* cup-shaped, ca 2 by 3 mm, barely 4- or 5-lobed, ciliate. *Petals* 5 or 6, overlapping, linear, 5–12(–15) by 2–2.5 mm, appressed hairs along margin and towards apex, adhering to staminal tube in lower half in bud. *Staminal tube* 10–12 mm long, subglabrous to hairy, margin (5–)8(–10)-bifid lobes to 2 mm long. *Anthers* 8–10, inserted inside tube, included within, locellate, long hairs on dorsal side. *Disk* prominent, subtubular, 0.5–1 mm tall, glabrous. *Ovary* ovoid, ca 2.5 by 2 mm, hairy, 4-locular, style linear, 7–9 mm, densely with apically pointing orange-brown hairs near base, density decreasing to glabrous in upper third, stigma capitate, expanded ring around apical half, glabrous. *Infructescence* slightly pendulous, 20–70 cm long. *Capsules* clustered at distal end of rachis in groups of 3–10, subglobose, 3–5 cm diam., slightly (3)4 grooved, pink, then dark red, dehiscing

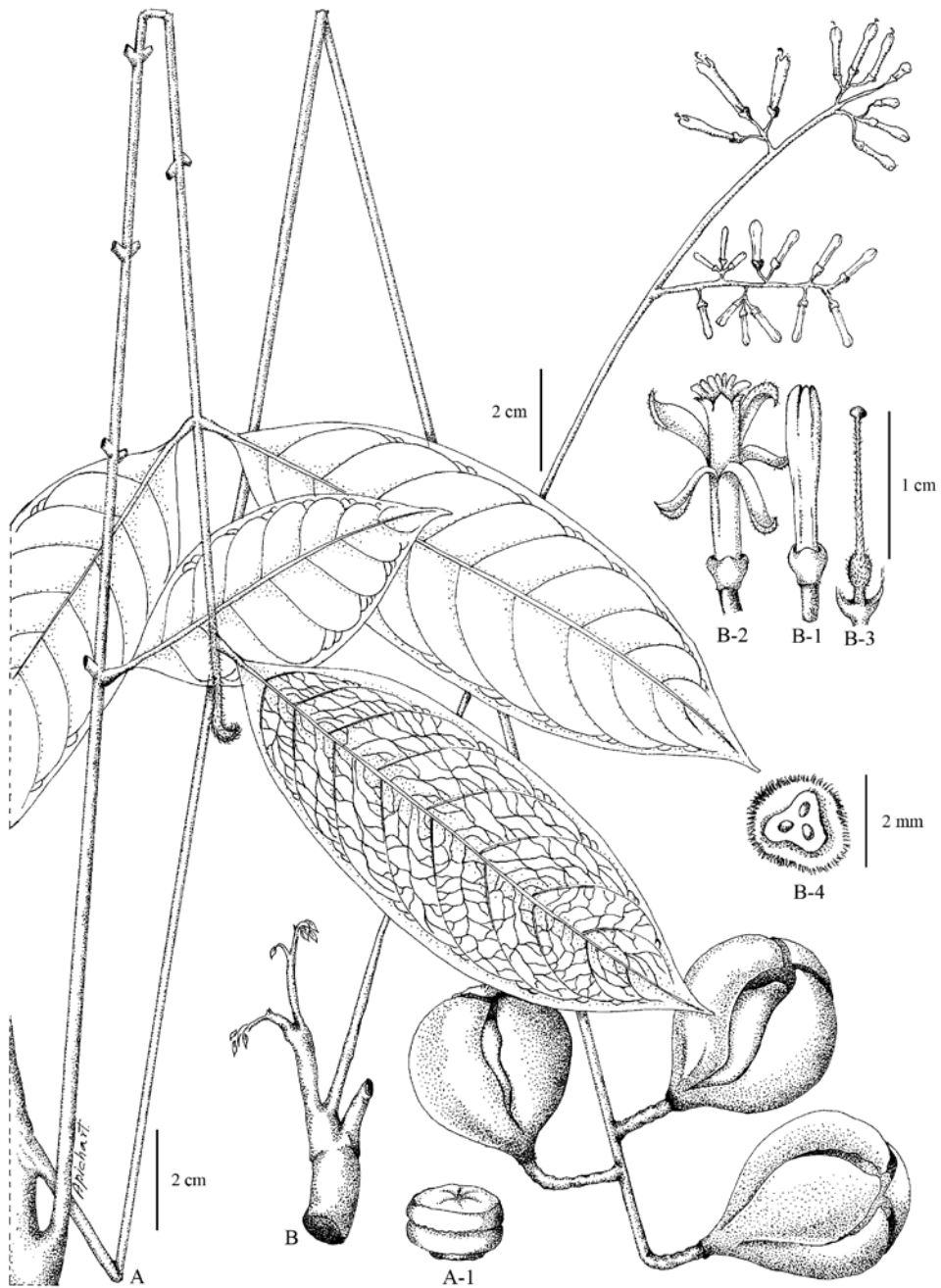


Figure 20. *Chisocheton amabilis* (Miq.) C.DC.: A. twig with infructescence, A-1 seed (C. Niyomdham 5286); B. inflorescences, B-1 immature flower, B-2 mature flower, B-3 stamen arrangement, B-4 stamens, B-5 pistil (Th. Wongprasert 013-03). Drawn by Apichart Ropsri.

longitudinally into (3)4; thick pericarp; stipe 1.7–2.2 cm long. *Seeds* 3 or 4 seeds, ca 9 mm long, half covered with a yellow-orange aril.

T h a i l a n d.— PENINSULAR: Narathiwat.

D i s t r i b u t i o n.— Malaysia, Indonesia (type), Brunei.

E c o l o g y.— In peat swamp forest; altitude 0–100(–300) m.

2. *Chisocheton ceramicus* (Miq.) C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 553. 1878; Mabb., Bull. Brit. Mus. (Nat. Hist.) Bot. 6: 361. 1979; Tree Fl. Malaya 4: 234. 1989; P.H. Hô, Fl. Vietnam ed. 3, 2(1): 493. 1992; Mabb., Fl. Males., ser. I, 12(1): 179. 1995; Gardner et al., Forest Trees S. Thailand 2: 1254, 1459, f. 1640. 2016; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 230. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 166. 2013.— *Schizochiton ceramicum* Miq., Ann. Mus. Bot. Lugdono-Batavia 4: 27. 1868.— *S. spectabile* Miq., Ann. Mus. Bot. Lugdono-Batavia 4: 27, 29. 1868.— *Chisocheton spectabilis* (Miq.) C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 539. 1878.— *C. macrothyrus* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 33. 1895; Ridl., Fl. Malay Penins. 1: 389. 1922.— *C. sandoricocarpus* Koord. & Valetton, Bijdr. Boomsort. Java 3: 111. 1896; Backer & Bakh.f., Fl. Java 2: 124. 1965.— *C. globosus* Pierre, Fl. Forest Cochinch. Fasc. 5: t. 347A. 1897; Pellegr. in Lecomte, Fl. Indo-Chine 1: 740. 1911.

Trees 10–25 m tall, (65–)90–200 cm girth; buttresses 3 m high, 2 m outwards; bark pale brown to greyish brown, flaky, inner bark yellowish to red, fibrous; sapwood yellow, white latex; twigs densely appressed simple hairs when young, glabrescent, conspicuous petiole scars. *Leaves* to 1.5 m long, paripinnate, pseudogemmate, 20–30 cm long; petiole 3–10(–30) cm long, grooved above, swollen near base; leaflets 3–8(–17) on each side of rachis, opposite to subopposite, oblong to obovate, (10–)13–30(–34) by (4.5–)6–12.5 cm, narrowed abruptly to a short acute acumen to 10 mm long, rounded at base, coriaceous to subcoriaceous, glabrous, short simple appressed hairs numerous on midrib and lateral veins on both surfaces, usually with few to numerous regularly spaced appressed white hairs below, lateral veins (6–)9–15(–18) on each side of midrib, curved upwards near margin, more or less anastomosing, midrib depressed above, prominent below, lateral veins slightly depressed above, prominently sharply ridged below, reticulation visible, often widely scalariform below; petiolules 10–20 mm long, densely hairs like on twigs. *Inflorescence* axillary or supra-axillary, near ends of twigs, 10–81 cm long, erect or pendulous, with 1 or 2 orders of branching; peduncles 6–20 cm, densely hairs like on twigs, sometimes glabrescent. *Flower* fragrant; pseudopedicels 2.5–3.5 mm long, pedicels 1–10 mm, both markedly wrinkled when dry. *Calyx* cup-shaped, ca 2 by 3 mm, outer surface densely hairs like on twigs, margin truncate or obscurely 5-lobed. *Petals* (4–)5(–6), white, cream-coloured or pink, linear, 13–19 by 2–3 mm, thick, outer surface densely hairs like on twigs. *Staminal tube* tubular, ca 20 mm long, hairy in central region outside, densely hairy below anthers inside, margin (4–)5(–8)-lobed, lobes to 4 mm long, more or less truncate. *Anthers* 4, 5 or 6, ca 1.5(–3.8) by 0.3 mm, locellate, inserted below margin of staminal tube, included. *Disk* a glabrous cushion at base of ovary. *Ovary* subobovoid or ovoid, ca 3 by 1.5 mm, hairy, (2)3-locular, each locule with 1(2) ovules, style linear, 8–10 mm long, densely pubescent except at apex, stigma shortly cylindrical, glabrous. *Infructescence* pendulous, 6–45(–80) cm long, peduncle, rachis, branches and pedicels densely hairs like on twigs. *Capsules* subglobose, 3.2(–6.5) by 4(–6.5) cm in diam., white or colourless latex when unripe; stipe to 2 cm, with 2 strong and 2 faint sutures, yellow, ripening through yellow and orange to

red or pink; pericarp 1–1.5 cm thick, spongy, white latex, numerous appressed simple hairs outside, yellowish white with pink septa when fresh, longitudinally dehiscent into 2 (rarely 3) locules; calyx often enlarged and persistent in fruit, resembling a small cupule at base of fruit; stipe to 1.5–2 cm long, sometimes apiculate at apex. *Seeds* 1 or 2 (rarely 3), ca 1.5 cm long, flattened, partly covered with an orange aril.

T h a i l a n d.— PENINSULAR: Surat Thani, Yala, Narathiwat.

D i s t r i b u t i o n.— Vietnam, Malaysia, Indonesia (type), Philippines, New Guinea and New Britain.

E c o l o g y.— Evergreen forest; altitude 50–525(–645) m.

V e r n a c u l a r.— Yom yai (ยมใหญ่), kra thon rok (กระต้อนรอก)(Peninsular).

3. *Chisocheton cumingianus* (C.DC.) Harms subsp. *balansae* (C.DC.) Mabb., Taxon 26: 528. 1977; Bull. Brit. Mus. (Nat. Hist.) Bot. 6. 4.: 347. 1979; P.H. Hô, Fl. Vietnam in ed. 3, 2(1): 492. 1992; Gardner et al., Forest Trees N. Thailand 117, f. 226. 2000; Gardner et al., Forest Trees S. Thailand 2: 1255, 1459, f. 1641. 2016; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 230. 2011.— *C. balansae* C.DC., Bull. Herb. Boissier 2: 578. 1894; Pellegr. in Lecomte, Fl. Indo-Chine 1: 737. 1911; Lecomte, Atlas Bois Indoch.: 134. 1925.— *C. paniculatus* Hiern in Hook.f., Fl. Brit. India 1: 552. 1875; Pellegr. in Lecomte, Fl. Indo-Chine 1: 736. 1911.— *Schizochiton paniculatum* (Hiern) Kurz, J. Asiat. Soc. Bengal 44(2): 145. 1875; Kurz, Forest Fl. Brit. Burma: 216. 1877.— *Chisocheton coriaceus* Pierre, Fl. Forest Cochinch. Fasc. 5: t. 346 A. 1897.— *C. thorelii* Pierre, Fl. Forest Cochinch. Fasc. 5: sub t. 347. 1897.— *C. cochinchinensis* Pierre, Fl. Forest Cochinch. Fasc. 5: t. 356 B. 1897.— *C. harmandianus* Pierre, Fl. Forest Cochinch. Fasc. 5: t. 347 1897.— *C. siamensis* Craib, Bull. Misc. Inform. Kew 1926: 342. 1926; Craib, Fl. Siam. 1: 253. 1926; Pellegr. in Lecomte, Fl. Indo-Chine, Suppl. 1: 692. 1946; Gardner et al., Forest Trees N. Thailand 117, 403, f. 226. 2000. Fig. 21.

Trees (4–)8–30 m tall, 60–200 girth; bark greyish, smooth or scaly, inner bark brownish; sapwood brownish; heartwood reddish brown; twigs with numerous simple stiff hairs patent and at varying angles to surface, lenticellate. *Leaves* 30–100(–120) cm long, pseudogemmate; petiole 10–30 cm long, swollen near base, sparsely pubescent; leaflets (3–)7–12(–15) on each side of rachis, opposite or subopposite, oblong, or oblong-lanceolate, (3–)8–25 by 3–7(–9) cm, rounded or acuminate at apex, obtuse acumen to 15 mm, cuneate or rounded at asymmetrical base, subcoriaceous to chartaceous, sometimes with numerous hairs like on twigs below, glabrescent, lateral veins (5–)9–12(–15) on each side of midrib, midrib depressed and glabrous or sparsely hairy above, prominent and glabrous or hairy below, lateral veins faintly depressed above, prominent below, reticulation slightly raised above, subprominent below; petiolules 0.5–1 cm long, pubescent. *Inflorescence* axillary, supra-axillary or on short shoots on defoliated twigs, 50–130 cm long in male, shorter and unbranched in female; peduncles up to 20 cm long, pseudopedicels 2 mm, pedicels 2–4 mm, pubescent, glabrescent. *Flower* 15 mm long, a few simple hairs on calyx and corolla outside. *Calyx* shallowly cup-shaped, 1.5–3 by 1.5–2 mm, margin more or less entire, with a few simple hairs outside. *Petals* 4, free or adnate to staminal tube for ca ½ of length, linear or oblanceolate, 14–20(–25) by 2–2.5 mm, white or yellowish, a few simple hairs outside. *Staminal tube* cylindrical, 12–18 mm long, (5–)7–9 blunt lobes 2 mm long, lobes shallowly divided into 2 or 3, densely simple hairs including on lower part of lobes outside, glabrous



Figure 21. *Chisocheton cumingianus* (C.DC.) Harms subsp. *balansae* (C.DC.) Mabb.: A. twig with infructescence, A-1 longitudinal section of flower, A-2 stamen, A-3 cross section of ovary (Winit 1136); B. drupe, B-1 seed (R. Geesink et al. 5724). Drawn by Orathai Kerdkaew.

or with a few hairs inside. *Anthers* (5–)6–8, 1 by 0.3 mm, with 1 or a few long hairs on dorsal side, inserted inside staminal tube below margin at bases of sinuses between lobes. *Disk* to 0.5 mm tall, annular, glabrous. *Ovary* ovoid, 1.5–2 by 1 mm, hairy, 3 or 4-locular, each locule with 1 (or 2) ovules; style linear, 10–20 mm long, hairy in lower part, stigma discoid or capitate. *Infructescence* 30–105 cm long, a pendulous raceme with fruits in a terminal cluster. *Capsules* subglobose to obovoid, 5–6(–8) by 5–7 cm, slightly 3–4 grooved, reddish brown or yellowish red and shining; stipe 1.5–1.7 cm; pericarp usually with white latex, longitudinally dehiscent into 3 or 4 locules, strongly wrinkled when dried. *Seeds* 3 or 4, blackish or reddish brown, partially with thin orange-red aril.

T h a i l a n d.—NORTHERN: Chiang Mai (Mê Hawng Sawm, Mê Mue, type of *Chisocheton siamensis* Craib, *Kerr 6171*, lectotype K, isoelectotypes ABD, BK, BM, SING, TCD), Chiang Rai, Phayao, Tak; SOUTH-EASTERN: Chachoengsao, Chanthaburi, Trat.

D i s t r i b u t i o n.—India, China (type), Myanmar, Indochina. Mainland Asia only. Type subspecies: Philippines, Indonesia, Bismarck Archipelago.

E c o l o g y.—In evergreen or deciduous dipterocarp forest, along streams on limestone bedrock; altitude 300–750 m.

V e r n a c u l a r.—Yom makok (ยวมะกอก)(General).

4. *Chisocheton dysoxylifolius* Kurz, *J. Asiat. Soc. Bengal*, Pt. 2, Nat. Hist. 40: 49. 1871; Hiern in Hook.f., *Fl. Brit. India* 1: 551. 1875; C.DC. in A.DC. & C.DC., *Monogr. Phan.* 1: 537. 1878; Prain, *Bengal Pl.* 1: 315. 1903; Mabb., *Bull. Brit. Mus. (Nat. Hist.)*, Bot. 6. 4: 346. 1979; T.Wongprasert et al., *Thai Forest Bull.*, Bot. 39: 230. 2011. Fig. 22.

Trees (4–)10–25 m tall, 50–100 cm girth; bark smooth, grey, ca 1.5 cm thick; sapwood yellowish brown. *Leaves* 30–100 cm long, pseudogemmate; petiole 10–15 cm, grooved above, swollen near base, pubescent, glabrescent; leaflets 3–10 on each side of rachis, alternate, subopposite, oblong, ovate-oblong or oblanceolate, 12–31(–35) by 5–9(–12) cm, narrowed abruptly to acuminate apex, acute acumen to 10 mm, rounded or cuneate at asymmetrical base, subcoriaceous to coriaceous, a few stiff simple hairs on veins and leaflet below, lateral veins 7–12(–18) on each side of midrib, curved upwards near margin, more or less anastomosing, midrib prominent below, lateral veins slightly depressed above, subprominent below, reticulation visible below; petiolules 8–15 mm long, pubescent. *Inflorescence* paniculate, 1 or 2 orders of branching; male 20–70 cm long, branches to 16 cm long; female a pendulous raceme, to 81 cm, terminating in clusters of flowers, pubescent; bracteolate, bracteoles triangular, to 1 mm long, pubescent persisting after flowers fall; peduncles 10–40 cm long. *Flowers* fragrant; pedicels 1–2 mm long, pubescent. *Calyx* cup-shaped, ca 4 mm long, undulate or with (4 or) 5 lobes ca 1/3 of the length, densely tomentose or with numerous hairs outside, glabrous inside. *Petals* (3 or) 4 (or 5), oblong or obovate-oblong, ca 20 by 1.5 mm, densely tomentose outside, glabrous inside, yellow, adnate to staminal tube at base. *Staminal tube* 1.5–2 cm long, densely hairy outside, glabrous inside, margin undulate or 5–7 lobes 2 mm long, further divided to 1 mm. *Anthers* (5)6–7(8), inserted inside staminal tube near margin, included, hairy on back. *Disk* obscure. *Ovary* ovoid, ca 2.5 by 2 mm, hairy; (3–)4-locular, each locule with 1 (or 2) ovule, style linear ca 2 cm long, hairy, stigma capitate, depressed above, glabrous. *Infructescence* rope-like, rachis reported to be to 5 m, (not more than 81 cm on specimens seen). *Fruits* subglobose to obovoid, to ca 7 cm in diam., densely tomentose, short stipe and weakly rostrate. *Seeds* unknown.

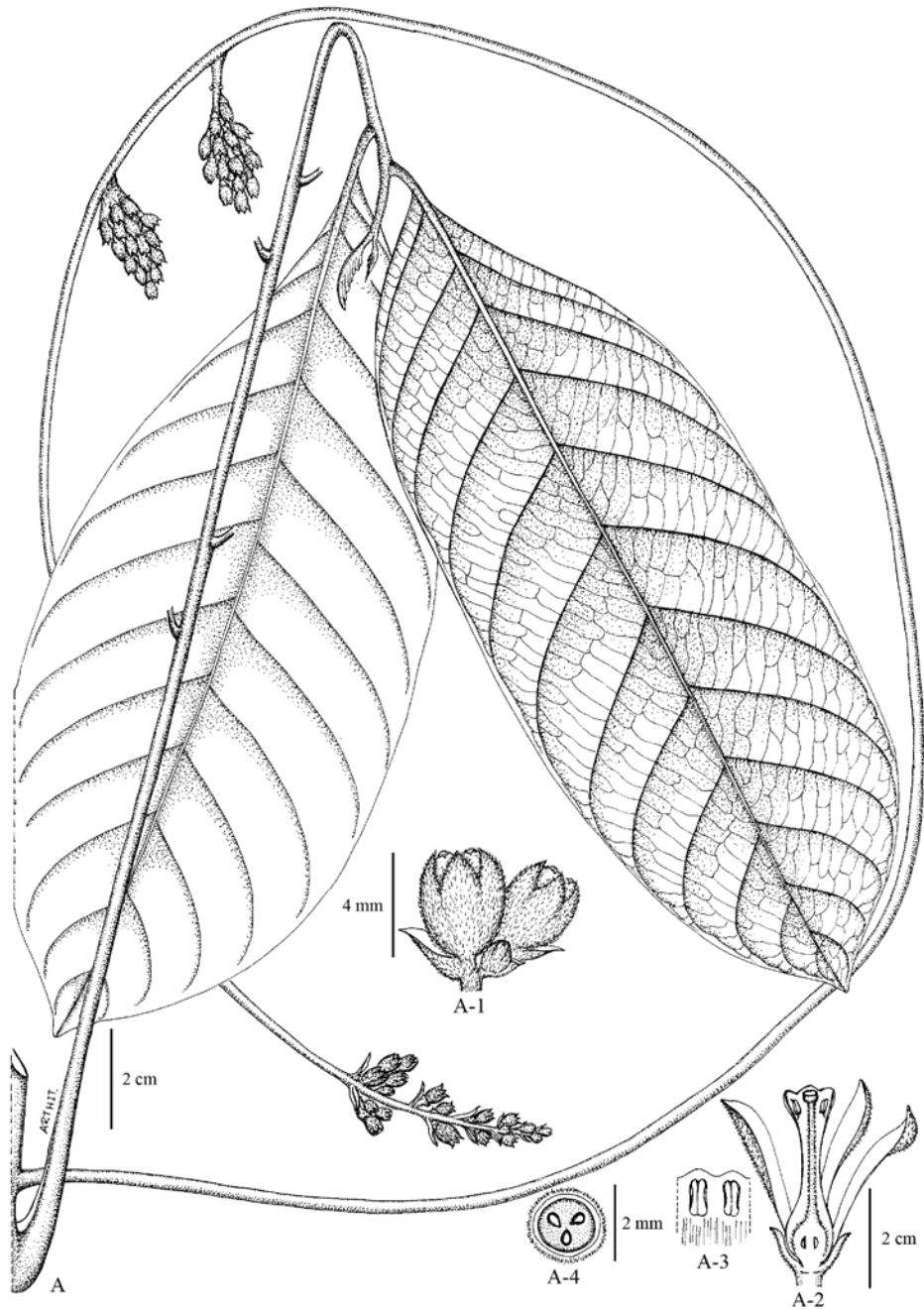


Figure 22. *Chisocheton dysoxylifolius* (Kurz) Hiern: A. twig with inflorescences, A-1 budding, A-2 longitudinal section of flower, A-3 stamens, A-4 cross section of ovary (C.F. van Beusekom & C. Phengklai 277). Drawn by Arthit Khamkamnoed.

T h a i l a n d.— NORTHERN: Chiang Mai, Nan; SOUTH-WESTERN: Kanchanaburi. PENINSULAR: Trang, Songkhla, Yala, Narathiwat.

D i s t r i b u t i o n.— Myanmar (type).

E c o l o g y.— Evergreen forest, near streams; altitude to 900(–1,000)m

V e r n a c u l a r.— Ta suea (ตาเสือ)(Northern).

5. *Chisocheton erythrocarpus* Hiern in Hook.f, Fl. Br. Ind. 1: 550. 1875; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 31. 1895; Ridl., J. Str. Br. Roy. As. Soc. 33 (1) 59. 1900; Fl. Malay Pen. 1: 388. 1922; Mabb., Bull. Br. Mus. Nat. Hist. Bot. 6: 368. 1979; Tree Fl. Malaya 4: 235. 1989; Mabb. & Pannell, Fl. Malesiana 1, 12: 183. 1995; Gardner et al., Forest Trees S. Thailand 2: 125, 1460, f. 1642. 2016; Mabb., Tree Fl. Sabah & Sarawak 6: 123, t. 5B, 5C. 2007; Kochummen, Tree Fl. Pasoh For.: 321. 1997; PROSEA 5, 3: 161. 1998.— *Chisocheton* sp. C, Mabb., Bull. Br. Mus. Nat. Hist. Bot. 6 (1979) 372.

Medium-sized trees 20(–25) m tall, to 80(–125) cm girth, crown small; buttresses to 1 m tall and out, 10 cm thick; bark smooth to cracking, dark grey to chocolate-brown, inner bark reddish brown; sapwood cream; twigs rough, dark brown, 4–10 mm diam. apically, densely and minutely pale brown hairy. *Leaves* to 50 cm long, pseudogemmate; petioles 4–11 cm long; leaflets to 9 on each side of rachis, opposite, elliptic-oblong to ovate, (1.5–) 4.5–17 by (1.5–) 2.5–8 cm, acuminate at apex, acumen 5–9 mm long, rounded or cuneate at asymmetrical base, chartaceous, scattered inconspicuous appressed simple white hairs or glabrous above except for hairy on midrib, softly rusty-hairy below, hairs patent and often curved, lateral veins (3–)5–10(–12) on each side of midrib, curved upwards near margin, midrib depressed above, prominent below, lateral veins and reticulation visible above and subprominent below; petiolules 2–10 mm long. *Inflorescences* to 14(–28) cm long, supra-axillary in upper axils, minutely rusty tomentose; lateral branches short. *Flowers* 11 by 3–8 mm; pedicels short, ca 3 mm. *Calyx* cup-shaped, 3–4 by 3–4 mm, margin truncate or shallowly divided into 5 lobes, densely appressed hairy outside, glabrous inside. *Petals* 5 or 6 in 1 whorl, narrowly boat-shaped, 9–13 by 3–4 mm, creamy-white, valvate in bud, separating when dry, fleshy, appressed silky hairy outside, glabrous inside. *Staminal tube* 5 or 6 lobes, lobes ca 2.5 mm long, toothed, silky hairy outside above base and including lobes, similarly pubescent inside. *Anthers* 2.5–3 by 0.5 mm, inserted at bases of sinuses of lobes. *Ovary* 2 locules, ovary and style minutely hairy, becoming glabrous near apex of style, stigma cylindrical, apically mamillate, glabrous. *Infructescence* to 30 cm long. *Capsules* depressed globose, 3–6 cm diam., abruptly narrowed to a stipe 5–10 mm long, minutely beaked, minutely hairy (hairs non-irritant), yellowish brown, ripening blood-red; pericarp with white latex, inner surface pink. *Seeds* 2, ca 2.5 cm long, somewhat flattened, sarcotesta thick, orange-red or deep yellow.

T h a i l a n d.— PENINSULAR: Songkhla.

D i s t r i b u t i o n.— Peninsular Malaysia (type), Singapore, Borneo and the Philippines.

E c o l o g y.— In slightly disturbed lowland evergreen forest; altitude 150 m.

6. *Chisocheton grandiflorus* (Kurz) Hiern in Hook.f., Fl. Brit. India 1: 552. 1875; C.DC in A.DC. & C.DC., Monogr. Phan. 1: 534. 1878; Mabb., Bull. Brit. Mus. (Nat. Hist.) Bot. 6:

358. 1979; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 232. 2011; Gardner et al., Forest Trees S. Thailand 2: 1257, f. 1643. 2016.— *Schizocheton grandiflorum* Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 41: 296. 1872; Forest Fl. Brit. Burma 1: 216. 1877.

Trees 10–20 tall, 100–200 cm girth; bark flaky, rough, brownish, ca 5 mm thick, inner bark reddish brown; sapwood white or yellowish. *Leaves* paripinnate, 30–55 cm long, pseudogemmate; petiole 9–20 cm long, swollen near base, a few spiky brown hairs; leaflets 2–7 on each side of rachis, alternate especially lower ones, oblong or oblong-lanceolate, 10–24(–28.5) by 3.5–8 cm, acuminate at apex, obtuse or acute acumen to 15 mm long, rounded at asymmetrical base, margin entire, chartaceous or subcoriaceous, sparsely hairy below, lateral veins (10–)12–18 on each side of midrib, curved upwards, more or less anastomosing near margin, midrib and lateral veins depressed above, prominent below, reticulation visible on both surfaces; petiolules to 5 mm. *Inflorescence* 5–20(–60) cm long, pendent, sparsely branched; bracteoles triangular, at bases of flower clusters, to 3 mm long; peduncles 3–5 cm long, numerous patent hairs. *Calyx* cup-shaped, 5–7 by ca 6 mm, 4 or 5-toothed or entire, densely hairy outside, glabrous inside. *Petals* 4–6, linear, 12–14(–17) by 2.5–4 mm, greenish to yellowish, densely hairy outside, glabrous inside. *Staminal tube* tubular, ca 12 mm long, margin crenulate or 6 or 7 truncate lobes, glabrous or long hairs both sides. *Anthers* 6–8, 1 by 0.5 mm, inserted inside staminal tube, protruding. *Disk* cup-shaped, ca. 1 by 1 mm, adnate to ovary, glabrous. *Ovary* obovoid, ca 0.5 by 1.5 mm, 3-locular, each locule with 1(or 2) ovule, style 9–12 mm long, hairy, becoming glabrous near apex, stigma 0.5–1 by 0.5–1 mm, subcapitate with a flattened apex, glabrous; pedicels 0–3 mm long. *Fruits* (no fruiting specimens seen) reported to be large, apple-like or pyriform with 3 locules.

T h a i l a n d.— NORTHERN: Nan, Phrae.

D i s t r i b u t i o n.— Myanmar (type).

E c o l o g y.— Hill evergreen forest; altitude 600–1,400 m.

V e r n a c u l a r.— Ta sua khon (ตาเสือคอน)(Northern). [Fig. 43.??](#)

7. *Chisocheton macrophyllus* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 32. 1895.

subsp. **fulvescens** Mabb., Bull. Brit. Mus. (Nat. Hist.) Bot. 6: 346. 1979; Fl. Males., ser. I, 12(1): 178. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 232. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 168. 2013; Gardner et al., Forest Trees S. Thailand 2: 1257, 1460, f. 1645. 2016. Fig. 23.

Trees 10–25(–30) m tall, 100–200 cm girth; bark greyish brown, smooth or slightly narrowly vertically cracked; inner bark yellow or white, fibrous; sapwood brownish white; twigs stout, lenticellate, conspicuous leaf scars, white latex, a few spiky brown or almost white hairs appressed or at an angle to surface, glabrescent. *Leaves* to 2.4 m long, pseudogemmate; petiole 10–15 cm long, pubescent, glabrescent, swollen near base; leaflets 12–16(–28) on each side of rachis, opposite, rarely subopposite, oblong or elliptic-oblong, (7.5–)10–30 by (3–)4.5–11 cm, basal leaflets markedly smaller than the rest, broadly acuminate at apex, obtuse acumen to 5 mm long, cuneate or rounded at asymmetrical base, subcoriaceous or chartaceous, glabrous or minutely hairy above, a few to numerous spiky brown or almost white hairs appressed or at an angle to surface below, lateral veins (16–)20–25 on each side of midrib, rather straight then curved upwards near margin, midrib depressed above, prominent below, lateral veins subprominent below, reticulation visible and faintly

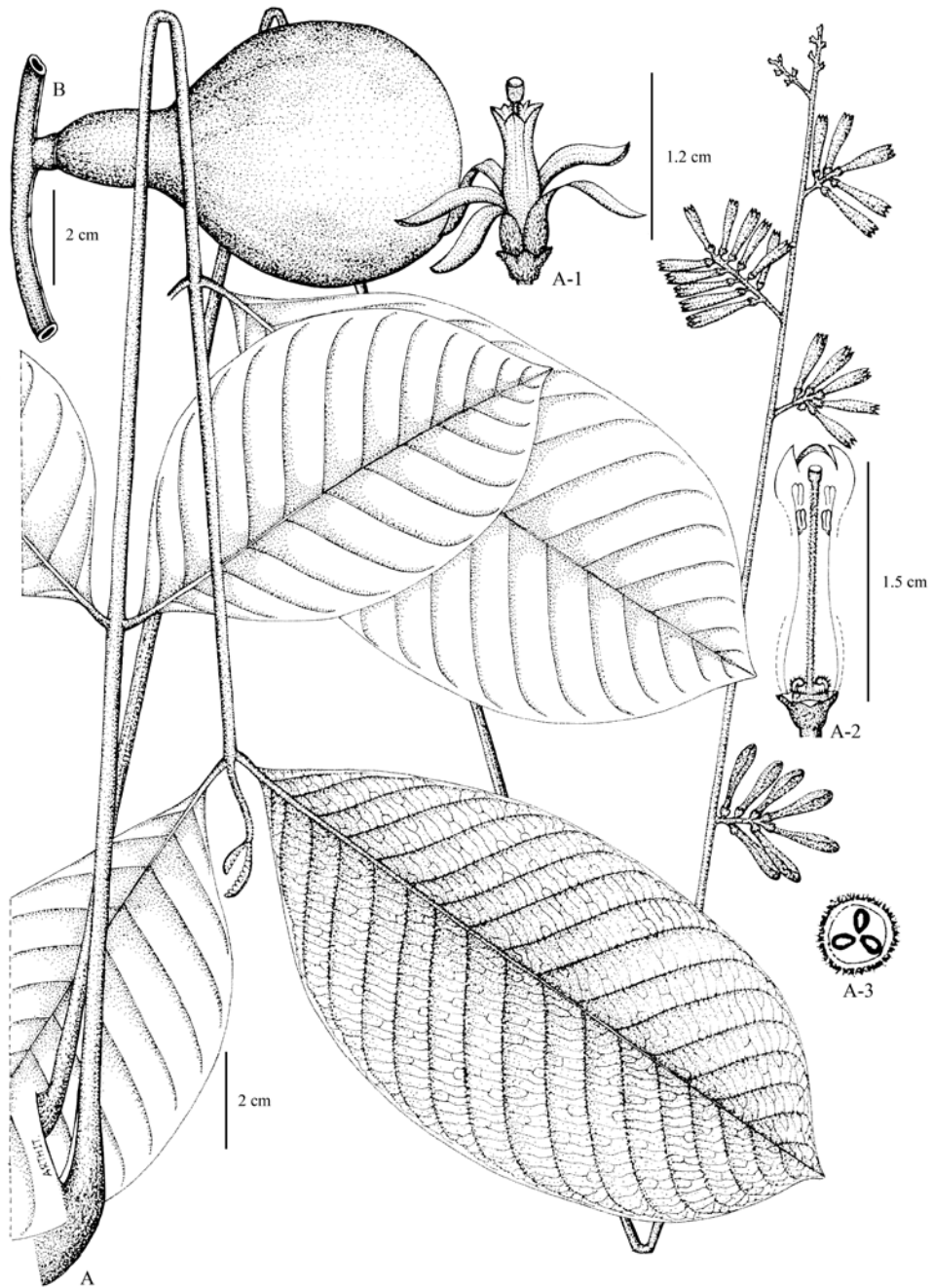


Figure 23. *Chisocheton macrophyllus* King var. *fulvescens* Mabb.: A. twig with inflorescences, A-1 flower, A-2 longitudinal section of flower, A-3 cross section of flower (*S. Phusomsaeng* 35); B. capsule. Drawn by Arthit Khamkamnoed.

scalariform below; petiolules 5–15 mm long, densely pubescent. *Inflorescence* 50–100 cm long, at least two orders of branching, hairs like on twigs; peduncles up to 50 cm long. *Flowers* ca 19 by 1.5–3 mm, fragrant; sessile. *Calyx* cup-shaped, 2–3 by ca. 2 mm, entire or obscurely 4 or 5 lobed, densely hairy outside, glabrous inside. *Petals* (3)4 or 5, linear ca 15 mm long, densely hairy outside, glabrous inside, yellowish white, adhering to staminal tube for half their length. *Staminal tube* salverform, up to 16 mm long, enlarged at apex to accommodate anthers, margin with 6–8 lobes ca 2.5 mm long, lobes often further shallowly divided, long orange brown hairs in middle of staminal tube outside and near base inside. *Anthers* 5–8(9), 2.5 by 0.5 mm, locellate, inserted below margin, included or protruding. *Disk* obscure. *Ovary* ovoid, ca 0.5 by 0.5 mm, silky hairy, (3)4-locular, each locule with 1 ovule, style silky hairy, becoming glabrous near apex, stigma capitate, flat-topped, glabrous; pedicels ca 1 mm long. *Infructescence* a raceme; peduncle ca 34 cm. *Capsules* obovoid, 8–9 by 5–9 cm, narrowing to a short stipe, 1–2.5 by ca 1.3 cm, subtended by a very stout pedicel to 3.5 cm, pericarp orange ripening red, slightly longitudinally 4-lobed, dehiscent into 4; pericarp thin and brittle when dry 2–4 mm thick, white latex. *Seeds* (3)4, ca 4.5 cm long, shaped like orange segments; testa bright red, partly enclosed in an orange-red aril which extends around edges of seed, leaving most of abaxial surface of testa exposed.

T h a i l a n d.— PENINSULAR: Nakhon Si Thammarat, Phatthalung, Trang, Songkhla, Yala, Narathiwat.

D i s t r i b u t i o n.— Malaysia (type).

E c o l o g y.— Evergreen forest; altitude 80–100 m.

V e r n a c u l a r.— Ta sua (ตาสือ), sai (สาย), ma-a (มะอ้า)(Peninsular).

8. *Chisocheton patens* Blume, Bijdr.: 169. 1825; C.DC. in A.DC. & C.DC. Monogr. Phan. 1: 529. 1878; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 34. 1895; Mabb., Bull. Brit. Mus. (Nat. Hist.), Bot. 6.: 350. 1979; Tree Fl. Malaya 4: 235. 1989; Fl. Males., ser. I, 12(1): 167. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 232. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 168. 2013; Gardner et al., Forest Trees S. Thailand 2: 1258, 1460, f. 1646. 2016.— *C. divergens* Blume, Bijdr.: 169. 1825; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 35. 1895; Ridl., Fl. Malay Penins. 1: 390. 1922; Backer & Bakh.f., Fl. Java 2: 124. 1965; T.D.Penn., Blumea 22: 496. 1975.— *C. divergens* Blume var. *robustus* Valetton, Pl. Bogor. Exs. 68. 1904; Craib, Fl. Siam. 1: 253. 1926.— *C. fragrans* Hiern in Hook.f., Fl. Brit. India 1: 551. 1875.— *C. glomeratus* Hiern in Hook.f., Fl. Brit. India 1: 551. 1875; Ridl., Fl. Malay Penins. 1: 389. 1922.— *C. holocalyx* Hiern in Hook.f., Fl. Brit. India 1: 551. 1875. Fig. 24. Plate CXXVI: A.

Trees 5–25(–35) m tall, 80–200 cm girth, often flowering when 2–3 m tall; buttresses 1.5–2 m tall, steep and thin; bark flaky, dark brown or grey to brownish, scaly in patches, inner bark white, yellowish red to orange, fibrous; sapwood yellowish white or white; twigs with prominent leaf scars. *Leaves* 15–30(–150) cm long, paripinnate or pseudogemmate; petiole 7–15 cm long, few to numerous straight simple hairs, patent and/or at various angles to surface, glabrescent; leaflets 2–7(–14) on each side of rachis, often maturing all together, opposite to subopposite, oblong or ovate-oblong, 6–28 by 2.5–10 cm, acuminate at apex, cuneate, rounded or rarely subcordate at more or less asymmetrical base, chartaceous, few to numerous hairs below, lateral veins (6–)9–15 on each side of midrib, curved upwards near margin, midrib slightly depressed above, few to numerous hairs, prominent below, lateral

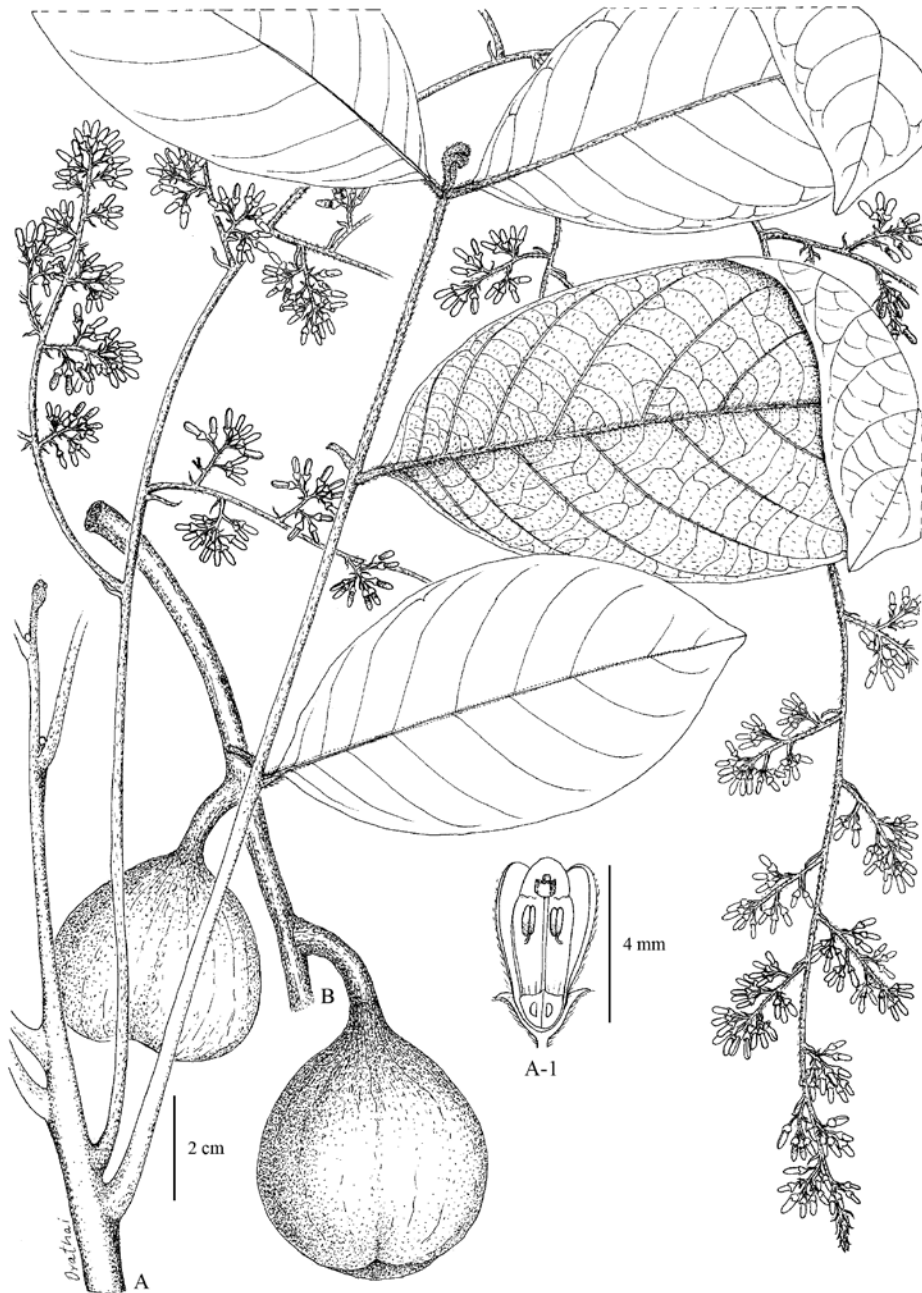


Figure 24. *Chisocheton patens* Blume: A. twig with inflorescences, A-1 longitudinal section of flower (R. Geesink & T. Santisuk 5283); B. part of infructescence (C. Niyomdham 788). Drawn by Orathai Kerdkaw.

veins and reticulation slightly raised above, subprominent below; petiolules (3–)5–6 mm long, few to numerous hairs. *Inflorescence* axillary, 50–90 cm long, a panicle at least two orders of branching, flowers subsessile or shortly pedicellate, mostly borne in cymes on ultimate branches; peduncles 10–20 cm long, hairy. *Flowers* fragrant; pseudopedicels to 0.5–1 mm, pedicels 1–2.5 mm long, glabrous or stiff pale orange brown appressed hairs. *Calyx* cup-shaped to shortly tubular, 1–3 mm long, margin subtire to minutely irregularly 4-toothed, glabrous or a few simple white hairs outside. *Petals* 4(5), subspathulate-elliptic, 4–10 mm long, glabrous outside, white, yellowish or greenish. *Staminal tube* tubular (4–)5–7(–8) mm tall, glabrous or hairy near apex outside, long simple white hairs in lower half inside, divided to almost half way into (5)6–8(9) linear-triangular lobes to 2 mm long, a little shorter than anthers, adhering to petals in bud, free from petals, spreading to patent in open flowers. *Anthers* (5)6 or 7(8), 1.2–2.5 by 0.2–0.3 mm, inserted in middle of staminal tube, at bases of sinuses of lobes. *Disk* absent or very short, fleshy, glabrous, more or less lobed. *Ovary* broadly ovoid, 0.25–0.3 by 0.25–1 mm, pubescent, flat-topped, 2-locular, each locule with 1(or 2) ovule, style to 4.5 mm long, glabrous to densely hairy, becoming glabrous near apex, stigma cylindrical to clavate, glabrous, protruding beyond aperture of staminal tube. *Infructescence* pendulous, 50–110 cm long, at least 1 order of branching, up to 40 fruits. *Capsules* depressed globose or obovoid 2.5–5 by 2.7–4.5 cm, orange to orange red, few to numerous simple hairs, glabrescent, slightly 2(3) longitudinally lobed, dehiscent into 2(3) locules; stipe 0.5–2 cm, woody. *Seeds* 2, black, flattened, half with an orange or yellow orange aril at base.

