

TREE FLORA of SABAH AND SARAWAK

Volume Four

edited by
E. Soepadmo, L.G. Saw and R.C.K. Chung



Government of Malaysia

TREE FLORA
of
SABAH AND SARAWAK

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Front cover: Lowland and hill forests on ultramafic soil, Bt. Tawai FR, Sabah. (Photograph
by E. Soepadmo.)

Back cover: *Koompassia excelsa* (Becc.) Taub. with new growth. (Photograph by
E. Soepadmo.)

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OLEACEAE

Ruth Kiew

Singapore Botanic Gardens,
Singapore

King & Gamble, J. As. Soc. Beng. 74, 2 (1906) 254; Merrill, EB (1921) 488; Ridley, FMP 2 (1923) 310; Masamune, EPB (1942) 610; Backer & Bakhuizen *f.*, FJ 2 (1965) 212; Anderson, CLTS (1980) 284; Corner, WSTM 3rd. edition 2 (1988) 601; Kiew, TFM 4 (1989) 285; Coode *et al.* (eds.), CLBD (1996) 247; Argent *et al.* (eds.), MNDF-CK 2 (1997) 487.

Trees, shrubs or climbers, evergreen, glabrous or pubescent. **Stipules** absent. **Leaves** opposite (rarely alternate), simple, trifoliate or pinnate, margin entire (sometimes toothed). **Inflorescences** basically cymose but often appearing racemose, paniculate or spicate (rarely flowers solitary), axillary, terminal, rarely ramiflorous. **Flowers** bisexual, sometimes polygamous or unisexual, radially symmetrical; calyx usually small or campanulate and undivided or divided into 4–(5–15) lobes or teeth; corolla gamopetalous with a long or short tube, or divided to base or petals joined in pairs at base, (2–)4(–12)-lobed, lobes imbricate or valvate-induplicate; stamens 2 (rarely 3 or 4), alternating with petals, epipetalous or inserted at base of corolla tube, filaments short or sometimes long, anthers oblong, dorsifixed, 2-loculed, dehiscing longitudinally, connective sometimes apiculate; disc absent; ovary superior, 2-loculed, styles usually short, rarely long, stigma capitate to shortly bifid; ovules 2 per locule, rarely 1 or 4–8, basally, laterally or apically attached, anatropous, rarely amphitropous. **Fruits** drupaceous (in *Chionanthus* and *Olea*), capsules (in *Schrebera*), or 2-lobed berries (in *Jasminum*). **Seeds** 1–4, erect or pendulous; testa thin (rarely fleshy); endosperm fleshy, horny, oily or absent; embryo straight, cotyledons in albuminous seeds thin, oblong-ovate, in exalbuminous seeds thick and fleshy; radicle short, rarely long.

Distribution. About 25 genera and 600 species worldwide in tropical, subtropical and temperate regions but mostly in the Old World. In Sabah and Sarawak, 6 genera and 47 (including three incompletely known) species are recorded.

Ecology. Apart from mangrove forest, species are found in all forest types from the lowlands to the summit of mountains but most species are uncommon, although a few are widespread.

Uses. A few exotic species of *Jasminum* are cultivated, especially *J. sambac* (L.) W.Ait. for its heavily scented flowers. Species of *Chionanthus*, *Ligustrum*, *Olea*, and *Schrebera* are trees but most are small, some are shrubby and none is either common or large enough to be a timber tree.

Key to genera

1. Climbing plants or scandent shrubs.....2
 Trees or shrubs.....4

2. Leaves trifoliolate or unifoliolate (i.e. the stalk is jointed indicating the blade represents a terminal leaflet). Corolla tube narrow, at least 6 mm long, with (4–)6 or more spreading lobes. Fruits bilobed.....
 - Jasminum** L.
 (Latinised Persian plant name—*jasmin*)
 Sp. Pl. 1 (1753) 7; King & Gamble, J. As. Soc. Beng. 74, 2 (1906) 255; Ridley, FMP 2 (1923) 310; Backer & Bakhuizen *f.*, FJ 2 (1965) 216; Kiew, Sandakania 4 (1994) 75, *ibid.* 5 (1994) 1; Coode *et al.* (eds.), CLBD (1996) 248.
 Mostly tropical and Old World, about 450 species. In Borneo, 12 species, of which 10 occur in Sabah and Sarawak.
Climbers or *scandent shrubs*, glabrous or pubescent. *Leaves unifoliolate* or *trifoliolate*. Inflorescences terminal or axillary, cymose or paniculate (rarely flowers solitary). Flowers bisexual and *heterostylous*; calyx joined at base with long or short lobes 4–10 mm long; *corolla tube narrow, at least 6 mm long*, white sometimes tinged rosy purple, *lobes 4 to many*, imbricate in bud; stamens with short filaments, inserted within corolla tube; ovary with long or short styles. *Fruits strongly bilobed* and 2-seeded, endosperm absent. Usually in lowlands on forest margins, along rivers, in disturbed forest, on hill tops to 1900 m altitude.
 - Leaves simple. Corolla tube short with 4 lobes. Fruits not bilobed.....3

3. Twigs quadrangular. Leaves with 3 longitudinal veins.....
 - Myxopyrum** Blume
 (Greek, *muxa* = mucus or slime, *puros* = wheat or fruit; referring to the mucilaginous fruit)
 Bijdr. Fl. Ned. Ind. (1826) 683; King & Gamble, J. As. Soc. Beng. 74, 2 (1906) 272; Ridley, FMP 2 (1923) 320; Backer & Bakhuizen *f.*, FJ 2 (1965) 215; Kiew, Blumea 29 (1984) 499; Coode *et al.* (eds.), CLBD (1996) 248.
 Four species from India, Indo-China and China (Hainan), throughout Malesia to New Britain. In Sabah and Sarawak two species, *M. nervosum* Blume subsp. *coriaceum* (Blume) Kiew and *M. pierrei* Gagnep.
Twining climbers or *scandent shrubs*. *Twigs acutely quadrangular*. *Leaves simple*, narrowly lanceolate or ovate or cordate, *triplinerved*, margin entire or toothed towards apex. Inflorescences terminal and axillary, cymose panicles. Flowers sessile, small, bisexual; calyx shortly tubular, lobes 4, short and acute; *corolla tube and lobes short*, lobes valvate in bud; stamens subsessile with anthers contained within corolla tube; ovary with subsessile stigma. Fruits globose, *not bilobed*, with 1 or 2 endospermic seeds.
 - Leaves terete. Leaves with pinnate venation.....
 - 1. Chionanthus** (in part; **C. macrobotrys**)

4. Leaves pinnate. Flowers to 20 mm long; corolla lobes (4–)6–8. Fruits woody 2-valved capsules with winged seeds.....**4. Schrebera**

- Leaves simple. Flowers to 8 mm long; corolla lobes 4. Fruit fleshy and drupaceous; seeds not winged.....5
5. Inflorescences terminal; style 1–2 mm long.....**2. Ligustrum**
 Inflorescences usually axillary, sometimes ramiflorous; style very short, stigma sessile or subsessile.....6
6. Leaves entire or serrate. Flowers polygamous; flower buds rounded, corolla tube equal to or slightly longer than lobes.....**3. Olea**
 Leaves always entire. Flowers bisexual (except in *C. polygamus*); flower buds pointed (except in *C. balgooyiana* and *C. ramiflorus*); corolla divided to base into 4 lobes joined in pairs, rarely with corolla tube and then shorter than the lobes.....
 **1. Chionanthus** (in part)

1. CHIONANTHUS L.

(Greek, *chion* = snow, *anthos* = flower, referring to white flower)

mok (Iban)

Sp. Pl. 1 (1753) 8; Stearn, Ann. Missouri Bot. Gard. 63 (1976) 355; Kiew, Malay. For. 42 (1979) 259, *ibid.* 43 (1980) 362, *ibid.* 44 (1981) 143, TFM 4 (1989) 286; Corner, WSTM 3rd. edition 2 (1988) 601; Coode *et al.* (eds.), CLBD (1996) 247; Argent *et al.* (eds.), MNDT-CK 2 (1997) 487. **Synonym:** *Linociera* Sw. in Schreber, Gen. 2 (1791) 784, Ridley, FMP 2 (1923) 316, Anderson, CLTS (1980) 284.