T h a i l a n d.— SOUTH-WESTERN: Ratchaburi, Phetchaburi, Prachuap Khiri Khan; PENINSULAR: Phangnga, Phuket, Krabi, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Trang, Songkhla, Yala, Narathiwat.

D i s t r i b u t i o n.— Myanmar, Malaysia, Singapore, Brunei, Indonesia (type), Philippines.

E c o l o g y.— Evergreen forest; altitude 0–350(–530) m.

V e r n a c u l a r.— Sang khriat (สังเคரியด), khamin (ขมิ้น), ku bi (กูบิ), sang khriat langsat (สังเคரியดกลางสาด), ta suea (ตาเสือ)(Southeastern)(Peninsular).

9. *Chisocheton penduliflorus* Planch. ex Hiern in Hook.f., Fl. Brit. India 1: 550. 1875; C.DC. in A.DC & C.DC., Monogr. Phan. 1: 536. 1878; Curtis, J. Straits Branch Roy. Asiat. Soc. 25: 22. 1894; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 38. 1895; Ridl., Fl. Malay Penins. 1: 388. 1922; Mabb., Bull. Brit. Mus. (Nat. Hist.), Bot. 6: 326. 1979; Tree Fl. Malaya 4: 237. 1989; Fl. Males., ser. I, 12(1): 145. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 232. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 174. 2013; Gardner et al., Forest Trees S. Thailand 2: 1259, 1460, f. 1647. 2016.— *Chisocheton kunstleri* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 27. 1895. Fig. 25. Plate CXXVI: B.

Small pachycaul trees 2–12 m tall, 40–60 cm girth; bark greyish or blackish, inner bark orange or brownish; sapwood brownish; twigs 6–7 mm diam., to 15 mm in fruit, densely ferruginous tomentose. *Leaves* 30–100 cm long, imparipinnate or pseudogemmate; petiole 15–22 cm long, swollen at base, densely hairy; leaflets (3–)8–16 on each side of rachis, opposite to slightly subopposite, ovate or oblanceolate, 10–30 by 4–11.5 cm, acuminate at apex, acumen acute, 3–15 mm long, cuneate rounded or subcordate at sometimes asymmetrical base, chartaceous to subcoriaceous, glabrescent above, numerous patent orange brown or



Figure 25. *Chisocheton penduliflorus* Planch. ex Hiern: A. twig with infructescence (*S. Phusomsaeng* 348); B. cluster of flowers, B-1 longitudinal section of flower, B-2 cross section of ovary (*S. Phusomsaeng* 324). Drawn by Apichart Ropsri.

white simple hairs on midrib and lateral veins below, scattered or numerous on the rest of that surface, lateral veins (5–)10–18(–22) on each side of midrib, curved upwards near margin, not quite anastomosing, midrib prominent, depressed and densely hairy above, midrib and lateral veins prominent and hairy below, reticulation subprominent on both surfaces; sessile or petiolules 3–11.5 mm long. *Inflorescence* supra-axillary, pendulous, female like a long rope to 7 m long, often trailing on ground, flowers congested in subsessile cymes at distal end, male shorter to 90 cm long, branched; peduncle to 11 cm, densely dark greyish or rusty tomentose. *Flowers* ca 20 by 4 mm in bud, spindle-shaped, subtended by up to 3 bracteoles; pedicels ca 1 mm long. *Calyx* cupular to shortly cylindrical, (1–)3–4 by 2.5–3 mm, margin truncate to obscurely 4-lobed. *Petals* (3 or) 4 or 5, oblanceolate, 18–22 by 1–3.5 mm, adnate to staminal tube in lower half, calyx and petals orange-red or dull pink densely appressed simple hairs outside, glabrous inside. *Staminal tube* cylindrical, ca (8–)13–16 by 1–3 mm, few hairs inside, simple upwardly pointing hairs outside, margin 3–5(or 6) irregularly bifid lobes, orange. *Anthers* 3–5(–7), 1.25–3 by 2–2.5 mm, locellate, inserted in staminal tube slightly below lobes, included or slightly protruding. *Disk* shallowly cup-shaped, 0.5 mm tall, fleshy, glabrous. *Ovary* ovoid, ca 3 by 2–3 mm, densely long hairy, (2)3(–5)-locular, each locule with 1(2) ovule, style linear, 10(–17) mm long, undulate, densely pilose, becoming glabrous below stigma, stigma subdiscoid to capitate, 0.5 by 0.5–1 mm, a more or less pubescent annulus. *Infructescence* pendulous, to 7 m long, densely irritant simple hairs. *Capsules* spindle-shaped, 3.5–5 by 1–2 cm, leathery, recurved, beaked when young, densely brown or pinkish red irritant simple hairs, dehiscent into 3 parts when mature. *Seeds* 3, black; partly with reddish orange aril.

T h a i l a n d.— SOUTH-WESTERN: Phetchaburi. PENINSULAR: Trang, Narathiwat.

D i s t r i b u t i o n.— Malaysia (type), Indonesia.

E c o l o g y.— Evergreen forest, near streams; altitude 50–300(–1,020) m.

V e r n a c u l a r.— Ma mui chang (หมามุ่ยช้าง), yom man (ยวมมัน)(Peninsular).

10. *Chisocheton pentandrus* (Blanco) Merr., Publ. Bur. Sci. Gov. Lab. 27: 31. 1905; Mabb. Bull. Brit. Mus. (Nat. Hist.), Bot. 6: 363. 1979; Tree Fl. Malaya 4: 237. 1989; Fl. Males., ser. I, 12(1): 180. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 232. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 175. 2013; Gardner et al., Forest Trees S. Thailand 2: 1260, 1461, f. 1649. 2016.—*Trichilia pentandra* Blanco, Fl. Filip.: 355. 1837.—*Chisocheton microcarpus* Koord. & Valetton, Bijdr. Boomsort. Java 3: 115. 1896; Backer et Bakh.f., Fl. Java 2: 125. 1965.—*C. philippinus* (Turcz.) Harms, in Engl. & Prantl., Nat. Pflanzenfam. 3, 4: 296. 1896. Fig. 26.

subsp. **paucijugus** (Miq.) Mabb., Bull. Brit. Mus. (Nat. Hist.), Bot. 6: 366. 1979; Fl. Males., ser. I, 12(1): 182. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 233. 2011; Fl. Penins. Malaysia, Ser. 2, 4: 176. 2013.—*Schizochiton paucijugum* Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 27, 30. 1868.—*Dasycoleum beccarianum* Baill., Adansonia 2: 263. 1874.—*Chisocheton spicatus* Hiern in Hook.f. Fl. Brit. India 1: 550. 1875; King. J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 26. 1895; Ridl., Fl. Malay Penins. 1: 387. 1922.—*C. paucijugus* (Miq.) B.D. Jackson, Ind. Kew. 1: 517. 1893. Fig. 26.

Trees (3–)7–12 m tall, 40–80 cm girth; bark greyish brown to dark brown, finely cracked with scattered raised lenticels, inner bark with alternate yellowish or red and white stripes; sapwood pale cream. *Leaves* 20–50 cm long, pseudogemmate; petiole 6–10



Figure 26. *Chisocheton pentandrus* (Blanco) Merr. subsp. *paucijugus* (Miq.) Mabb.: A. twig, A-1 inflorescences, A-2 flower, A-3 pistil, A-4 opened staminal tube. (*J.F. Maxwell 87-576*). Drawn by Orathai Kerdkaew.

cm long, minutely pubescent; leaflets 3–5(6) on each side of rachis, opposite to slightly subopposite, elliptic or elliptic-oblong, 5–20(–26.5) by 3.5–6(–9) cm, acuminate or acutely cuspidate at apex, cuneate at more or less asymmetrical base, chartaceous to subcoriaceous, a few prostrate pale brown simple hairs on midrib and veins below, occasional on the rest of lower surface, especially along margin, midrib slightly depressed above, prominent below, lateral veins 5–12 on each side of midrib, curved upwards near margin, not quite anastomosing, visible on both sides, reticulation visible, occasionally raised below; petiolules 6–8 mm long, pubescent. *Inflorescence* axillary or supra-axillary, to 24 cm long, a spike or raceme, usually unbranched; peduncles 8–15 cm, rachis finely densely appressed simple hairs. *Flowers* fragrant, subtended by up to 3 bracteoles; sessile or pedicels 2–5 mm long, pubescent, glabrescent. *Calyx* cup-shaped, 1–4 by 2 mm, margin truncate to obscurely or irregularly 4-lobed, more or less sparsely puberulous glabrous inside. *Petals* 4 or 5, oblong, 8–18 by 1.5–3 mm, adnate to staminal tube in lower 4 mm, creamy white, densely appressed simple hairs on exposed parts of petals on both sides. *Staminal tube* ca 6 by 1 mm, white, densely hairy both sides to base of lobes, sometimes including on lobes outside, margin with 4 or 5 lobes, lobes further shallowly divided into 3. *Anthers* 4 or 5(6), 2.5 by 0.3 mm, inserted inside at bases of sinuses of lobes, included. *Disk* absent. *Ovary* 0.5–1 mm diam., with 2-locular, each locule with 1(2) ovule, style cylindrical, 2–7.5 mm long, hairy on lower half, stigma capitate with an expanded lower half and flattened apex, glabrous. *Infructescence* to 30 cm long. *Capsules* spindle-shaped, to 4 by 2 cm, tapering to a stipe 1.1 cm long, a beak 1.5 cm long, usually with one longitudinal ridge, dull red when ripe, minutely grey tomentose. *Seeds* 2, to 1 cm long, flattened, with thin orange aril or sarcotesta.

T h a i l a n d.— SOUTH-WESTERN: Phetchaburi, Prachuap Khiri Khan; PENINSULAR: Ranong, Trang, Narathiwat.

D i s t r i b u t i o n.— Indonesia (type), Philippines

E c o l o g y.— Evergreen forest on granite bedrock or in swamp area; altitude 0–250 m.

V e r n a c u l a r.— Yom yot (ยวมยอต)(Peninsular).

11. *Chisocheton tomentosus* (Roxb.) Mabb., Bull. Brit. Mus. (Nat. Hist.), Bot. 6: 323. 1979; in Tree Fl. Malaya 4: 238. 1989; Fl. Males., ser. I, 12(1): 143. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 233. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 181. 2013; Gardner et al., Forest Trees S. Thailand 2: 1259, 1460, f. 1648. 2016.— *Melia tomentosa* Roxb., Fl. Ind., (Carey & Wall. ed.) 1: 394. 1832; Hiern in Hook.f., Fl. Brit. India 1: 543. 1875; C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 458. 1878; Curtis, J. Straits. Branch Roy. Asiat. Soc. 25: 21. 1894.— *Azedarach tomentosa* (Roxb.) Kuntze, Revis. Gen. Pl. 1: 110. 1891.— *Chisocheton princeps* Hemsl. in Hook.f., Fl. Brit. India 1: t. 1884. 1889; Ridl., Fl. Malay Penins. 1: 388. 1922; Whitmore, Trop. Rain For. Far East: t. 2. 7. 1975.— *C. rubiginosus* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 29. 1895; Ridl., Fl. Malay Penins. 1: 389. 1922.— *C. rugosus* Pierre, Fl. Forest Cochinch. Fasc. 5: t. 347. 1897. Fig. 27.

Trees 5–12 m tall, 30–40 cm girth, unbranched, rather slender; bark blackish brown, smooth or finely fissured, inner bark orange yellow to brownish; sapwood whitish. *Leaves* 50–80(–200) cm long, imparipinnate (especially on saplings) or pseudogemmate, pseudogemma sometimes deciduous, tomentose with irritant hairs throughout; petiole 10–30(–50) cm long, swollen near base, densely hairy; leaflets 8–15 on each side of rachis, subsessile, opposite or subopposite, oblong or elliptic, 13–30 by 3.5–12 cm, acute to acuminate at apex, acumen to 10 mm, obtuse to subcordate at base, coriaceous to subcoriaceous,

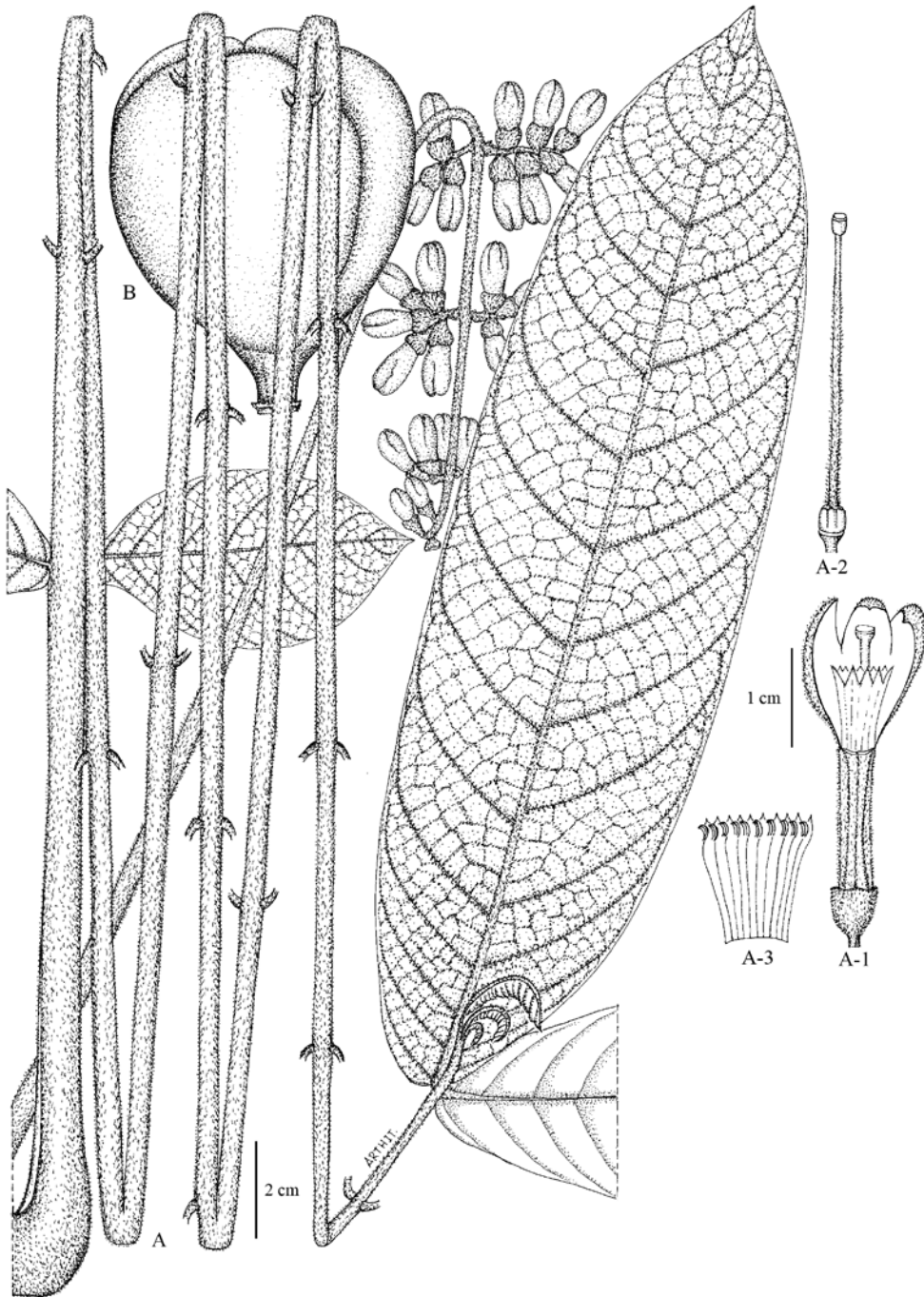


Figure 27. *Chisocheton tomentosus* (Roxb.) Mabb.: A. twig with inflorescences, A-1 flower, A-2 pistil, A-3 stamens, A-4 longitudinal section of flower (C. Niyomdham 5670); B. drupe (Curtis 1519). Drawn by Arthit Khamkamnoed.

sparsely tomentose with patent pale brown simple hairs above, glabrescent, except along nerves, densely tomentose below, lateral veins 12–19(–30) on each side of midrib, curved upwards near margin, sometimes anastomosing, midrib and lateral veins depressed, sparsely hairy above, prominent, densely tomentose below, especially on venation, reticulation areolate, depressed above, subprominent and numerous hairs below; petiolules 2–3(–10) mm long, swollen, hairy. *Inflorescence* axillary or supra-axillary, near end of twigs, 18–75(–90) cm long, pendulous, flowers on short branches near distal end, sometimes forming a congested terminal head, 10–15 by 6–8 cm, at least 400 flowers borne on branches to 2 cm long, densely tomentose; peduncles 30–50 cm long. *Flowers* 16–20 by 5–6 mm, subtended by a minute bracteole 1 by 0.5 mm, sweetly scented, reddish; bud 15 mm long; pedicel 1 mm, densely appressed brown hairs. *Calyx* cupular, 3–5 by 6.5 mm long, margin entire or obscurely 3- or 4-lobed, numerous short reddish brown hairs outside, glabrous inside. *Petals* 4(–6), obovate or oblanceolate, outer to 14 by 5 mm, inner to 13 by 2.5 mm, doubling in size when expanded, reflexed at anthesis, creamy, tomentose outside, glabrous inside. *Staminal tube* broadly tubular, 7–12 by ca 3 mm, margin irregularly 6–8-lobed, to 3 mm long, shorter than or same length as anthers, densely long upward pointing hairs from half way up the lobes outside, downward pointing and to base of lobes inside. *Anthers* boat-shaped, 6–8, 2–4.5–5 by 0.5–1 mm long, inserted at bases of sinuses of lobes, locellate, glabrous, attached near base. *Disk* to 1 mm tall, annular, surrounding ovary, densely upwardly pointing straight simple hairs. *Ovary* ovoid, ca 2 by 2 mm, densely upwardly pointing straight simple hairs, (4 or)5(or 6)-locular, each locule with 1(2) ovule, style cylindrical, ca 10 mm long, densely upwardly pointing hairs in lower 1/3, thinning to glabrous at distal end, stigma capitate, 1 by 1 mm, glabrous. *Infructescence* 20–90 cm long, pendulous. *Capsules* subglobose or obovoid, 6–7.5 by 5–6 cm, locules (4)5(6), longitudinally wrinkled, woody, golden brown velvety deciduous irritant hairs. *Seeds* 3–5, to 4 cm long, partly with white sarcotesta.

T h a i l a n d.— PENINSULAR: Trang, Yala, Narathiwat.

D i s t r i b u t i o n.— Malaysia (type), Indonesia.

E c o l o g y.— Evergreen forest; altitude 50–700 m.

V e r n a c u l a r.— Klong (กลอง)(Peninsular).

5. CHUKRASIA

A.Juss., Bull. Sci. Nat. Géol. 23: 239. 1830; Mém. Mus. Natl. Hist. Nat. 19: 251. t. 29. 1832; Harms. in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, 19b1: 65. 1940; T.D.Penn. & Styles, Blumea 22: 519. 1975; Mabb., Fl. Males., ser. I, 12(1): 354. 1995; Gardner et al., Forest Trees N. Thailand 121, 404, f. 232–3. 2000; Mabb. in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 195. 2011; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 233. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 183. 2013.

Trees, deciduous, simple hairs; bud scales present. *Leaves* spiral, paripinnate or imparipinnate, without pseudogemma, juvenile leaves bipinnate, incised or lobed leaflets. *Inflorescence* thyrses, axillary, often near end of twigs. *Flowers* unisexual, well-developed vestiges of opposite sex. *Calyx* (4)5-lobed. *Petal* (4)5, free, contorted, much longer than calyx in bud. *Staminal tube* cylindrical, somewhat narrowing distally, margin entire to crenulate. *Anthers* 10, attached to margin. *Disk* obscure to narrowly cushion-shaped. *Ovary* flask-shaped, 3–5-locular, each locule with numerous ovules, style slender, stigma capitate with 3–5 stigmatic ridges. *Capsules* ovoid or ellipsoid, woody, opening by 3–5 valves from

apex, valves separating into an inner and outer layer; columella with 3–5 sharply angled ridges, extending to apex of capsule, seeds scars conspicuous. *Seeds* 60–100 per locule, wings terminal, arranged horizontally at right angles to columella; endosperm present.

A monotypic genus, the 1 species ranges from Nepal, India (including the Andaman Islands) and Sri Lanka, eastwards through tropical Asia to S China (including Hainan) and W Malesia.

Chukrasia tabularis A.Juss., Bull. Sci. Nat. Géol. 23: 241. 1830; Pierre, Fl. Forest Cochinch. Fasc. 5: t. 357 C. 1897; Pellegr. in Lecomte Fl. Indo-Chine 1: 780. T. 84, f.5-11, 1911; Craib, Fl. Siam. 1: 266. 1926, *incl.* var. *attenpeuensis*, var. *dongnaiensis* (Pierre) Pellegr., var. *microcarpa* (Pierre) Pellegr., var. *velutina* (M.Roem.) Pellegr.; Fl. Indo-Chine Suppl.: 721. 1946, *incl.* var. *quadriavalvis* Pellegr.; T.D.Penn. & Styles, Blumea 22: 522, t.18c, d. 1975; C.Y.Wu, Fl. Yunnan. 1: 211, t. 49, f. 1–4. 1977, *incl.* var. *velutina* (M.Roem.) Pellegr.; Mabb., in Ng, Tree Fl. Malaya 4: 256, f. 10. 1989; Fl. Males., ser. I, 12(1): 354. 1995; Gardner et al., Forest Trees N. Thailand 121, 404, f. 232 & 233. 2000; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 233. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 183. 2013; Gardner et al., Forest Trees S. Thailand 2: 1261, 1461, f. 1650. 2016.— *Chickrassia tabularis* (A.Juss.) Wight & Arn., Prodr. Fl. Ind. Orient.: 123. 1834; Hiern in Hook.f., Fl. Brit. India 1: 568. 1875; Kurz, For. Fl. Burma 1: 227. 1877; Ridl., Fl. Malay Penins. 1: 415. 1922. Fig. 28. Plate CXXVI: C–E.

Trees 10–30 m tall, 300–400 cm girth; buttress to 1.5 m tall; bark orange brown or dark brown, fissured vertically, scaling or cracking into rectangular blocks, inner bark red-brown or pinkish orange, fibrous; sapwood straw-coloured; heartwood yellowish to reddish brown; twigs grey, lenticellate. *Leaves* to 60 cm long, densely pubescent on midrib and lateral veins below; petiole 4–10 cm long; leaflets 6–12 on each side of rachis, distal ones often slow to unfold, occasionally some leaflets further partially or wholly divided into 2–5 leaflets, elliptic, obovate, ovate to oblong, 4–15(–20) by 2.5–5(–9) cm, apex acuminate, base rounded, cuneate at asymmetrical or even falcate, pubescent or glabrescent on both surfaces, midrib prominent below, appressed above, lateral veins 9–13 on each side of midrib, curved upwards near margin, more or less bifurcating near margin, reticulation visible; petiolules 2–6 mm long, pubescent then glabrescent. *Inflorescence* 10–35 cm long, primary branches to 16 cm long, squarrose to ascending, secondary branches to 4 cm long, bearing fascicles of flowers, axes shortly pubescent; bracteoles narrowly triangular, 2–7(–10) mm long, often caducous; peduncle 8–10 cm. *Flowers* sweetly scented; bracteoles similar to bracts but smaller; pedicels terete, 4–5 mm long, articulated with pseudopedicels, 2–3 mm long, continuous with calyx, pubescent. *Calyx* shallowly cup-shaped, 2–3.5 mm in diam., more or less pubescent outside, margin undulate or with ovate lobes ca 1/3 the length of calyx. *Petals* linear-oblong or subspathulate, 6–15 by 2–4.5 mm, creamy green or yellowish, often tinged pink, sparsely puberulous. *Staminal tube* 5–6(–10) by 2–3(–6) mm, shallowly 5-lobed, glabrous, same colour as petals. *Anthers* 10, oblong, ca 1.5 by 1 mm, inserted by a short slender filament to margin of tube. *Ovary* 8–10 by 2–3 mm, densely appressed pubescent, style ca 7 mm, stigma capitate, ca 0.5 by 1 mm, just protruding through aperture of staminal tube. *Infructescence* pendulous, up to 6 fruits. *Capsule* ellipsoid, 2.5–5 by 2.5–4 cm, woody, pubescent, dark brown, conspicuously pale lenticellate. *Seeds* 3–3.5 by 1.2–3 cm.

T h a i l a n d.— NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Phayao, Lampang, Lamphun, Phrae, Tak, Sukothai, Phitsanulok; NORTH-EASTERN: Phetchabun, Loei,



Figure 28. *Chukrasia tabularis* A.Juss: A. twig with inflorescences, A-1 flower, A-2 ovary, A-3 part of ovary, A-4 stamens; B. capsules, B-1 seed. Drawn by Arthit Khamkamnoed.

Udon Thani, Khon Kaen; EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Kanchanaburi, Phetchaburi; CENTRAL: Saraburi, Nakhon Nayok; SOUTH-EASTERN: Chanthaburi; PENINSULAR: Surat Thani, Nakhon Si Thammarat, Trang.

Distribution.— Sri Lanka, India (type), Bangladesh, Indochina, Malaysia.

Ecology.— Limestone bedrock in evergreen, deciduous or mixed deciduous forest; altitude 60–1,680 m (most commonly 200–700 m).

Vernacular.— Kadao chang (กะเดาข้าง), yom hin (ยมหิน), sadao chang (สะเดาข้าง), sadao hin (สะเดาหิน)(Northern, Northeastern, Central); fak dap (ฝักดาบ)(Southeastern).

Note.— The distinctions between the various varieties commonly described appear not to supportable as intermediates commonly occur.

6. CIPADESSA

Blume, Bijdr.: 162. 1825; Harms in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, 19b1: 93. 1940; T.D.Penn., Blumea 22: 479. 1975; Mabb., Tree Fl. Malaya 4: 239. 1989; Fl. Males., ser. I, 12(1): 57. 1995; in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 202. 2011; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 234. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 186. 2013.

Shrubs to small trees, hairs simple; bud scales absent. *Leaves* imparipinnate; leaflets opposite or subopposite. *Inflorescence* axillary thyrses, near end of twigs. *Flowers* bisexual and unisexual on same plant (polygamous). *Calyx* 5-lobed in apical half. *Petals* 5(–6), free, valvate. *Stamens* 10, filament alternatively long and short, connate near base, terminated by a pair of narrowly lanceolate to filiform or erose appendages. *Anthers* acute, inserted between appendages, pubescent. *Disk* annular. *Ovary* 5(–6)-locular, each locule with 1(2) collateral ovules, style short, stout, columnar, stigma capitate with 5(–6) small stigmatic lobes. *Fruit* a subglobose drupe with 5(–6) pyrenes, each 1(–2)-seeded, endocarp bony. *Seeds* shaped like orange segments, without aril; testa thin; embryo embedded in endosperm.

A monotypic genus, with 1 species in tropical and subtropical Asia ranging from Nepal, India and Sri Lanka to S China, Cambodia, Laos and Vietnam, Indonesia and Philippines.

Cipadessa baccifera (Roth.) Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 6. 1868; C.DC. in A.DC. & C.DC. Monogr. Phan. 1: 426. 1878; Craib, Fl. Siam. 1: 251. 1926; Elmer in Leaflet Philipp. Bot. 9: 3348. 1937; Pellegr. in Lecomte Fl. Indo-Chine, Suppl. 1: 722. 1946; How & Chen, Acta Phytotax. Sin. 4: 34. 1955; Backer & Bakh.f., Fl. Java 2: 118. 1965; T.D.Penn., Blumea 22: 479. 1975; Mabb., Tree Fl. Malaya 4: 239. 1989; Fl. Males., ser. I, 12(1): 59. 1995; Hô, Fl. Vietnam ed. 3, 2(1): 484. 1992; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 234. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 187. 2013; Gardner et al., Forest Trees S. Thailand 2: 1262, 1461, f. 1651. 2016.— *Melia baccifera* Roth, Nov. Sp. Pl. Ind. Or.: 215. 1821.— *Cipadessa fruticosa* Blume, Bijdr.: 162. 1825; Hiern in Hook.f., Fl. Brit. India 1: 545. 1875; Pellegr. in Lecomte Fl. Indo-Chine 1: 782. 1911. Fig. 29. Plate CXXVII: A–B.

Shrubs to small trees 2–7(–20) m tall, 20–40 cm girth; bark thin, smooth or finely fissured, inner bark white to pinkish; twigs lenticellate, more or less finely hairy. *Leaves* 15–28 cm long, pubescent throughout; petiole 2.5–10 cm long; leaflets 4–6(7) on each side of rachis, opposite, elliptic to elliptic-oblong, 3–10 by 1.5–4 cm, apex acuminate, base rounded or broadly cuneate, weakly asymmetric, margin entire or apparently minutely dentate towards apex where bases of simple hairs persist, dull red before falling, midrib subdepressed above,



Figure 29. *Cipadessa baccifera* (Roth.) Miq.: A. twig with infructescences, A-1 capsule, A-2 part of capsule (*R. Pooma 1175*); B. twig with inflorescences, B-1 longitudinal section of flower. Drawn by Orathai Kerdkaew.

prominent below, lateral veins (5–)7–10 on each side of midrib, curved upwards near margin, not anastomosing, venation darker or paler, visible against the rest of lower leaflet surface when dry, midrib and veins above with fewer prostrate pale long wavy simple hairs, midrib and veins below with numerous similar hairs and sometimes a few on the rest of that surface; petiolules 0.2–0.5(–2.5) cm, densely pubescent. *Inflorescence* 5–21 cm long, branches at apex of rachis 4–12 cm long, densely with numerous prostrate hairs; bracts slender tapering to a point, 1.5 mm long, hairy; bracteoles ca 1 mm long, hairy; pseudopedicels ca 3 mm long, hairy. *Calyx* lobes ca 0.5 mm long, triangular, pubescent outside, glabrous inside, persistent in fruit. *Petals* ovate or lanceolate, 3 or 4 by ca 1 mm, yellow, creamy, creamy-white, greenish white or white, densely hairy outside, glabrous inside. *Stamen* with filaments flattened, 1.5–2.5 mm long. *Anthers* yellow. *Ovary* 5 or 6-angular, ca 0.5 by 0.5 mm, glabrous, style ca 0.5 mm, glabrous. *Infructescence* about same size as inflorescence, usually below leaves. *Drupes* 3–5 mm diam., longitudinally grooved, woody, reddish brown to dark red when mature.

T h a i l a n d.— NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Phayao, Nan, Lampang, Tak; NORTH-EASTERN: Loei, Nong Khai; EASTERN: Chaiyaphum; SOUTH-EASTERN: Chanthaburi.

D i s t r i b u t i o n.— India, Sri Lanka, S. China, Cambodia, Laos and Vietnam, Indonesia, Philippines (type).

E c o l o g y.— On granite bedrock or limestone ridges in hill evergreen or mixed deciduous scrub, swampy often near streams; altitude (220–)700–1,500(–2,250) m.

7. DIDYMOCHETON

Blume, Bijdr. Fl. Ned. Ind.: 177. 1825. Holzmeyer et al, Taxon 70(6): 1258. 2021.— *Dysoxylum* subg. *Didymocheton* (Blume) Hook.f. in Benth. & Hook., Gen. Pl. 1: 333. 1862.— *Dysoxylum* sect., (Blume) Ann. Mus. Bot. Lugduno-Batavi 4: 8. 1868.— *Hartighsea* A.Juss. in Bull. Sci. Nat. Géol. 23: 237. 1830.— *Dysoxylum* subg. *Hartighsea* (A.Juss.) Hook.f. in Benth.; Hook., Gen. Pl. 1: 333. 1862.— *Cambania* Comm. ex M.Roem., Fam. Nat. Syn. Monogr. 1: 83, 102. 1846.— *Didymocheton fraserianus* (A.Juss.) Mabb. & Hauenschild, Taxon 70(6): 1259. 2021.— *Macrochiton* M.Roem., Fam. Nat. Syn. Monogr. 1: 84, 104. 1846.— *Didymocheton bijugus* (Labill.) Holzmeyer & Mabb., Taxon 70(6): 1259. 2021.

Trees or shrubs, usually dioecious, hairs simple; bud scales absent. *Leaves* spirally inserted on shoot apices, pinnate, occasionally tardily developed apical leaflets; leaflets alternate, subopposite or opposite, entire. *Inflorescence* a compound thyrse; bracteoles conspicuous, these transitional to distinct sepals. *Flowers* unisexual, rarely bisexual. *Calyx* with 3–5(6) sepals, free or united near base. *Petals* 3–6, free or adnate to base of staminal tube, valvate. *Staminal tube* cylindrical to urceolate, margin entire, lobed or tipped with 6–10(–13) appendages. *Anthers* 6–16, included within throat of staminal tube. *Disk* free, tubular, though sometimes short or even subannular, margin sometimes with a lobed margin. *Ovary* 2–6-locular, each locule with 1 or 2 ovules, stigma capitate to discoid. *Fruit* capsular, 2–6 locules, each valve with 1 or 2 seeds. *Seeds* usually with a fleshy aril or sarcotesta.

43 species, Indo-Pacific, almost all east of Wallace's Line, to Tonga. 1 species in Thailand.

Didymocheton mollissimus (Spreng.) Mabb., *Taxon* 70(6): 1258. 2021.— *Trichilia mollissima* Spreng., *Syst. Nat.* 4(2): 252. 1827.— *Dysoxylum mollissimum* (Spreng.) Blume ex G. Don, *Gen. Syst.* 1: 683. 1831; Backer & Bakh.f., *Fl. Java* 2: 123. 1965; Mabb., *Tree Fl. Malaya* 4: 245. 1989; *Blumea* 38: 309. 1994; *Fl. Males.*, ser. I, 12(1): 90. 1995; T.Wongprasert et al., *Thai Forest Bull., Bot.* 39: 240. 2011; Mabb., *Fl. Penins. Malaysia, Ser. 2*, 4: 217. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1274, 1464, f. 1665. 2016.— *D. hamiltonii* Hiern in Hook.f., *Fl. Brit. India* 1: 548. 1875.— *D. teysmannii* C.DC. in A.DC. & C.DC., *Monogr. Phan.* 1: 510. 1878.— *D. hainanense* Merr., *Lingnan Sci. J.* 6: 280. 1930. Fig. 30.

Trees (5–)8–34(–60) m tall, 80–10 cm girth; apical buds fist-shaped, 1–2 cm long minutely tomentose; bark smooth, greyish brown, elongated brown lenticels, then scaly, inner bark yellowish brown; sapwood brownish; heartwood dark red; young twigs sparsely lenticellate, conspicuous leaf scars, glabrous to densely pubescent with patent hairs of varying lengths. *Leaves* spiral, imparipinnate or paripinnate, 20–90 cm long, distal leaves often unfolding tardily; petiole 5–12 cm long, sparsely pubescent, often lenticellate, somewhat flattened adaxially; leaflets 7–14(–17) on each side of rachis, opposite or subopposite, elliptic, elliptic-oblong or oblong, 5–12(–16) by 2.5–3.5(–5) cm, acuminate at apex, acute, rounded or cuneate at asymmetrical base, margin entire, chartaceous, numerous patent simple hairs below, lateral veins (7–)10–12(–15) on each side of midrib, rarely with domatia in axils, midrib prominent below, flat or depressed above, lateral veins narrowly ridged below, inconspicuous above, reticulation slightly raised; petiolules 5–10 mm long, sparsely hairy, glabrescent. *Inflorescence* axillary to supra-axillary, to 60 cm long, pubescent; peduncles 4–5 cm long; bracts and bracteoles 2 or 3, narrowly triangular, ca 0.5 mm long, more or less pubescent. *Flowers* sweetly scented; pedicels, ca 1 mm long. *Calyx* cup-shaped, 1–2 mm long, 4-lobed, lobes irregularly triangular, pubescent outside, glabrous inside. *Petals* 4(5), linear-oblong, ca 1 cm long, adnate to staminal tube in lower half, sparsely pubescent on both sides, white to yellowish. *Staminal tube* ca 5 mm long, sparsely hairy on both sides, margin subtruncate or divided into 8 lobes, lobes somewhat emarginate. *Anthers* 8, oblong, ca 0.5 mm long, included. *Disk* cupuliform, ca 2–4 mm long, green, margin with 4 irregular lobes. *Ovary* ovoid, ca 0.5 by 0.5 mm, pilose, 4-locular, each locule with 1 ovule, style terete, hairy on lower half, stigma subdiscoid, glabrous. *Capsule* depressed globose, 1–1.3 by 1.5–2.5 cm, glabrous, 4-locular, reddish brown, smooth or pustular lenticellate; pericarp with white latex. *Seeds* 1–4, ca 1.5 cm long, plano-convex, with red aril.

T h a i l a n d.— PENINSULAR: Nakhon Si Thammarat, Songkhla.

D i s t r i b u t i o n.— India (Assam), China (Yunnan, Hainan), Myanmar, Malaysia (type), Indonesia to Bali, Philippines.

E c o l o g y.— Uncommon in evergreen forest.

V e r n a c u l a r.— Ta sua khop chak (ตาเสือขอบจัก)(General).