Trees or *shrubs*, rarely scandent climbers. **Leaves** simple with entire margin, pinnately veined, surface appearing glabrous but minutely punctate from sunken lepidote trichomes. **Inflorescences** axillary, rarely ramiflorous or terminal, much branched panicle, racemose or short and spicate; bracts scarious sometimes foliaceous, usually caducous. **Flowers** to 8 mm long, bisexual (rarely polygamous, *C. macrobotrys* and *C. polygamus*), white or yellow, fragrant; buds pointed (except in *C. balgooyiana* and *C. ramiflorus*); calyx shallowly 4-lobed, persistent, pubescent or glabrous; corolla 4-lobed, lobes usually free to base and joined in pairs, rarely with distinct tube and then lobes longer than the tube, induplicate (rarely valvate), frequently twisting at anthesis; stamens attached at the base where the corolla lobes are joined in pairs, subsessile or filament very short and anthers hardly exposed in open flower, anthers oblong, connective sometimes apiculate; ovary ovoid, c. 2 mm long, style very short, stigma slightly bilobed, sessile. **Fruits** drupaceous, smooth, ridged or pimply; epicarp fleshy, mesocarp and endocarp either drying thin and brittle, thick and leathery or woody. **Seeds** not winged, usually albuminous, if exalbuminous then cotyledons thick and fleshy.

Distribution. About 100 species, largely tropical with species in all continents. The two temperate species, which are cultivated as ornamentals, are deciduous and have large flowers with petals c. 2 cm long. Thirty (including three incompletely known) species are found in Sabah and Sarawak.

Ecology. As for family.

Key to *Chionanthus* species

1. Leaf base cordate.....**4. *C. cordulatus***
 Leaf base not cordate.....2
2. Twigs quadrangular in cross-section. Fruit ridged and curved.....**6. *C. curvicarpus***
 Twigs round in cross-section. Fruit not curved, rarely superficially 4-ridged or longitudinally ridged or verrucose or rugose.....3
3. Petiole drying brown or fawn.....4
 Petiole drying black.....7
4. Leaf apex cuspidate; lateral veins 5–8 pairs; petiole 0.5–1 cm long.....5
 Leaf apex rounded to acuminate; lateral veins 8–15 pairs; petiole 1.5–3 cm long...6
5. Shrub to 2 m tall. Leaf 20–28 cm long, drying fawn to midbrown. Fruit ovoid, *c.* 0.4 cm long.....
C. longipetalus (Merr.) Kiew
 (Latin, *longi-* = long, *petalus* = petal; with long petals)
 Malay. For. 43 (1980) 379, *p.p.*, *l.c.* (1981) 152, *p.p.* Basionym: *Linociera longipetala* Merr., PEB (1929) 249, Masamune, EPB (1942) 612. Type: *Elmer 20455*, Borneo, Sabah, Tawau (holotype K; isotype L).
Shrub 1–2 m tall. Twigs round in cross-section, drying pale brown, nodes slightly flattened, minutely lenticellate, glabrous. Leaves subcoriaceous, glabrous, drying fawn or midbrown, with lateral veins darker than leaf blade beneath; lanceolate to broadly lanceolate 20–28 × 8–11 cm, base cuneate to rounded, margin slightly recurved, apex cuspidate, acumen 1–1.5 cm long; midrib slightly raised above, prominent beneath; lateral veins 6–8 pairs, plane above and prominent beneath, marginal vein c. 3 mm from margin; petiole 0.5–1 cm long, thickened, drying fawn. Inflorescences axillary, solitary, racemose with 2–3 pairs of widely spaced flowers, 0.6–1 cm long; peduncle c. 2 mm long, glabrous; bracts scarious, c. 1 mm long, minutely pubescent, persistent. Flowers bisexual, white; pedicel 0.5–1 mm long; buds pointed; calyx c. 0.5 mm long, deeply divided, lobes acute, glabrous; corolla 7–12 mm long, divided almost to the base, lobes narrowly linear, sometimes twisted at anthesis; stamens inserted on the corolla tube by thick filaments of 0.5–1 mm long, anthers oblong-ovate, 1–1.5 mm long; ovary oblong-ovoid, c. 2 mm long, glabrous, stigma narrowly notched. Fruits (immature) ovoid, c. 0.4 × 0.3 cm, not curved or ridged.
 Endemic to Borneo. In Sabah, only known from the type collection in Tawau and *SAN 90114* from Tingkayu in Kunak district. Also known in E Kalimantan (e.g., *Endert 2788*, *Endert 3039*, *Kostermans s.n.*, *Kostermans 10460*). In lowland mixed dipterocarp forest, to 150 m altitude.
 Tree 3–17 m. Leaf 10–17 cm long, drying pale grey-green. Fruit globose, *c.* 1.8 cm long.....**25. *C. spicatus***
6. Twigs stout. Leaf larger, 23–38 × 7–13 cm; lateral veins obscure beneath. Inflorescence ramiflorous. Fruit ovoid, smooth, *c.* 2.5 × 2 cm.....**3. *C. callophyllus***
 Twigs slender. Leaf smaller, 17–28 × 6–10 cm; lateral veins conspicuous beneath. Fruit ellipsoid, superficially 4-ridged, *c.* 3 × 1.5 cm.....**2. *C. callophyloides***

7. Leaf thickly coriaceous.....8
 Leaf coriaceous, subcoriaceous or chartaceous.....13
8. Petiole to 0.7 cm long. Inflorescence racemose, *c.* 0.5 cm long.....**15. C. palustris**
 Petiole 1 cm or longer. Inflorescence paniculate, 1–11 cm long.....9
9. Leaf obovate to oblong-lanceolate, base strongly tapering.....10
 Leaf lanceolate to broadly elliptic, base cuneate or rounded.....11
10. Lower leaf surface rugose, lateral veins obscure beneath. Fruit ellipsoid, 3.5–4.5 cm long.....**7. C. evenius**
 Lower leaf surface smooth, lateral veins prominent beneath. Fruit globose, 2–2.5 cm diameter... ..**8. C. globosus**
11. Leaf to 14 × 6 cm. Flowers in tight clusters, densely brown hairy. Fruit ovoid, *c.* 2.5 cm long.....**18. C. polycephalus**
 Leaf 14–30 × 5.5–13 cm. Flowers spaced, sparsely pubescent. Fruit globose, 1.5–1.8 cm diameter.....12
12. Lateral veins 7–8 pairs, plane and obscure on upper surface.....**11. C. leopoldi**
 Lateral veins 8–14 pairs, deeply impressed on upper surface....**14. C. pachyphyllus**
13. Inflorescence (or infructescence) racemose.....14
 Inflorescence (or infructescence) paniculate.....18
14. Leaf surface conspicuously glossy, slightly bullate (drying wrinkled) above.....
**12. C. lucens** (in part)
 Leaf surface dull and plane above.....15
15. Intercostal veins forming a conspicuous network on lower leaf surface.....
**10. C. kinabaluensis**
 Intercostal veins obscure.....16
16. Leaf apex bluntly rounded into the acumen. Fruit *c.* 2.5 cm long.....**9. C. havilandii**
 Leaf apex cuspidate. Fruit to 1.2 cm long.....17
17. Leaf oblong-ovate, base rounded to cuneate; lateral veins obscure beneath. Fruit smooth.....**5. C. crispus**
 Leaf lanceolate, base tapered; lateral veins prominent beneath. Fruit rugose.....
**23. C. rugosus**
18. Leaf obovate.....19
 Leaf lanceolate, broadly elliptic or oblong.....21
19. Intercostal veins prominent in dry leaf. Flower buds rounded. Fruit *c.* 2 cm long, with thin pericarp.....**22. C. ramiflorus** (in part)
 Intercostal veins obscure. Flower buds pointed. Fruit 4.5–6 cm long, with thick pericarp20