8. DYSOXYLUM

Blume ex Raspail in *Bull. Sci. Nat. Géol.* 11: 68. 1827. *Taxon* 70(6): 1262. 2021 — *Dysoxylum* sect. *Cyrtochiton* Miq. in *Ann. Mus. Bot. Lugduno-Batavi* 4: 9, 23. 1868.— *Dysoxylum* Blume, *Bijdr. Fl. Ned. Ind.*: 172. 1825, *nom. non rite publ. (sine descr.)*, p.p.; Harms in Engl. & Prantl, *Nat. Pflanzenfam.*, ed. 2: 19b1: 160. 1940; T.D.Penn., *Blumea* 22: 504. 1975, p.p.; Mabb. in *Fl. Nouvelle Calédonie & Dépend.* 15: 23. 1988, p.p.; *Tree Fl. Malaya* 4, f. 6: 239. 1989, p.p.; *Fl. Males.*, ser. I, 12(1): 61. 1995, p.p.; in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.*

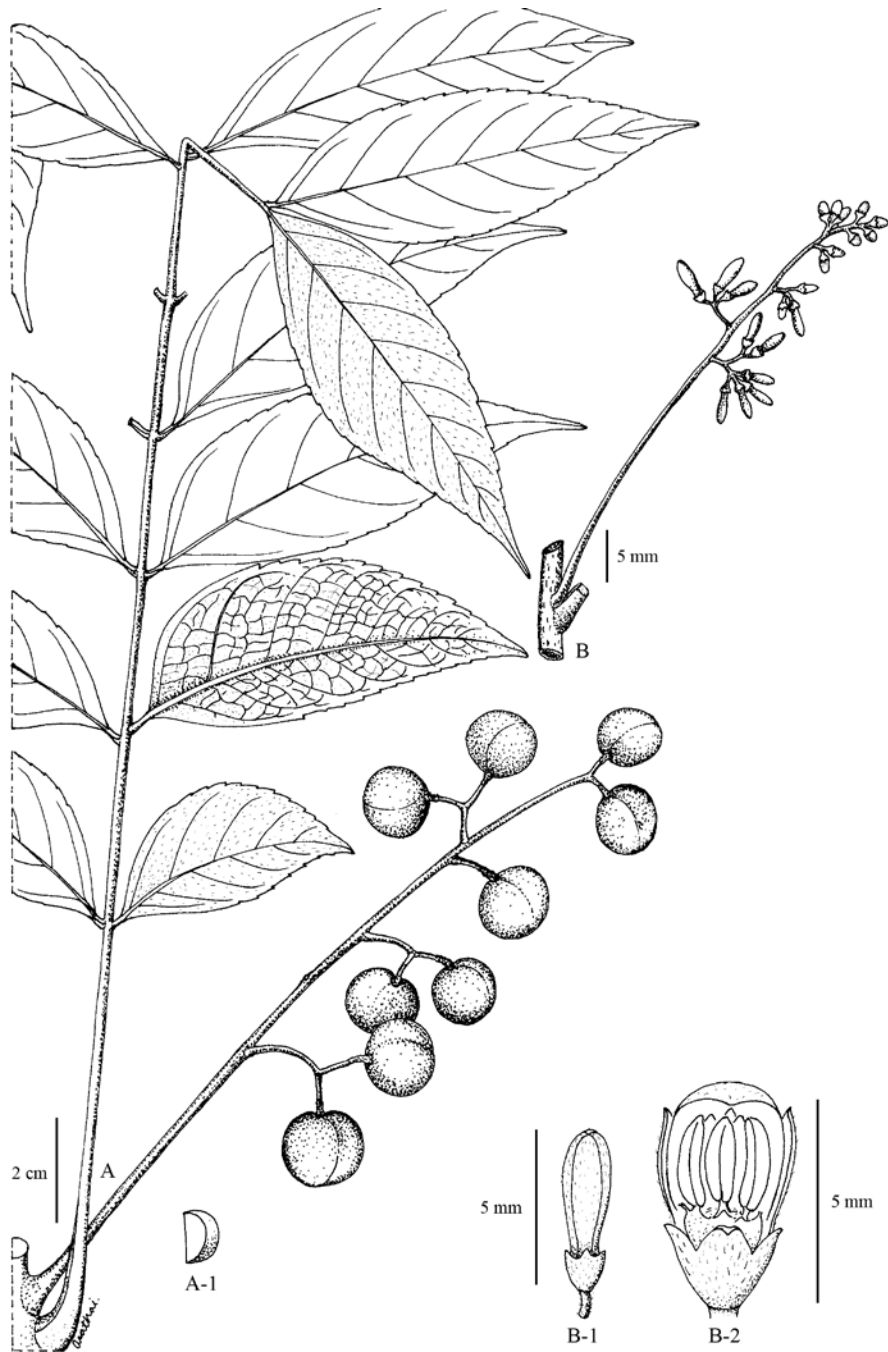


Figure 30. *Didymocheton mollissimus* (Spreng.) Mabb.: A. twig with infructescence (B. Everett-KEP. 104905 B.), A-1 seed; B. inflorescence, B-1 flower (D.J. Collins 1534), B-2 longitudinal section of flower. Drawn by Orathai Kerdkaew.

10: 206. 2011, *p.p.*; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 235. 2011, *p.p.*; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 189. 2013, *p.p.*; Gardner et al., Forest Trees S. Thailand 2: 1262–1274, 1462–1464, 1472 f. 1654–65. 2016 *p.p.*

Trees or shrubs, usually dioecious, hairs simple; bud scales absent, apical bud nearly always stiletto-shaped, rarely fist-shaped (*D. papillosum* in Thailand). *Leaves* spiral, rarely opposite, paripinnate or imparipinnate, occasionally tardily developed apical leaflets; leaflets alternate, subopposite or opposite (*D. acutangulum* in Thailand). *Inflorescence* racemose or spicate; axillary, sometimes with conspicuous bracteoles. *Flowers* unisexual, rarely bisexual. *Calyx* 3–5 (or 6), free or united near base. *Petals* 4 or 5, free or adnate to base of staminal tube, valvate. *Staminal tube* cylindrical to urceolate, margin entire, or with 6–8(–10) apical truncate or notched lobes. *Anthers* 6–8(–10), inserted within throat of staminal tube, included or slightly protruding. *Disk* free, tubular, sometimes short, or subannular, margin sometimes lobed. *Ovary* (3–)4(–5)-locular, each locule with 1 or 2 ovules, stigma capitate to discoid. *Fruit* capsular, with 3 or 4(–5) locules, each valve with 1 or 2 seeds. *Seeds* usually with fleshy aril or sarcotesta.

28 Indomallesian species from India and Sri Lanka to Australia and the Solomon Islands. 7 species in Thailand.

KEY TO THE SPECIES

- | | |
|--|----------------------------------|
| 1. Leaves subdecussate | 1. <i>D. acutangulum</i> |
| 1. Leaves spiral | |
| 2. Terminal leaflet present (leaf imparipinnate); apical bud with young leaves like a clenched fist; leaflet below with raised bumps and numerous hairs | 7. <i>D. papillosum</i> |
| 2. Terminal leaflet absent (leaf paripinnate); apical bud spike-like or stiletto-shaped; leaflet below smooth or rugulose, not with raised bumps, hairy or not | |
| 3. leaflet below with numerous simple hairs | 5. <i>D. grande</i> |
| 3. leaflet below glabrous to subglabrous | |
| 4. leaflet below conspicuously rugulose | 3. <i>D. flavescens</i> |
| 4. leaflet below not or only minutely rugulose | |
| 5. Leaflets minutely rugulose. Fruits subglobose or depressed globose, orange brown when dry | |
| 6. Fruits to 10 cm in diam.; pericarp thick and woody when dry | 6. <i>D. macrocarpum</i> |
| 6. Fruits to 3.5 cm in diam.; pericarp thin and brittle when dry | 4. <i>D. gotadhora</i> |
| 5. Fruits obovoid, black or very dark brown when dry | |
| 7. Leaflets greenish brown when dry, without pits, minutely rugulose below, midrib and lateral veins white or orange below | 4. <i>D. gotadhora</i> |
| 7. Leaflets uniformly brown or with midrib and lateral veins reddish brown when dry, numerous pits (sometimes faint) above, not minutely rugulose below | 2. <i>D. cyrtobotryum</i> |

1. *Dysoxylum acutangulum* Miq., Fl. Ned. Ind., Suppl. 1: 196, 503. 1861; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 41. 1895; Ridl., Fl. Malay Penins. 1: 393. 1922; Mabb., Fl. Males., ser. I, 12(1): 129. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 235. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 192. 2013; Gardner et al., Forest Trees S. Thailand 2: 1264, 1462, f. 1654. 2016.— *Alliaria acutangula* (Miq.) Kuntze, Revis. Gen. Pl. 1: 109. 1891.— *Dysoxylum schultzei* C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 502. 1878.

Trees 20–25(–34) m tall, 100–150 cm girth; apical buds stiletto-like, 1–2 cm long, finely fulvous tomentose; bark smooth or irregularly cracked, shedding in large scales, brownish grey, lenticellate, inner bark dark yellow, fibrous; sapwood yellowish brown; young twigs somewhat 4-angled, conspicuous leaf scars and lenticels. *Leaves* 15–30 cm

long, subdecussate, paripinnate, with minute apical spike or its scar; petiole 5–11 cm long, grooved and angled adaxially when dry, base somewhat swollen; leaflets 2–4(–7) on each side of rachis, opposite or subopposite, elliptic or elliptic-oblong, (6–)9–15 by 2–5(–6.5) cm, acute to acuminate at apex, rounded to slightly cuneate at base, more or less asymmetrical, margin entire or slightly undulate, coriaceous, minutely rugulose, numerous pits on both surfaces when dry, a few short appressed simple hairs on midrib below, glabrous elsewhere, lateral veins 11–16 on each side of midrib, with or without domatia in axils, shorter lateral veins in between, midrib prominent below, depressed above, lateral veins barely visible, reticulation indistinct; petiolules 5–10 mm long, glabrous, scarcely swollen. *Inflorescence* axillary to ramiflorous, spicate, 3–10 cm long, erect, fascicles of 1–few flowers, sparsely hairy; peduncles 1–3 cm long; bracts and bracteoles narrowly triangular, ca 0.5 mm long, densely pubescent. *Flowers* sweetly scented; pedicels to 1 mm long. *Calyx* shallowly bowl-shaped, ca 2–3 mm long, confluent with pseudopedicel ca 1 mm long, 4 lobes ca ½ of the length, sparsely hairy outside, glabrous inside. *Petals* 4, free, linear-oblong, 9–13 by ca 2.5 mm, valvate, hairy on both surfaces, yellowish. *Staminal tube* cylindrical, 5–7 by ca 4 mm, sparsely pubescent outside, hairy or glabrous inside, margin crenulate. *Anthers* 8(–10), ovoid to ellipsoid, ca 1 by 0.25 mm, not or slightly protruding. *Disk* shallowly cup-shaped, 0.5–1.5 mm tall, fleshy, glabrous or hairy inside, red. *Ovary* ovoid, 0.5–1 by 0.5–1 mm, densely pubescent, (3) 4-locular, each locule with 2 ovules, style cylindrical, ca 0.2 mm long, hairy on lower half, stigma subdiscoid, glabrous. *Infructescence* erect, 5–10 cm long. *Capsule* subglobose to pear-shaped, 5–7.5 by 5–8 cm, orange when mature, dehiscent into 3(4) locules; pericarp to 1 cm thick, heavily veined when old, inner side orange yellow, glabrous, white latex. *Seeds* 0 or 1 in each locule, ellipsoid, ca 2 cm long, black, with a small orange aril on one side.

T h a i l a n d.— SOUTH-WESTERN: Kanchanaburi, Phetchaburi; PENINSULAR: Chumphon, Satun, Nakhon Si Thammarat.

D i s t r i b u t i o n.— Malaysia, Indonesia (type), Philippines, Australia.

E c o l o g y.— Evergreen forest; altitude 100–1,250 m.

V e r n a c u l a r.— Ta sua (ตาสือ)(General).

2. *Dysoxylum cyrtobotryum* Miq., Fl. Ned. Ind. Suppl. 1: 196, 504. 1861; Mabb., Tree Flora Malaya 4: 243. 1989; Fl. Males., ser. I, 12(1): 123. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 237. 2011 (pro parte); Mabb., Fl. Penins. Malaysia Ser. 2, 4: 205. 2013; Gardner et al., Forest Trees S. Thailand 2: 1269, 1463, f. 1659. 2016.— *D. venulosum* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 42. 1895; Ridl., Fl. Malay Penins. 1: 397. 1922.— *D. alternatum* Ridl., Fl. Malay Penins. 1: 397. 1922.— *Dysoxylum pallens* Hiern in Hook.f, Fl. Brit. India 1: 548. 1875.— *Dysoxylum andamanicum* King, J. Asiat. Soc. Bengal Pt. 2., Nat. Hist. 64: 49. 1895; Craib, Fl. Siam. 1: 251. 1926; Gardner et al., Forest Trees N. Thailand 116, 403, f. 224. 2000.— *Dysoxylum cochinchinense* Pierre, Fl. Forest Cochinch. Fasc. 22, ante t. 350A. 1897; Craib, Fl. Siam. 1: 252. 1926; Gardner et al., Forest Trees N. Thailand 116, 403, f. 223. 2000.— *D. spicatum* H. L. Li., J. Arnold Arbor. 25: 303. 1944. Fig. 31. Plate CXXVII: C–E.

Trees 8–20(–30) m tall, 60–120 cm girth; bark grey to mid greyish brown, smooth, lenticellate to scaly, inner bark dark orange or pale yellow with dark orange stripes; sapwood pale yellow; heartwood yellowish brown to red brown, sour smelling; twigs hairy. *Leaves*



Figure 31. *Dysoxylum cyrtobotryum* Miq.: A. twig with infructescences, A-1 seed (Th. Wongprasert 985); B. inflorescence, B-1 flower, B-2 longitudinal section of flower (K. Larsen 9392). Drawn by Orathai Kerdkaew.

more or less imparipinnate, with a scar next to terminal leaflet, 20–60(–67) cm long; petiole 7–20 cm, sparsely pubescent, glabrescent; leaflets 3–5 on each side of rachis, alternate, elliptic, elliptic-oblong, (7–)10–20(–23) by (3–)4–12 cm, acuminate, acute or caudate at apex, rounded or cuneate, at asymmetrical base, chartaceous, brown when dry, glabrous or a few short hairs on midrib and lateral veins below, numerous reddish brown pits on both surfaces when dry, midrib depressed above, prominent below, lateral veins 7–13 on each side of midrib, curved upwards, scarcely anastomosing at margin, slightly or hardly visible above, subprominent below, often reddish brown when dry, often with shorter inconspicuous laterals in between, reticulation barely visible; petiolules 0.5–1 cm long, pubescent. *Inflorescence* (5–)8–36 cm long, erect racemes in axils of leaves near ends of twigs or ramiflorous, rachis sparsely hairy; peduncle 3–8 cm long; bracts narrowly triangular, ca 2 by 1 mm, caducous. *Flowers* clumped along rachis, fragrant; bracteoles minute; pedicels 1–2 mm long, pubescent; pseudopedicel ca 1 mm. *Calyx* cup-shaped, 2–4 mm long, puberulent outside, divided up to half way into 4(5)-ciliate lobes. *Petals* (3 or) 4 (or 5), 5–7 by 1.5–2 mm, densely pubescent outside, glabrous or hairy inside, yellowish or white, sometimes pinkish at apex. *Staminal tube* 4–5 by 2.5 mm, sparsely pubescent outside, glabrous inside, off-white, margin (7)8(–10) lobes to 0.5 mm, shallowly notched. *Anthers* (6–)8(–10), 0.8–1.5 by 0.3–0.5 mm long, yellow, inserted at bases of sinuses of lobes, included or protruding. *Disk* (0.3–)1–1.5 mm tall, margin undulate, enclosing base of ovary but not exceeding, glabrous outside, densely hairy inside, margin irregularly 8–12-toothed. *Ovary* ovoid, 1–2 by ca 1 mm, hairy, (2)3(4)-locular, each locule with 2 ovules, style cylindrical, 1.5–3 mm long, hairy in lower half, stigma subcapitate, white to pale orange, glabrous. *Infructescence* to 8(–30) cm long, erect, rarely pendulous, up to 24 fruits inserted singly; peduncle ca 3 cm. *Capsule* 2.5–3.6(–6.5) by 2–2.5(–6) cm, subglobose to fig-shaped (*Ficus carica*), longitudinally wrinkled; stipe to 1 cm, woody, glabrous, orange yellow or red, black when dry, dehiscing into 2 or 3 locules; pericarp with white latex; pedicel to 5 cm. *Seeds* (1–)4–5(6), 2–3.5 by 1.5–2 cm; testa shiny black, fleshy orange or red seed coat covering half of seed.

T h a i l a n d.— NORTHERN: Chiang Mai, Tak; NORTH-EASTERN: Phetchabun, Loei; EASTERN: Chaiyaphum, Nakhon Ratchasima; SOUTH-WESTERN: Kanchanaburi, Phetchaburi, Prachuap Khiri Khan; SOUTH-EASTERN: Chon Buri, Chanthaburi; CENTRAL: Nakhon Nayok; PENINSULAR: Surat Thani, Nakhon Si Thammarat, Trang, Yala, Narathiwat.

D i s t r i b u t i o n.— India (Nicobar and Andaman Islands), Indo-China, Malaysia, Indonesia (type), Philippines.

E c o l o g y.— On limestone or granite bedrock, in evergreen forest near streams; altitude (150–) 200–950(–1,720) m.

V e r n a c u l a r.— Khang khao elit (ค้ำคาวอิลิต)(Southeastern); ma duk (มะดูก), mak duk (หมากดูก)(Northern); ta suea (ตาเสือ)(Northeastern).

3. *Dysoxylum flavescens* Hiern in Hook.f., Fl. Brit. India 1: 549. 1875; Ridl., Fl. Malay Penins. 1: 396. 1922; Mabb., Tree Fl. Malaya 4: 244. 1989; Fl. Males., ser. I, 12(1): 128. 1995; Thai Forest Bull., Bot. 39: 239. 2011; Mabb. & Pannell, Fl. Penins. Malaysia, Ser. 2, 4: 210. 2013.— *D. griffithii* Hiern in Hook.f., Fl. Brit. India 1: 549. 1875; King, J. Asiat. Soc. Bengal 64(2): 46. 1895. Fig. 32.

Tree to 14 m tall, ca 150 cm girth; apical bud stiletto-like, 1–2 cm long, very short pale or reddish brown appressed simple hairs on young stems and buds. *Leaves* 19–22 cm long,

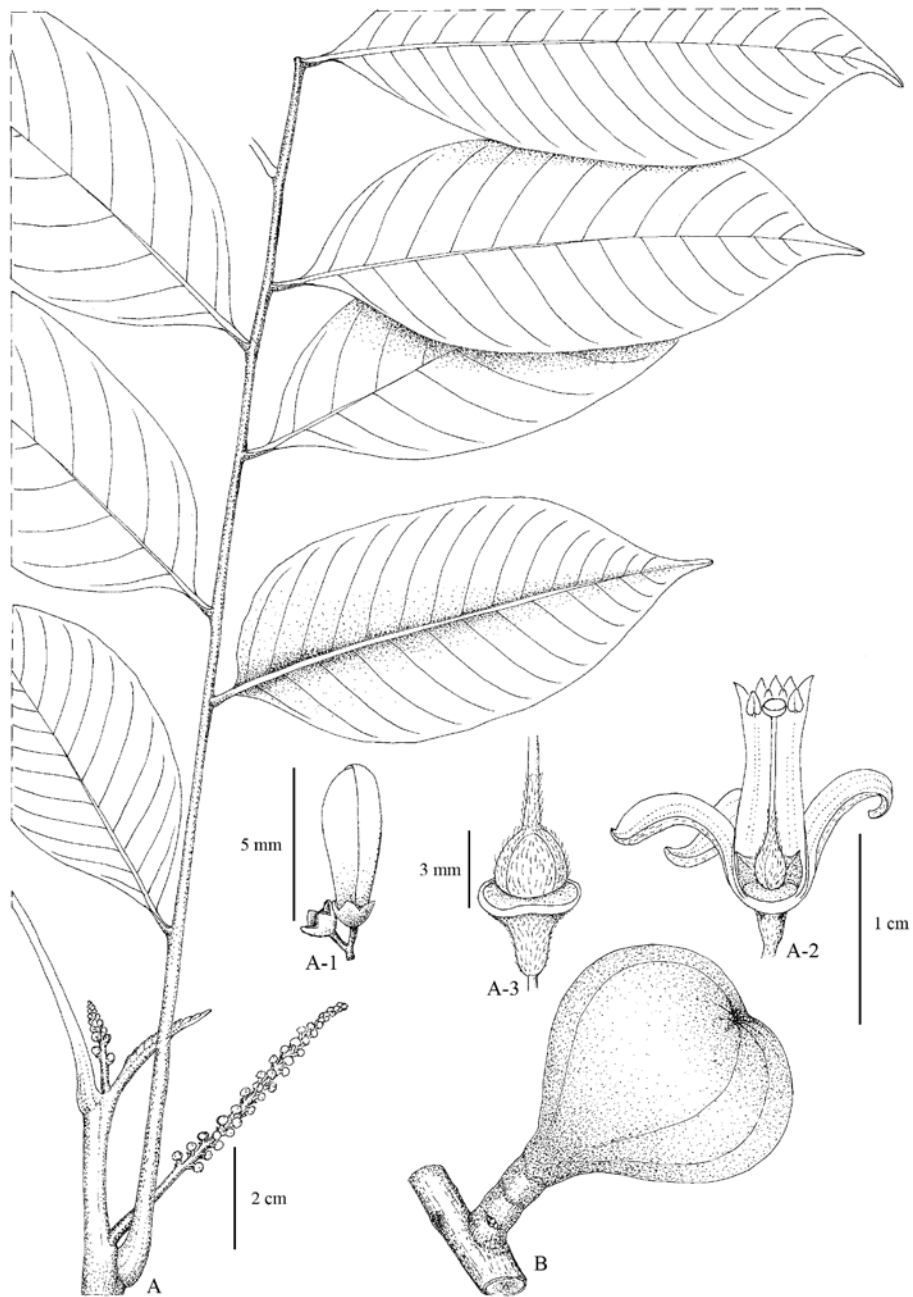


Figure 32. *Dysoxylum flavescens* Hiern: A. twig with infructescence, A-1 flower bud, A-2 longitudinal section of flower, A-3 ovary, (*S. Gardner et al. ST 2335*); B. fruit (*Chulalongkorn Univ. BKF 96855*). Drawn by Orathai Kerdkaew.

imparipinnate, spiral; petiole 5–9.5 cm; leaflets 3–7 on each side of rachis, ovate or elliptic, 5.5–14 by 2–4 cm, yellowish brown or pale brown when dry, acuminate at apex, acumen to 5 mm, rounded on one side, cuneate on other at asymmetrical base, lateral veins 12–19 on each side of midrib, with shorter laterals in between, slightly raised above, prominent below, lateral veins barely visible, reticulation not visible, rugulose, numerous pits on both surfaces, glabrous; petiolule 5–10 mm. *Inflorescence* an axillary or supra-axillary raceme 4–4.5 cm long; pedicels ca 1 mm, subtended by triangular bracteoles ca 1 by 1 mm. *Calyx* ca. 2.5 mm diam., minutely hairy outside, merging into pseudopedicel ca 1 mm long, cup-shaped, deeply divided into 4 lobes. *Petals* 4, ca 7 mm long, minutely hairy both sides. *Staminal tube* thick, few hairs distally, margin crenate. *Anthers* 8, ovate, included. *Disk* shortly cup-shaped, glabrous, fleshy. *Ovary* pubescent, 4-locular, each locule with 2 collateral ovules, style pubescent in proximal half, style-head discoid, protruding beyond staminal tube aperture. *Infructescence* 7–8 by 5–9 cm; peduncle 2.5–3 cm. *Fruits* subglobose, 3.7–4.4 by 3.8–4.7 cm, short stipe ca 7 mm, pedicel short and stout 1.5–1.7 by 7–10 mm; pericarp orange-red, woody, to 9 cm thick when dry, dehiscing into 4 locules, each with 0 or 1 seed. *Seeds* brown or black with a small orange aril.

T h a i l a n d.— PENINSULAR: Ranong, Nakhon Si Thammarat.

D i s t r i b u t i o n.— Malaysia (type).

E c o l o g y.— Evergreen forest.

V e r n a c u l a r.— Ta suea (ตาเสือ)(Peninsular).

N o t e.— The wood is used for making furniture.

4. *Dysoxylum gotadhora* (Buch.-Ham.) Mabb. in Wu & al., Fl. China 11: 127. 2008.— *Guarea gotadhora* Buch.-Ham., Mem. Wern. Nat. Hist. Soc. 6: 307. 1 Jan 1832.— *G. binectarifera* Roxb., Fl. Ind. 2 (not before 14 Jan. 1832) 240.— *Dysoxylum binectariferum* (Roxb.) Hook.f. ex Bedd. Trans. Linn. Soc. London 25(2) 212 1865. Fig. 33.

Small trees 8–12(–15) m tall; twigs pale brown. *Leaves* to 55 cm, imparipinnate; petiole 7–17 cm; leaflets (2–)4–5 on each side of rachis, subopposite or alternate, narrowly elliptic, obovate or oblanceolate, to (5–)6.5–15 by (2–)3–6 cm, acuminate at apex, acute acumen to 1.5(–2) cm, cuneate or rounded at asymmetrical base, margin slightly recurved when dry, usually pale green, paler than leaflet below when dry, minutely rugulose on both surfaces, short simple hairs at various angles few to numerous on midrib below, lateral veins 8–10(–14) on each side of midrib, ascending and curved upwards near margin, not anastomosing, slightly raised, sometimes with faint intercostals not reaching leaflet margin, reticulation barely visible; pits absent; petiolule 3–7 mm. *Inflorescence* a supra-axillary raceme, 3–16 cm long; peduncle 1–20 mm long, numerous short simple hairs. *Flowers* on short pedicels 2(–6) mm long; pseudopedicel 0.5 mm with numerous short hairs. *Calyx* shallowly saucer-shaped, ca 2 mm, divided shallowly or to $\frac{2}{3}$ into 4 rounded or pointed lobes, numerous short hairs outside, glabrous inside. *Petals* 4, 6–8 by 2–4 mm, numerous short hairs outside, few to numerous inside. *Staminal tube* 7 by 5 mm, free from petals, apical margin divided to less than 1 mm into 7 or 8 notched lobes, few to numerous short hairs, mostly glabrous inside. *Anthers* 7 or 8, ovoid, 1.5 by 0.5 mm, inserted just inside margin of staminal tube at bases of sinuses of lobes. *Disk* cup-shaped, ca 1.5 by 1.5 mm, barely longer than ovary, barely undulate, glabrous outside or a few hairs, densely appressed hairy inside. *Ovary* ovoid, ca 1 by 1 mm, locules (2)3–4, each with 2 ovules, style to 7 mm long, less

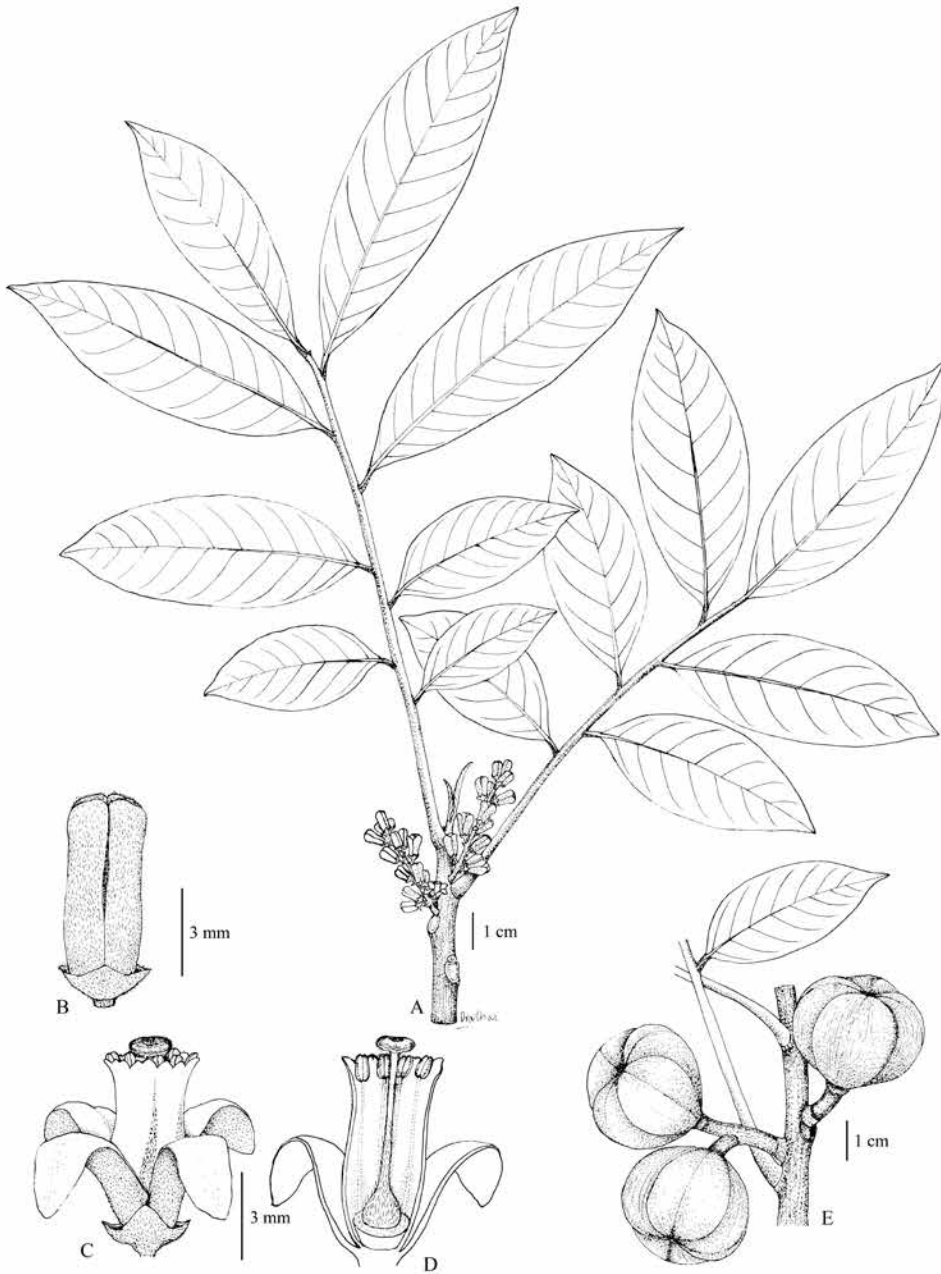


Figure 33. *Dysoxylum gotadhora* (Buch.-Ham.) Mabb.: A. twig with inflorescence; B. flower bud; C. flower ; D. longitudinal section of flower; E. twig with infructescences. Drawn by Orathai Kerdkaew.

than 1 mm wide, ovary and style densely appressed hairy, becoming glabrous near apex of style, stigma 1 mm in diam., 0.5 mm thick, disc-shaped, protruding beyond staminal tube. *Infructescence* spicate or branched once, few fruits; peduncle to 1.3–2.5 cm. *Fruits* obovoid or depressed globose, 3.5(–6) by 2.5–3.3(–4.2) cm, lobed where pericarp dried around seeds, without a stipe, sometimes with a short beak, tapering into a broad insertion to main rachis, yellow or dark yellow when fresh, usually dark orange when dry, rarely blackish green, longitudinally wrinkled when dry, usually glabrous, dehiscing into 3 or 4, with 0 or 1 seed in each locule. *Seeds* longitudinally depressed ovoid, 16–21 by (9–)11–15 mm, with complete or partial red or orange red aril.

Thailand.—NORTHERN: Chiang Mai, Chiang Rai, Phayao, Nan, Lamphun, Lampang, Phrae; NORTH-EASTERN: Loei; EASTERN: Chaiyaphum; SOUTH-WESTERN: Kanchanaburi, Phetchaburi, Prachuap Khiri Khan; SOUTH-EASTERN: Chon Buri, Chanthaburi; PENINSULAR: Ranong, Surat Thani, Nakhon Si Thammarat, Phatthalung, Trang.

Distribution.—India (type), Nepal, Bhutan, Laos, Vietnam.

Ecology.— Mostly in dense seasonal forests in mountainous ravines; altitude (20–)400–1,700 m.

5. *Dysoxylum grande* Hiern in Hook.f., Fl. Brit. India 1: 547. 1875; Mabb., Tree Fl. Malaya 4: 244. 1989; Fl. Males., ser. I, 12(1): 117. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 239. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 210. 2013.— *Chisocheton grandiflorus* (non Kurz) Hiern in Hook.f., Fl. Brit. India 1: 522. 1875.— *C. costatus* Hiern in Hook.f., Fl. Brit. India 1: 522. 1875.— *Dysoxylum interruptum* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 40. 1895; Ridl., Fl. Malay Penins. 1: 392. 1922.

Trees 8–30(–39) m tall, 30–100 cm girth; apical buds with long stiletto-like young leaves; bark smooth to diphled, tan or brownish grey, lenticellate, inner bark pink or white, dark brown lines at intervals; sapwood white, yellowish to brownish; twigs slightly 4 angled, grey to white hairs, lenticellate. *Leaves* 30–100 cm long, spiral, paripinnate; petiole 10–25 long, swollen near base, densely hairy; leaflets (3) 4–10 on each side of rachis, opposite or subopposite, oblong, elliptic or lanceolate, 7–26 by 4–10.5 cm, apex acuminate or shortly caudate to 2.3 cm long, rounded or shortly cuneate at asymmetrical base, margin entire, somewhat recurved, chartaceous, few to numerous long simple yellow brown hairs at more or less patent, various angles and directions to leaflet surface, midrib conspicuously prominent below, subdepressed above, hairy along veins above, both surfaces usually numerous minute black dots, lateral veins (11–)16–28 on each side of midrib, shorter lateral veins in between, reticulation usually subprominent below; petiolule 0.5–1 cm long, puberulous. *Inflorescence* a compound thyrse to 30(–50) cm long in male, raceme to 10 cm long in female, pendulous or erect, axillary or supra-axillary, near end of twigs; peduncles 5–20 cm, long; bracts and bracteoles narrowly triangular, ca 2 by 1 mm, caducous. *Flowers* fragrant; pedicels ca 1 mm long, densely pubescent. *Calyx* 2–4.5(–11 in female) mm tall, 5–7(–11 in female) mm diam., shallowly cup-shaped, margin 4-lobed, densely hairy outside, glabrous inside. *Petals* 4, free, linear oblong, 7–9(–16 in female) mm by 3–3.5 mm, densely tomentose both sides, cream or yellow. *Staminal tube* ca 5(–8 in female) by 4 mm, puberulous outside, glabrous inside, margin with 8 truncate or broadly triangular lobes. *Anthers* 8, ca 1.2 mm long, included. *Disk* cup-shaped, 1.3–1.5 mm tall, often closely enveloping ovary, subglabrous outside, densely long yellow brown simple hairs inside. *Ovary* ovoid, 1.3–2 by 1.3–2 mm, densely pilose, (3)4(5)-locular, each locule with 1 ovule, style 3–4 mm long, 4-angled, pubescent

on lower half, stigma cylindrical-capitate, with basal annulus, glabrous. *Infructescence* erect, rarely pendulous, 8–20 cm long, watery sticky latex. *Capsules* 1–4 on stout pedicels, depressed globose, 4–5.8 by 4–9.5 cm (5–8 by 7–11 cm when fresh); pericarp white latex, conspicuously 3 or 4(5)-lobed, woody, glabrous, orange red, dehiscing longitudinally. *Seeds* 1–4, ca 2.5 cm long, with a thick yellow or red aril or sarcotesta.

T h a i l a n d.— NORTHERN: Kamphaeng Phet; NORTH-EASTERN: Loei; EASTERN: Chaiyaphum; SOUTH-WESTERN: Uthai Thani; CENTRAL: Nakhom Nayok; SOUTH-EASTERN: Prachin Buri; PENINSULAR: Ranong, Phatthalung, Trang.

D i s t r i b u t i o n.— India (type), Myanmar, China, Cambodia, Laos, Vietnam, Malaysia, Indonesia.

E c o l o g y.— Lowland to hill evergreen forest, savannah forest, on limestone bedrock; altitude (50–)100–800(–1,600) m.

V e r n a c u l a r.— Tabu (ต่าบู)(Northeastern); ta suea (ต่าเสื่อ)(Southwestern); ta khwai (ต่าควาย)(Peninsular).

6. *Dysoxylum macrocarpum* (Spreng.) Blume ex G. Don, Gen. Hist. 1: 683. 1831; Backer & Bakh.f., Fl. Java 2: 123. 1965; Mabb., Tree Fl. Malaya 4: 244. 1989; Fl. Males., ser. I, 12(1): 116. 1995; T. Wongprasert et al., Thai Forest Bull., Bot. 39: 240. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 214. 2013; Gardner et al., Forest Trees S. Thailand 2: 1273, 1464, f. 1664. 2016.— *Trichilia macrocarpa* Spreng., Syst. Veg. 4(2): 252. 1827. Fig. 34.

Trees 10–33 m tall, 50–200 cm girth; crown narrow with few main branches; apical buds spike-like, 1.5–2(–5) cm long, densely pubescent; plank buttresses to 2 m tall; bark dark brown, greyish brown, or pale prange brown, smooth or with longitudinal furrows, finely lenticellate, inner bark pale yellow with red stripes at intervals, fibrous; sapwood pale brown; twigs with wide pith, conspicuous leaf scars and lenticellate. *Leaves* 30–50(–100) cm long, spiral, imparipinnate; petiole 8–15(–38) cm long, swollen at base; leaflets 3 or 4 on each side of rachis, alternate (rarely subopposite), ovate to oblong, 7–30 by 5–10 cm, apex acute to acuminate, rounded or subcuneate at slightly asymmetrical base, margin entire, chartaceous, minutely rugulose on both surfaces when dry, short simple hairs appressed to midrib below, sometimes scattered on the rest of leaflet below, midrib strongly prominent below, depressed above, lateral veins 8–25 on each side of midrib, curved upwards near margin, indistinctly anastomosing, sharp ridged below, slightly depressed above, reticulation inconspicuous; petiolules 0.6–2 cm long, lenticellate, slightly swollen, few short simple hairs. *Inflorescence* to 32 cm long, 1 order of spreading branches, axillary or supra-axillary, near end of twigs, densely pubescent; bracts and bracteoles narrowly triangular, 1–2 by ca 1 mm, caducous. *Flowers* narrowly obovoid, ca 7 by 2.5 mm, foetid or slightly aromatic. *Calyx* 1–2 mm long, shallowly divided into 4 rounded lobes, numerous short simple hairs outside, glabrous inside, tapering into a pseudopedicel 1.5 mm long. *Petals* 4, free, oblong, 5–10 mm long, imbricate, creamy white to orange, numerous short simple hairs outside, glabrous inside. *Staminal tube* 5–6 mm long, glabrous outside, sparsely hairy or glabrous inside, margin undulate or with 8 more or less truncate lobes. *Anthers* 8, inserted inside staminal tube. *Disk* broadly cup-shaped, ca 1.5 by 1 mm, serrulate margin, or with 8 rounded lobes 0.25 mm long, minutely papillose outside, glabrous both sides. *Ovary* ovoid, ca 2 by 1 mm, densely hairy, 4-locular, each locule with 2 ovules, style narrowly cylindrical, 5–6 mm long, hairy

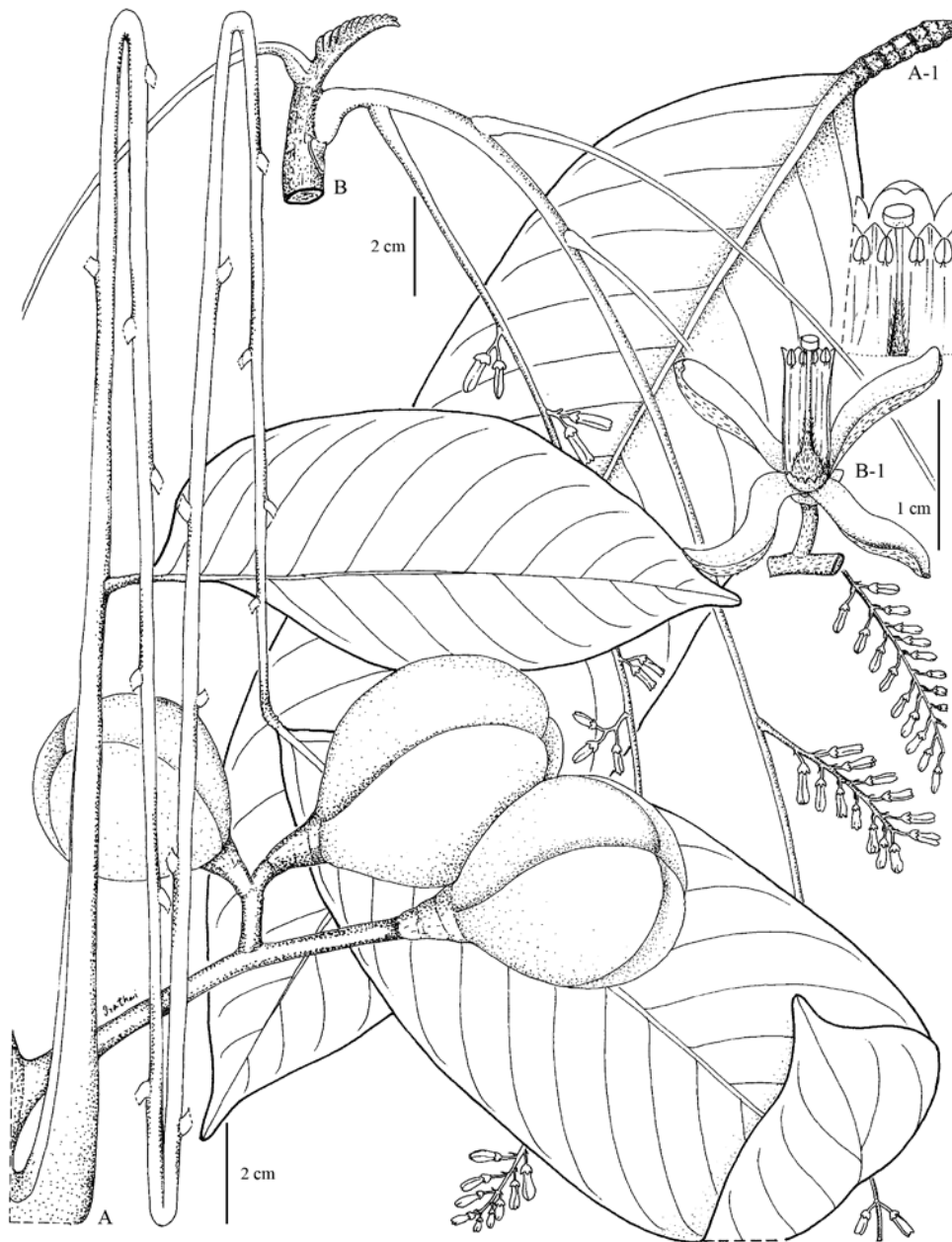


Figure 34. *Dysoxylum macrocarpum* (Spreng.) Blume ex G. Don: A. twig with infructescence, A-1 another form of leaf (M.R. Henderson 23664); B. inflorescences, B-1 flower, B.2 longitudinal section of flower (P. Suvanakoses 167). Drawn by Orathai Kerdkaew.

on lower half, stigma depressed globose, glabrous. *Infructescence* erect, 5–10 cm long, axes to 8 mm diam., fruits 1–3. *Capsule* subglobose or obovoid, 6–7.5 by (6–)8–10 cm, orange-red, with 3 or 4 longitudinal grooves; pericarp with white latex, inner pericarp orange yellow. *Seeds* 1–4, ca 4.5 by 2.3–2.5 cm, shaped and arranged like the segments of an orange; testa dark brown, thick orange or dark red aril.

T h a i l a n d.— SOUTH-WESTERN: Kanchanaburi; PENINSULAR: Ranong, Nakhon Si Thammarat, Narathiwat.

D i s t r i b u t i o n.— Vietnam, Malaysia, Indonesia (type), Philippines.

E c o l o g y.— Evergreen forest; altitude 500–750 (–1,520) m.

V e r n a c u l a r.— Ta sua khao (ตาเสือขาว)(Peninsular).

7. *Dysoxylum papillosum* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 50. 1895; Ridl., Fl. Malay Penins. 1: 397. 1922; Mabb., Tree Fl. Malaya 4: 245. 1989; Fl. Males., ser. I, 12(1): 116. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 240. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 218. 2013; Gardner et al., Forest Trees S. Thailand 2: 1263. 2016.