20. Petiole 1.5–3 cm long. Peduncle less than half the length of inflorescence. Fruit smooth....
 **13. C. macrocarpus**
 Petiole 2.5–5.5 cm long. Peduncle more than half the length of inflorescence. Fruit deeply
 ridged..... **20. C. porcatus**
21. Leaf coriaceous. Flowers polygamous.....22
 Leaf chartaceous to subcoriaceous. Flowers bisexual.....23
22. Tree 12–30 m tall. Calyx grey hairy. Fruit pear-shaped, *c.* 1.2 cm long.....
 **19. C. polygamus**
 Scandent, sometimes shrubby plants. Calyx not grey hairy. Fruit not pear-shaped...
C. macrobotrys (Merr.) Kiew
 (Greek, *makro* = large, *botrys* = bunch; referring to the inflorescence)
 J. Arn. Arb. 64 (1983) 620. Basionym: *Linociera macrobotrys* Merr., Philip. J. Sci. Bot. 13
 (1918) 117. Type: *Foxworthy 367*, Borneo, Sarawak, G. Pueh (holotype A). Synonyms: *Linociera*
scandens Merr., Philip. J. Sci. 37 (1928) 189, *syn. nov.* Type: *Ramos & Edano BS 45740*, the
 Philippines, Luzon, Mt. Alzapan (holotype A); *Myxopyrum enerve* van Steenis, Blumea 15 (1967)
 152; *Chionanthus enerve* (van Steenis) Kiew, J. Arn. Arb. 64 (1983) 622, *syn. nov.* Type: *Asah*
S 22740, Borneo, Sarawak, Mt. Dulit (holotype L; isotypes A, K).
Twigs round in cross-section, greyish brown. Leaves coriaceous, glabrous, punctate
beneath; lanceolate to slightly ovate, 4–12.5 × 1.5–6.5 cm, base rounded to truncate,
margin entire and recurved, apex acute to acuminate; midrib impressed above; lateral
veins 4–8 pairs, obscure on both surfaces; petiole drying black. Inflorescences axillary,
sometimes terminal, paniculate with up to fourth-order branching, 3–15 cm long.
Flowers polygamous; buds rounded. Fruits ovoid, c. 0.7 × 0.6 cm, not curved or
ridged.
 Borneo and the Philippines. In Borneo, recorded from Sabah (e.g., *Carr 27662A, Carr*
27905, Clemens 30910, Clemens 40704A, Clemens 50128, and RSNB 4499), Sarawak
 (e.g., *Argent & Jermy 1015, S 33831, S 33950, S 44617, and S 50866*), Brunei (e.g.,
Coode 7433 and Wong WKM 730), and Kalimantan (e.g., *Hallier 688, Hallier 709* and
Kostermans 13083B). In montane forest at 1100–2500 m altitude; once collected from
 limestone habitat (G. Api, Sarawak).
23. Panicle with second or third order branching.....24
 Panicle with first order branching.....25
24. Leaf drying chestnut-brown; petiole 0.5–1.5 cm long. Flower buds pointed; flowers
 crowded at tips of inflorescence branches. Fruit wall (pericarp) pimply (verrucose) and
 thick..... **17. C. pluriflorus**
 Leaf drying greenish brown; petiole 1.5–3 cm long. Flower buds rounded; flowers
 spaced. Pericarp smooth and thin..... **22. C. ramiflorus** (in part)
25. Leaf glossy above, slightly bullate (drying wrinkled) above..... **2. C. lucens** (in part)
 Leaf dull and plane above.....26
26. Leaf widest in the lower half; apex strongly cuspidate. Fruit *c.* 0.9 cm long, minutely
 rugose..... **1. C. balgooyiana**
 Leaf widest at the middle; apex acute, acuminate to cuspidate. Fruit 1.5–2.3 cm long,
 smooth.....27