Trees 5–8 m tall, 20–50 cm girth, flowering when ca 1 m tall; apical buds with fist-shaped young leaves, 1.5–2 cm long, densely tawny tomentose; bark dark grey with pale patches, inner bark orange; twigs tomentose and lenticellate. *Leaves* 12–24(–40) cm long, spiral, paripinnate, apical spike to 1.5 cm long or its scar; petiole 7–20 cm long, densely yellow tomentose; leaflets 2 or 3 on each side of rachis, lower pair subopposite, obovate or oblanceolate, 14–30 by 5–12 cm, apex acuminate or acute, base cuneate to obtuse, margin entire, chartaceous to subcoriaceous, numerous raised bumps below, numerous hairs along midrib, veins and leaflet below, numerous red dots below, midrib and lateral veins depressed above, prominent below, lateral veins 8–15 on each side of midrib, curved upwards near margin, not anastomosing, reticulation inconspicuous; petiolules 0.3–1 cm long, densely reddish brown tomentose. *Inflorescence* 3–7.5 cm long, spicate, axillary or supra-axillary, near ends of twigs; peduncles 2–3 cm long, silky hairy; bracts and bracteoles narrowly triangular, ca 2 by 1 mm. *Flowers* sweetly scented; pedicels ca 1 mm long. *Calyx* 1–2 mm long, shallowly divided into 4 broadly ovate lobes, numerous short simple hairs outside, glabrous inside. *Petals* 4, free, linear, 6–10 mm long, imbricate, glabrous or numerous short simple hairs outside, white or pinkish. *Staminal tube* ca 4 mm long, glabrous on both sides, apical margin undulate or 8 emarginate lobes. *Anthers* 8, oblong, alternating with lobes. *Disk* 1.5 by 1 mm, obconical with 8 rounded lobes, 2–3 mm long or annular at base of ovary, glabrous both sides. *Ovary* ovoid, ca 0.5 by 0.5 mm, densely upwardly pointing hairs, 4-locular, each locule with (1)2 ovules, style cylindrical, ca 2 mm long, pilose on lower half, stigma discoid, glabrous. *Infructescence* erect, 1–3 cm long. *Capsules* obovoid, 2–3 by 2.7–3.3 cm, apiculate, orange red, woody, densely hairy, with 3 or 4 longitudinal lobes, dehiscent into 3 or 4 locules, each with 1 seed. *Seeds* 2–4, black or brown, with a white aril.

T h a i l a n d.— PENINSULAR: Narathiwat.

D i s t r i b u t i o n.— Malaysia (type).

E c o l o g y.— Evergreen forest; altitude 300–500 m.

V e r n a c u l a r.— Sua si hu (เสือสีหู)(Peninsular).

9. EPICHARIS

Blume, Bijdr. Fl. Ned. Ind.: 166. 1825; Holzmeyer et al, Taxon 70(6): 1264. 2021.—*Dysoxylum* sect. *Epicharis* (Blume) Miq. in Ann. Mus. Bot. Lugduno-Batavi 4: 7. 1868.F—*Piptosaccos* Turcz. in Bull. Soc. Imp. Naturalistes Moscou 31: 415. 1858.

Trees or shrubs, usually dioecious, hairs simple; bud scales absent, apical buds with fist-shaped young leaves. *Leaves* spiral, rarely opposite, usually imparipinnate, occasionally with tardily developing apical leaflets; leaflets alternate, subopposite or opposite, asymmetrical at base, cuneate on one side, rounded on the other, lateral veins looped. *Inflorescence* a thyrse, raceme or spike, sometimes reduced to fascicles or a solitary flower, ramiflorous or cauliflorous. *Flowers* unisexual, rarely bisexual. *Calyx* closed in bud, later splitting into 2–5 irregular lobes, finally dehiscing at base (circumscissile). *Petals* 3 or 4, free or adnate to base of staminal tube, valvate. *Staminal tube* cylindrical to urceolate, margin entire or lobed. *Anthers* 6–9, included in staminal tube. *Disk* free, tubular, margin sometimes lobed. *Ovary* 2–4 locular, each locule with 1 or 2 ovules, stigma capitate to discoid. *Fruit* capsular, 2–4 locules, each with 1 or 2 seeds. *Seeds* usually with fleshy aril or sarcotesta.

6 species in SE Asia. 2 in Thailand.

KEY TO THE SPECIES

1. Inflorescences and infructescences ramiflorous or cauliflorous, almost to ground level. Fruits with few hairs; pericarp red, aril bright orange **1. *E. cuneata***
1. Inflorescences and infructescences ramiflorous only. Fruits densely simple greyish brown hairs, aril white **2. *E. densiflora***

1. *Epicharis cuneata* (Hiern) Harms in Engler & Prantl, Nat. Pflanzenfam., ed. 2, 19bI: 168. 1940.—*Dysoxylum cuneatum* Hiern in Hooker, Fl. Brit. India 1: 549. 1875, *excl. fr.* [= *Aphanamixis polystachya* (Wall.) R.N.Parker].—*Dysoxylum cauliflorum* Hiern in Hook.f., Fl. Brit. India 1: 549. 1875; Ridl., Fl. Malay Penins. 1: 396, t. 40. 1922; Mabb., Tree Fl. Malaya 4: 242. 1989; Fl. Males., ser. I, 12(1): 86. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 237. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 202. 2013; Gardner et al., Forest Trees S. Thailand 2: 1267, 1462, f. 1657. 2016. Fig. 35. Plate CXXVII: F.

Trees 10–25(–30) m tall, 80–120 cm girth, more or less pubescent; sometimes fluted or with small buttresses to 60 cm tall; bark dark brown, flaking in vertical rectangles, or grey and smooth with lenticels and bosses where inflorescences produced; sapwood yellowish brown; twigs lenticellate. *Leaves* 30–70 cm long, spiral, imparipinnate; petiole 5–14 cm long, terete to flattened or grooved adaxially when dry, more or less orange brown hairy, swollen at base; leaflets 3–7 on each side of rachis, subopposite or alternate, elliptic-oblong, oblong or lanceolate, 9–21 by 4–9 cm, apical one the largest, apex caudate to 15 mm long, rounded on one side, cuneate on the other at asymmetrical base, margin entire, chartaceous to subcoriaceous, a few simple patent hairs on midrib and veins below and sparse on leaflet surface, midrib prominent below, depressed above, lateral veins 9–15 on each side of midrib, curved upwards near margin, anastomosing, sharply ridged below, conspicuous above, reticulation subprominent below; petiolules 0.5–1(–1.5 on terminal leaflet) cm long, few to numerous short simple hairs, somewhat swollen proximally. *Inflorescence* spicate or a thyrse, 5–10 cm long, usually in fascicles, ramiflorous, on persistent tubercles to 7 cm



Figure 35. *Epicharis cuneata* (Hiern) Harms: A. twig, A-1 infructescence (C. Phengklai 12657); B. inflorescences, B-1 flower, B-2 longitudinal section of flower (C. Niyomdham 4703). Drawn by Orathai Kerdkaew.

diam., or cauliflorous almost to ground level, numerous simple hairs on all parts; peduncles 1–2 cm long; bracts narrowly triangular, ca 1 by 0.5 mm, appressed pubescent. *Flowers* sweetly scented; pedicels ca 1 mm long, pubescent. *Calyx* broadly cup-shaped, 1.5–3 mm tall, 3–4 irregular shallow teeth, appressed pubescent outside, glabrous inside. *Petals* (3)4, free, linear, 7–10 mm long, imbricate at least at apices, glabrous or sparsely hairy outside, white or pinkish. *Staminal tube* ca 3 mm long, glabrous to puberulous outside, silky hairy inside, white margin, (6–)8 bifid lobes. *Anthers* (6–)8, ovate, ca 1 mm long, inserted at bases of sinuses between lobes. *Disk* cylindrical, 3–4 mm long, margin irregular lobed, glabrous. *Ovary* ovoid, ca 0.5 by 0.5 mm, pilose, (3)4(5)-locular, each locule with 1–2 ovules, style terete, ca 2 mm long, pilose on lower half, stigma depressed globose, yellow, glabrous. *Capsule* solitary or clustered at end of peduncle, 4–10 cm long, ellipsoid or ovoid, 2–3 by 1.2–2 cm, with 3 or 4 longitudinal angular ridges, leathery, bright red, with few hairs outside, dehiscent into 3–4 longitudinal lobes, each with 1 seed. *Seeds* 1–4, black, 2–3 by 0.8–1.8 cm, bright orange aril at base of seed.

T h a i l a n d.— SOUTH-WESTERN: Kanchanaburi; SOUTH-EASTERN: Chon Buri, Chanthaburi; PENINSULAR: Krabi, Trang, Narathiwat.

D i s t r i b u t i o n.— Cambodia, Vietnam, Malaysia (type), Indonesia, Philippines.

E c o l o g y.— Evergreen forest, near streams; altitude to 700 m.

V e r n a c u l a r.— Ta suea taptim (ตาเสือทับทิม)(Southeastern).

2. *Epicharis densiflora* Blume, Bijdr. Fl. Ned. Ind.: 167. 1825.— *Dysoxylum densiflorum* (Blume) Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 9. 1868; King, J. Asiatic Soc. Bengal, Pt. 2, Nat. Hist. 64: 46. 1895; Ridl., Fl. Malay Penins. 1: 396. 1922; Backer & Bakh.f., Fl. Java 2: 122. 1965; Mabb., Tree Fl. Malaya 4: 243. 1989; Fl. Males., ser. I, 12(1): 81. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 239. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 207. 2013; Gardner et al., Forest Trees S. Thailand 2: 1270, 1463, f. 1661. 2016.— *Epicharis densiflora* Blume, Bijdr. Fl. Ned. Ind.: 167. 1825.— *Hartighsea ramiflora* Griff., Notul. 4: 501. 1854.— *Dysoxylum griffithii* Hiern in Hook.f., Fl. Brit. India 1: 549. 1875.

Trees 7–20 m tall, 40–180 cm girth; buttresses to 3.5 m tall, forming plank-roots to 5 m long at base; apical buds with fist-shaped young leaves; bark dark brown, cream to orange with orange brown lenticels, flaking and roughly cracked, inner bark dull yellow, turning dark orange when exposed; sapwood brownish. *Leaves* 16–50(–100) cm long, in dense spirals at ends of twigs, imparipinnate (occasionally paripinnate); petiole 7–20 cm long, sparsely hairy, glabrescent, swollen near base; leaflets 5–9 on each side of rachis, lower pair subopposite, oblanceolate, elliptic or ovate, (4.5–)14–21 by (2–)4.5–9 cm, apex acute to acuminate, base obtuse to cuneate or subcordate, asymmetrical, margin entire, chartaceous to subcoriaceous, glabrous, midrib slightly depressed above, lateral veins 7–15(–17) on each side of midrib, curved upwards, often dividing near margin, not or barely anastomosing, drying paler above, subprominent few to numerous appressed hairs on midrib and veins below, sparse on leaflet surface, reticulation inconspicuous; petiolules 1–5(–10) mm (–20 mm on apical leaflet). *Inflorescence* on twigs and branches of 8 mm diam. or more, racemose or narrowly thyrsoid, pendulous or suberect, to 13 cm long, solitary or fascicled, numerous short wavy hairs; peduncles 1–2 cm long; bracts narrowly triangular, ca 1 by 0.5 mm, pubescent. *Flowers* sweetly scented; pedicels ca 1 mm long, pubescent. *Calyx* cup-shaped, 2–3.5 mm tall, divided to 1/3 into 4 triangular lobes, hairy outside, numerous appressed

hairs outside, glabrous inside. *Petals* 4, free or lower half adnate to staminal tube, linear, 7–10 mm long, acute, imbricate, sparsely hairy outside, white, yellowish or dull orange. *Staminal tube* 6.5–8 by 2.5–4 mm long, glabrous to puberulous outside, long wavy pale yellowish brown hairs inside, conspicuously 8 (or 9)-striate, white, margin 8-lobed, lobes subtruncate, emarginate or irregularly toothed. *Anthers* 8 (or 9), oblong-ovate, 0.8–1 by ca 0.3 mm, inserted at bases of sinuses of lobes, included. *Disk* 1.2–4 by 1.5–2.7 mm, annular or cylindrical, margin irregularly lobed, glabrous or sparsely hairy inside. *Ovary* ovoid, ca 4 by 2 mm, appressed pubescent, (3 or) 4-locular, each locule with 1–2 ovules, style cylindrical, 2–6 mm long, hairy on lower half, stigma 0.4 by 1 mm, depressed globose, glabrous, papillose, just protruding through aperture of staminal tube. *Infructescences* erect, 4–10 cm long or fruits solitary; peduncles to 3 cm. *Capsules* ellipsoid or fusiform, 3.5–4.5 by 2–2.5 cm, with (3)4 longitudinal grooves, dehiscing into (3)4 locules; pericarp greyish green, appressed silky grey-green hairy, soft, white latex, calyx breaking off at base in fruit, leaving a circumscissile scar. *Seeds* 2–4; testa black, partly with a white aril.

T h a i l a n d.— NORTHERN: Chiang Mai, Lampang; SOUTH-WESTERN: Kanchanaburi; SOUTH-EASTERN: Chanthaburi; PENINSULAR: Ranong, Surat Thani, Phangnga, Nakhon Si Thammarat, Trang, Narathiwat.

D i s t r i b u t i o n.— Myanmar, China, Malaysia, Indonesia (type).

E c o l o g y.— Dry or moist evergreen forest, near streams or on ridges; altitude (80–)100–700(–1,000) m.

V e r n a c u l a r.— Hang kan (ฮั่งก่าน)(Northern); sang khriat langsat (สังเคี้ยกลางสาต), ko oak (กอโอ๊ก)(Peninsular).

10. GONIOCHETON

Blume, Bijdr. Fl. Ned. Ind.: 177. 1825; Holzmeyer et al, Taxon 70(6): 1265. 2021.— *Dysoxylum* subg. *Goniocheton* (Blume) Hook.f. in Benth. & Hook., Gen. Pl. 1: 333. 1862.— *Dysoxylum* sect. *Goniocheton* (Blume) Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 9. 1868.

Trees or treelets, hairs simple or 2-armed; bud scales absent, apical buds fist-shaped young leaves. *Leaves* spiral, rarely opposite, imparipinnate, sometimes with a faintly winged rachis; leaflets alternate, subopposite or opposite. *Inflorescence* a compound thyse, axillary near apices of twigs. *Flowers* unisexual, rarely bisexual, often pentamerous. *Calyx* 3–5(6), free or united near base. *Petals* 3–6, free or adnate to base of staminal tube, valvate. *Staminal tube* cylindrical to urceolate, margin entire, lobed or tipped with 6–10(–13) appendages. *Anthers* 6–16, within throat of staminal tube. *Disk* free, tubular, sometimes short or even subannular, margin sometimes lobed. *Ovary* 2–6-locular, each locule with 1 or 2 ovules, stigma capitate to discoid. *Fruit* capsular, white to pink, with (3–)5 valves, each valve with 1 or 2 seeds. *Seeds* usually with fleshy aril or sarcotesta.

4 species from India and China to Australia and Vanuatu. 2 species in Thailand.

KEY TO THE SPECIES

- | | |
|--|-----------------------------------|
| 1. Inflorescences and infructescences axillary, 10–15 cm long | 1. <i>G. arborescens</i> |
| 1. Inflorescences and infructescences ramiflorous, 5–7 cm long | 2. <i>G. lenticellatus</i> |

1. *Goniocheton arborescens* Blume, Bijdr. Fl. Ned. Ind.: 177. 1825.—*Dysoxylum arborescens* (Blume) Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 24. 1868; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 38. 1895; Ridl., Fl. Malay Penins. 1: 391. 1922; Backer & Bakh.f., Fl. Java 2: 123. 1965; Mabb., Tree Fl. Malaya 4: 242. 1989; Fl. Males., ser. I, 12(1): 103. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 237. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 199. 2013; Gardner et al., Forest Trees S. Thailand 2: 1266, 1462, f. 1656. 2016.—*D. maingayi* Hiern in Hook.f., Fl. Brit. India 1: 547. 1875. Fig. 36. Plate CXXVIII: A–B.

Trees (4–)8–20 m tall, 30–100 cm girth, sometimes flowering from 1 m tall; fluted or with buttresses to 1 m; bark greyish brown, rough, raised brown lenticels in horizontal lines, inner bark creamy yellow; sapwood pale brown; twigs slender, drooping, lenticellate in horizontal lines, densely hairy near apex. *Leaves* 8–20(–45) cm long, spiral, imparipinnate (occasionally paripinnate); petiole 3–5(–8) cm long, densely or sparsely pubescent, drying blackish; leaflets to 4 on each side of rachis, opposite, ovate-oblong to oblanceolate, 4–28 by 2.5–6.5 cm, apex acuminate to caudate, base asymmetrically cuneate, margin entire, chartaceous to subcoriaceous, few appressed simple and 2-armed hairs below, distinctive pink or grey pallor when dry, midrib and lateral veins often reddish brown, young leaves black when dry, midrib prominent below, flat to subdepressed above, lateral veins (4–)5–10 on each side of midrib, curved upwards, more or less anastomosing, reticulation faintly visible on both surfaces; petiolules 5–12 mm long, drying blackish brown. *Inflorescence* axillary, at or near end of twigs, a compound thyrse, 10–15 cm long, hairy. *Flowers* sweetly scented; pedicels yellowish green, 3–7 mm long, hairy; bracteoles narrowly triangular, ca 1.5 by 0.5 mm, caducous. *Calyx* shallowly cup-shaped, 1–4 mm diam., pseudopedicel 2–6 mm long, margin irregularly divided into 5 subrotund lobes, lobes ca $\frac{1}{3}$ of the length, numerous hairs outside and along margin, glabrous inside. *Petals* (4)5(6), linear-oblong, 6–10 by 1.8–2.2 mm, adhering to staminal tube at base valvate, waxy, white or yellowish, glabrous or a few hairs outside, glabrous inside, adhering to staminal tube at base. *Staminal tube* 4.5–6 by 2.5 mm, sparsely appressed hairy inside, glabrous outside, margin subtruncate to weakly crenulate or 8–(10)-lobed. *Anthers* (8–)10(–11), 0.5–1 by ca 0.3 mm, inserted inside staminal tube at bases of sinuses of lobes, not protruding beyond aperture. *Disk* cup-shaped, ca 1 mm tall, glabrous outside, densely stiff golden hairs inside. *Ovary* ovoid, 0.5–2 by 1 mm, densely hairy; (3)4 or 5-locular, each locule with 2 ovules, style narrowly cylindrical, (4–)6–7 mm long, numerous hairs except near apex, stigma ca 0.5 by 0.25 mm, capitate, papillose in upper half, glabrous. *Infructescence* solitary or a small cluster, up to 10–25 cm long. *Capsule* ovoid, 2–2.5 by (2.1–)3–4 cm, depressed globose, with (3–)5 locules, often somewhat irregular and weakly angled between valves, white ripening bright pinkish red, drying black, few to numerous 2-armed hairs outside; inner pericarp white. *Seeds* 1–6, ca 2 by 1.5 cm, plano-convex; testa bright orange, sarcotestal; hilum ca 8 mm diam., white.

T h a i l a n d.— SOUTH-WESTERN: Phetchaburi; SOUTH-EASTERN: Chanthaburi; PENINSULAR: Nakhon Si Thammarat, Phatthalung, Trang, Narathiwat.

D i s t r i b u t i o n.— India (Nicobar and Andaman Is.), Malaysia (type), Indonesia, Philippines, Taiwan, New Guinea, Australia, Solomon Islands and Vanuatu.

E c o l o g y.— On granite or limestone bedrock, near streams in evergreen forest; at low attitudes to 800 m.

V e r n a c u l a r.— Ta sua khon (ตาเสือขน).



Figure 36. *Goniocheton arborescens* Blume: A. twig with inflorescences, A-1 another form of leaf, A-2 flower (S. Phusomsaeng 81); B. part of infructescence (A.D.E. Elmer 18180). Drawn by Arthit Khamkamnoed.

2. *Goniocheton lenticellatus* (C.Y.Wu) Mabb., *Taxon*, 70: 1266. 2021.—*Dysoxylum lenticellatum* C.Y.Wu, *Fl. Yunnan.*, 1: 251. 1977; T.Wongprasert et al., *Thai Forest Bull., Bot.* 39: 240. 2011. Fig. 37.

Trees 8–10(–30) m tall, 40–60 cm girth, sometimes deciduous; twigs smooth, pale brown, glabrescent, conspicuously yellow and up-curved lenticels. *Leaves* imparipinnate 17–25 cm long; petiole 6–8 cm long, grooved above, swollen near base, pubescent then glabrescent; leaflets 3–5 on each side of rachis, opposite, oblong or oblanceolate, 6–21 by 3–6 cm, apex shortly acuminate, base rounded or cuneate, asymmetrical, margin entire, slightly recurved, chartaceous, glabrous except hairy along midrib and lateral veins, midrib and lateral veins conspicuous below, flat to subdepressed above, lateral veins 7–12 on each side of midrib, curved upwards near margin, not anastomosing, reticulation hardly visible; petiolules 0.5–1 cm long, puberulous, glabrescent. *Inflorescence* a compound thyrse, on old and second year branches, 3–5(–7) cm long; peduncles 1–2 cm long; bracts and bracteoles narrowly triangular, ca 2 by 1 mm, caducous. *Flowers* with pedicels ca 1(–5) mm long. *Calyx* broadly cup-shaped, ca 2 mm long, margin 4-lobed, hairy outside, puberulous inside. *Petals* (4)5(6) free, linear or more or less oblanceolate, 5–8 by 1.5–2 mm, numerous appressed hairs outside, glabrous inside. *Staminal tube* 3–5 mm long, puberulous outside, glabrous inside, margin 8-lobed. *Anthers* (8–)10(–12), inserted at base of sinuses of lobes. *Disk* a fleshy collar adnate to base of ovary. *Ovary* ovoid, ca 2.5 by 2 mm, hairy, with 4 longitudinal lobes, 4-locular, each locule with 2 ovules, style cylindrical, ca 2.5 mm, hairy on lower half, stigma discoid, glabrous. *Infructescence* erect, 5–10 cm long. *Capsule* obovoid, 2–2.5 by 1.5–2.5 cm, with conspicuous 3 or 4-longitudinal lobes, pinkish red, sparse yellow, round lenticels. *Seeds* ovoid, ca 1.2 by 1 cm, an incomplete red aril.

T h a i l a n d.—NORTHERN: Chiang Mai.

D i s t r i b u t i o n.—China (type), Myanmar.

E c o l o g y.—Uncommon in hill evergreen forest, near streams; altitude 1,050 m.

V e r n a c u l a r.—Ta suea pom (ตาเสือปม)(Northern).

11. HEYNEA

Roxb., *Bot. Mag.* 41: sub t. 1738. 1815; Harms in Engl. & Prantl, *Nat. Pflanzenfam.*, ed. 2, 19b1: 117. 1940; Mabb., *Fl. Males.*, ser. I, 12(1): 41. 1995; in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 10: 201. 2011; T.Wongprasert et al., *Thai Forest Bull., Bot.* 39: 240. 2011; Mabb., *Fl. Penins. Malaysia*, Ser. 2, 4: 223. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1275, 1464, f. 1666. 2016.—*Ailantopsis* Gagnep., *Not. Syst.* 11: 163. 1944.—*Picroderma* Gagnep., *Not. Syst.* 11: 165. 1944.—*Trichilia* auct. non L., Bentv., *Acta Bot. Neerl.* 11: 12. 1962; T.D.Penn. & Styles, *Blumea* 22: 467. 1975.

Small shrubs or trees, dioecious, pubescent to glabrous. *Leaves* spiral, imparipinnate; leaflets opposite, except apical one, lower surface papillate. *Inflorescence* corymbose cymes; peduncles long. *Flowers* unisexual (plant dioecious) or bisexual. *Calyx* 4(5)-lobed, lobes imbricate. *Petals* 4(5), free, more or less imbricate in bud. *Stamens* 8 or 10, filament fused $\frac{1}{3}$ of the length into staminal tube, tube cylindrical, filament apex bifid. *Disk* annular. *Ovary* 2 or 3-locular, each locule with 2 ovules, stigma (2 or) 3-lobed. *Fruit* a dehiscent capsule, ovoid or ellipsoid. *Seeds* 1 (or 2), black, arillate.

2 species in E and SE Asia. 1 species in Thailand.



Figure 37. *Goniocheton lenticellatus* (C.Y.Wu) Mabb.: twig with infructescence. Drawn by Orathai Kerkaew

Heynea trijuga Roxb. ex Sims, Curtis, Bot. Mag. 41: t. 1738. 1815; Hiern in Hook.f., Fl. Brit. India 1: 565. 1875; Pierre, Fl. Forest. Cochinch. 5: t. 355 a. 1897; Ridl., Fl. Malay Penins. 1: 413. 1922; Craib, Bull. Misc. Inform. Kew 1911: 27. 1911 & Abdn. Uni. Stud. 57: 36. 1912; Fl. Siam. Enum. 1: 264. 1931; Mabb., Fl. Males., ser. I, 12(1): 41. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 240. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 223. 2013; Gardner et al., Forest Trees S. Thailand 2: 1275, 1464, f. 1666. 2016.— *Walsura trijuga* (Sims) Kurz, J. Asiat. Soc. Bengal 44(2): 148. 1875; Kurz, Forest Fl. Brit. Burma 1: 225. 1877.— *Heynea connaroides* (Wight et Arn.) Voigt, Hort. Suburb. Calc.: 136. 1845.— *W. pallida* Craib, Bull. Misc. Inform. Kew 1926: 345. 1926; Fl. Siam. 1: 262. 1926.— *Trichilia connaroides* (Wight & Arn.) Bentv., Acta Bot. Neerl. 11: 13. 1962; Mabb., Tree Fl. Malaya 4: 251. 1989; Hô, Fl. Vietnam ed. 3, 2(1): 488. 1992; Gardner et al., Forest Trees N. Thailand 123, 404, f. 237. 2000. Fig. 38. Plate CXXVII: G.

Shrubs to trees 5–20 m tall, (12–)70–80(–120) cm girth; bark pale grey or dark brown to blackish, slightly rough with brown lenticels, usually shallowly fissured, inner bark creamy to yellowish; twigs reddish or dark brown to blackish, lenticellate. *Leaves* 5–27(–50) cm long; petiole slender, 3–15 cm long, usually wrinkled and blackish at base when dry; rachis pale brown with dark brown nodes, contracted immediately above point of insertion of petiolules when dry; leaflets opposite, 3(–5) on each side of rachis, elliptic-oblong, ovate or ovate-lanceolate, 3–17 by 1.5–8 cm, apex acuminate, broadly obtuse to acute at slightly asymmetrical base, margin entire to slightly undulate, chartaceous, densely papillose below, numerous simple hairs or glabrous below, lateral veins 8–12 on each side of midrib, curved upwards, more or less anastomosing near margin, midrib and lateral veins subdepressed above, prominent below, reticulation inconspicuous; petiolules 0.5–1 cm, glabrous, articulated. *Inflorescence* 8–37 cm long, slender, erect glabrous; peduncles 5–16(–24) cm long; bracts small, caducous. *Flowers* fragrant; pedicels 1.5–2 mm long, pubescent, each with 2 small persistent bracteoles. *Calyx* ca 1 mm tall, pale pink or white, lobes ovoid, ca 0.5 mm long, apices rounded to acuminate, outside sparsely hairy, glabrescent, glabrous inside, ciliate. *Petals* ovoid or oblong, ca 3–4 by 0.7–2 mm, acute, white to pink or creamy, often hairy outside, glabrescent. *Staminal tube* cylindrical for $\frac{1}{2}$ the length of filaments, glabrous, white, filaments 8 or 10, alternately long and short, flattened with bifid apices, upper half of filaments hairy. *Anthers* 8–10, ovoid, ca 1 mm long, apiculate, subglabrous, bright yellow, inserted between teeth at apex of filament. *Disk* annular, fleshy. *Ovary* glabrous. *Infructescence* slender, erect; peduncle pinkish or red. *Capsule* ellipsoid or ovoid, 1.5–2.3 by 1.2–1.5 cm, beaked, green when young, turning yellow and ripening a vivid pink or dark red when mature. *Seeds* 1(2), ovoid, black, almost covered with thin white aril.

T h a i l a n d.—NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Phayao, Nan, Lamphun, Lampang, Uttaradit, Tak, Phitsanulok; NORTH-EASTERN: Phetchabun, Loei (Dan Sai, Hui Nam Man, Type of *Walsura pallida* Craib, *Kerr 5813*, lectotype **K**, isolectotypes **ABD**, **BK**, **BM**), Sakon Nakhon, Nakhon Phanom, Mukdahan; EASTERN: Roi Et, Ubon Ratchathani; SOUTH-WESTERN: Kanchanaburi, Ratchaburi, Phetchaburi; CENTRAL: Saraburi; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Nakhon Si Thammarat, Songkhla, Yala.

D i s t r i b u t i o n.—India, Nepal (type), China (Yunnan), Myanmar, Indo-China, Malaysia, Indonesia (type?).

E c o l o g y.—In lowland to hill evergreen forest, scrub forest, oak-pine forest, mixed deciduous or dipterocarp forest; altitude (70–)200–1,000(–1,700) m.

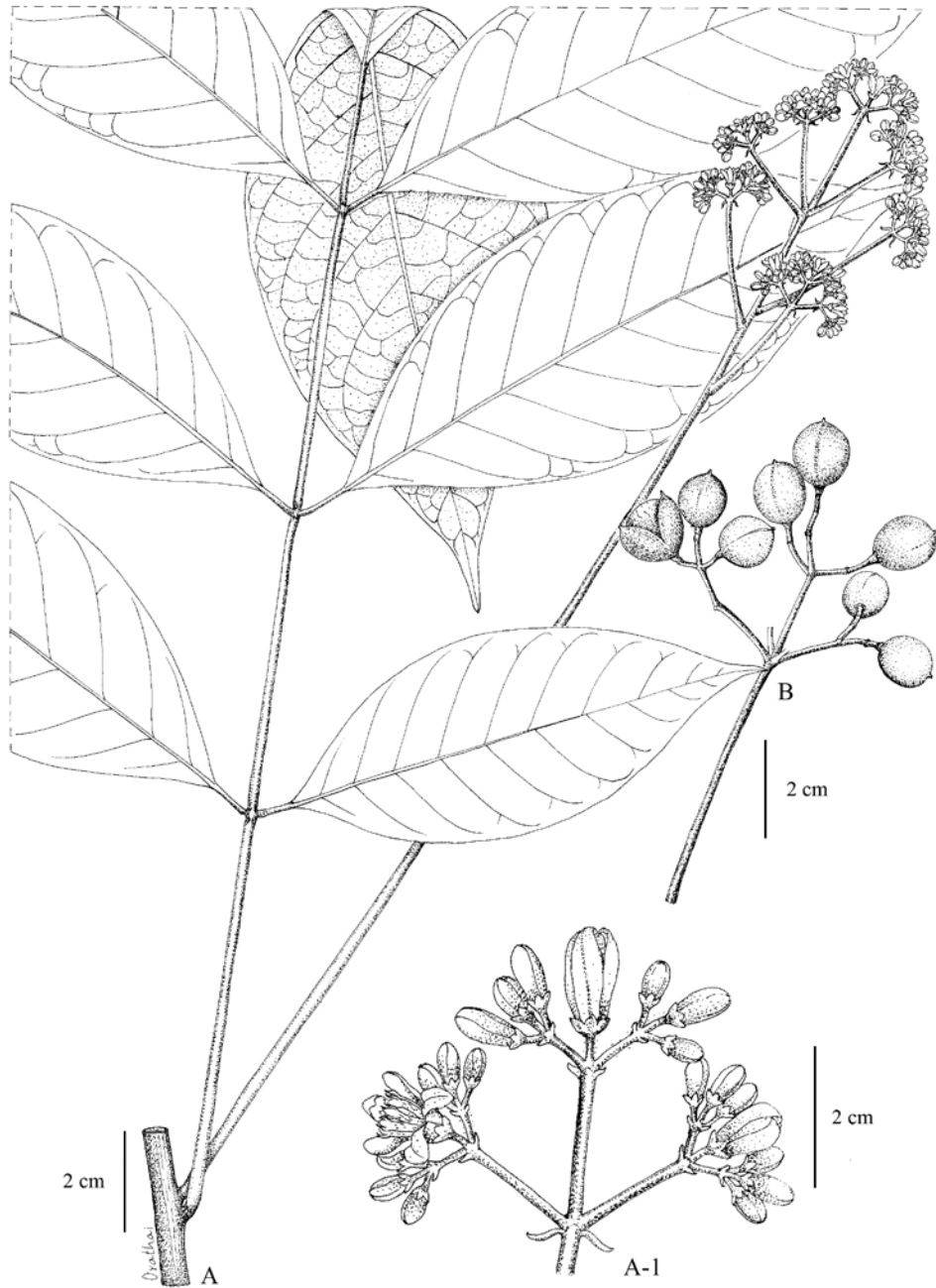


Figure 38. *Heynea trijuga* Roxb. ex Sims: A. twig with inflorescence, A-1 part of inflorescence, A-2 longitudinal section of flower, A-3 stamen (*F. Konta 10882*); B. infructescence, B-1 longitudinal section of drupe (*N. Fukuoka T-63752*). Drawn by Orathai Kerdkaew.

V e r n a c u l a r.— Chok khon (จ๊กขน)(Northern); ta pla ton (ตาปลาดั่น), nang yai (นางไย), fan noi (แฟนน้อย), chang chuet (จางจืด)(Northeastern).

U s e s.— Root taken to cure intoxication

12. KHAYA

A.Jussieu, Bull. Sci. Nat. Géol. 23: 238. 1830; Gardner et al., Forest Trees S. Thailand 2: 1276, 1464, f. 1667. 2016.

Trees, monoecious. *Leaves* spiral, paripinnate; leaflets glabrous, margin entire. *Inflorescences* axillary or subterminal. *Flowers* unisexual, well-developed vestiges of opposite sex present. *Calyx* 4- or 5-lobed almost to base, imbricate. *Petals* 4 or 5, distinct, contorted, much longer than calyx in bud. *Staminal tube* urceolate or cup-shaped. *Anthers* 8–10, inserted near apex inside of tube. *Disk* cushion-shaped. *Ovary* 4- or 5-locular, 12–16(–18) ovules per locule, stigma disciform, 4 grooves on apex. *Capsule* subglobose, woody, apically 4- or 5-valvate when mature. *Seeds* with vestigial endosperm; cotyledons flat, collateral; radicle lateral.

6 species: tropical Africa, Madagascar. 1 species (introduced) in Thailand.

Khaya senegalensis (Desrousseau) A. Jussieu, Mém. Mus. Hist. Nat. 19: 250. 1832.— *Swietenia senegalensis* Desrousseau in Lamarck, Encycl. 3: 679. 1791; Gardner et al., Forest Trees S. Thailand 2: 1276, 1464, f. 1667. 2016.

Trees to 25 m tall or more; bark exfoliating; young branches with dark greyish brown lenticels. *Leaves* 15–60 cm or more; petiole and rachis cylindrical, glabrous; leaflets 4–16 on each side of rachis, subopposite to alternate, apical 2 pairs opposite; leaflet blades basally on rachis ovate but apically on rachis oblong to elliptic, 7–17 by 3–6 cm, rounded at apex, broadly cuneate to ± rounded at slightly asymmetrical base, margin entire, lateral veins 9–14 on each side of midrib, prominent on both surfaces when dry; petiolules 5–10 mm. *Inflorescences* shorter than leaves, glabrous. *Sepals* 4, distinct, oblong, ca 1 mm. *Petals* 4, oblong to obovate, ca 3 mm, glabrous. *Staminal tube* urceolate. *Ovary* ovoid, usually 4-locular. *Capsule* subglobose, woody, septicidal from apex when mature; pericarp thick. *Seeds* ellipsoid to suborbicular, broad, margin with a round membranous wing.

T h a i l a n d.— Introduced as a street tree in Southern Thailand.

D i s t r i b u t i o n.— Tropical Africa, including Senegal (type).

E c o l o g y.— It is resistant to flooding and can be planted on swampy soils.

13. LANSIUM

Corrêa, Annuaire Mus. Nat. Hist. Nat. Paris 10: 157. 1807; T.D.Penn., Blumea 22: 483. 1975; Mabb., Tree Fl. Malaya 4: 246. 1989; Fl. Males., ser. I, 12(1): 314. 1995; in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 209. 2011; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 243. 2011; Gardner et al., Forest Trees S. Thailand 2: 1276, 1465, f. 1668. 2016.

Shrubs or trees; buttress short; young parts with simple hairs. *Leaves* spiral, paripinnate; leaflets subopposite to alternate, one of terminal pair usually the largest; petiolules pulvinate at base. *Inflorescence* ramiflorous or cauliflorous spikes, racemes or basally branching

panicles with spicate branches. *Flowers* unisexual (trees dioecious) or bisexual, the latter larger than male ones. *Calyx* deeply 5-lobed, imbricate. *Petals* 5, free, united with staminal tube in proximal third to half, imbricate in bud. *Staminal tube* globose to cup-shaped, margin more or less undulate. *Anthers* (8–)10 in one whorl, inserted inside throat of staminal tube, included. *Disk* absent. *Ovary* ovoid, 3(–5)-locular, each locule with 1(–2) ovules, style broad-columnar, its flanks ribbed with impressions of surrounding anthers. *Fruits* ovoid or obovoid; pericarp soft. *Seed* 1–5, completely with thick white fleshy aril.

3 species in SE Asia. 1 species in Thailand.

Lansium domesticum Corrêa, *Annuaire Mus. Nat. Hist. Nat. Paris* 10: 157. 1807; A.Juss., *Mém. Mus. Natl. Hist. Nat. Paris* 19: 233. 1832; Blanco, *Fl. Filip. Ed. 2*: 228. 1845; Hiern in Hook.f., *Fl. Brit. India* 1: 558. 1875; Ridl., *Fl. Malay Penins.* 1: 411. 1922; Craib, *Fl. Siam.* 1: 259. 1926; P. H. Hô & Duong, *Fl. Vietnam*: 248. 1960; Backer & Bakh.f., *Fl. Java* 2: 125. 1965; Mabb., *Blumea* 31: 141. 1985; Mabb. & Pannell, *Tree Fl. Malaya* 4: 246. 1989; Mabb., *Fl. Males.*, ser. I, 12(1): 315. 1995; T.Wongprasert et al., *Thai Forest Bull., Bot.* 39: 243. 2011; Mabb., *Fl. Penins. Malaysia, Ser. 2*, 4: 227. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1276, 1465, f. 1668. 2016.— *Aglaiia domestica* (Corrêa) Pellegr. In *Lecomte Fl. Indo-Chine* 1: 766. 1911.— *Amoora racemosa* Ridl., *J. Fed. Malay States Mus.* 10: 88. 1920; Craib, *Fl. Siam.* 1: 261. 1926. Fig. 39. Plate CXXVIII: C–D.

Trees 5–10 m tall, 40–80(–170) cm girth, sometimes flowering at 3 m; buds densely hairy; bark creamy, flaking and sticky with white latex when exposed, slightly scaling, with tubercles of old infructescences, inner bark pale cream or purplish red; sapwood whitish brown; twigs greyish pubescent, sparsely oblong and brownish lenticels. *Leaves* 5–35(–100) cm long; petiole 4–20 cm long, swollen near base, pubescent then glabrescent; leaflets (1)2–4(5) on each side of rachis, alternate or subopposite, oblong, obovate-oblong, obovate or elliptic, (4–)8–37 by (2.8–)4–17(–22) cm, apex shortly acuminate, acumen 1–1.5(–2.5) cm long, base acute to cuneate, asymmetrical, margin entire, sometimes chartaceous, usually subcoriaceous to coriaceous, dark green above, pale below, glabrous on both surfaces, midrib prominent below, subdepressed above, lateral veins 7–18 on each side of midrib, curved upwards, more or less anastomosing near margin, sharp ridged below and depressed above, reticulation subprominent, conspicuous on both surfaces, lamina sometimes bullate; petiolules 1–2 cm long, swollen near base, subglabrous. *Inflorescence* racemose, 4–20 cm long, solitary or usually in fascicles of 2–10 racemes; bracts ovate, ca 1 mm long. *Flowers* sweetly scented; pedicels 2–3 mm long. *Calyx* lobes broadly ovate, 1.5–2 by 1.5–2 mm, sparsely pubescent outside, glabrous inside, ciliate. *Petals* obovate, 1.5–2 by 1.5 mm, yellowish green to yellow, glabrous. *Staminal tube* subglabrous, margin undulate to crenate. *Anthers* 1–2 mm long, included or slightly protruding beyond margin of tube. *Ovary* 2–3 mm in diam., pubescent, style stout, densely pilose, large flat stigma protrudes just beyond anthers. *Infructescence* to 25 cm long. *Fruits* indehiscent, ellipsoid to globose, 2–3.5 by 1.5–2.5 cm, brownish or yellow; pericarp thin with sticky white latex. *Seeds* 1–5, ellipsoid, ca 13 by 7 mm, with white, thick, sweet and soft aril, including in locules in which no seed develops.

T h a i l a n d.— PENINSULAR: Chumphon, Ranong, Phangnga, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Songkhla, Pattani, Narathiwat.

D i s t r i b u t i o n.— Malaysia (type).

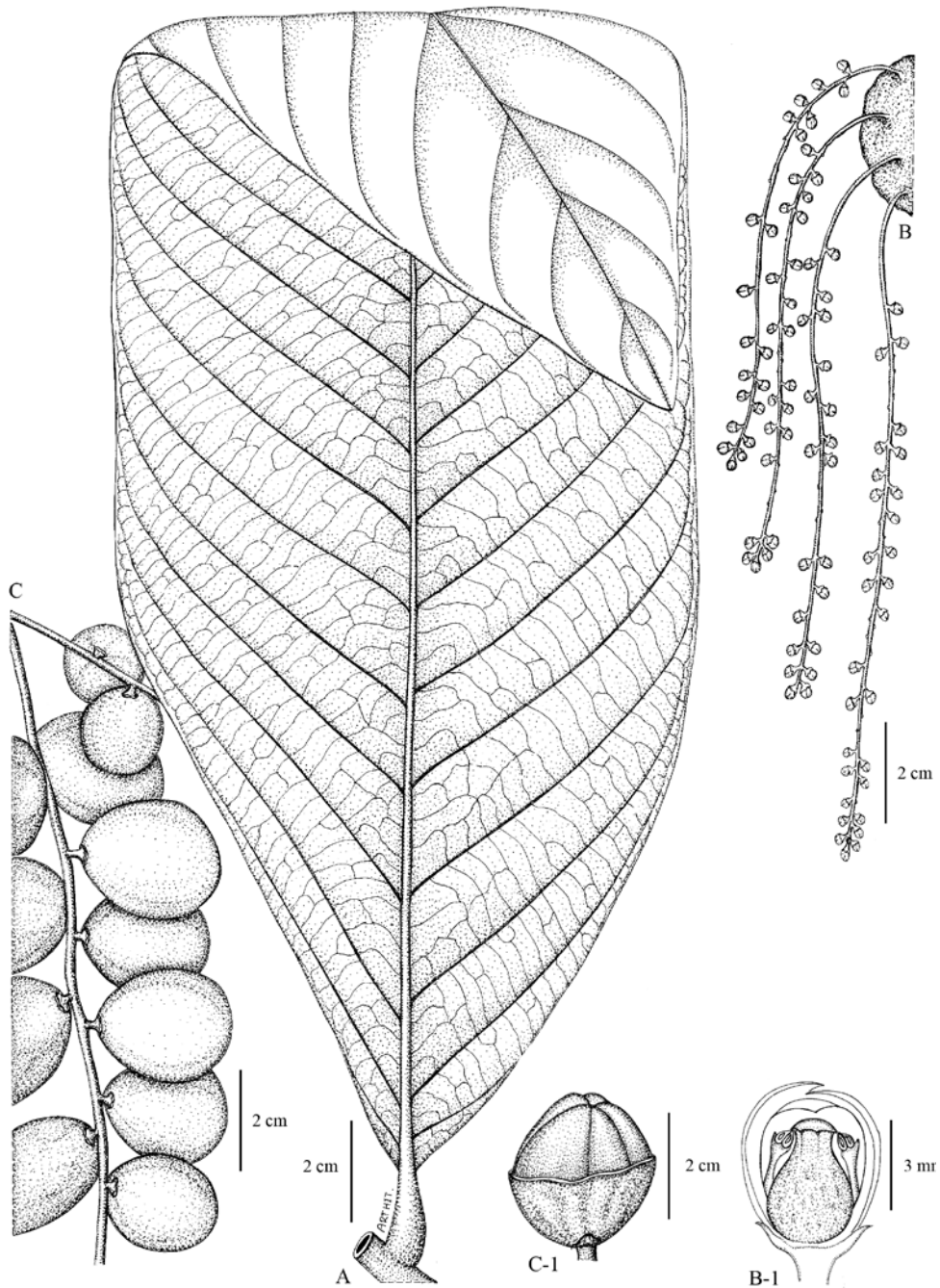


Figure 39. *Lansium domesticum* Corrêa: A. leaf; B. inflorescences, B-1 longitudinal section of flower, B-2 cross section of ovary (R. Geesink 5196); C. infructescence (J.F. Maxwell 85-513). Drawn by Arthit Khamkamnoed.

E c o l o g y.— Cultivated for its fruits throughout the peninsular and southeast of the country.

V e r n a c u l a r.— Lang sat (กลางสาต), long gong (ลองกอง), langsat pa (กลางสาตป่า) (Peninsular).

14. MELIA

L., Sp. Pl. 1: 384. 1753; Harms in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, 19 b1: 99. 1940; T.D.Penn., Blumea 22: 463. 1975; Mabb., Gard. Bull. Sing. 37: 463. 1984; Fl. Males., ser. I, 12(1): 329. 1995; in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 199. 2011; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 243. 2011; Gardner et al., Forest Trees S. Thailand 2: 1278, 1465, f. 1669. 2016.— *Azedarach* Mill., Gard. Dict., Abr. ed. 4: 170. 1754.

Trees; young parts with simple and stellate hairs. *Leaves* spiral, imparipinnate, 2(3) pinnate, opposite; leaflets opposite. *Inflorescence* an axillary thyrse. *Flowers* bisexual and male on same tree (polygamous). *Calyx* 5(6), lobed to near base, somewhat imbricate. *Petals* 5(6), free, imbricate. *Staminal tube* narrowly cylindrical, with 10(–12) longitudinal ribs, slightly expanded at mouth, 10–12 serrate lobes. *Disk* small, surrounding base of ovary. *Anthers* 10(–12), inserted at margin or within tube, alternating with or opposite lobes. *Ovary* (4–)8-locular, each locule with 2 superposed ovules, stigma capitate, with 4–8 stigmatic lobes. *Drupe* globose, 3–8-locular, endocarp thick. *Seed* 1(–2) in each locule, oblong, laterally compressed, with fleshy aril.

1 species in Thailand and throughout Indomalaysia, tropical Australia, Solomon Is. One or possibly two closely related species in south and east tropical Africa. Cultivated and naturalised in warm climates worldwide.

Melia azedarach L., Sp. Pl.: 384. 1753; Burm.f., Fl. Ind.: 101. 1767; A.Juss., Mém. Mus. Natl. Hist. Nat. Paris 19: 219. 1832; Hiern in Hook.f., Fl. Brit. India 1: 544. 1875; Pierre, Fl. Forest Cochinch. 5: t. 356B. 1897; Pellegr. in Lecomte, Fl. Indo-Chine 1: 727. 1911; Ridl., Fl. Malay Penins. 1: 384. 1922; Craib, Fl. Siam. 1: 249. 1926; Backer et Bakh.f., Fl. Java 2: 120. 1965; T.D.Penn., Blumea 22: 461. 1975; Mabb., Gard. Bull. Sing. 37: 55. 1984; Fl. Males., ser. I, 12(1): 330. 1995; Gardner et al., Forest Trees N. Thailand 115, 402, f. 221. 2000; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 244. 2011; Gardner et al., Forest Trees S. Thailand 2: 1278, 1465, f. 1669. 2016.— *M. sempervirens* (L.) Sw., Prodr. Veg. Ind. Occ.: 67. 1788; Backer & Bakh.f., Fl. Java 2: 120. 1965.— *M. dubia* Cav., Diss. 7, Septima Diss. Bot.: 364; Gardner et al., Forest Trees N. Thailand 115, 402. 2000; Hiern in Hook.f., Fl. Brit. India 1: 545. 1875; Backer & Bakh.f., Fl. Java 2: 120. 1965.— *M. composita* Willd., Sp. Pl. 2: 559. 1799; Pierre, Fl. Forest Cochinch. 5: t. 356 A. 1897; Ridl., Fl. Malay Penins. 1: 384. 1922.— *M. birmanica* Kurz, J. Asiatic Soc. Bengal 43, 2: 183. 1874.— *M. toosendan* Sieber & Zucc. in Abh. Akad. München 4,2: 159. 1843; Craib, Bull. Misc. Inform. Kew 1911: 27. 1911; Abdn. Uni. Stud. 57: 36. 1912; Fl. Siam. 1: 250. 1926; Gardner et al., Forest Trees N. Thailand 115, 402, F. 219. 2000. Fig. 40. Plate CXXVIII: E–F.

Trees (3–)10–25(–40) m tall, 60–180 cm girth; bark grey to brown, ca 1 cm thick, finely longitudinal fissured, with sparse light brown lenticels, inner bark yellowish; heartwood brown; twigs brown, sparsely stellate hairy; buds oblong, densely brownish stellate hairy. *Leaves* 15–80 cm long, imparipinnate, 2(3)-pinnate; leaflets 3–9 on each side of rachis; petiole 5–10 cm long, densely or sparsely stellate hairy, glabrescent, paired

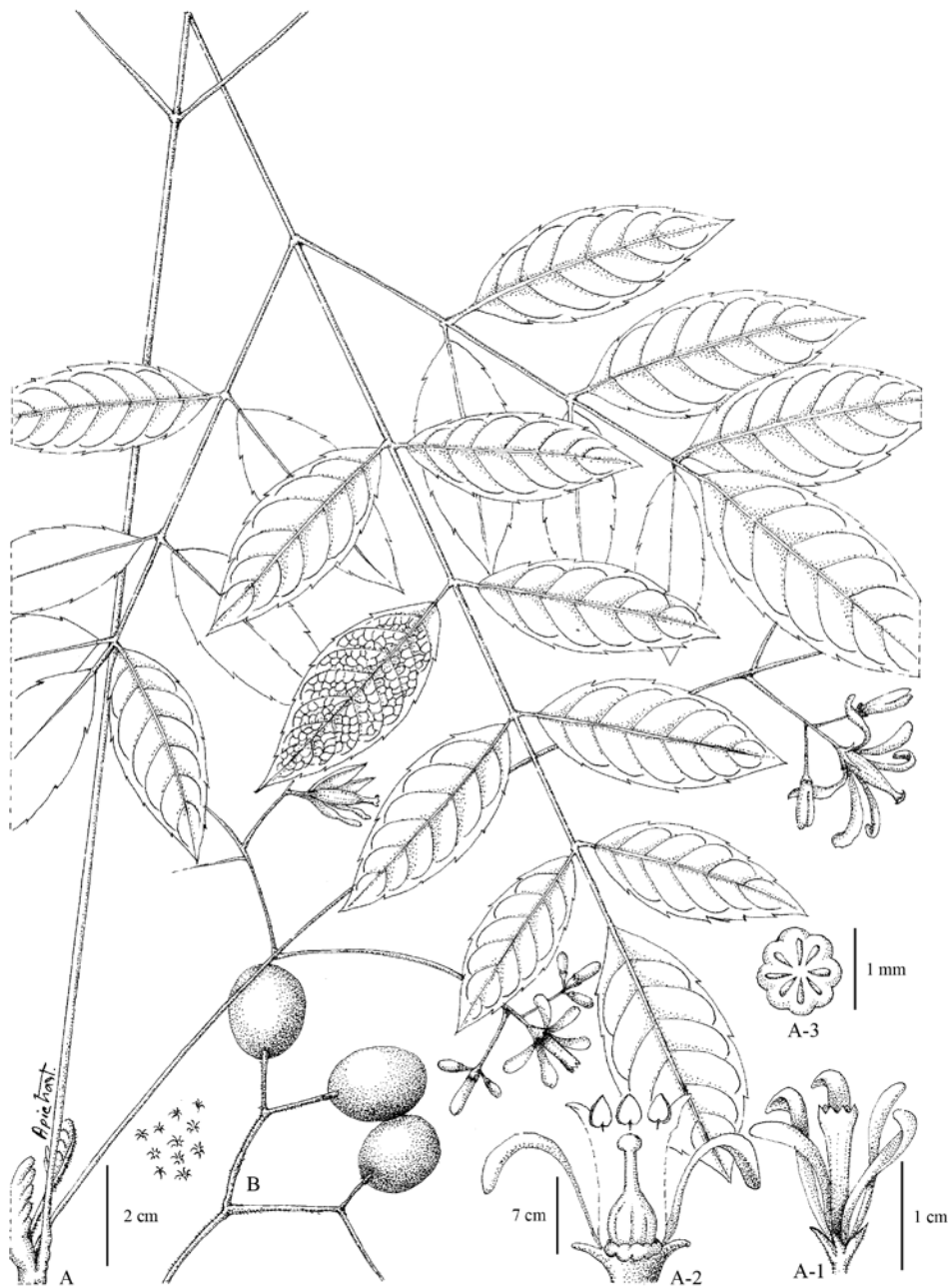


Figure 40. *Melia azedarach* L.: A. twig with inflorescences, A-1 flower, A-2 stamens & ovary, A-3 cross section of ovary (C. Phengkhai 10801); B. infructescence (R. Pooma 2418). Drawn by Apichart Ropsri.

orbicular glands at base (field character). *Leaflets* elliptic, obovate to ovate-oblong, 2–6 by 1–2.5 cm, apex acute to acuminate or caudate, base obtuse-cuneate, asymmetrically, margin entire to irregularly serrate, midrib subdepressed above, prominent below, lateral veins 5–10 on each side of midrib, conspicuous below, reticulation inconspicuous; petiolules 3–7 mm long. *Inflorescence* to 30 cm long, greenish; all parts with stellate hairs; bracts filiform, 3–10 mm long, bracteoles smaller. *Flower buds* oblong or tubular, 0.5–1 cm long; pedicels 2–3 mm long. *Calyx* lobes lanceolate or ovate, ca 2 by 0.5 mm, hairy outside, margin ciliate. *Petals* spatulate or oblanceolate, ca 15 by 2 mm, whitish purple to light purple or pale lilac, simple and stellate hairy outside, glabrous inside, midvein conspicuous. *Staminal tube* purple, subglabrous outside, densely simple hairy inside, lobes bifid, or 4-fid. *Anthers* green or yellowish, ca 1.5 mm, apiculate, more or less hairy, inserted opposite lobes. *Disk* obscure. *Ovary* ovoid, green, with 8 shallow longitudinal grooves, style cylindrical, greenish, stigma discoid, lobed, ca 0.7 mm diam., yellowish. *Infructescence* axillary or in axis of upper leaf-scars. *Drupes* oblong, globose or broadly ellipsoid, 1.5–2.5 by 1.5–2.5 cm, glabrous, dull green, yellow brown when ripe; pedicel ca 0.5 cm, glabrous; locules 3–6, endocarps fused to form a stone, ellipsoid, 1.5–2 by 1–1.5 cm, with 6–8 longitudinal grooves, flesh thin, yellowish white.

T h a i l a n d.— Native and cultivated throughout the country.

D i s t r i b u t i o n.— North America, Africa, India (type), Indo-China, Malesia, to tropical Australia.

E c o l o g y.— Seasonal forests, bamboo thickets; altitude to 1,200 m.

V e r n a c u l a r.— Lian (เลี่ยน)(General).

U s e s.— Cultivated as an ornamental plant. It is a fast-growing tree in forest plantations throughout the country.

15. MUNRONIA

Wight, Ic. 1,5: [1]. 1838; Harms in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, 19b1: 91. 1940; T.D.Penn., Blumea 22: 452. 1975. Mabb., Fl. Males., ser. I, 12(1): 30. 1995; in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 201 f. 37. 2011; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 244. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 229. 2013.— *Philastrea* Pierre, Bull. Mens. Soc. Linn. Paris 1: 475. 1885.

Small shrubs, sometimes a suffrutex with suckers of short-lived shoots on a woody rootstock; all parts with simple, 2-armed or stellate hairs or a mixture of these. *Leaves* simple to imparipinnate, leaves and leaflets often crenate to serrate. *Flowers* solitary or in few-flowered thyrses, axillary, bisexual, usually white; pseudopedicellate. *Calyx* 5-lobed to near base, lobes somewhat leaf-like. *Petals* 5, valvate or imbricate, adnate to staminal tube basally. *Staminal tube* narrowly cylindrical or subobconical, margin 10 entire or bilobed appendages. *Anthers* 10, sparsely pubescent, inserted on tube margin, alternating with appendages, connective apically forming a filiform appendage. *Disk* conspicuous. *Ovary* (3 or) 5-locular, each locule with (1)2 ovules, stigma capitate. *Capsule* obconical, dehiscent into 5 longitudinal locules. *Seeds* 2 in each locule.

About 5 species restricted to tropical Asia and subtropical China, 2 of them extending into Malesia, from Peninsular Malaysia eastwards to Timor. 2 species in Thailand.

KEY TO THE SPECIES

1. Leaves simple
1. Leaves imparipinnate

1. *M. humilis*
2. *M. pinnata*

1. *Munronia humilis* (Blanco) Harms, Ber. Deutsch. Bot. Ges. 35: 80. 1917; Pellegr. in Lecomte, Fl. Indo-Chine, Suppl. 1: 688. 1946; Mabb., Fl. Males., ser. I, 12(1): 32, 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 244. 2011.— *Plagianthus humilis* Blanco, Fl. Filip.: 526. 1837.— *Turraea humilis* (Blanco) Merr., Philipp. Govt. Lab. Bur. Bull. 27: 30. 1905; Craib, Fl. Siam. 1: 248. 1926; Backer & Bakh.f., Fl. Java 2: 119. 1965.— *T. pumila* Benn., Pl. Jav. Rar.: 183. 1840; C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 440. 1878. Fig. 41. Plate CXXIX: A.

Suffrutex 15–40 cm tall, rootstock up to 20 cm long, usually unbranched; apical bud cylindrical, 1–1.5 by 0.5 mm, densely simple and/or stellate hairs; stems densely pubescent then glabrescent; heartwood white or yellowish white;. *Leaves* simple, elliptic, elliptic-oblong or obovate, 3–8 by 1.5–3.5(–4) cm, apex acuminate, acute to broadly acute, base acute to attenuate, margin serrate or undulate, papery, sparsely appressed hairy above, appressed simple and stellate hairy below, glabrescent except along veins on both surfaces, green above, pale green below, midrib finely simple hairy below, sometimes stellate hairs interspersed, pinkish when dry, subdepressed with simple and stellate hairs above, lateral veins 4–7 on each side of midrib, conspicuous on both surfaces, reticulation inconspicuous; petiole slender, 0.5–1.5 cm long, densely simple and stellate hairy, glabrescent. *Inflorescence* 1–1.5 cm long; buds oblong, 1–1.5 cm long, simple and/or stellate hairy; bracts and bracteoles 0.5–1 mm long, subulate, caducous; pseudopedicels 6–9 mm long. *Calyx* lobes lanceolate, ca 0.5 cm long, densely hairy, glabrescent. *Petals* salverform, 3–4 cm long, pale green to white, sparsely hairy outside. *Staminal tube* white, 10 filiform appendages reflexed, curved outward at tips to form a subapical ruff. *Anthers* orange, inserted at apex of tube and exposed in a ring. *Disk* inconspicuous. *Ovary* obconical, ca 1 by 1 mm, hairy, 5-locular, each locule with 2 ovules, style narrowly cylindrical, 5–7 cm long, glabrous, stigma just protruding beyond anthers. *Capsules* obconical, ca 1 by 0.8 cm, hairy. *Seed* plano-convex, ca 5 by 3 mm, with a sarcotesta covering adaxial surface of seed.

T h a i l a n d.— NORTHERN: Mae Hong Son, Chiang Mai, Lamphun, Lampang, Uttaradit, Tak; NORTH-EASTERN: Phetchabun, Loei, Khon Kaen; EASTERN: Chaiyaphum, Nakhon Ratchasima; SOUTH-WESTERN: Kanchanaburi, Ratchaburi.

D i s t r i b u t i o n.— Myanmar, Philippines (type).

E c o l o g y.— On limestone bedrock, near streams, in evergreen or mixed deciduous forest; altitude (20–)100–500(–800) m.

2. *Munronia pinnata* (Wall.) Theob. in Mason, Burma., ed. 4, 2: 581. 1883; Harms, Ber. Deutsch. Bot. Ges. 35: 78. 1917; Whitmore, Enum. Fl. Pl. Nepal 2: 85. 1979; B. C. Stone, Malayan Nat. J. 37: 189. 1984; Mabb., Tree Fl. Malaya 4: 202. 1989; Fl. Males., ser. I, 12(1): 30. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 245. 2011; Mabb. Fl. Penins. Malaysia, Ser. 2, 4: 232. 2013.— *Turraea pinnata* Wall., Pl. Asiat. Rar. 2: 21. 1830.— *Munronia wallichii* Wight, 3.1: 147. 1840; Hiern in Hook.f., Fl. Brit. India 1: 543. 1875.— *M. javanica* Benn., Pl. Jav. Rar.: 176. 1840; C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 448. 1878; Backer & Bakh.f., Fl. Java 2: 119. 1965. Fig. 42.

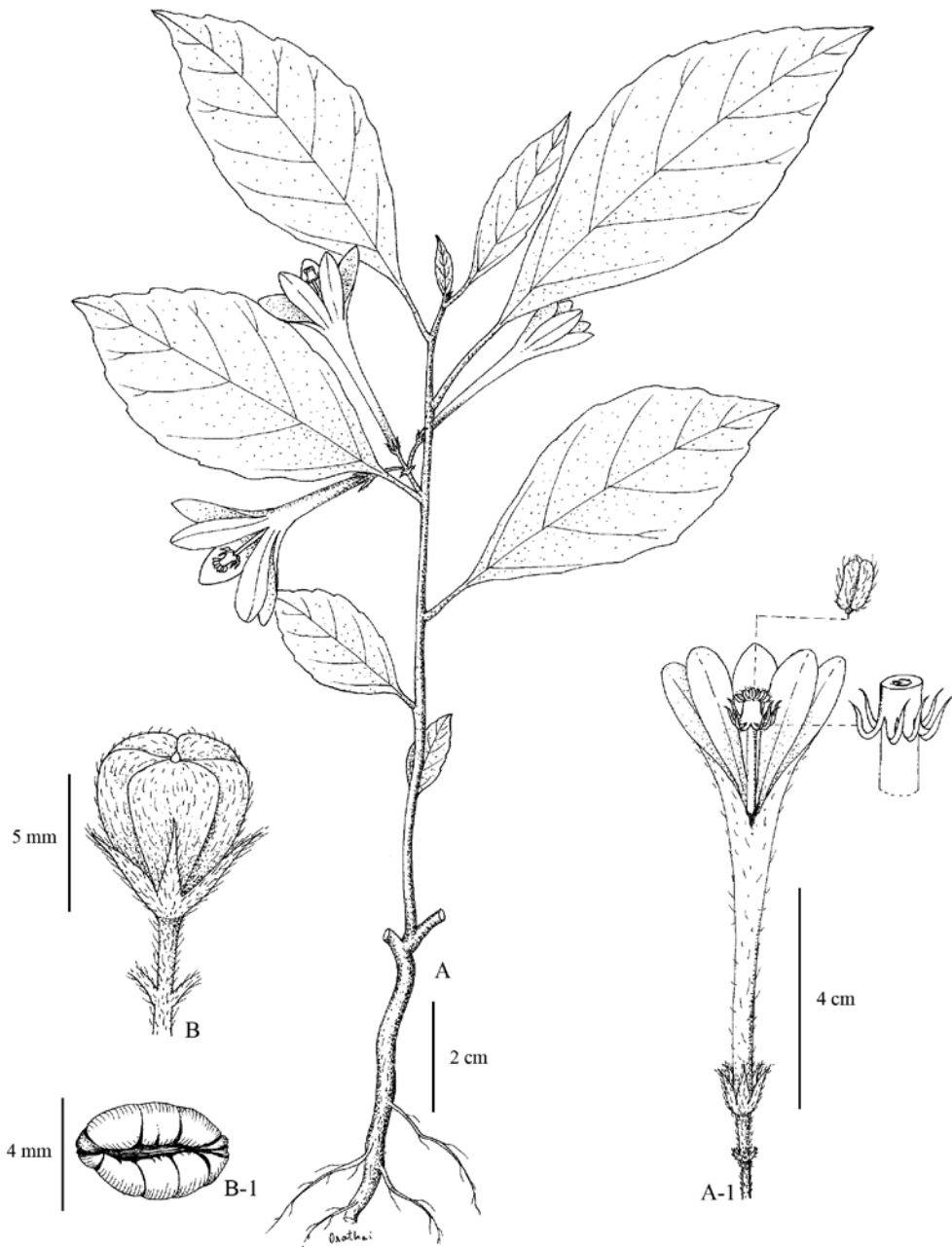


Figure 41. *Munronia humilis* (Blanco) Harms: A. habit, A-1 flower (*Th. Wongprasert 075-2*); B. capsule, B-1 seed (*Th. Wongprasert 075-2*). Drawn by Orathai Kerdkaew.

Undershrubs 15–40 cm tall, 1–1.5 cm girth; taproot stout, thicker than stem or some branchlets; densely mixture of simple, bifid and stellate hairs, glabrescent; bark smooth, brownish, sparsely lenticellate; heartwood brownish. *Leaves* imparipinnate, 5–15 cm long, rachis hairy; petiole 1.5–6 cm long, hairy; leaflets 1–4 on each side of rachis, opposite, except the upper pair, ovate to obovate or subrhomboidal, 1–8 by 1–4.5 cm, oval to orbicular, apical one the largest, apex acute, base cuneate or obtuse, asymmetrical, margin entire, to more or less lobed or serrate on upper half, sometimes apical leaflet 3-lobed, chartaceous to subcoriaceous, glabrous above, sparsely hairy below, glabrescent except along midrib and lateral veins, midrib distinct below, conspicuous or subdepressed above, lateral veins 3–5 on each side of midrib, inconspicuous above, conspicuous below, reticulation inconspicuous; petiolules 0.1–1.5 cm, hairy. *Inflorescence* 1.5–2.5 cm long; buds oblong, 1–1.5 cm long, with simple or stellate hairs; bracts 0.5–2.5 mm long, subulate, densely hairy. *Flowers*: pedicels 1–2 mm long, densely hairy; pseudopedicels ca 5 mm long, hairy. *Calyx* lobes lanceolate or linear, 3–7 mm long, hairy outside, glabrous inside. *Petals* white, adnate to staminal tube 1.7–2 cm, lobes oblong or oblanceolate, 1–2 cm long, sparsely hairy outside, midvein conspicuous. *Staminal tube* ca 3 cm long, free for apical 6–10 mm, hairy inside, margin with 10 entire lobes reflexed at anthesis. *Anthers* yellow-brown, short apical appendices. *Disk* conical, 2–3 mm tall, hairy. *Ovary* obconical, ca 1 by 1 mm, hairy, style 5–7 cm long, glabrous except at base, stigma protruding beyond anthers, yellow-brown. *Capsule* depressed globose, ca 1 by 1 cm, strongly 5-ribbed, sparsely stellate hairy. *Seed* ca 5 by 3 mm, with a sarcotesta covering the adaxial surface of seed.

T h a i l a n d.— NORTHERN: Chiang Mai, Phayao; NORTH-EASTERN: Loei; SOUTH-WESTERN: Kanchanaburi, Ratchaburi, Prachuap Khiri Khan.

D i s t r i b u t i o n.— Sri Lanka, India (type), Myanmar, Malaysia, Indonesia.

E c o l o g y.— In dry evergreen forest, bamboo forest; altitude 200–700 m.

V e r n a c u l a r.— Kradueng piak (กระดังเพี้ยก), saribat (สาริบาท)(Southwestern).

N o t e.— All parts of the plant *Munronia pinnata* are used in Ayurvedic medicine as a substitute for chiretta (*Swertia* spp., Gentianaceae) in the treatment of fevers, dysentery, leprosy and other skin diseases.

16. PRASOXYLON

M.Roem., Fam. Nat. Syn. Monogr. 1: 83, 101. 1846. Holzmeyer et al., Taxon 70(6): 1266. 2021.— *Dysoxylum* sect. *Prasoxylon* (M.Roem.) Miq. in Ann. Mus. Bot. Lugduno-Batavi 4: 9. 1868.— *Alliaria* Rumpf ex Kuntze, Rev. Gen. Pl. 1: 108. 1891, *nom. illeg.*, non Heister ex Fabr. 1759 (Cruciferae).

Trees or shrubs, usually dioecious, hairs simple or two-armed; bud scales absent, apical buds with fist-shaped young leaves; when fresh, foliage and seeds of most species with a strong smell of garlic. *Leaves* spiral, paripinnate, rarely imparipinnate, occasionally with tardily developed apical leaflets; leaflets alternate, subopposite or opposite. *Inflorescence* a compound thyrse; axillary or supra-axillary. *Flowers* unisexual or bisexual. *Calyx* 3–5 (or 6), free or united near base. *Petals* 3–6, free or adnate to base of staminal tube, valvate. *Staminal tube* cylindrical to urceolate, margin entire or with 6–10 (–16) lobes. *Anthers* 6–10, within throat of staminal tube. *Disk* free, tubular, sometimes short or even subannular,

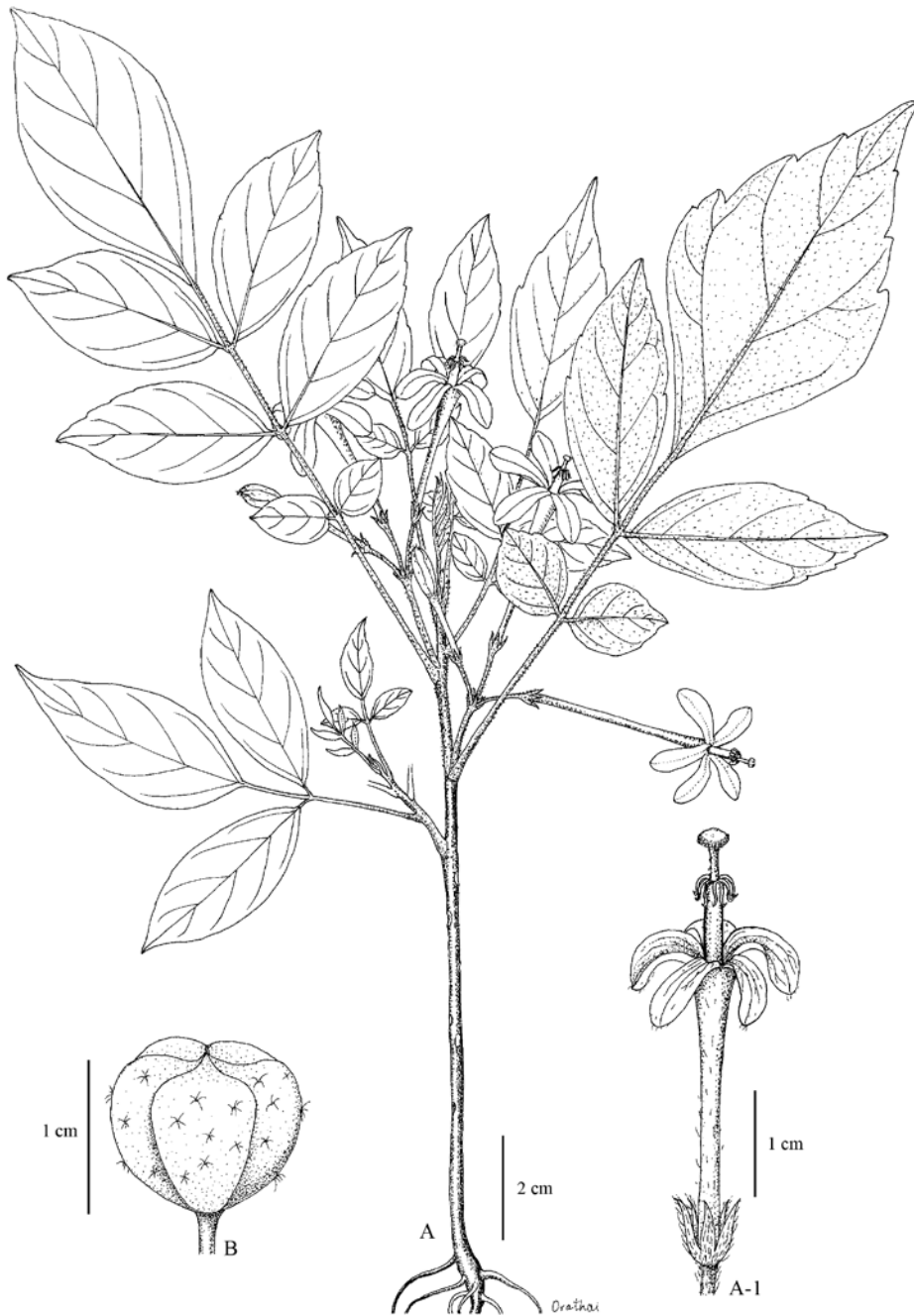


Figure 42. *Munronia pinnata* (Wall.) Theob.: A. habit with inflorescences, A-1 flower (*S. Indrapong 108*); B. capsule (*J.F. Maxwell 87-893*). Drawn by Orathai Kerdkaw.

margin sometimes lobed. *Ovary* 2–6-locular, each locule with 1 or 2 ovules, stigma capitate to discoid. *Fruit* capsular, 2–6 valves, each valve with 1 or 2 seeds. *Seeds* usually with fleshy aril or sarcotesta.

7 species from Sri Lanka to China and the Solomon Islands. 2 species in Thailand.

KEY TO THE SPECIES

- | | |
|---|-------------------------------|
| 1. Flowers 11–15 by 3.5–7 mm, densely appressed simple and 2-armed hairs on corolla and calyx outside | 2. <i>P. excelsum</i> |
| 1. Flowers 6–12 by ca 3 mm, glabrous or nearly so on corolla and calyx outside | 1. <i>P. alliaceum</i> |

1. *Prasoxylon alliaceum* (Blume) M.Roem., Fam. Nat. Syn. Monogr.: 101. 1846. Holzmeier et al., Taxon 70(6): 1266. 2021.— *Dysoxylum alliaceum* (Blume) Blume ex A.Juss. in Mém. Mus. Hist. Nat. 19: 225. 1832, Blume, Bijdr.: 172. 1825; Miq., Fl. Ned. Ind., Suppl. 1,2: 536. 1859; Backer & Bakh.f., Fl. Java 2: 123. 1965; Mabb., Tree Fl. Malaya 4: 240. 1989; Fl. Males., ser. I, 12(1): 106. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 237. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 193. 2013; Gardner et al., Forest Trees S. Thailand 2: 1265, 1462, f. 1655. 2016.— *Guarea alliacea* Blume in Flora 7(1): 290.— *Hartighsea costulata* Miq., Fl. Ind. Bat. 1, 2: 505. 1859.— *Dysoxylum costulatum* (Miq.) Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 21. 1868; Hiern Hook.f., Fl. Brit. Ind. 1: 546. 1875; King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 43. 1895; Ridl., Fl. Malay Penins. 1: 394. 1922.— *D. brevipes* Hiern in Hook.f., Fl. Brit. India 1: 546. 1875.— *D. pulchrum* Ridl., J. Straits Branch Roy. Asiat. Soc. 75: 17. 1917, Fl. Malay Penins. 1: 395. 1922. Fig. 43.

Shrubs to trees (3–)20–30(–38) m tall, (25–)100–200 cm girth, sometimes flowering at 3 m; bark grey or brown, finely fissured, creamy lenticellate, inner bark reddish brown, yellow to dark orange or brown; heartwood reddish brown; twigs few to numerous pale simple hairs. *Leaves* paripinnate (occasionally imparipinnate), 20–90(–120) cm long, usually smelling of garlic when crushed; petioles 5–13(–15) cm long, sparsely hairy, glabrescent; leaflets 2–5(–8) on each side of rachis, alternate, elliptic-oblong, oblong-lanceolate to lanceolate, 5–25 by 3–7 cm, apex acuminate, base asymmetrical, rounded or cuneate, margin entire, chartaceous to subcoriaceous, faintly pitted on both surfaces, glabrous on both surfaces or very few appressed simple hairs below, midrib prominent below, depressed above, lateral veins 7–12(–14) on each side of midrib, curved upwards near margin, not anastomosing, sometimes with shorter laterals in between, depressed above, ridged below, reticulation faintly visible below, not scalariform; petiolules 0.5–1 cm, glabrous. *Inflorescence* 10–20(–40) cm long; peduncles 1–15 cm long, sparsely pubescent; bracts and bracteoles narrowly triangular, ca 2 by 1 mm, caducous. *Flowers* sweetly scented. *Calyx* shallowly cup-shaped, 2.5–3 mm diam., divided to about $\frac{2}{3}$ into 4 lobes, glabrous or with occasional hairs outside, glabrous inside; pseudopedicel 0.5–1 mm. *Petals* 4 or 5, oblanceolate, 5–12 by 1–3 mm, free or adnate to staminal tube at base, glabrous or with occasional hairs both sides, pink or white. *Staminal tube* tubular, 5–6 by 2 mm, a few long wavy hairs in upper part outside, scattered or densely inside, margin subtruncate, undulate or 8(–10) denticulate lobes. *Anthers* 8(–10), ca 0.8 by 0.2 mm, inserted at bases of sinuses of lobes, included or just protruding. *Disk* 1–1.2 mm long, truncate to obscurely lobed, sparsely hairy outside, hairy in upper half inside, densely hairy along inner margin. *Ovary* ovoid, 1.2–1.5 by 1 mm, numerous long simple

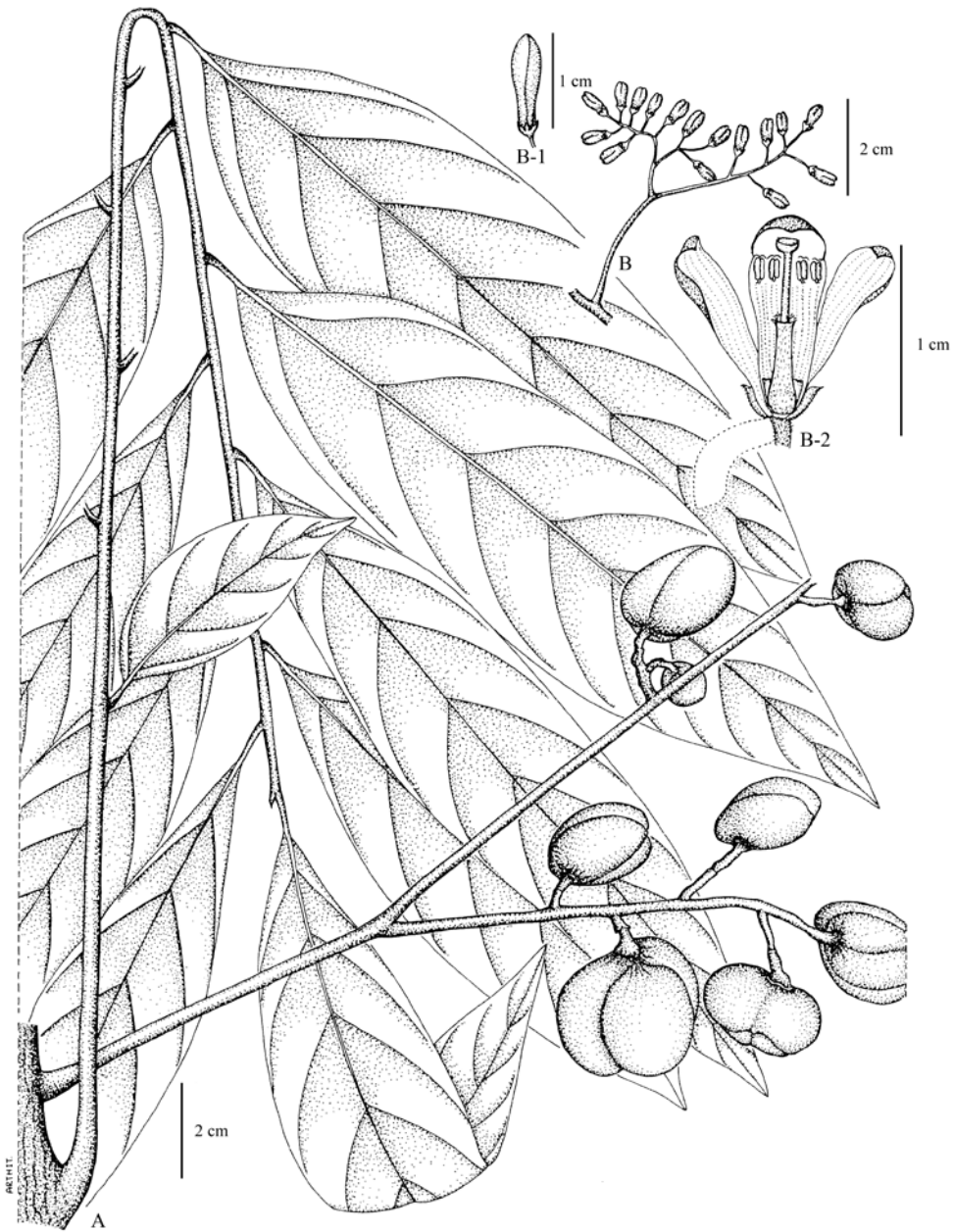


Figure 43. *Prasoxylon alliaceum* (Blume) M. Roem.: A. twig with infructescences (*S. Phusomsaeng 234*); B. part of inflorescence, B-1 flower bud, B-2 longitudinal section of flower (*Elmer 10736*). Drawn by Arthit Khamkamnoed.

hairs, 3 (or 4)-locular, each locule with (1 or) 2 ovules, style 2.5–6 mm long terete, hairy, stigma ca 0.4 by 1 mm, discoid, glabrous, minutely papillose above, just protruding beyond aperture of staminal tube; pedicels 2–5 mm long. *Infructescence* 13–25 by ca 9 cm, erect or pendulous; peduncle 2.3–3 cm. *Capsule* subglobose or depressed globose, 2–3.5 by 1.3–5 cm, dehiscent into 3(4) locules, with 2–4 prominent longitudinal lobes where pericarp dries moulded around seeds, sometimes with a beak, greenish white when unripe, pink, reddish or yellowish brown outside, white inside when ripe, black when dry, glabrous; pedicels 8–12 mm. *Seeds* 1–4 per fruit, oblong-globose, with a red or white aril, smelling of garlic, producing white latex when cut.

T h a i l a n d.— SOUTH-WESTERN: Phetchaburi; PENINSULAR: Ranong, Surat Thani, Phangnga, Nakhon Si Thammarat, Trang, Narathiwat.

D i s t r i b u t i o n.— Myanmar, Vietnam, Malaysia, Indonesia (type), Philippines, Australia.

E c o l o g y.— Tropical evergreen to dry or hill evergreen forest, usually near streams; altitude (200–)700–1,100(–1,700) m.

V e r n a c u l a r.— Ta suea khao (ตาเสือขาว)(Peninsular).

2. *Prasoxylon excelsum* (Spreng.) Mabb. in Holzmeyer et al., *Taxon* 70(6): 1266. 2021.— *Trichilia excelsa* Spreng., *Syst. Veg.* 4(2): 252. 1827.— *Dysoxylum excelsum* (Spreng.) Blume ex G. Don, *Gen. Hist.* 1: 683. 1831, Blume, *Bijdr.*: 176. 1825; Backer & Bakh.f., *Fl. Java* 2: 124. 1965; Mabb., *Tree Fl. Malaya* 4: 244. 1989; *Fl. Males.*, ser. I, 12(1): 109. 1995; Gardner et al., *Forest Trees N. Thailand* 116, 403, f. 224. 2000; T. Wongprasert et al., *Bot.* 39: 239. 2011; Mabb., *Fl. Penins. Malaysia*, Ser. 2, 4: 210. 2013 Gardner et al., *Forest Trees S. Thailand* 2: 1271, 1463, f. 1662. 2016.— *D. procerum* Hiern in Hook.f., *Fl. Brit. India* 1: 547. 1875; Pellegr. in Lecomte, *Fl. Indo-Chine* 1: 744, t. 81, f. 6–11. 1911; Craib, *Fl. Siam.* 1: 252. 1926.(illeg.).— *D. turbinatum* King, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist* 64: 43. 1895; Ridl., *Fl. Malay Penins.* 1: 394. 1922.— *D. microbotrys* King, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 64: 48. 1895.— *D. macrothyrsum* Miq. var. *microbotrys* (King) Ridl., *Fl. Malay Penins.* 1: 394. 1922.— *D. macrothyrsum* auct. non Miq. Ridl., *Fl. Malay Penins.* 1: 394. 1922. Fig. 44. Plate CXXIX: B–C.

Trees 10–20(–35) m tall, 30–100 cm girth, sometimes fruiting at 2 m; bark smooth, brown, slightly flaking, lenticellate, inner bark reddish brown; sapwood white; heartwood brownish red; twigs lenticellate, pubescent when young. *Leaves* (7–)15–40(–90) cm long, paripinnate with a terminal scar; petiole 5–15 cm, pubescent; leaflets (2)3–5 (or 6) on each side of rachis, opposite or alternate, oblong, elliptic or ovate, 5–33 by 3–13 cm, apex acute or acuminate to 13 mm long, rounded or cuneate at slightly asymmetrical base, subcoriaceous, glabrous above, brown when dry, few to numerous long wavy simple and 2-armed hairs on and near midrib and lateral veins below, midrib and lateral veins strongly prominent below, flat to subdepressed above, lateral veins 6–15 on each side of midrib, curved upwards near margin, anastomosing, reticulation faintly scalariform below; petiolules 0.3–1 cm long, densely hairy, glabrescent, grooved when dry. *Inflorescence* (8–)15 to 40(–100) cm long, axillary or supra-axillary near end of twigs; peduncles 0.5–15 cm long, hairy; bracteoles triangular, ca 2 by 1 mm, hairy. *Flowers* sweetly scented, 8–15 by 3.5–7(–15 mm at anthesis when petals reflexed); pedicels 1–2 mm long hairy, articulated with pseudopedicels to 3 mm long. *Calyx* shallowly cup-shaped, 1–3 by 4–5.5 mm diam., pinkish, numerous appressed



Figure 44. *Prasoxylon excelsum* (Spreng.) Mabb.: A. twig with inflorescences, A-1 & A-2 flowers, A-3 longitudinal section of flower (Th. Wongprasert 082-28); B. infructescence (T. Santisuk 286). Drawn by Orathai Kerkaew.

simple and 2-armed hairs outside, glabrous inside, divided into 4 (or 5) rounded or acute lobes. *Petals* 4 (or 5), linear-oblong, 8–11 by ca 2.5 mm, white or yellowish white, sometimes adnate to staminal tube for lower $\frac{1}{3}$, densely appressed simple and 2-armed hairs outside, glabrous inside. *Staminal tube* 5–12 by 2–4 mm, a few simple or 2-armed hairs outside, glabrous or with many simple or 2-armed hairs inside, margin 8(–16) crenate lobes. *Anthers* 8(–10), ellipsoid, 1–2 by 0.3–0.5 mm, inserted at bases of sinuses between lobes, included. *Disk* cupuliform, (3.5–)5.5–6 by (1–)1.5–4 mm, up to half as long as staminal tube, margin with 8(–12) shallow, sometimes bifid lobes, glabrous or hairy only at base or in upper $\frac{1}{3}$ outside, inside densely simple or 2-armed hairs, protruding above margin. *Ovary* ovoid, 1.5–3 by 1–2.5 mm, hairy, (3)4-locular, each locule with 1 or 2 ovules, style 8–13 mm, hairy, stigma discoid to subcapitate, 0.3–0.5 by 0.5–1 mm; pedicels 1–8 mm, simple and 2-armed hairs. *Infructescence* 10–20 cm long, barely branched. *Capsule* depressed obovoid, 3–6 by 3–5.5 cm, often with a stipe, usually with 3 or 4 lobes, woody, glabrous, dehiscent in (3)4 longitudinal parts, orange or brown when ripe. *Seeds* 1–4, subreniform, ca 2.5 by 1.5 cm, testa bright-red, hilum white.

Thailand.—NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Nan, Lamphun, Tak; NORTH-EASTERN: Phetchabun; EASTERN: Chaiyaphum; SOUTH-WESTERN: Kanchanaburi, Ratchaburi; CENTRAL: Nakhon Nayok; SOUTH-EASTERN: Chon Buri, Rayong, Chanthaburi, Trat; PENINSULAR: Ranong, Phangnga, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Yala, Narathiwat.

Distribution.—Sri Lanka, Nepal, India, China, Myanmar, Indo-China, Malaysia, Indonesia (type), Philippines, New Guinea, Solomon Islands.

Ecology.—Evergreen forest, near streams; altitude (10–)100–700(–900) m.

Vernacular.—Ta suea (ตาสื่อ)(Northern); sang khriat (สังเคี๋ยด)(Peninsular).

17. PSEUDOCLOUSENA

T.P.Clark, *Blumea* 38: 291. 1994; Clark, *Fl. Males.*, ser. I, 12(1): 55. 1995; Mabb. in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 10: 202. 2011; T.Wongprasert et al., *Thai Forest Bull.*, Bot. 39: 245. 2011; Mabb., *Fl. Penins. Malaysia*, Ser. 2, 4: 234. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1279, 1466, f. 1670. 2016.

Trees, pubescent to glabrous. *Leaves* spiral, imparipinnate; rachis not swollen at insertion of leaflets; leaflets opposite, without papillae. *Inflorescence* axillary near ends of twigs. *Flowers* female or male. *Calyx* deeply 5-lobed. *Petals* 5, free, imbricate. *Staminal tube* short, more or less cylindric, free filaments flattened with a bifid apex. *Disk* absent. *Ovary* 4(–5)-locular, each locule with 1 ovule. *Fruit* ovoid, indehiscent, asymmetric with a short beak. *Seeds* 1 or 2, ellipsoid, without aril.

A monotypic genus, with the 1 morphologically variable species distributed from Thailand to Irian Jaya.

Pseudoclausena chrysogyne (Miq.) T.P.Clark, *Blumea* 38: 291, f. 20, 21: 1994; *Fl. Males.*, ser. I, 12(1): 55. 1995; T.Wongprasert et al., *Thai Forest Bull.*, Bot. 39: 245. 2011; Mabb., *Fl. Penins. Malaysia*, Ser. 2, 4: 234. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1279, 1466, f. 1670. 2016.—*Clausena chrysogyne* Miq., *Fl. Ned. Ind.*, Suppl. 1: 502. 1861.—

Walsura chrysogyne (Miq.) Bakh.f., *Blumea* 16: 359. 1968.— *W. multijuga* King, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 64: 83. 1895; *Ridl., Fl. Malay Penins.* 1: 412. 1922; *Craib, Fl. Siam.* 1: 262. 1926. Fig. 45.

Tree 10–25 m tall; bark brown, smooth, inner bark pink with dark stripes; sapwood whitish with red or pink tinge; twigs glabrous or with simple hairs, sometimes sparsely lenticellate. *Leaves* 10–22 cm long; petiole 2.5–10 cm long; leaflets (1)2(3) on each side of rachis, elliptic, ovate-lanceolate or obovate, (3.5–)7–15(–19.5) by (1.5–)2.5–5.5(–6.8) cm, apex acuminate, cuneate at base, slightly asymmetrical, margin entire or slightly undulate, chartaceous, midrib prominent and ridged below when dry, lateral veins 6–8 on each side of midrib, curved upwards near margin, not anastomosing, reticulation not conspicuous below; petiolules 0.5–1 cm long, except uppermost up to 3(–4) cm long. *Inflorescence* in axils of upper leaf scars near ends of twigs, 1–10(–20) cm long, peduncle, rachis and branches with few to numerous hairs. *Flowers* female or male, fragrant; buds cylindrical to barrel-shaped, 3–3.6 by 1.4–2.6 mm. *Calyx* 1–1.8 mm long, divided to 0.8–1.2 mm into 5 rounded lobes, glabrous. *Petals* 5, obovate, oblanceolate or narrowly elliptic-oblong, 2–4.8 by 1–1.8 mm, glabrous, free, imbricate in bud. *Staminal tube* short, 1.5–3.3 by 0.9–1.8 mm, tubular for $\frac{1}{4}$ to $\frac{1}{2}$ the length, free part of filaments flattened, glabrous or hairy, forked at tip, anther inserted between the teeth. *Anthers* 0.4–0.5 mm long. *Ovary* 4 or 5-locular, densely hairy, style 0.4–0.6 mm long, glabrous, stigma subcapitate, shallowly 2-lobed. *Fruit* a 1- or 2-seeded berry, subglobose, ca 1.3–2.3 cm diam., short beak, 3–5 mm long, positioned asymmetrically on fruit; pericarp coriaceous, brown tomentose, ripening yellow. *Seed* ellipsoid, 0.8–1.3 cm long, testa dark brown and shining, lacking an aril.

T h a i l a n d.— NORTHERN: Chiang Mai; NORTH-EASTERN: Phetchabun; SOUTH-WESTERN: Uthai Thani; PENINSULAR: Ranong, Surat Thani, Phangnga, Songkhla, Narathiwat.

D i s t r i b u t i o n.— Malaysia, Indonesia (type), Philippines.

E c o l o g y.— Evergreen forest; altitude 500–1,400(–1,650) m.

18. REINWARDTIODENDRON

Koord., *Meded. Lands Plantentuin* 19: 389 (1898)19: 389. 1898; Pennington & Styles, *Blumea* 22: 486. 1975; Mabb., *Mal. For.* 42: 451. 1982; *Blumea* 31: 144. 1985; *Tree. Fl. Malaya* 4: 247. 1989; *Fl. Malesiana* 1, 12(1): 322. 1995; *Pl. Book*, 3rd ed.:730. 2008; *Tree Fl. Sabah & Sarawak* 6: 184. 2007; in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 10: 209. 2011; *PROSEA* 5, 3: 490. 1998; Gardner et al., *Forest Trees S. Thailand* 2: 1280, 1466, f. 1671. 2016.— *Lansium* Corrêa sect. *Neolansium* Harms, *Nat. Pflanzenfam.* ed. 2, 19b: 124. 1940.— *Aglaiia* Lour. sect. *Lansium* (Corrêa) Kosterm., *Reinwardtia* 7, 3: 221. 1966, *nom. illeg.*, p.p.

Trees, simple hairs; bud scales absent. *Leaves* spirals, pinnate or trifoliolate; leaflets alternate, most distal on one side appearing terminal; petiolules often swollen; domatia frequently present. *Inflorescences* axillary spikes or basally branched panicles of spikes. *Flowers* bisexual, yellow. *Calyx* deeply 5-lobed, lobes orbicular, imbricate. *Petals* 5, free from each other, united with staminal tube at base. *Staminal tube* globose to ovoid, undulate to toothed margin. *Anthers* 10, in 2 whorls of 5, upper ones partly protruding, lower ones larger, alternating with upper ones, completely included, their connectives extended to form a short acute appendage. *Disk* nectary absent. *Ovary* 5-locular, each locule with one ovule, stigma sessile capitate, obscurely lobed. *Fruits* 1–5-seeded berry. *Seeds* apparently sarcotestal.

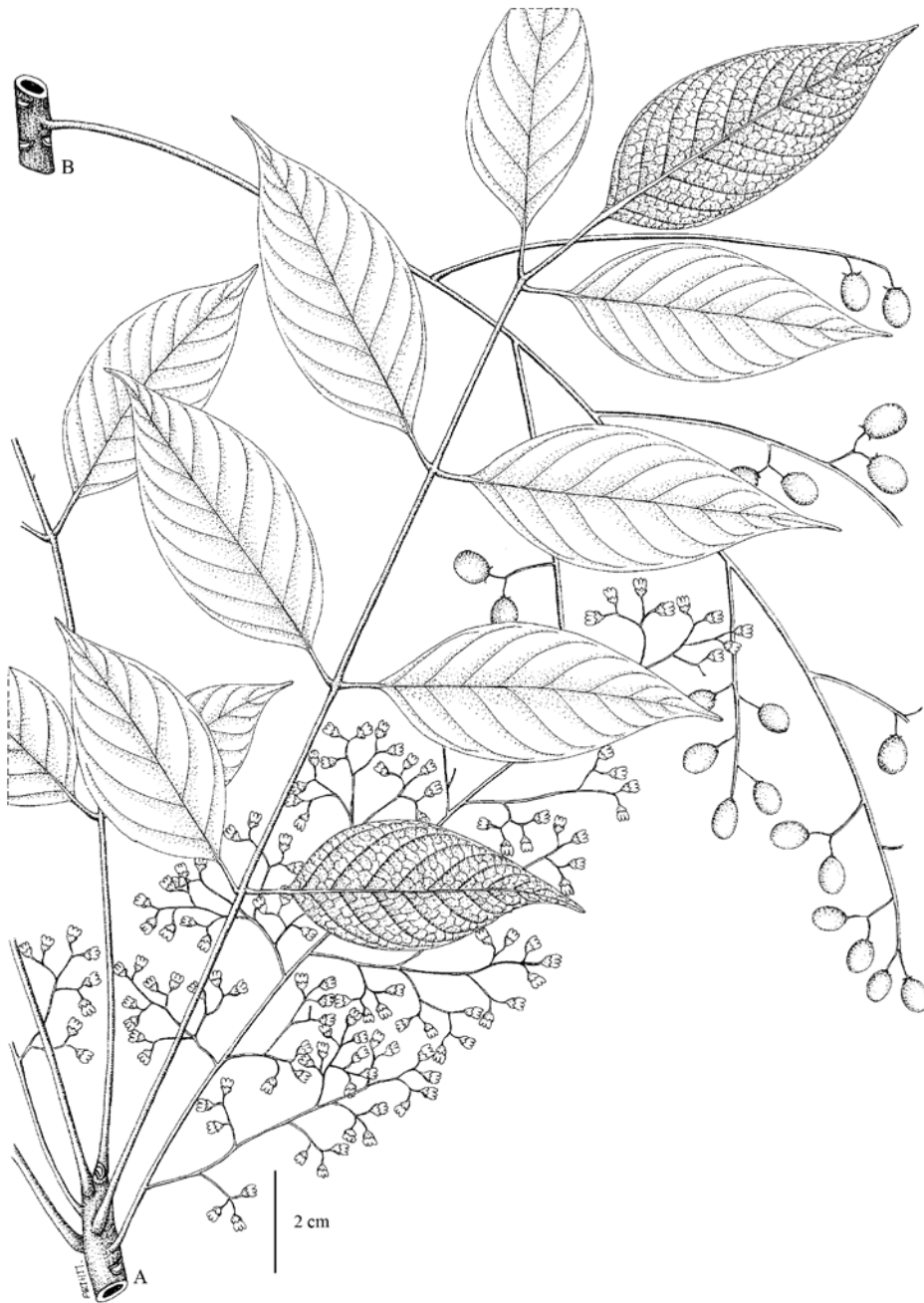


Figure 45. *Pseudoclausena chrysogyne* (Miq.) T.P.Clark.: A. twig with inflorescences, B-1 longitudinal section of flower (*Th. Wongprasert 083-25*); B. infructescence, B-1 longitudinal section of fruit (*W. Nanakorn 4106*). Drawn by Arthit Khamkamnoed.

Probably 7 species restricted to Indo-Malesia, from India (Western Ghats) to Irian Jaya. 1 species in Thailand.

Reinwardtiidendron humile (Hassk.) Mabb. Mal. For. 45: 452. 1982; Blumea 31:145. 1985; Tree Fl. Malaya 4: 249. 1989; Mabb. & Pannell, Fl. Malesiana 1, 12: 326. 1995; Mabb., Tree Fl. Sabah & Sarawak 6: 187, fig. 27. 2007; Rueangr. et al., Thai For. Bull., Bot. 43: 79. 2015; Gardner et al., Forest Trees S. Thailand 2: 1280, 1466, f. 1671. 2016.—*Lansium humile* Hassk., Retzia, ed. nov. 1 (1858) 121, Back. & Bakh. f., Fl. Java 2: 125: 1965. Fig. 46.

Trees to 27 m tall, to 40 cm diam. girth, flowering when small, fluted at base; buttresses to 4 m tall, to 5 m out; bark smooth with scaly patches, fawn, inner bark yellow to reddish brown; sapwood yellowish; twigs subglabrous except minutely pubescent apices, dark brown when dry. *Leaves* 10–25 cm long; petioles 2–4 cm long; leaflets 2 or 3 on each side of rachis, elliptic to elliptic-obovate or oblanceolate, 6–15 by 1.8–5 cm, apex acuminate, acumen to 1.5 cm long, base weakly asymmetrical, cuneate, chartaceous to subcoriaceous, more or less glabrous, lateral veins not clearly distinct from intermediary ones, particularly on leaflet above, together some 20–30 on each side of midrib, parallel, straight, forming an angle of about 60° to midrib, curved upwards, anastomosing near margin, subprominent on both surfaces, sparse appressed simple hairs on midrib below; petiolules 4–6 mm long. *Inflorescences* clustered near apices of twigs, racemes or panicles, to 15 cm long; peduncles very sparsely hairy; bracts ca 2 mm long, acute, usually with a pair of smaller bracteoles, all sparsely pubescent. *Flower* 3–4 by 3–4 mm. *Calyx* shallowly cup-shaped, 1–3 by 1–3 mm, divided into 5 rounded or ovate ciliate lobes. *Petals* 5, 2.5 by 2 mm, yellow, glabrous. *Staminal tube* obovoid, 1.5–5 by 1.5–2.5 mm, aperture 1.5–2 mm in diam. *Anthers* 10, in two whorls of 5, ca 1.1 by 0.3 mm and 1.5 by 0.5 mm, upper whorl protruding and filling aperture, hairs on both surfaces in longitudinal lines and tufts. *Ovary* ovoid, ca 1 by 1 mm, with 5 longitudinal lobes, 5 loculi, densely hairy, stigma ovoid, ca 0.3 by 0.3 mm, sessile, glabrous. *Fruit* subglobose or obovoid, especially when immature, 2–2.5(–3.6) cm diam., to 5 cm diam. when fresh, with an apical depression, sometimes with 5 ridges, densely short simple hairs, ripening yellow-green. *Seed* 1, white, sweet-tasting aril.

T h a i l a n d.— SOUTH-EASTERN: Phetchaburi; PENINSULAR: Phangnga, Songkhla, Narathiwat, Surat Thani.

D i s t r i b u t i o n.— S. China (Hainan), Indo-China, Sumatra (type), Peninsular Malaysia, Java, Borneo, the Philippines and Sulawesi.

E c o l o g y.— Lowland primary dipterocarp forest; altitude to 680 m.

19. SANDORICUM

Cav., Diss. 7, Septima Diss. Bot.: 359. 1789; Harms in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, 19 b1: 170. 1940; T.D. Penn., Blumea 22: 507. 1975; Mabb., Blumea 31: 146. 1985; Fl. Males., ser. I, 12(1): 344. 1995; in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 200. 2011; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 245. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 241. 2013; Gardner et al., Forest Trees S. Thailand 2: 1281, 1466, f. 1674. 2016.

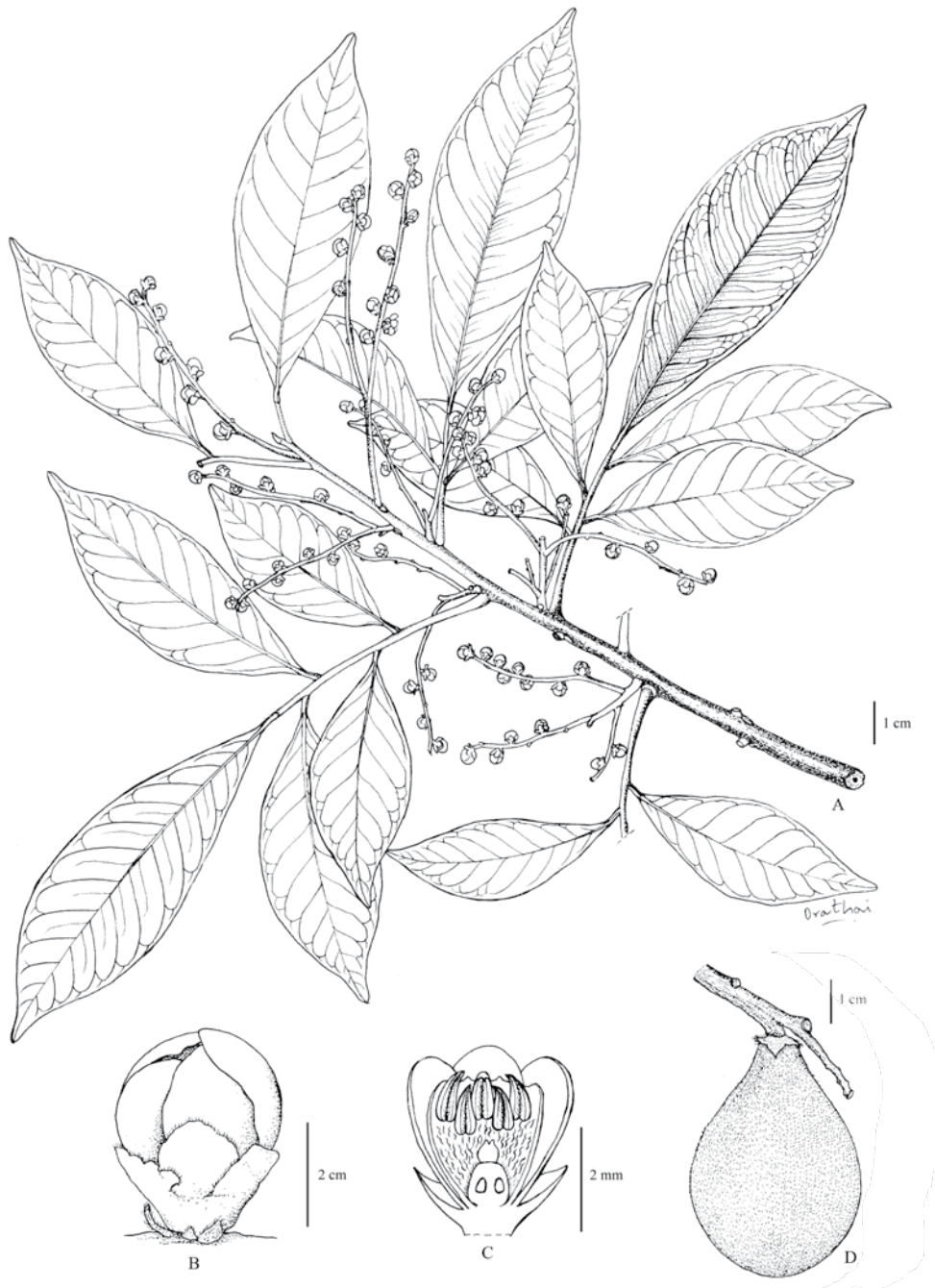


Figure 46. *Reinwardtiodendron humile* (Hassk.) Mabb.: A. leaves and infl orescences; B. flower bud; C. flower longitudinal section of male flower; D. fruit. Drawn by Orathai Kerdkaew.

Trees, hermaphrodite, subglabrous to fulvous tomentose. *Leaves* spiral, trifoliolate. *Inflorescence* a compound thyrse, axillary. *Calyx* united to $\frac{1}{2}$ way, 4–5-lobed. *Petals* (4 or)5, free, imbricate in bud. *Staminal tube* cylindrical or slightly urceolate. *Anthers* (8–)10, in one whorl, inserted near margin of staminal tube, included. *Disk* tubular, free, membranous, margin irregularly laciniate. *Ovary* (4–)5-locular, each locule with 2 ovules, stigma 4–5-lobed. *Drupe* ovoid or obovoid, 1–5-locular, pyrenes 1(or 2)-seeded; outer mesocarp rather dry-fleshy or soft and fibrous, inner mesocarp fleshy or spongy-fibrous, endocarp thin, cartilaginous. *Seeds* kidney-shaped, laterally compressed, thin sarcotesta.

5 species, 4 of which are restricted to W. Malesia. *Sandoricum koetjape* is probably native eastwards to New Guinea. 2 species in Thailand.

KEY TO THE SPECIES

1. Leaflets obovate, apex rounded or emarginate, glabrous on both surfaces. Thyrses up to 6 cm long. Petals glabrous on both sides. Stigma sometimes protruding beyond margin of staminal tube. Fruits obovoid, more or less curved to one side, ca 2.5 cm diam. **1. *S. beccarianum***
1. Leaflets ovate, apex acuminate, pubescent especially below. Thyrses more than 10 cm long. Petals pubescent outside. Stigma at about same level as margin of staminal tube. Fruits globose or depressed-subglobose, 5–8 cm diam. **2. *S. koetjape***

1. *Sandoricum beccarianum* Baill., *Adansonia* 11: 264. 1874; Mabb., *Blumea* 31: 151. 1985; *Tree Fl. Malaya* 4: 249. 1989; *Fl. Males.*, ser. I, 12(1): 353. 1995; T.Wongprasert et al., *Thai Forest Bull.*, Bot. 39: 247. 2011; Mabb., *Fl. Penins. Malaysia*, Ser. 2, 4: 242. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1281, 1467. 2016.— *S. emarginatum* Hiern in Hook.f., *Fl. Brit. India* 1: 264. 1875; Ridl., *Fl. Malay Penins.* 1: 385. 1922; Burkill, *Dict. Econ. Prod. Malay Penins.*: 1946. 1935; Corner, *Gard. Bull. Singapore*, Suppl. 1: 77, 86, 89. 1978. Fig. 47.

Trees 20–35 m tall, 80–150 cm girth; bark brown or reddish brown, many horizontal lenticels, minutely cracked to deeply fissured, inner bark reddish brown, to 1 cm thick; sapwood whitish to brownish; heartwood pink to reddish brown; twigs with minute appressed simple hairs, few pale lenticels. *Leaves* 10–25 cm long; petiole 2.5–6.5 cm long, glabrous, flattened adaxially at base; leaflets obovate, 4–12(–14) by 2.5–7(–9) cm, apex emarginate or rounded (young leaf of seedling usually acuminate), acute to subcuneate at base, margin entire or slightly undulate, more or less recurved, coriaceous, glabrous on both surfaces or minutely hairy on midrib below, midrib prominent below, depressed above, lateral veins 6–8 on each side of midrib, curved upwards near margin, more or less anastomosing, reticulation inconspicuous; petiolules 3.5–10 cm long, glabrous, apical one longer. *Inflorescence* 1–5.5 cm long, produced both with new leaves and in axils of fallen leaves near twig apices; bracts narrowly triangular, ca 1 mm long, caducous. *Flowers* with bracteoles narrowly triangular, ca 0.5 mm, minutely pubescent; pedicels 4–6 mm long, hairy, articulated with a pseudopedicel, ca 1 mm long. *Calyx* shallowly cup-shaped, 2–2.5 mm tall, minutely hairy, red-brown, margin truncate to irregular (4 or) 5-lobed, ca $\frac{1}{2}$ of the length, margins ciliate. *Petals* 4–5, oblanceolate, 3–7 by ca 2.5 mm, yellowish green to white, glabrous. *Staminal tube* fleshy, long, deeply (8–)10-ribbed, (8–)10 emarginate lobes. *Anthers* (8–)10, ca 1 mm long, apiculate, inserted opposite lobes. *Disk* cup-shaped, 0.5–2 mm tall, membranous, glabrous, margin irregularly laciniate. *Ovary* ovoid, glabrous, style cylindrical, up to 2 mm

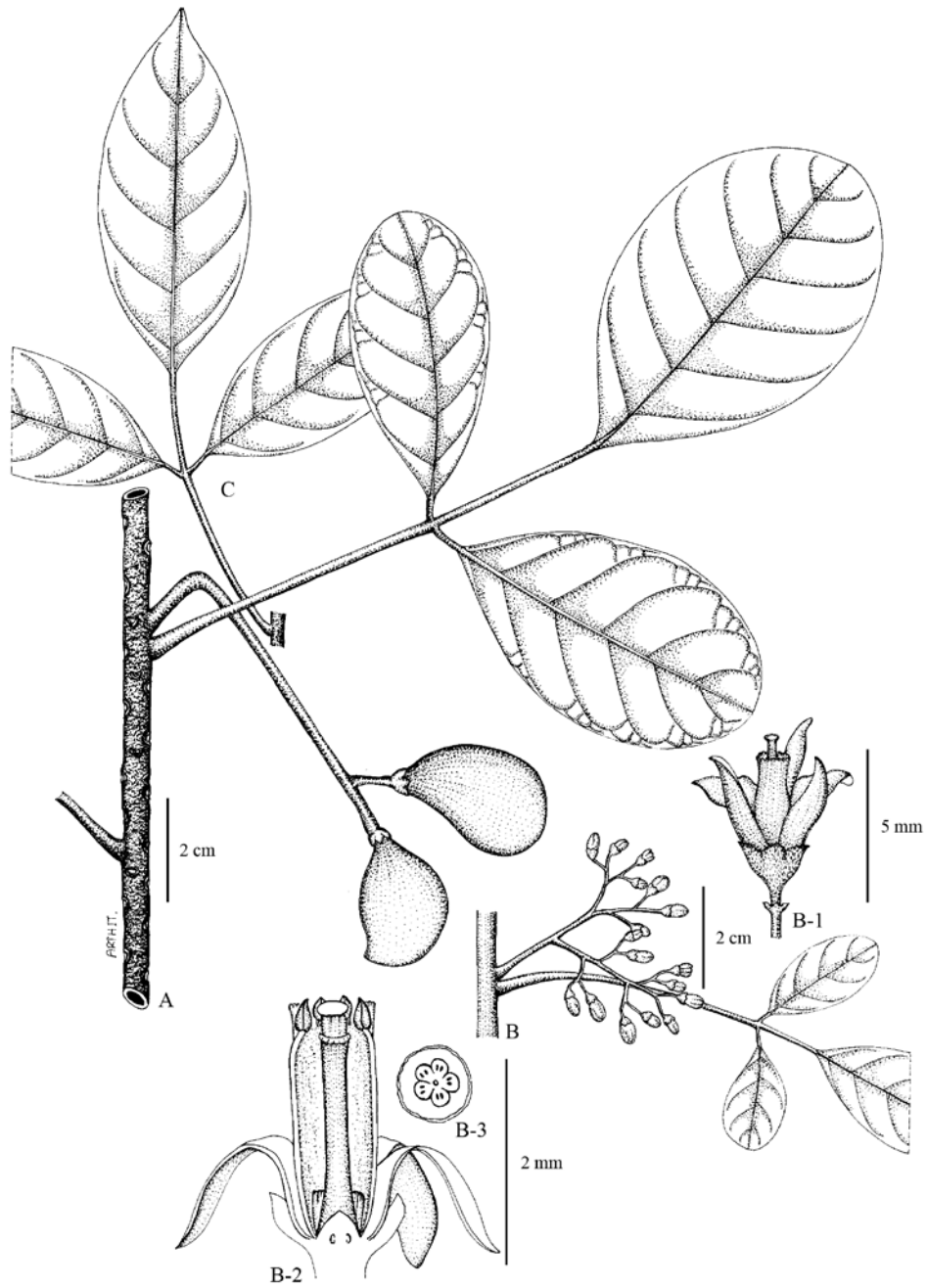


Figure 47. *Sandoricum beccarianum* Baill.: A. twig with infructescence; B. inflorescences, B-1 flower, B-2 longitudinal section of flower, B-3 cross section of ovary (*W. Heijer 2382*); C. another form of leaf (*C. Niyomdham 841*). Drawn by Arthit Khamkamnoed.

long, stigma protruding or not. *Infructescence* with peduncles 3–6 cm long, subglabrous; fruit-stalk 0.5–1 cm long. *Fruits* obovoid or ovoid, 2.5–3 by 1.5–2.5 cm, stipe to 5 mm long, usually curved to one side, densely minutely hairy, glabrescent, pinkish yellow ripening red or orange red; pericarp with white latex. *Seeds* 2, ca 2 by 1 cm, sometimes with a third mesocarp present, without seed.

T h a i l a n d.— PENINSULAR: Narathiwat.

D i s t r i b u t i o n.— Malaysia, Indonesia (type), Singapore.

E c o l o g y.— In peat swamp forest; altitude 0–10 m.

V e r n a c u l a r.— Sathon nok (สะท้อนนก), sathon phru (สะท้อนพรุ), sato burong (สะโตบุร้ง)(Peninsular).

2. *Sandoricum koetjape* (Burm.f.) Merr., Philipp. J. Sc., Bot. 7: 237. 1912; Fl. Manila: 274. 1912; Backer & Bakh.f., Fl. Java 2: 121. 1965; Mabb., Tree Fl. Malaya 4: 249, f. 8B. 1989; Fl. Males., ser. I, 12(1): 345. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 247. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 244. 2013; Gardner et al., Forest Trees S. Thailand 2: 1281, 1466, f. 1673. 2016.— *Melia koetjape* Burm.f., Fl. Ind. 101. 1768.— *S. indicum* Cav., Diss.: 359, t 202, 203. 1789; Hiern in Hook.f., Fl. Brit. India 1: 553. 1875; Kurz, Forest Fl. Brit. Burma 1: 217. 1877; Pierre, Fl. Forest Cochinch. 5: t. 353A. 1897; Ridl., Fl. Malay Penins. 1: 385. 1922; Craib, Fl. Siam. 1: 353. 1926.— *S. nervosum* Blume, Bijdr.: 163. 1825; Ridl., Fl. Malay Penins. 1: 385. 1922; Craib, Fl. Siam. 1: 254. 1926.— *S. maingayi* Hiern in Hook.f., Fl. Brit. India 1: 554. 1875; Ridl., Fl. Malay Penins. 1: 385. 1922. Fig. 48. Plate CXXIX: D.

Trees 8–30(–45) m tall, 80–200(–250) cm girth; buttresses up to 3 m tall; bark pale pinkish brown, finely fissured, lenticellate to peeling in round flakes, inner bark reddish brown to dark brown, ca 3 cm thick; sapwood yellowish; heartwood pink or reddish; twigs brown, short patent simple hairs numerous to densely covering stems, glabrescent, distinct petiole scars. *Leaves* 15–40 cm long; petiole 8–12 cm long, hairy, flattened or winged adaxially towards more or less swollen base; leaflets broadly ovate, (8–)15–18(–25) by (5–)8–12(–15) cm, apical one always bigger, apex acute to acuminate, acumen less than 1.5 cm long, base obtuse to broadly obtuse, more or less asymmetrical on lateral leaflets, margin entire, coriaceous, numerous patent simple hairs along midrib above, more densely so below, lateral veins below and lower leaflet surface with few to numerous patent simple hairs, midrib prominent below, depressed above, lateral veins 7–15 on each side of midrib, curved upwards, anastomosing near margin, conspicuous on both surfaces, reticulation visible below; petiolules 4–9 mm long on lateral leaflets, 3–6 cm long on apical ones, hairy. *Inflorescence* 2.5–24 cm long, axillary near end of twigs, densely hairy; bracts narrowly oblong, 1–7 by 0.5–2 mm, densely pubescent, caducous. *Flowers* fragrant; bracteoles somewhat smaller than bracts, subopposite, densely hairy; pedicels 2–5 mm long; articulated with pseudopedicels, 1–1.5 cm long, pubescent. *Calyx* deeply cup-shaped, 2–3.5 mm, irregularly 5-lobed, barely or up to ½ of the length, pubescent outside, margin ciliate, yellow-green. *Petals* linear-lanceolate to oblanceolate, 4–9 by 1–2 mm, white, greenish white to orange when mature, hairy outside, reflexed at anthesis, apex rounded to emarginate. *Staminal tube* to 5 mm tall, (8–)10 longitudinal ribs, obtuse to bifid lobes at their apices. *Anthers* (8 or)10, narrowly oblong or ovoid, 1–1.5 mm long, apiculate, more-or-less in 2 whorls, slightly protruding.



Figure 48. *Sandoricum koetjape* (Burm.f.) Merr.: A. twig with inflorescences, A-1 flower (B. Sangkachand 3165); B. drupe, B-1 drupe with seeds (Th. Wongprasert 086-27). Drawn by Orathai Kerdkaw.

Disk membranous, cup-shaped, ca 1.5 mm tall, glabrous, margin irregularly lacinate. *Ovary* ovoid, glabrous, style cylindrical, up to 4 mm long, stigma just protruding beyond anthers. *Infructescence* with peduncles, 5–10 cm long. *Fruits* depressed globose, 5–8 cm diam., velvety hairy, yellow or brownish when ripe, smooth to longitudinally wrinkled; pericarp with milky latex, mesocarp white, juicy, sweet to sour, endocarp tough. *Seeds* (4)5, 2–3.5 by 1–2 by 1–2 cm.

T h a i l a n d.— NORTHERN: Mae Hong Son, Chiang Mai, Chiang Rai, Phayao, Nan, Lampang, Phrae, Tak, Sukhothai, Phitsanulok; NORTH-EASTERN: Phetchabun, Loei, Buengkan, Sakon Nakhon; EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Uthai Thani, Kanchanaburi, Phetchaburi, Prachuap Khiri Khan; CENTRAL: Saraburi, Nakhon Nayok; SOUTH-EASTERN: Chachoengsao, Chon Buri, Chanthaburi, Trat; PENINSULAR: Ranong, Surat Thani, Trang, Satun, Songkhla.

D i s t r i b u t i o n.— Sri Lanka, India, Myanmar, Indo-China, Malaysia, Indonesia (type), Philippines, Brunei.

E c o l o g y.— In evergreen forest, near streams; altitude 50–600(–1,025) m. Cultivated for its fruits in lowland orchards.

V e r n a c u l a r.— Kra thon (กระถ่อน)(General); ma tong (มะตอง)(Northern).

20. SWIETENIA

Jacq., Enum. Syst. Plan 4: 1760; P.Hua & Mabb., in Fl. China 11: 116. 2008; Mabb. in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 196. 2011; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 247. 2011; Gardner et al., Forest Trees S. Thailand 2: 1282–3, 1467–8, f. 1675–6. 2016.

Trees, evergreen (or briefly deciduous); bud scales present, buds glabrous. *Leaves* spiral, paripinnate; leaflets opposite to subopposite, glabrous, margin entire. *Inflorescence* thyrses, axillary or subterminal. *Flowers* small, unisexual, well-developed vestiges of opposite sex present. *Calyx* cup-shaped, 5-lobed. *Petals* (4 or)5, free, imbricate, contorted, reflexed in open flower. *Staminal tube* cup-shaped or urceolate, apically (8–)10-lobed, glabrous on both sides. *Anthers* (8–)10, appendages inserted just below margin of tube, alternating with lobes of staminal tube. *Disk* discoid or annular, glabrous. *Ovary* ovoid, glabrous, (4–)5(–6)-locular, each locule with 9–16 pendulous ovules, style cylindrical, stigma disciform with (4–)5 lobes. *Fruits* capsules, erect, woody, ovoid, opening by 5 valves from base or from base and apex simultaneously, valves separating into outer thickly woody, inner thinner layer, columella 5-angled. *Seeds* 9–16 per locule, winged, hanging by wing-end from distal part of columella, lying parallel with it, flattened, overlapping, in 2 rows per locule.

3 species: tropical West Africa, tropical and subtropical America. 2 introduced species widely cultivated in Thailand.

KEY TO THE SPECIES

1. Leaflets (8–)9–15(–18) cm long. Sepals and petals ciliate. Capsule 10–15(–20) cm long. Seeds 7.5–10 cm long, including wing **1. S. macrophylla**
1. Leaflets 3.5–6(–8) cm long. Sepals and petals not ciliate. Capsule (4.5–)6–10 cm long. Seeds 2–5 cm long, including wing **2. S. mahogani**

1. *Swietenia macrophylla* King in Hook. Icon. Pl. 16: t. 1550. 1886; Craib, Fl. Siam. 1: 266. 1926; Backer & Bakh.f., Fl. Java 2:118. 1965; Mabb., Fl. Males., ser. I, 12(1): 383. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 248. 2011; Gardner et al., Forest Trees S. Thailand 2: 1282, 1467, f. 1675. 2016. Fig. 49.

Trees 10–40 m tall, 80–200 cm girth; buttress plank-like. *Leaves* 15–40 cm long; petiole 6–12 cm long, slender, swollen near base; leaflets (2–)3–6(–8) on each side of rachis, elliptic-oblong or ovate-oblong, (8–)9–15(–18) by 3–5(–6) cm, usually curved to one side, apex acuminate, base asymmetrically cuneate or obtuse, margin entire or undulate (when young). *Inflorescence* 10–18(–20) cm long, erect. *Calyx* 0.2 mm in diam., 5-lobed, reflexed. *Petals* 5, white, linear or slightly obovate, 4.5–6 mm long, ciliate. *Staminal tube* ca 1 mm long, margin 10 lobes. *Anthers* 10, more or less included. *Ovary* 5-locular, style slightly narrowed upward, glabrous, stigma capitate. *Capsule* 10–15(–20) by 6–8(–10) cm. *Seeds* 6–9 cm (including wing) long.

T h a i l a n d.— Commonly planted for shade throughout the country.

D i s t r i b u t i o n.— Central America, Honduras (type), South America.

E c o l o g y.— Cultivated as avenue trees or wayside trees; altitude up to 100 m.

V e r n a c u l a r.— Mahokkani bai yai (มะฮอกกานีใบใหญ่)(Central).

2. *Swietenia mahagoni* (L.) Jacq., Enum. Syst. Pl. Carib: 20.1760; Backer & Bakh.f., Fl. Java 2: 118. 1965; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 248. 2011; Gardner et al., Forest Trees S. Thailand 2: 1282, 1467, f. 1676. 2016.— *Cedrela mahagoni* L., Syst. Nat., ed. 10, 2: 940. 1759. Fig. 50.

Trees 10–20(–30) m tall, 80–200 cm girth; buttress short or blunt. *Leaves* 10–20(–25) cm long; petiole 5–10 cm long, slender, swollen near base; leaflets 2–4(5) on each side of rachis, opposite, elliptic-oblong or ovate-oblong, 3.5–6(–8) by (1.5–)2.5–3 cm, usually curved to one side, apex caudate to acuminate, base asymmetrically cuneate, margin entire or undulate (when young). *Inflorescence* (5–)8–15(–20) cm long, erect; peduncles 5–10 cm long; bracts narrowly triangular, caducous. *Calyx* broadly campanulate or cup-shaped, 3–4 mm tall, 5-lobed. *Petals* white, linear, 3.5–4.5 by 2–2.5 mm, glabrous. *Staminal tube* urceolate, ca 1 mm tall, glabrous on both sides, margin (8–)10 truncate lobes. *Anthers* 10, included. *Ovary* ovoid, style cylindrical 1–2 mm, glabrous, stigma disciform. *Capsule* (4.5–)6–10 by 3–6 cm. *Seeds* numerous, 4–5 cm long (including wing).

T h a i l a n d.— Commonly planted for shade throughout the country.

D i s t r i b u t i o n.— Tropical America, Caribbean islands (type).

E c o l o g y.— Cultivated as avenue trees or roadside trees, but much less commonly than *Swietenia macrophylla*; altitude up to 100 m.

V e r n a c u l a r.— Mahokkani bai lek (มะฮอกกานีใบเล็ก)(Central).

21. TOONA

(Endl.) M.Roem., Fam. Nat. Syn. Monogr. 1: 131, 139. 1846; Pellegr. in Lecomte, Fl. Indo-Chine 1: 792. 1911; Harms in Engl. & Prantl, Nat. Pflanzenfam. 3, 4: 269. 1896. T.D.Penn.

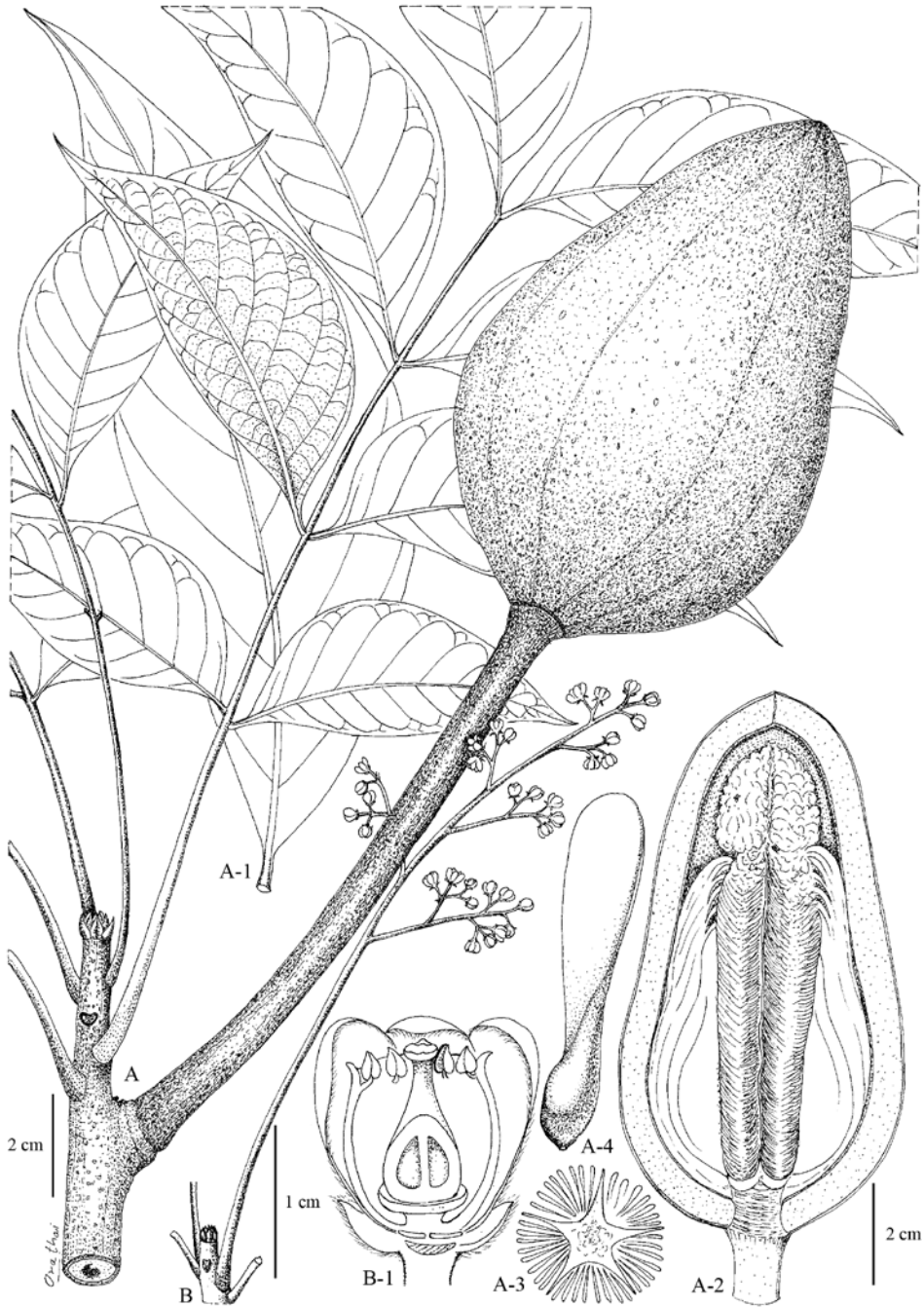


Figure 49. *Swietenia macrophylla* King: A. twig with infructescence, A-1 leaf, A-2 longitudinal section of capsule, A-3 cross section of core, A-4 seed (Th. Wongprasert 077-45); B. inflorescences, B-1 longitudinal section of flower (Th. Wongprasert 074-1). Drawn by Orathai Kerdkaew.



Figure 50. *Swietenia mahagoni* (L.) Jacq.: A. twig with inflorescences, A-1 longitudinal section of flower; B. capsule, B-1 cross section of core. Drawn by Orathai Kerdkaw.

& Styles, *Blumea* 22: 512. 1975; Edmonds, *Fl. Males.*, ser. I, 12(1): 358. 1995; Mabb. in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 10: 193. 2011; T.Wongprasert et al., *Bot.* 39: 248. 2011; Edmonds in Mabb. & Pannell, *Fl. Penins. Malaysia*, Ser. 2, 4: 246. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1284–5, 1468–9, f. 1677–9. 2016.— *Cedrela* L., sect. *Toona* Endl., *Gen. Pl.* 2: 1055. 1840.— *Cedrela* L., Hiern in *Fl. Brit. Ind.* 1: 568. 1875; King, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 64: 89. 1895; Ridl., *Fl. Mal. Penins.* 1: 415. 1922.

Trees, monoecious, hairy to glabrous; often with buttresses; bud scales present. *Leaves* spiral, paripinnate, leaflets opposite to subopposite, sometimes with domatia in axils between midrib and lateral veins, both surfaces more or less papillose. *Inflorescence* a compound thyrse, axillary, near apices of twigs, rarely terminal. *Flowers* unisexual, rarely bisexual. *Calyx* 5(6), united near base, 5(6) lobes, or sepals free. *Petals* 5(6), free, imbricate, adnate to androgynophore. *Stamens* 5(6), free, sometimes alternating with 5 (or 6) filamentous staminodes, all arising from androgynophore. *Disk* absent. *Ovary* 5-locular, each locule with 6–10 ovules, stigma discoid, usually 5-rayed. *Capsules* woody, valves opening from apex, columella 5-angled, softly woody. *Seeds* winged at both ends or at one end, lying parallel with columella, wings papery.

5 or 6 species from E Pakistan to S China and E Australia. 4 species in Thailand.

KEY TO THE SPECIES

1. Inflorescences and infructescences terminal, erect. Petiolules subsessile to short up to 2 mm long; leaflet base cordate, below with prominent reticulation, numerous patent simple hairs. Outside of flowers densely hairy
1. *T. calcicola*
1. Inflorescences and infructescences axillary, pendulous. Petiolules 3 mm long or longer; leaflet base asymmetrically cuneate or rounded, reticulation not or barely prominent, glabrous or with few hairs
2. Leaflets serrate or dentate. Ovary glabrous. Capsule smooth, columella convex without apical scarring. Seeds winged at one end. Sapwood pungent smelling (like garlic)
3. *T. sinensis*
2. Leaflets entire. Ovary hairy. Capsule smooth to lenticellate; columella concave with apical scarring. Seeds winged at both ends. Sapwood pleasantly aromatic
3. Leaflets glabrous. Styles glabrous. Capsule smooth or minutely lenticellate
2. *T. ciliata*
3. Leaflets pilose along midrib on both surfaces. Styles pilose or not. Capsule with large conspicuous lenticels
4. *T. sureni*

1. *Toona calcicola* Rueangr., Tagane & Suddee, *Thai For. Bull., Bot.* 43: 79. 2015. Fig. 51. Plate CXXIX: E.

Trees to 15 m tall, deciduous; bark greyish white to brown, fissured and flaking; young twigs 1–1.3 cm in diam., puberulent, lenticellate; leaf scar ovate, 0.8–1.4 by 0.7–1.1 cm, five vein scars visible in lower half in a V formation. *Leaves* spiral, paripinnate, occasionally one leaflet at apex not developing (making leaf appear imparipinnate), 30–55 cm long; petiole 6.5–13.5 cm long, petiole and rachis with numerous short pale brown erect simple hairs, lenticellate; leaflets opposite, 6–14 on each side of rachis, ovate-lanceolate to oblong-lanceolate, 3–12 by 1.4–4.7 cm, tapering to an acute acumen, base cordate, asymmetric, lobes overlapping rachis, margin entire, revolute, erect white simple hairs scattered above, more numerous on veins, numerous erect short pale brown simple hairs, especially along midrib and veins below, reticulation brown and lamina surface in between much paler and papillose when dry, giving it a glaucous appearance, midrib sunken above, prominent below with small lenticels, lateral veins 10–19 on each side of midrib, sometimes with membranous domatia in axils, sometimes with shorter lateral veins in between, densely

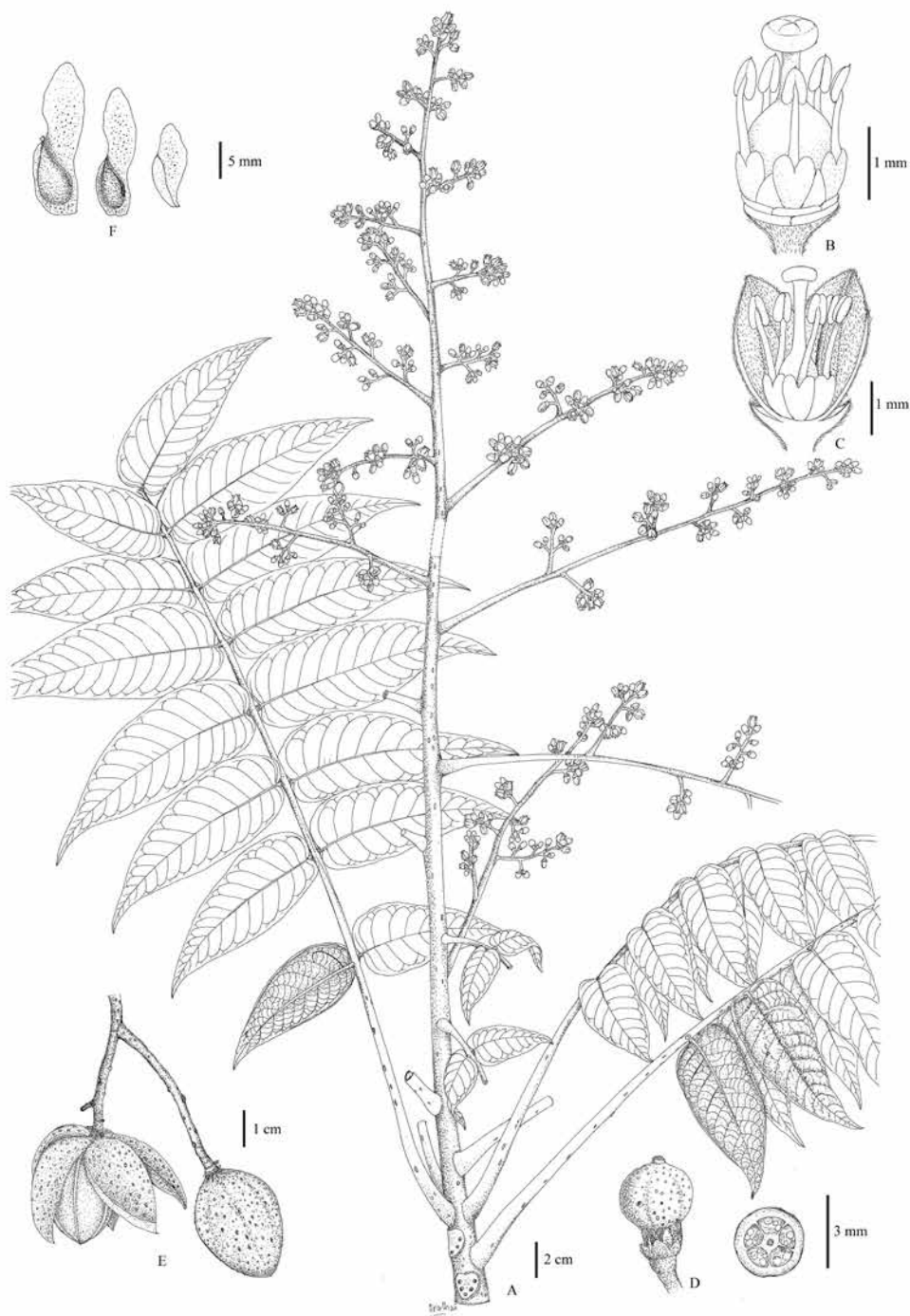


Figure 51. *Toona calcicola* Rueangr., Tagane & Suddee: A. leaves and infl orescences; B. female flower with sepals and petals re-moved; C. longitudinal section of male flower; D. young fruit, whole and cross-section showing ovules; E. capsules; F. seeds. A–D from Tagane *et al.* T3673 (BKF); E–F from Tetsana *et al.* NT919 (BKF). Drawn by Orathai Kerdkaew.

hairy, reticulation scalariform. subsessile, petiolules to 2 mm long, puberulent *Inflorescences* terminal, erect, panicles, 59–79.5 cm by 70 cm, rachis and branches reddish brown, numerous short pale brown erect simple hairs. *Flowers* 5 by 3–3.5 mm; pedicel 0.5–1.6 mm long, densely hairy. *Calyx* ca 1.5 mm long, divided to about ½ way into 5(6) broadly triangular lobes, densely appressed simple almost white hairs outside, glabrous inside, margin shortly ciliate. *Petals* 5(or 6), elliptic-oblong, 5 by 2.5–3 mm, cream when fresh, densely appressed simple almost white hairs, except for a narrow glabrous margin, few hairs inside. *Male flowers*: 5(6) anthers, 0.75–1.2 by 0.3–0.8 mm, filaments ca 1.8 mm long, glabrous; staminodes absent; androgynophore 1.8–2 mm in diam., yellowish to reddish orange; ovary 5-locular, ca 2.5 by 2 mm, glabrous, style ca 2.5 mm long, glabrous, stigma capitate, ca 1 mm in diam. *Female flowers*: antherodes 5(6), ca 0.8 by 0.4 mm, filaments 1–1.3 mm long, glabrous, androgynophore 1.8–2 mm in diam., reddish orange, glabrous; ovary sessile on androgynophore, 5-locular, 1–3 by 1.5–2.3 mm, glabrous, lenticellate, ovules 8–10 per locule, style ca 1–3 mm long, glabrous, stigma capitate, ca 1.2 mm in diam. *Infructescence* to 90 by 80 cm, maturing when leafless. *Mature capsule* ovoid, 2.5–3 by 2–2.5 cm, lenticels scattered. *Seeds* winged at one end, flat, 1.2–2 by 0.4–0.8 cm, seed body 0.5–1 by 0.2–0.5 cm, brown when dry, attached by seed-end to proximal part of columella.

T h a i l a n d.— NORTH-EASTERN: Loei (Suan Hin Pha Ngam Forest Park, Suan Sawan Nature Trail, limestone area, Tagane et al. T3673, holotype BKF, isotypes FU, K, KYO, P), Khon Kaen; SOUTH-WESTERN: Kanchanaburi.

D i s t r i b u t i o n.— Endemic.

E c o l o g y.— On limestone bedrock; altitude to 547 m.

V e r n a c u l a r.— Yom hin pun (ยมหินปูน)(General).

2. *Toona ciliata* M.Roem., *Fam. Nat. Syn. Monogr.* 1: 139. 1846; Kitam. in H. Kihara, *Fauna; Fl. Nepal Himalaya.* 1: 170. 1955; C.Y.Wu, *Fl. Yunnan.* 1: 207. 1977; Edmonds, *Fl. Males.*, ser. I, 12(1): 366. 1995; Gardner et al., *Forest Trees of Northern Thailand:* 122, 404 f. 234. 2000; T.Wongprasert et al., *Thai Forest Bull., Bot.* 39: 248. 2011; Edmonds in Mabb. & Pannell, *Fl. Penins. Malaysia, Ser. 2,* 4: 248. 2013; Gardner et al., *Forest Trees S. Thailand 2:* 1284, 1468, f. 1678. 2016.— *Cedrela toona* Roxb. ex Rottler apud Willd., *Neue Schr. Naturf. Freunde Berlin* 4: 198. 1803; Hiern in Hook.f., *Fl. Brit. India* 1: 568. 1875; Kurz, *Forest Fl. Brit. Burma* 1: 228. 1877; Craib, *Fl. Siam.* 1: 267. 1926.— *Cedrela microcarpa* C.DC. in A.DC. & C.DC., *Monogr. Phan.* 1: 745. 1878; Craib, *Fl. Siam.* 1: 267. 1926; Gardner et al., *Forest Trees N. Thailand* 122, 404. 2000. Fig. 52. Plate CXXIX: F.

Trees 10–30(40) m tall, 100–300 cm girth; bark brown, flaking or shallowly fissured, inner bark brown to pinkish, sweetly aromatic, without latex; sapwood white or pink; heartwood reddish brown, scented; twigs olive green, lenticels small inconspicuous. *Leaves* 20–70 cm long; petiole 6–9 cm long, glabrous, lenticels sparse, dark pink when dry; leaflets (6–)8–10 on each side of rachis, ovate-oblong or ovate-lanceolate, 8–17 by 3–4.5 cm, apex acuminate to caudate, base asymmetrically rounded or cuneate, margin entire, usually slightly curved to one side, chartaceous, glabrous, midrib prominent below, depressed above, dark red when dry, lateral veins 8–15 on each side of midrib, curved upwards near margin, nearly anastomosing, reticulation conspicuous on both surfaces; petiolules 1–1.5 cm glabrous. *Inflorescence* 20–50 cm long, glabrous or pubescent, dull light green, peduncles and pedicels green. *Calyx* united near base, 5-round-lobed, ca 1 by 1 mm,

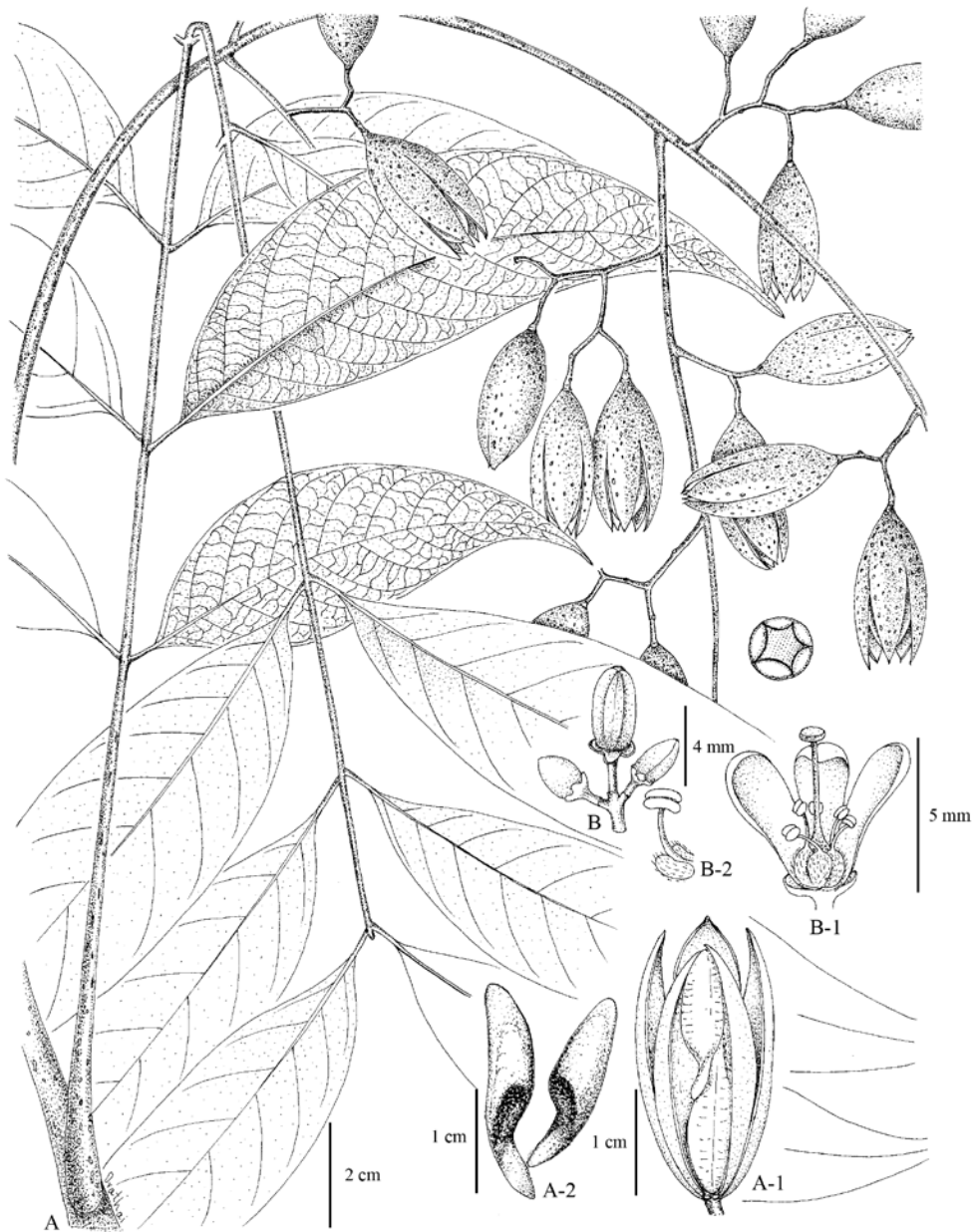


Figure 52. *Toona ciliata* M. Roem.: A. twig with infructescences, A-1 longitudinal section of drupe, A-2 seeds (*Th. Wongprasert 072-14*); B. part of inflorescence, B-1 longitudinal section of flower, B-2 stamen (*Th. Wongprasert 0612-1*). Drawn by Orathai Kerdkaew.

whitish near margin, shortly ciliate. *Petals* spatulate-obovate, ca 5 by 1.5–2 mm, white or greenish white, ciliate, fragrant. *Stamens* 5, filaments hairy at base, (0.75–)2–3 mm, long. androgynophore 3–5 mm long, *Ovary* ovoid or ellipsoid, ca 1 by 0.5 mm, 5 angular valves, each with 5–8 ovules, hairy, style cylindrical ca 3 mm long, more or less glabrous, stigma discoid, glabrous. *Infructescence* pendulous, 30–50 cm long. *Capsule* ellipsoid, 2–4 by 1.5–3 cm, greenish, yellowish when unripe to dark brown when mature, sparsely to densely brown lenticellate with small inconspicuous scattered lenticels, splitting into 5 longitudinal parts when dry. *Seeds* winged at both ends, flat, 15–20 mm long (including wing), upper wing ca 10 mm long, lower ca 5 mm long, papery, seed body 3–4 by 2–3 mm.

T h a i l a n d.— NORTHERN: Chiang Mai, Phrae, Tak, Sukhothai, Phitsanulok; EASTERN: Chaityaphum, Nakhon Ratchasima; SOUTH-WESTERN: Uthai Thani, Kanchanaburi, Ratchaburi, Phetchaburi; CENTRAL: Nakhon Nayok; SOUTH-EASTERN: Prachin Buri, Chanthaburi; PENINSULAR: Ranong, Nakhon Si Thammarat, Trang, Satun.

D i s t r i b u t i o n.— Africa, Pakistan, India, Nepal, Bangladesh, China, Myanmar, Laos, Vietnam, Cambodia, Malaysia (type), Indonesia, Australia.

E c o l o g y.— In evergreen or mixed deciduous forest, near streams, on limestone or granite bedrock; altitude (30–)100–800(–1,300) m.

V e r n a c u l a r.— Yom hom (ยวมหอม)(General); siat om (เสียดอ้อม)(Northern); sadao pa (สะเดาป่า)(Southeastern).

3. *Toona sinensis* (A.Juss.) M.Roem., *Fam. Nat. Syn. Monogr.* 1: 139. 1846; Backer & Bakh.f., *Fl. Java* 2: 117 1965; C.Y.Wu, *Fl. Yunnan*. 1: 210. 1977; Mabb., *Tree Fl. Malaya*. 4: 256. 1989. Edmonds, *Fl. Males.*, ser. I, 12(1): 360. 1995; T.Wongprasert et al., *Bot.* 39: 249. 2011; Edmonds in Mabb. & Pannell, *Fl. Penins. Malaysia*, Ser. 2, 4: 251. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1285, 1468, f. 1679. 2016.— *Cedrela sinensis* A.Juss., *Bull. Sci. Nat. Geol.* 23: 241. 1830.— *C. serrata* Royle, *Ill. Bot. Him.*: 144, t. 25. 1839; Kurz, *Forest Fl. Brit. Burma* 1: 229. 1877. Fig. 53.

Trees 20–35 m tall, 100–250 cm girth; bark grey to dark brown, shallowly fissured, inner bark pink or red, fibrous, strong garlic odor, without latex; sapwood creamy; heartwood reddish brown; twigs olive green, lenticellate. *Leaves* 30–120 cm long; petiole 5–20 cm long, glabrous or sparsely hairy; leaflets 9–15 on each side of rachis, narrowly lanceolate to linear-lanceolate, usually curved to one side, 11–22 by 3–5.6 cm, apex acuminate, base asymmetrically obtuse, margin serrate or serrulate, chartaceous, glabrous or minutely hairy on midrib and lateral veins with club-shaped glandular hairs and simple hairs on upper midrib, rachis, petiole, and midrib prominent below, depressed above, lateral veins 10–13 on each side midrib, curved upwards near margin, not anastomosing, reticulation inconspicuous; petiolules 3–10 mm, glabrescent. *Inflorescence* 50–100 cm long, glabrous or sparsely hairy. *Flowers* glabrous. *Calyx* cup-shaped, 1–1.5 mm, lobes ca ½ of the length, margin ciliate. *Petals* spatulate-obovate, 3–4 by 1–3 mm, white or pinkish, glabrous outside, margin not ciliate. *Stamens* with filaments glabrous at base, staminodes present, androgynophore 2–4 mm, long. *Ovary* ovoid or ellipsoid, ca 1 by 0.5 mm, 5 angular valves, each with up to 6 ovules, glabrous, style cylindrical, ca 5 mm long, glabrous, stigma flattened, glabrous. *Infructescence* pendulous, to 1 m long. *Capsule* ellipsoid 1.5–3 by 0.5–1 cm, reddish to dark brown, sparsely lenticellate, splitting into 5 longitudinal parts when dry. *Seeds* to 16 by 3.5–6.2 mm (including wing), winged at one end.; seed body 8–10 by 1.7–4 mm.

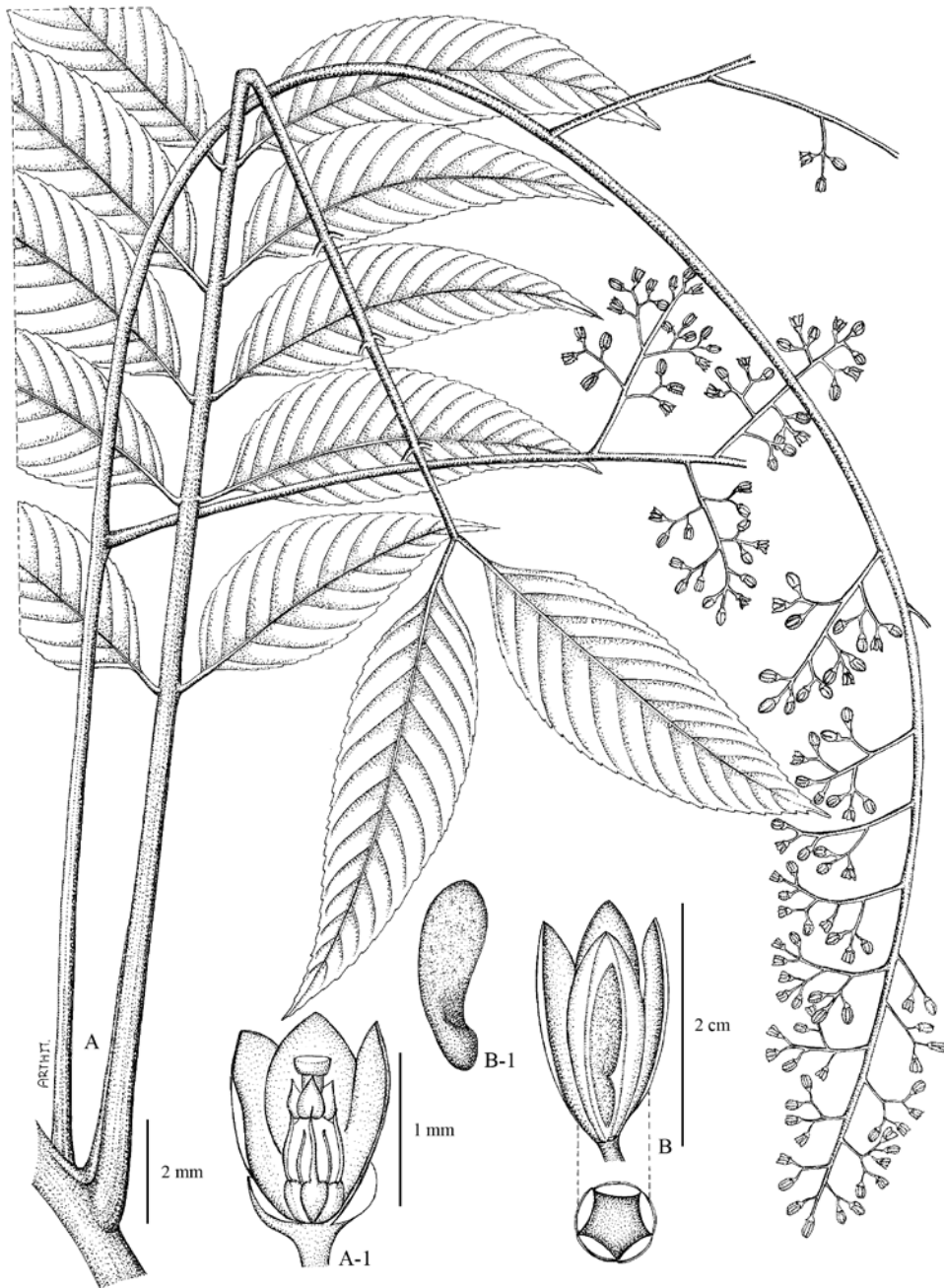


Figure 53. *Toona sinensis* (A.Juss.) M.Roem.: A. twig with inflorescences, A-1 longitudinal section of flower; B. longitudinal section drupe, B-1 seed. Drawn by Arthit Khamkamnoed.

T h a i l a n d.— PENINSULAR: Krabi.

D i s t r i b u t i o n.— India, Nepal, Sri Lanka, China (type), Myanmar, Malaysia, Indonesia.

E c o l o g y.— In evergreen forest; altitude 700–800 m.

4. *Toona sureni* (Blume) Merr., Interpr. Rumph. Herb. Amb.: 305. 1917; Backer & Bakh.f., Fl. Java 2: 117 1965; Mabb., Tree Fl. Malaya 4: 258. 1989; Edmonds, Fl. Males., ser. I, 12(1): 363. 1995; Gardner et al., Forest Trees N. Thailand 122, 404. 2000; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 249. 2011; Gardner et al., Forest Trees S. Thailand 2: 1285, 1468. 2016.— *Swietenia sureni* Blume, Cat. Gew. Buitenz.: 72. 1823.— *Cedrela sureni* (Blume) Burkill, Gard. Bull. 5: 122. 1930.— *Cedrela febrifuga* Blume, Verh. Batav. Gen. 9: 135. 1823; Ridl., Fl. Malay Penins. 1: 415. 1922.— *Toona febrifuga* (Blume) M.Roem., Synops. Monogr. 1: 139. 1846; Pellegr. in Lecomte, Fl. Indo-Chine 1: 793. 1911. Fig. 54.

Trees 12–25(–40) m tall, 100–150 cm girth, monoecious; bark whitish, greyish brown or brown, usually fissured and flaking, inner bark pinkish whitish brown or reddish brown, fibrous, without latex; sapwood whitish pink or reddish, scented; heartwood reddish brown; twigs pilose, prominently lenticellate, large greyish brown, warty lenticels. *Leaves* 30–80 cm long; petiole 6–12 cm long, pubescent then glabrescent; leaflets 8–10 on each side of rachis, lanceolate or ovate-lanceolate, slightly curved to one side, 8–13(–16) by 3–5(–6) cm, apex acuminate, rarely acute, base obtuse, slightly asymmetric, margin entire, simple hairs and club-shaped glandular hairs on midrib above, hairy below, glabrescent, midrib prominent below, depressed above, lateral veins 8–14 on each side of midrib, curved upwards near margin, not anastomosing, reticulation hardly visible; petiolules 0.4–1 cm, pilose then glabrescent. *Inflorescence* 30–50 cm long, pendent, sparsely hairy. *Flowers* bisexual, fragrant; pedicels 0.5–1 mm long, pilose. *Calyx* 1–1.5 mm long, united near base, hairy, glabrescent, lobes divided ½ of the length. *Petals* oblong, 3.5–5 by 1–3 mm, white or yellow, hairy, glabrescent, margin conspicuously ciliate in bud. *Stamens* 5, filaments free, 1.2–3 mm long, hairy on lower half, androgynophore 2–5 mm, long, *Ovary* ovoid or ellipsoid, hairy, 5(–6) locular, each locule with up to 6 ovules, style cylindrical, 3–4 mm long, pilose on lower half, stigma discoid. *Infructescence* 40–60 cm long, pendulous. *Capsule* ellipsoid, 1.5–3.5 by 0.5–1.5 cm, valves dark to blackish brown, conspicuous lenticels. *Seeds* 12–24 by 4–6 mm, winged at both ends, seed body 5–8 by 1.5–3 mm.

T h a i l a n d.— NORTHERN: Chiang Mai, Sukhothai; NORTH-EASTERN: Phetchabun; SOUTH-WESTERN: Kanchanaburi, Ratchaburi; PENINSULAR: Trang, Yala.

D i s t r i b u t i o n.— India, Nepal, Bhutan, China, Myanmar, Laos, Vietnam, Cambodia, Malaysia, Indonesia (type) to New Guinea, Philippines.

E c o l o g y.— In evergreen forest, near streams; altitude 80–550 m.

V e r n a c u l a r.— Su r i a n (สุหรี่ยน)(Peninsular).

22. TURRAEA

L., Mant. Altera: 150. 1771; Harms in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, 19b1: 85, t. 20. 1940; T.D.Penn., Blumea 22: 455. f. 3. 1975; Mabb. & Cheek, Taxon 41: 541. 1992; Mabb., Fl. Males., ser. I, 12(1): 24. 1995; in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 204.

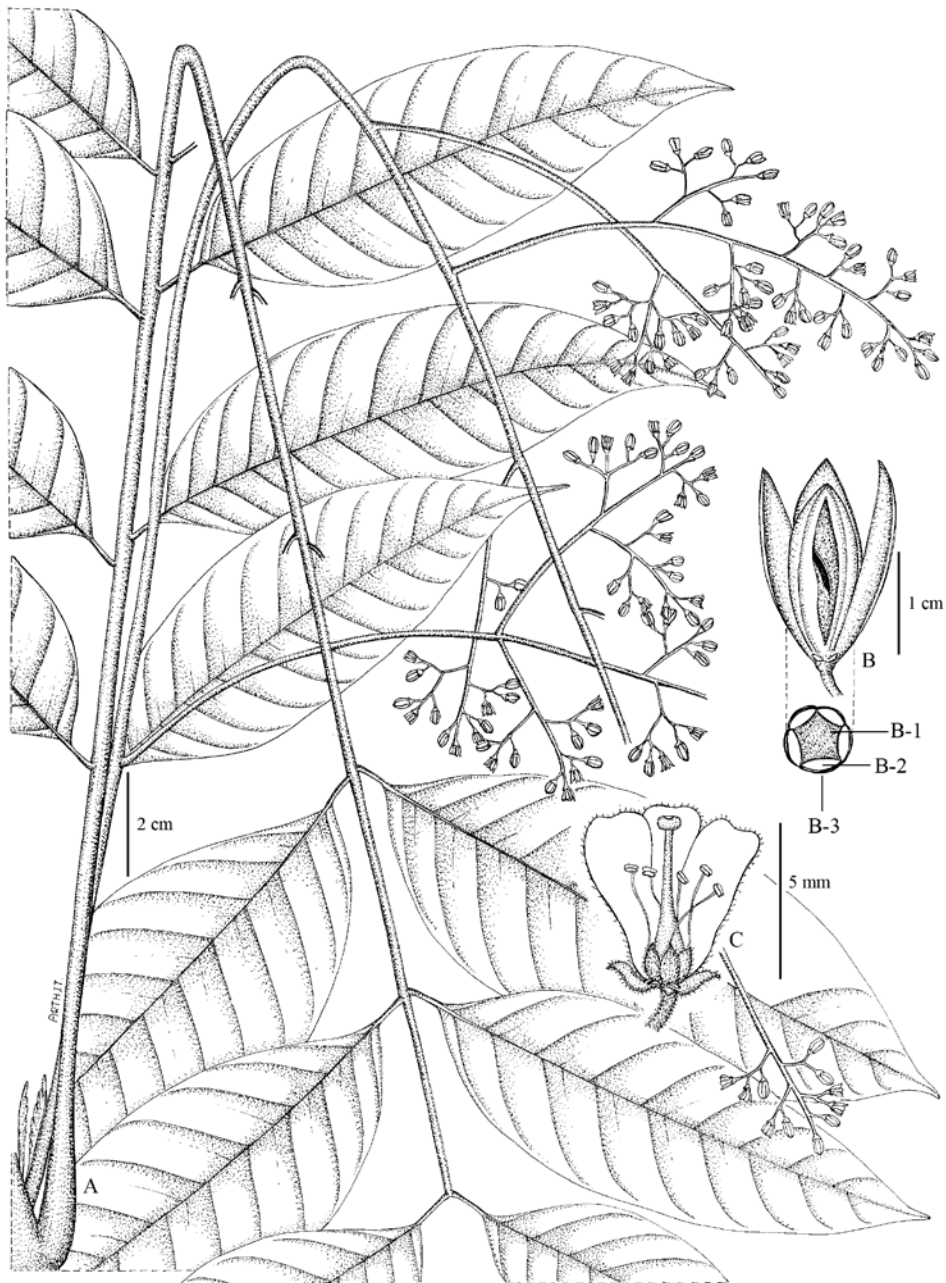


Figure 54. *Toona sureni* (Blume) Merr.: A. twig with inflorescences, C. longitudinal section of flower (B. Sangkhachand 1564); B. capsule, B-1 core, B-2 space for seeds, B-3 cross section of capsule. Drawn by Arthit Khamkamnoed.

2011; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 249. 2011; Gardner et al., Forest Trees S. Thailand 2: 1285, 1469, f. 1681. 2016.

Shrubs, simple hairs. *Leaves* simple, spiral or alternate. *Inflorescences* in fascicles or condensed cymes; ramiflorous or axillary. *Flowers* bisexual. *Calyx* (4–)5, united for lower half. *Petals* 5, free, imbricate or contorted. *Staminal tube* cylindrical, filaments completely or at least $\frac{2}{3}$ united, margin fringed and reflexed. *Anthers* 10. *Disk* absent. *Ovary* ovoid, (3–)5(–10)-locular, each locule with 2 ovules. *Capsule* ovoid or obovoid, 3–5 valved, each with 1(2) seed, arillate.

2 species from Africa, to Arabia, India, SE Asia to Australia. 1 species in Thailand.

Turraea pubescens Hell., Kongl. Vetensk. Acad. Nya Handl. 9: 309, t. 10 f. 3. 1788; Pellegr. in Lecomte, Fl. Indo-Chine 1: 735, t. 80, f. 5–12. 1911; Craib, Fl. Siam. 1: 249. 1926; Backer & Bakh.f., Fl. Java 2: 191. 1965; T.D.Penn., Blumea 22: 456, f. 3b. 1975; Mabb., Fl. Males., ser. I, 12(1): 25. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 249. 2011; Gardner et al., Forest Trees S. Thailand 2: 1285, 1469, f. 1681. 2016.— *T. villosa* Benn., Fl. Jav. Rar.: 182. 1840; Hiern in Hook.f., Fl. Brit. India 1: 542. 1875. Fig. 55. Plate CXXX: A–B.

Shrub 0.5–4 m tall, often scrambling; buds linear to lanceolate, 5–10 mm long, pubescent; bark silvery grey to reddish, sparse round lenticels, inner bark with white fibres; sapwood creamy or yellowish; twigs with simple hairs and lenticellate. *Leaves* spiral, elliptic, elliptic-oblong or obovate, 2–9 by 1–4.5 cm, apex acuminate, base slightly cuneate or obtuse, margin entire, slightly undulate or serrate on upper half, chartaceous, densely hairy especially along nerves and veins below, glabrescent, midrib and lateral veins distinct below, subdepressed above, lateral veins (4)5–6(–9) on each side of midrib; petiole ca 1 cm long, densely hairy. *Inflorescence* in fascicles or condensed cymes, flowers up to 6, sweetly scented, sometimes produced on leafless branches. *Calyx* cup-shaped, ca 2.2 cm tall, lobes narrowly triangular, $\frac{1}{2}$ of the total calyx length, hairy outside, glabrous inside. *Petals* (4)5, 2–3 by 0.1–0.2 cm, white, chartaceous. *Staminal tube* salverform, 2–5 cm long, margin usually 10 appendages, each sometimes divided apically into 2(–4) lobes, reflexed at anthesis. *Anthers* 10, ca 1 mm long at tube apex. *Ovary* ca 1.5 by 1 mm, with 5 longitudinal lobes, glabrous, 5-locular, style linear, 2.5–4 cm long, protruding well beyond staminal tube, style head expanded to form a ‘receptaculum pollinis’, surmounted by a small apical stigmatic area., pollen shed onto style-head before flower opens. *Capsule* ovoid or obovoid, ca 1.8 by 1.5 cm, on young twigs in clusters of 2–5 capsules, green or dark brown, glabrous, more or less shining, dehiscent into 5 parts, each bearing 2 seeds. *Seed* plano-convex, black and shining, woody, ca 0.6 cm long, orange aril confined to area around point of attachment to inner pericarp.

T h a i l a n d.— NORTHERN: Chiang Mai, Lampang, Phrae, Nakhon Sawan; NORTH-EASTERN: Loei, Nong Khai, Sakon Nakhon, Khon Kaen; EASTERN: Si Sa Ket; SOUTH-EASTERN: Sa Kaeo, Chachoengsao, Chon Buri, Chanthaburi.

D i s t r i b u t i o n.— India, China (type), Indonesia, Philippines, Australia.

E c o l o g y.— In evergreen or moist mixed deciduous forest, preferred near streams; altitude (50–)100–300 m.

V e r n a c u l a r.— Muk tia (มุกเตี้ย)(Northeastern).



Figure 55. *Turraea pubescens* Hell.: A. twig with inflorescences, A-1 flower, A-2 ovary (Winit 1398); B. infructescence, B-1 seed (K. Larsen et al. 32143). Drawn by Arthit Khamkamnoed.

23. WALSORA

Roxb., Fl. Ind., (Carey & Wallich. ed.) 2: 386. 1832; C.DC. in A.DC. & C.DC., Monogr. Phan. 1: 633. 1878; Harms in Engl. & Prantl, Nat. Pflanzenfam. 3, 4: 302 & ed. 2 19b1:118. 1940. 1896; T.D.Penn., Blumea 22: 472. 1975; Clark, Blumea 38(2): 257. 1994; Clark, Fl. Males., ser. I, 12(1): 45. 1995; Mabb. in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 200. 2011; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 249. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 257. 2013; Gardner et al., Forest Trees S. Thailand 2: 1286–87, 1469–70, f. 1682–84. 2016.

Trees; bud scales absent; young parts with simple and/or 2-armed hairs. *Leaves* imparipinnate; leaflets opposite, rachis swollen slightly at node(s), leaflet below papillose, giving it a glaucous appearance when dry; petiole usually swollen slightly immediately beneath base of lamina, sometimes slightly geniculate. *Inflorescences* axillary, 3 orders of regular branches concentrated at distal end of inflorescence. *Flowers* bisexual and male or unisexual, ovoid to obconical. *Calyx* 5-lobed, divided up to $\frac{2}{3}$ to base. *Petals* 5, free, valvate to imbricate in bud, hairy outside. *Stamens* 10, filaments flattened, free or united to half way into a staminal tube. *Disk* annular, glabrous or hairy. *Ovary* ovoid or flattened, densely hairy or glabrous, 2-locular, each locule with 2 ovules. *Fruit* ovoid or ellipsoid, indehiscent. *Seeds* 2, with transparent fleshy aril.

16 species from Sri Lanka through India to the Himalayas, eastwards through China, Myanmar, Cambodia, Vietnam, Malaysia, through Malesia and the Philippines to New Guinea. 3 species in Thailand.

KEY TO THE SPECIES

1. Leaflets white-dotted below, lateral veins often only 5 (5–8). Stamens free, filaments not forming a staminal tube. Style hairy. Inner surface of pericarp hairy **2. *W. robusta***
1. Leaflets uniformly glaucous, lateral veins 8–12. Filaments partially united into a staminal tube. Style glabrous. Inner surface of pericarp glabrous
 2. Leaflets 5–7(–9), mostly rounded at apex, leaflet above relatively dull and reticulation not raised. Flowers densely hairy in congested clumps on inflorescences; staminal tube divided for about $\frac{1}{2}$ of the length, alternate filaments shorter. Fruits usually ellipsoid, short beak **3. *W. trichostemon***
 2. Leaflets 3–5(–7), usually distinct acumen, leaflet above relatively shiny reticulation somewhat prominent on both surfaces of leaflets. Flowers not densely hairy, not in congested clumps; staminal tube divided for about $\frac{1}{3}$ of the length, filaments all the same length. Fruits usually subglobose **1. *W. pinnata***

1. *Walsura pinnata* Hassk., Retzia 1: 147. 1855; Miq., Fl. Ned. Ind., Suppl. 1, 2: 542. 1859; Backer & Bakh.f., Fl. Java 2: 129. 1965; Mabb., Tree Fl. Malaya 4: t. 9 B, 254. 1989; Clark, Fl. Males., ser. I, 12(1): 48. 1995; T.Wongprasert et al., Bot. 39: 250. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 258. 2013; Gardner et al., Forest Trees S. Thailand 2: 1286, 1469, f. 1682. 2016.— *W. hypoleuca* Kurz, J. Asiat. Soc. Bengal 42, 2: 296. 1872; Hiern in Hook.f., Fl. Brit. India 1: 564. 1875; Kurz, Forest Fl. Brit. Burma 1: 224. 1877.— *W. neurodes* Hiern in Hook.f., Fl. Brit. India 1: 564. 1875; Ridl., Fl. Malay Penins. 1: 412. 1922.— *Heynea cochinchinensis* Baillon, Adansonia 11: 265. 1879.— *Walsura elata* Pierre, Fl. Forest Cochinch. Fasc. 21: pl. 355. 1897.— *Napeodendron altissimum* Ridl., J. Roy. As. Soc. Str. Br. 82: 179. 1920; Ridl., Fl. Malay Penin. 1: 505. 1922.— *Walsura angulata* Craib, Bull. Misc. Inform. Kew 1926: 344. 1926.— *W. intermedia* Craib, Bull. Misc. Inform. Kew 1926: 345. 1926; Fl. Siam. 1: 261. 1926, Fig. 56.



Figure 56. *Walsura pinnata* Hassk.: A. twig with inflorescences, A-1 longitudinal section of flower (R. Geesink 8356); B. infructescence, B-1 capsule, B-2 longitudinal section of capsule (Martin van de Bult 764). Drawn by Orathai Kerdkaew.

Trees 5–15(–37) m tall, 40–100 cm girth; buds slender, 1–1.5 cm long; bark smooth and thin, greyish brown, often with lenticels, peeling in patches, inner bark pinkish brown; sapwood pink to pinkish yellow; twigs glabrous, greyish brown and sparsely lenticellate. *Leaves* 10–20(–50) cm long; petiole 2–5(–9) cm long; leaflets 1–2 (or 3) on each side of rachis, ovate, obovate to ovate-oblong, (2.5–)5.5–25 by (1.8–)2–11.5 cm, apex acuminate or sometimes broadly obtuse, base obtuse or slightly cuneate, margin entire, chartaceous to subcoriaceous, papillae evenly distributed and glabrous or numerous appressed white simple and 2-armed hairs below, midrib prominent below, slightly depressed above, lateral veins (5–)7–12(–20) on each side of midrib, curved upwards towards margin, not anastomosing, with shorter lateral veins in between, somewhat raised above, subprominent below, relatively shiny above, reticulation somewhat raised on both surfaces; petiolules 0.5–1.5(–3) cm, glabrous, swollen at both ends. *Inflorescence* 8–20(–35) by 10 cm; peduncle to 20 cm; bracts and bracteoles triangular, ca 1.5 by 1 mm, hairy, caducous. *Flowers* bisexual and male, rectangular in outline; pedicels 0.5–2 mm, hairy. *Calyx* 1–2 mm long, lobed divided ca ½ of the length, shortly hairy outside. *Petals* oblong, 3–5 by 1.5–2 mm, imbricate, shortly hairy outside, sparsely so inside, white or yellowish white. *Filaments* united into a staminal tube for ½ to ⅔ of their length, hairy inside in upper half, filament apex obtuse or shortly bifid with lobes ca 0.2 mm long. *Anthers* 0.6–0.8 mm long inserted between lobes. *Disk* 0.2–0.4 mm tall. *Ovary* flattened, hairy, style cylindrical, ca 1.5 mm long, glabrous, stigma ca 0.4 by 0.7–1 mm, capitate with flattened apex. *Fruits* subglobose or ovoid, 1–3 by 1–3 cm, rounded apex, indehiscent, yellowish, hairy, calyx accrescent, persistent. *Seeds* 2, subglobose or ellipsoid, (0.7–)1.7–2.3 by 0.9–1.3 cm, fleshy, sweet, white aril.

T h a i l a n d.— NORTHERN: Mae Hong Son, Chiang Mai (Doi Phu Ka, type of *Walsura intermedia* Craib, Kerr 4959, lectotype K, isolectotypes ABD, BK, BM), Nan; NORTH-EASTERN: Phetchabun, Loei, Nong Khai, Buengkan, Sakon Nakhon, Nakhon Phanom; EASTERN: Chaiyaphum, Nakhon Ratchasima, Ubon Ratchathani; CENTRAL: Saraburi, Nakhon Nayok; SOUTH-EASTERN: Prachin Buri, Chon Buri (Nong Kao, Si Racha, type of *Walsura angulata* Craib, Kerr 6793, lectotype K, isolectotype ABD, BM) Chanthaburi, Trat; SOUTH-WESTERN: Phetchaburi; PENINSULAR: Ranong, Phangnga, Krabi, Nakhon Si Thammarat, Trang, Songkhla, Yala.

D i s t r i b u t i o n.— China, Myanmar, Cambodia, Laos, Vietnam, Malaysia, Indonesia (type), to Maluku and western New Guinea, Philippines.

E c o l o g y.— In evergreen or mixed deciduous forest, preferred near streams; altitude 70–500(–1,200) m.

V e r n a c u l a r.— Kaeo lao (แก้วลาว)(Southeastern).

2. *Walsura robusta* Roxb., Fl. Ind., ed. Carey, 2: 386. 1832; Hiern in Hook.f., Fl. Brit. India 1: 565. 1875; Kurz, Forest Fl. Brit. Burma 1: 223. 1877; Lecomte in Fl. Indo-Chine: 785. 1911; Schmidt, Fl. Koh Chang: 405. 1916, Craib, Abdn. Uni. Stud. 57: 36. 1912; Fl. Siam. 1: 262. 1926; Clark, Blumea 38(2): 259. 1994; Fl. Males., Ser. I, 12(1): 47. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 250. 2011; Gardner et al., Forest Trees S. Thailand 2: 1287, 1470, f. 1684. 2016. Fig. 57.

Trees 8–20(–31) m tall, 60–140 cm girth; buds slender, 2–3 cm long; bark brown, smooth to flaking, inner bark pink to reddish, fibrous; sapwood white to yellowish; heartwood brown; twigs hairy, glabrescent, sparsely to densely yellowish or reddish lenticels. *Leaves*

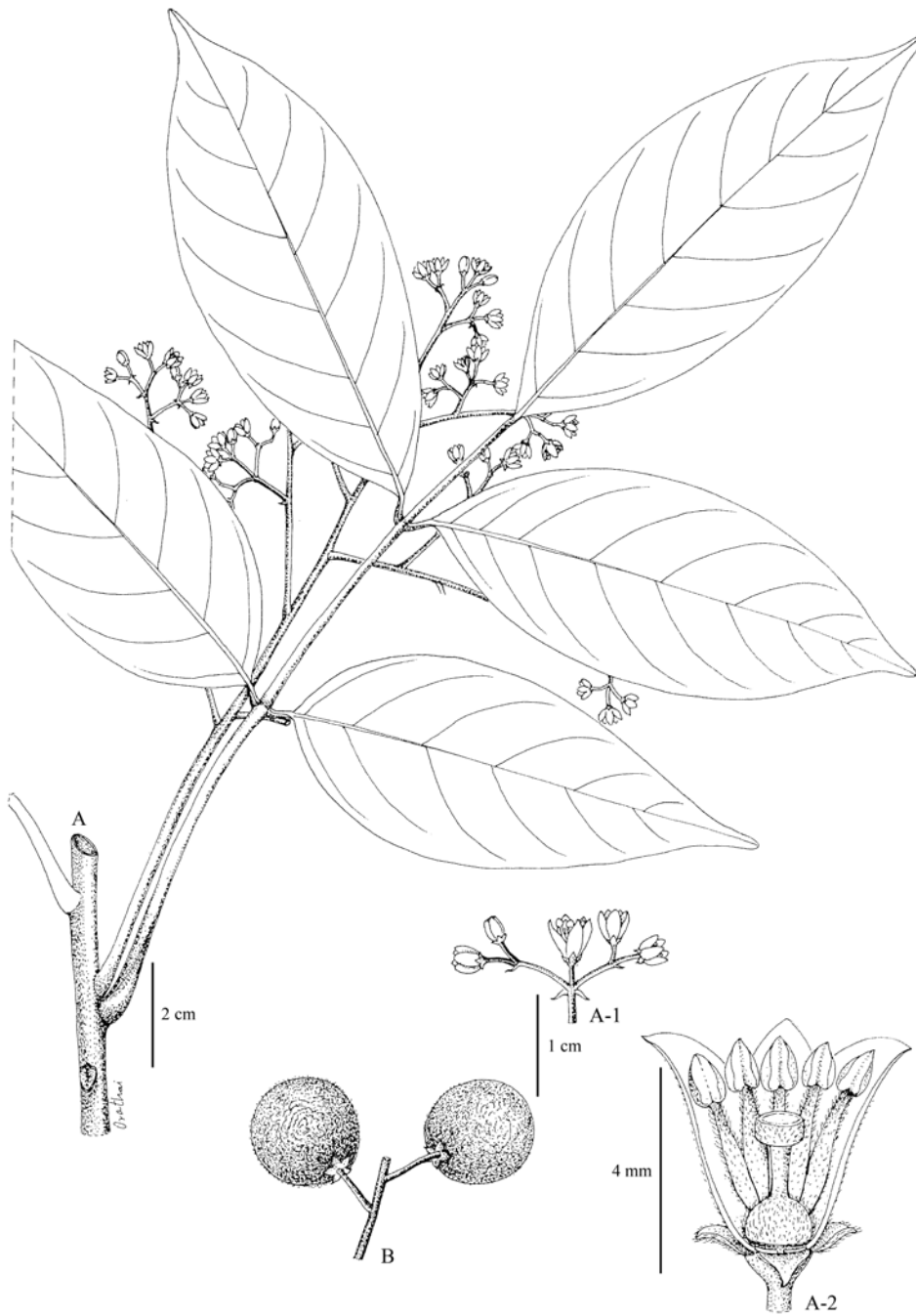


Figure 57. *Walsura robusta* Roxb.: A. twig with inflorescence, A-1 part of inflorescence, A-2 longitudinal part of flower (*S. Phusomsaeng* 79); B. part of infructescence (*C. Phengkhai* 1041). Drawn by Orathai Kerdkaew.

10–28 cm long; petiole 2–6 cm long; leaflets (1 or) 2 on each side of rachis, oblong, elliptic, elliptic-oblong or lanceolate, (2–)5.5–13 by (1.1–)2.5–5(–6.5) cm, apex acuminate, acumen to 25 mm, base cuneate or shortly attenuate, margin entire or undulate, subcoriaceous, papillate cells showing as round white spots confined to lamina between smallest reticulate veins below, glabrous, midrib prominent below, flattened to subdepressed above, lateral veins 5–8 on each side of midrib, curved upwards, not anastomosing, pinkish when dry, reticulation inconspicuous; petiolule (0.1–)0.5–1.2(–3.5) cm, dark brown when dry, usually geniculate with midrib, white indumentum. *Inflorescence* (5–)8–18 cm long; bracts and bracteoles triangular, ca 1.5 by 1 mm, hairy, caducous. *Flowers* unisexual (and bisexual?), cylindrical; pedicels 2–3 mm long, densely hairy. *Calyx* 0.9–1.5 by 2 mm, divided to about $\frac{2}{3}$ into triangular lobes, hairy outside, glabrous inside. *Petals* 2.5–4 by 0.9–1.5 mm, valvate, hairy outside, greenish, white or yellowish. *Stamens* with distinct filaments, each filament narrowly triangular, 1.2–1.3 by 0.6–0.7 mm, wider at base, apex acute, glabrous to sparsely shortly hairy both sides. *Anthers* 0.4–0.5 mm long, inserted on filament apex, glabrous. *Disk* 0.2–0.4 mm tall, minutely hairy. *Ovary* broadly ovoid, ca 1.5 mm, hairy, style cylindric, ca 1.5 mm, hairy, stigma 0.6–0.7 in diam., disc-shaped. *Fruits* subglobose, 1–1.9 cm diam., apex rounded, yellowish or white, hairy, including inside of pericarp; calyx accrescent and persistent. *Seed* 1(2), globose or ellipsoid, enclosed in fleshy, sweet, white aril.

T h a i l a n d.—NORTHERN: Chiang Rai, Phayao, Nan, Lamphun, Lampang, Phrae, Uttaradit; NORTH-EASTERN: Loei, Nong Khai, Buengkan, Sakon Nakhon, Khon Kaen; EASTERN: Nakhon Ratchasima, Surin, Ubon Ratchathani; SOUTH-WESTERN: Kanchanaburi, Phetchaburi; CENTRAL: Saraburi, Nakhon Nayok; SOUTH-EASTERN: Sa Kaeo, Prachin Buri, Rayong, Chanthaburi, Trat; PENINSULAR: Surat Thani, Trang.

D i s t r i b u t i o n.—India (Andamans), Bangladesh (type), Bhutan, China, Myanmar, Laos, Vietnam, Peninsular Malaysia.

E c o l o g y.—In evergreen or mixed deciduous forest, on granite bedrock, preferred near streams and near the coast; altitude (30–)100–400(–800) m.

V e r n a c u l a r.—Khi ai (ขี้ไฉ้)(Northern); daeng dong (แดงดอง)(Northeastern).

3. *Walsura trichostemon* Miq., Ann. Mus. Bot. Lugduno-Batavi 4: 60. 1868; Craib, Fl. Siam. 1: 262. 1926; Clark, Blumea 38(2): 267. 1994; Thai Forest Bull., Bot. 39: 251. 2011.—*Walsura villosa* Wall. ex Hiern, in Hook.f., Fl. Brit. India 1: 564. 1875, *nom. superfl.* - *W. trichostemon*; Craib, Bull. Misc. Inform. Kew 1911: 27. 1911; Abdn. Uni. Stud. 57: 36. 1912; Fl. Siam. 1: 263. 1926; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 251. 2011; Gardner et al., Forest Trees S. Thailand 2: 1287, 1469, f. 1683. 2016. Plate CXXX: C.

Trees 7–20(–24) m tall, 60–140 cm girth; bark scaly, brown, flaking, thick with longitudinal grooves, inner bark dark red with white stripes at intervals, fibrous; sapwood white; heartwood brown to dark brown; twigs hairy, sometimes glabrescent, numerous oblong lenticels. *Leaves* 11–24 cm long; petiole 2–11 cm, hairy, swollen at base; leaflets 2 on each side of rachis, elliptic-oblong or ovate, rarely oblong, 4.5–15 by 2–7 cm, apex rounded, obtuse or acute, rarely acuminate, cuneate or obtuse at base, margin entire or undulate, coriaceous, rarely chartaceous, simple or 2-armed hairs numerous on veins and sparse on lamina in between, papillae evenly distributed below, giving it a glaucous or whitish appearance, young leaves reddish brown above, pale below, midrib and lateral veins prominent below, barely depressed above, lateral veins 6–10(–12) on each side of

midrib, curved upwards, more or less anastomosing near margin, reticulation subprominent or inconspicuous, few to numerous simple or sometimes 2-armed hairs, especially on veins below; petiolules (0.1–)0.5–2 cm, (1.5)2–4 cm on terminal leaflet, geniculate at base. *Inflorescence* 5.5–20(–27) cm long, flowers in congested clumps, densely or sparsely hairy with simple and a few 2-armed hairs; bracts and bracteoles narrowly triangular, ca 2 by 1 mm, hairy, caducous. *Flowers* bisexual, 3.5–5 by 2.5–3.5 mm, cylindrical in bud, 4–6 mm in diam. at anthesis; pedicels 1–3 mm, densely hairy. *Calyx* ca 1.5–1.9 mm long, lobe divided to ca ½ of the length, hairy outside, glabrous inside. *Petals* obovate–oblong, 3–4 by 1–1.5 mm, white or yellowish white, hairy outside, glabrous inside except near base inside. *Staminal tube* broadly urceolate, 2.3–3.1 by 2–2.5 mm, hairy on both sides, tubular for ⅓–½ of the length, filaments alternating long and short, bifid or truncate at apex, with a few long straggly hairs. *Anthers* inserted between apical lobes. *Disk* 0.3–0.4 mm tall, undulate, glabrous. *Ovary* ovoid, ca 1 by 1.5 mm, hairy, style with 6 longitudinal angles, 0.7–1.4 by 0.2 mm at base, 0.6 mm at apex, glabrous, stigma 0.3–0.4 by 0.5–0.8 mm, capitate, glabrous. *Fruits* indehiscent, ellipsoid or ovoid with a short beak, often resulting in a spindle shape, 2–3 by 1.5–3 cm, greyish green, yellowish green, to yellow, densely minutely hairy, calyx not accrescent, persistent. *Seed* 1, ca 1.3 by 1 cm, slightly depressed along longitudinal sides, enclosed with fleshy, sweet, white or yellowish aril.

T h a i l a n d.— NORTHERN: Chiang Mai, Lamphun, Lampang, Phrae, Tak, Nakhon Sawan; NORTH-EASTERN: Loei, Buengkan, Nakhon Phanom, Mukdahan, Maha Sarakham; EASTERN: Chaiyaphum, Nakhon Ratchasima, Si Sa Ket, Ubon Ratchathani; SOUTH-WESTERN: Uthai Thani, Kanchanaburi; SOUTH-EASTERN: Sa Kaeo, Prachin Buri.

D i s t r i b u t i o n.— Myanmar, Thailand (Teijsmann 5968, lectotype U, isolectotype L), Laos, Vietnam, Cambodia.

E c o l o g y.— Dry or mixed evergreen or deciduous forest to lower montane forest, on granite, sandstone or limestone bedrock, often near streams; altitude (5–)100–600 m.

V e r n a c u l a r.— Kat lin (กั๊ดลิ้น), lam yai pa (ลำไยป่า), khi ai dong (ขี้ไต้ดง)(Northern).

24. XYLOCARPUS

Koenig, *Naturforscher* 20: 2. 1784; Harms in Engl. & Prantl, *Nat. Pflanzenfam.*, ed. 2, 19b1: 81. 1940; T.D.Penn. & Styles, *Blumea* 22: 525. 1975; Mabb., *Malaysian Forester* 45: 448. 1982; *Fl. Males.*, ser. I, 12(1): 371. 1995; in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 10: 197, f. 36. 2011; T.Wongprasert et al., *Thai Forest Bull., Bot.* 39: 251. 2011; Mabb., *Fl. Penins. Malaysia*, Ser. 2, 4: 261. 2013; Gardner et al., *Forest Trees S. Thailand* 2: 1288, 1470–71, f. 1685–7. 2016.

Trees, pubescent to glabrous; bud scales present; indumentum of simple hairs. *Leaves* spiral, paripinnate; leaflets opposite, entire, glabrous. *Inflorescence* a compound thyrses, axillary, near end of twigs. *Flowers* unisexual, well-developed vestiges of opposite sex present. *Calyx* 4-lobed, lobes valvate. *Petals* 4, free, contorted, much longer than calyx in bud. *Staminal tube* margin with 8 suborbicular or dentate lobes. *Anthers* 8, inserted in staminal tube, included. *Disk* cushion-shaped, below or surrounding and united with ovary, red. *Ovary* 4(5)-locular, each locule with 3–4(–6) ovules, style short, stigma discoid. *Capsule* large, pendulous, subglobose, tardily dehiscent by 4 (or 5) leathery valves from apex. *Seeds* 5–20, attached to central columella, irregularly tetrahedral or pyramidal shaped, with corky testa, without aril.

3 species in coastal regions from East Africa to the Western Pacific. All 3 are found in Thailand.

KEY TO THE SPECIES

1. Trees of rocky and sandy coasts with neither conspicuous buttresses nor pneumatophores. Leaflets in 2–4 (or 5) on each side of rachis, ovate to cordate at base. Staminal tube margin entire. Fruits subglobose, 7–7.5 cm diam.
 3. **X. rumphii**
1. Trees of mangrove swamps and other muddy substrates. Leaflets in 1–3 (or 4) on each side of rachis, not ovate to cordate. Staminal tube margin serrate or undulate. Fruits 7–14 cm diam.
 2. Trees with winding, flattened, ribbon-like buttresses, pneumatophores absent. Leaflets obovate, coriaceous or subcoriaceous. Pedicel widening below calyx. Petals with hairs outside. Fruits globose, 10–14 cm diam.
 1. **X. granatum**
 2. Trees with peg-like pneumatophores, erect and pointed. Leaflets elliptic or elliptic-oblong, chartaceous. Pedicel not widening below calyx. Petals glabrous. Fruits obovoid, 7–10 cm diam.
 2. **X. moluccensis**

1. *Xylocarpus granatum* J.Koenig, Naturforscher 20: 2. 1784; Backer & Bakh.f., Fl. Java 2: 118. 1965; Mabb., Malaysian Forester 45: 450. 1982; Tree Fl. Malaya 4: 260, f. 12B. 1989; Mabb., Fl. Males., ser. I, 12(1): 378. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 252. 2011; Mabb., Fl. Penins. Malaysia, Ser. 2, 4: 262. 2013; Gardner et al., Forest Trees S. Thailand 2: 1288, 1470, f. 1685. 2016.— *Carapa granatum* (Koenig) Alston in Trim., Handb. Fl. Ceylon 6: 45. 1931.— *C. moluccensis* auct. non Lam.: DC., Prodr. 1: 626. 1824, p.p.; Hiern in Hook.f., Fl. Brit. India 1: 567. 1875, p.p.; Ridl., Fl. Malay Penins. 1: 414. 1922.— *C. obovata* Blume, Bijdr.: 179. 1825; Ridl., Fl. Malay Penins. 1: 414. 1922.— *Xylocarpus obovatus* (Blume) A.Juss., Mém. Mus. Natl. Hist. Nat. Paris 19: 244. 1832; Craib, Fl. Siam. 1: 265. 1926. Fig. 58. Plate CXXX: D–E.

Trees 5–15(–20) m tall, 40–100 cm girth; buttresses narrow winding flattened, ribbon-like, spreading out from base of bole, pneumatophores absent; bark thin, smooth or flaking in irregular scales, pale brown, inner bark reddish or pink; twigs dark red, glabrous, with sparse round lenticels. *Leaves* 3–12 cm long; petiole 3–6 cm long; leaflets 1–3 on each side of rachis, obovate, 4–10 by 2–7.5 cm, apex obtuse or round, then slightly narrowed to base, base cuneate or acute, margin entire to recurved, coriaceous to subcoriaceous, midrib prominent below, flat to subdepressed above, lateral veins 7–10 on each side of midrib, inconspicuous above, slightly conspicuous below, anastomosing near margin, reticulation subprominent on both surfaces; petiolules 3–5 cm long, glabrous. *Inflorescence* 3–6 cm long; bracts and bracteoles ca 0.5 mm, caducous. *Flowers* with pedicels 6–10 mm long, widening towards calyx, purplish brown, glabrous. *Calyx* cup-shaped, 1.5–2.5 mm long, lobes $\frac{1}{2}$ – $\frac{2}{3}$ of the length, broadly ovate. *Petals* ovate-oblong, 4–7 by 2–3 mm, spreading at anthesis, white, yellowish or pinkish, greenish orange at base inside, hairy to glabrous outside, glabrous inside. *Staminal tube* obovoid, to 4 by 3 mm, glabrous, margin with 8 serrate lobes. *Anthers* opposite staminal lobes. *Ovary* broadly ovoid, ca 2 by 2 mm, 4-locular, style tubular, ca 2 mm long, greenish, glabrous, stigma discoid. *Infructescence* up to 15 cm long, pendulous. *Capsule* subglobose, 10–14(–25) cm diam., yellowish brown or reddish brown, woody, longitudinally dehiscent. *Seeds* 8–16(–20), 5.4–7.7 by 4.3–6 by 3.8–4.6 cm.

T h a i l a n d.— CENTRAL: Samut Songkhram, Samut Sakhon; SOUTH-WESTERN: Phetchaburi, Prachuap Khiri Khan; SOUTH-EASTERN: Chon Buri, Rayong, Chanthaburi, Trat; PENINSULAR: Chumphon, Ranong, Surat Thani, Phangnga, Krabi, Trang.

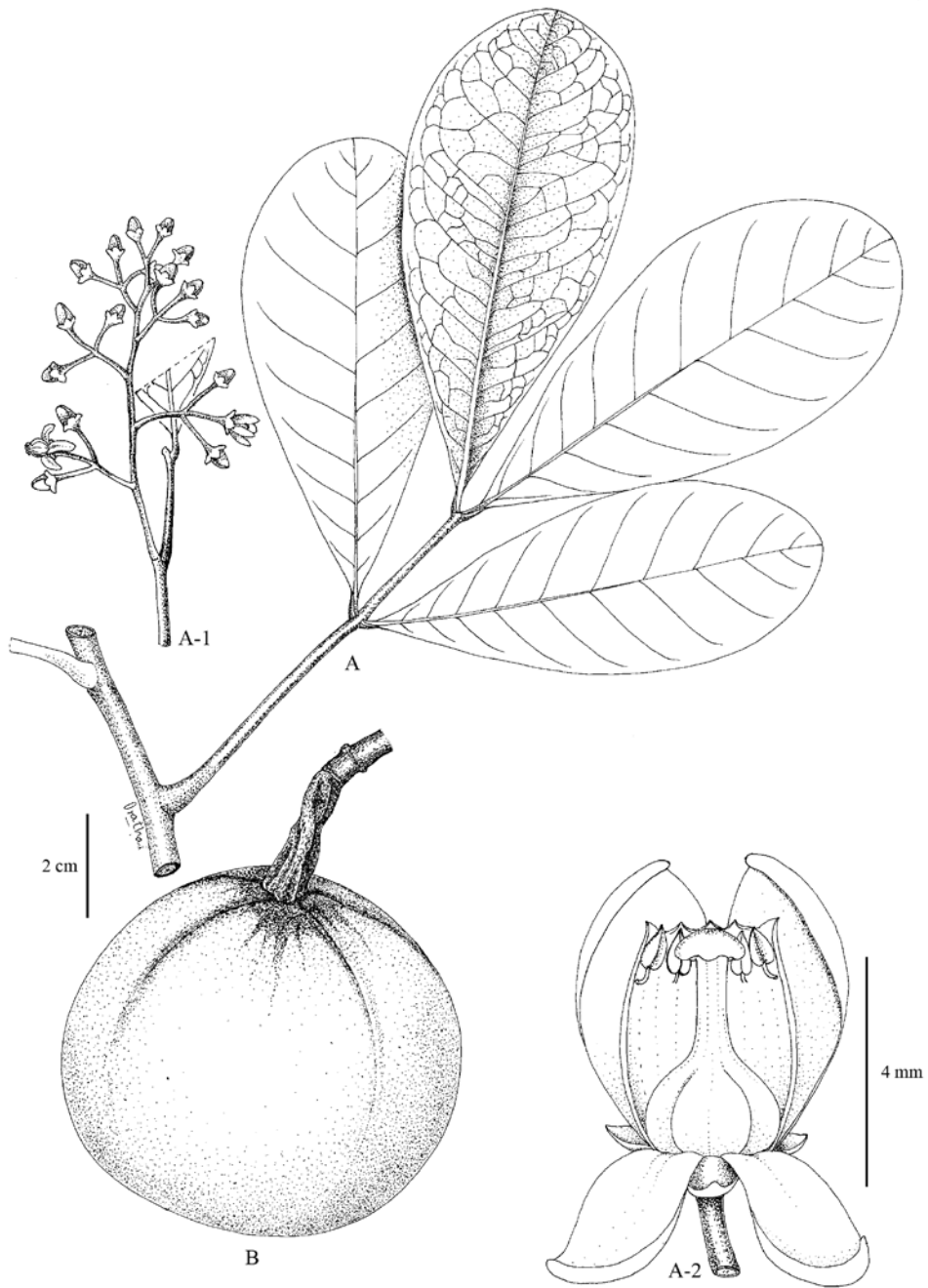


Figure 58. *Xylocarpus granatum* J.Koenig: A. twig, A.1 part of inflorescence, A.2 flower (*Th. Wongprasert 078-54*); B. drupe (*N. Fukuoka T-35700*). Drawn by Orathai Kerdkaew.

D i s t r i b u t i o n.— East Africa, Madagascar, India, China, Myanmar, Indochina, Malaysia, Singapore, Indonesia, Brunei, Philippines, Japan, Australia to Tonga.

E c o l o g y.— Scattered in mangrove swamps, bordering the banks of tidal streams.

V e r n a c u l a r.— Tabun khao (ตะบูนขาว)(General).

2. *Xylocarpus moluccensis* (Lam.) M.Roem., Fam. Nat. Syn. Monogr. 1: 124. 1846; Craib, Fl. Siam. 1: 265. 1926; Backer & Bakh.f., Fl. Java 2: 118. 1965; Mabb., Malaysian Forester 45: 450. 1982; Males., ser. I, 12(1): 376. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 252. 2011; Gardner et al., Forest Trees S. Thailand 2: 1288, 1470, f. 1686. 2016.— *Carapa moluccensis* Lam., Encycl. Méth. 1: 621. 1785.— *Xylocarpus mekongensis* Pierre, Fl. Forest Cochinch. 5: t. 359 B. 1897.

Trees 6–10 m tall, 60–100 cm girth: numerous erect, pointed pneumatophores; bark rough with longitudinal fissures, flaking in oblong scales, inner bark reddish or pinkish; twigs pale brown, glabrous, sparsely round lenticels. *Leaves* 4–12 cm long; petiole 2–5 cm long, glabrous; leaflets (1)2 or 3(4) on each side of rachis, ovate, 6.5–16 by 3–7 cm, apex acute or obtuse, base cuneate, broadly acute, slightly asymmetrical, margin entire or undulate, chartaceous to subcoriaceous, glabrous, midrib slightly prominent below, flat to subdepressed above, lateral veins 5–9 on each side of midrib, curved upwards, anastomosing far from margin, reticulation conspicuous or inconspicuous below; petiolules, ca 0.5 cm long, glabrous, pink to dark red when dry. *Inflorescence* 5–15 cm long, at end of twigs or axillary near end of twigs, pendulous and glabrous; bracts and bracteoles, ca 0.5 mm, persistent. *Flowers* with pedicels 3–8 mm long, not widening below calyx. *Calyx* cup-shaped, 1.5–2(–3) mm long, lobes ca $\frac{2}{3}$ of the length, ovate, glabrous on both sides. *Petals* oblong to obovate, 3–4 by 1.5–2 mm, creamy white to white, glabrous. *Staminal tube* ca 2 by 2 mm, glabrous, with 8 serrate lobes. *Ovary* broadly ovoid, ca 2 by 2 mm, 4-locular, each locule with 3 or 4 ovules, style tubular, ca 1 mm long, greenish, glabrous, stigma discoid, apex acute. *Infructescence* up to 20 cm long, pendulous. *Capsule* depressed globose, slightly 4-lobed, 6–7 by 7–10 cm, yellowish brown, woody, longitudinally dehiscent. *Seeds* 5–10, (2.7–)4–6.5 cm long.

T h a i l a n d.— SOUTH-WESTERN: Phetchaburi; SOUTH-EASTERN: Chanthaburi, Trat; PENINSULAR: Chumphon, Ranong, Phangnga, Nakhon Si Thammarat, Trang.

D i s t r i b u t i o n.— Somalia, India, Myanmar, Indo-China, Malaysia (type), Indonesia, Philippines, Australia.

E c o l o g y.— Scattered in mangrove swamps, along the banks of tidal streams.

V e r n a c u l a r.— Tabun dam (ตะบูนดำ)(General); taban (ตะบัน)(Peninsular).

3. *Xylocarpus rumphii* (Kostel.) Mabb., Malaysian Forester 45: 450. 1982; Mabb., Tree Fl. Malaya 4: 260, f. 12 A. 1989; Fl. Males., ser. I, 12(1): 375. 1995; T.Wongprasert et al., Thai Forest Bull., Bot. 39: 252. 2011; Gardner et al., Forest Trees S. Thailand 2: 1288, 1471, f. 1687. 2016.— *Carapa rumphii* Kostel., Allg. Med. Pharm. Fl. 5: 1988. 1836.— *C. moluccensis* auct. non Lam.: DC., Prodr. 1: 626. 1824, p.p.; Hiern in Hook.f., Fl. Brit. India 1: 567. 1875, p.p.— *Aglaiia zollingeri* C.DC., Bull. Herb. Boissier 2: 579. 1894; Backer & Bakh.f., Fl. Java 2: 127. 1965. Fig. 59.

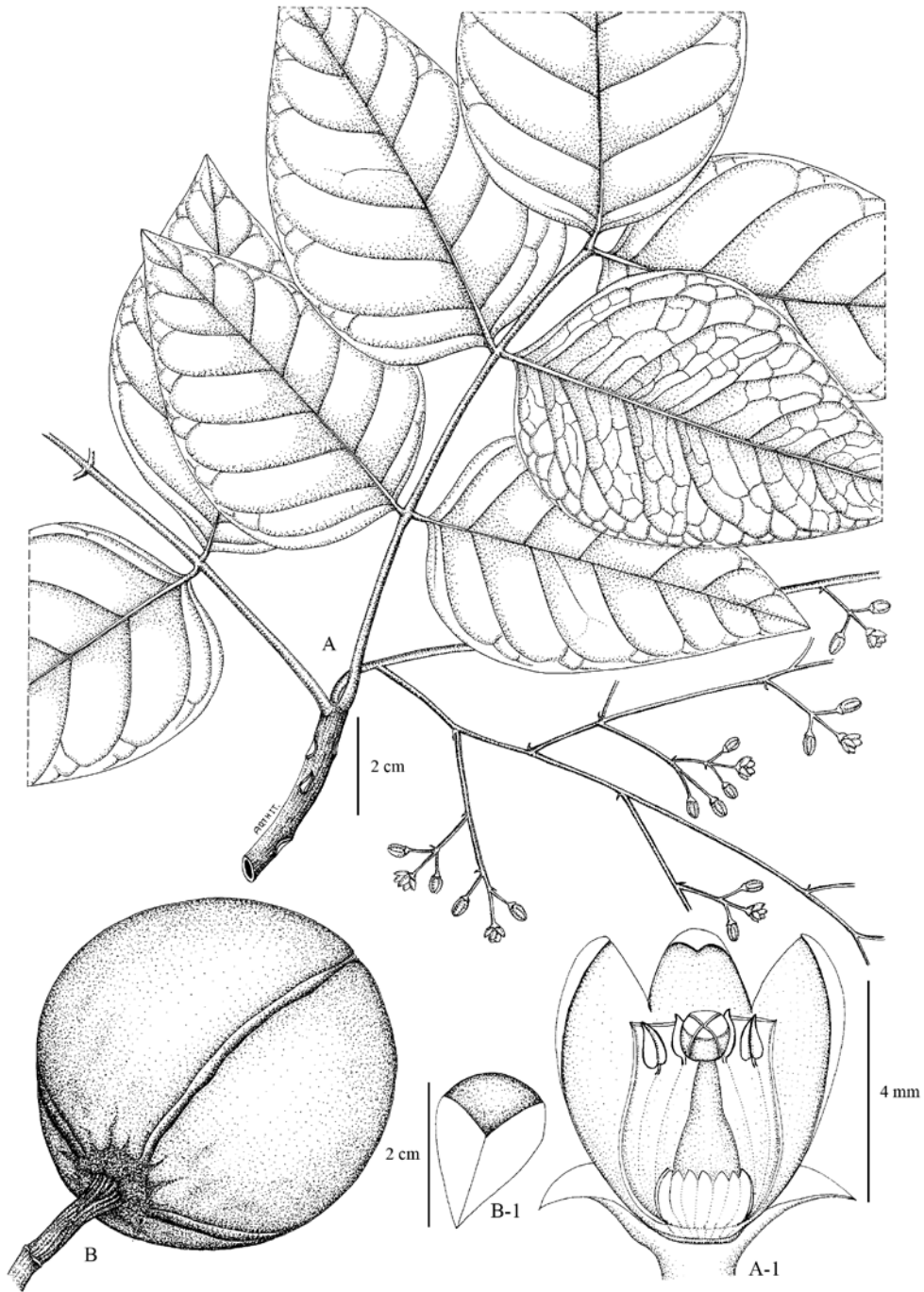


Figure 59. *Xylocarpus rumphii* (Kostel.) Mabb.: A. twig with inflorescence, A-1 longitudinal section of flower (C. Niyomdham 1954); B. capsule, B.1 seed (Th. Wongprasert 994-8). Drawn by Arthit Khamkamnoed.

Trees 5–10 m tall, 50–150 cm girth; bud ovoid, ca 5 by 3 mm; with neither conspicuous buttresses nor pneumatophores; bark greenish brown, scaly, inner bark pinkish purple, fibrous; sapwood brownish; twigs greyish brown, sparse brown lenticels. *Leaves* 5–22 cm long; petiole 2.5–8 cm long, glabrous, dark brown when dry; leaflets 1–4 on each side of rachis, rarely subalternate, ovate, 6–13 by 4–7 cm, apex acuminate to acute, base broadly obtuse to cordate, margin entire or minutely undulate, recurved, subcoriaceous or chartaceous, glabrous, midrib slightly conspicuous below, flat or subdepressed above, lateral veins 6–8 on each side of midrib, conspicuous both surfaces; sessile or petiolules 2–4 mm long, blackish when dry. *Inflorescence* 10–18 cm long, axillary near ends of twigs; bracts and bracteoles ca 1 by 1 mm, pubescent outside, caducous. *Flowers* fragrant; pedicels 2–2.5 mm long, hairy, glabrescent. *Calyx* ca 2 mm long, lobe ca ½ of the length, broadly ovate, pubescent outside, glabrous inside. *Petals* oblong, ca 5 by 2 mm, white, yellowish green to yellow, sparsely hairy outside, glabrous inside. *Staminal tube* urceolate, ca 3 by 2 mm, red, glabrous, margin with 8 serrate lobes. *Disk* enclosing ovary. *Ovary* ovoid, ca 2 by 1 mm, glabrous, 4-locular, each locule with 3 or 4 ovules, style ca 1 mm long, glabrous, stigma discoid. *Infructescence* up to 20 cm long, pendulous, usually one capsule remained. *Capsule* globose, 5.5–9 by 7–7.5 cm, slightly 4-angled, woody, usually dehiscent into 4 parts. *Seeds* 8–16, prism-shaped or obpyriform, 3.5–7 by 3.5–5 cm.

T h a i l a n d.— SOUTH-EASTERN: Chon Buri, Rayong, Trat; PENINSULAR: Ranong, Surat Thani, Phangnga, Krabi, Satun.

D i s t r i b u t i o n.— East Africa, Madagascar, India, Indo-China, Malaysia, Philippines, Indonesia (type) Australia, Fiji, Tonga.

E c o l o g y.— Sporadic along the rocky seashore adjoining sandy beach.

V e r n a c u l a r.— Taban (ต๊ะบัน)(General).