27. Leaf drying dark chestnut-brown; lateral veins conspicuously darker than leaf blade beneath..... **16. C. plurifloroides**
 Leaf drying greenish grey or greenish brown; lateral veins concolorous or slightly darker than leaf blade beneath.....28
28. Leaf narrowly lanceolate, 14–21.5 × 3.5–6 cm. Panicles 7–13 cm long. Fruit globose..... **25. C. sabahensis**
 Leaf broadly elliptic to lanceolate, 6–15 × 2.5–5.5 cm. Panicles 1.5–5 cm long. Fruit ovoid..... **21. C. pubicalyx**

1. *Chionanthus balgooyiana* Kiew

Fig. 1.

(Max M.J. van Balgooy, botanist and plant geographer, National Herbarium of the Netherlands, Leiden Branch, the Netherlands)

TFSS 4, App. (2002) 351. **Type:** *Martin S 38039*, Borneo, Sarawak, G. Mulu (holotype SAR; isotypes K, KEP, SAN, SING).

Tree to 20 m tall and 35 cm diameter; bole with low buttresses *c.* 20 cm tall. **Bark** greyish green or dark brown, flaky. **Twigs** slender, *round in cross-section*, drying greyish white, flattened at nodes when young, lenticellate, glabrous. **Leaves** *subcoriaceous, dull and plane above*, drying greyish green, very sparsely pubescent; *narrowly lanceolate, 7–8.5 × 2–3.5 cm, widest in the lower half, base cuneate*, margin recurved, *apex strongly cuspidate*, acumen 0.75–1.5 cm long; midrib raised above, plane beneath; lateral veins 4–6 pairs, plane and obscure on both surfaces, marginal vein absent; *petiole* 0.5–1 cm long, not thickened, *drying black*. **Inflorescences** axillary, solitary, *panicle with first order branching, (0.5–)1–2.75 cm long, branch c. 3 mm long with 2–4 spaced pairs of flowers; peduncle 2–4 mm long, glabrous; bracts scarious, c. 1 mm long, glabrous, persistent*. **Flowers** *bisexual*, white or greenish white; buds rounded; pedicel 1–3 mm long; calyx *c.* 1.5 mm long, divided more than halfway, lobes acute, glabrous; corolla 2–3.5 mm long, divided almost to base, lobes narrowly linear, involute, apex cucullate, straight at anthesis; stamens almost sessile, epipetalous, anthers rotund, *c.* 0.5 mm long, without apiculum; ovary conical, *c.* 1.25 mm long, glabrous, stigma bilobed. **Infructescences** *c.* 1.25 cm long, slightly thickened. **Fruits** (?immature) ovoid, *c. 0.9 × 0.6 cm, not curved, minutely rugose*, apex rounded, base tapered; stalk *c.* 3 mm long, slightly thickened. **Seeds** unknown.

Distribution. Endemic to Borneo, known in Sarawak only from Bt. Senyandang in the Second Division (e.g., *S 44254*), Dulit Range in the Fourth Division (e.g., *Richards 1706, Richards 1773, S 34896, and S 46777*) and G. Mulu (the type).

Ecology. In hill to lower montane forest on steep slopes, at 650–1400 m altitude.

2. *Chionanthus callophyloides* Kiew

(Greek, *-oides* = like; referring to its resemblance to *C. callophyllus*)

TFSS 4, App. (2002) 351. **Type:** *Saikeh SAN 79917*, Borneo, Sabah, Sandakan district, Sepilok FR (holotype SAN; isotype SING).

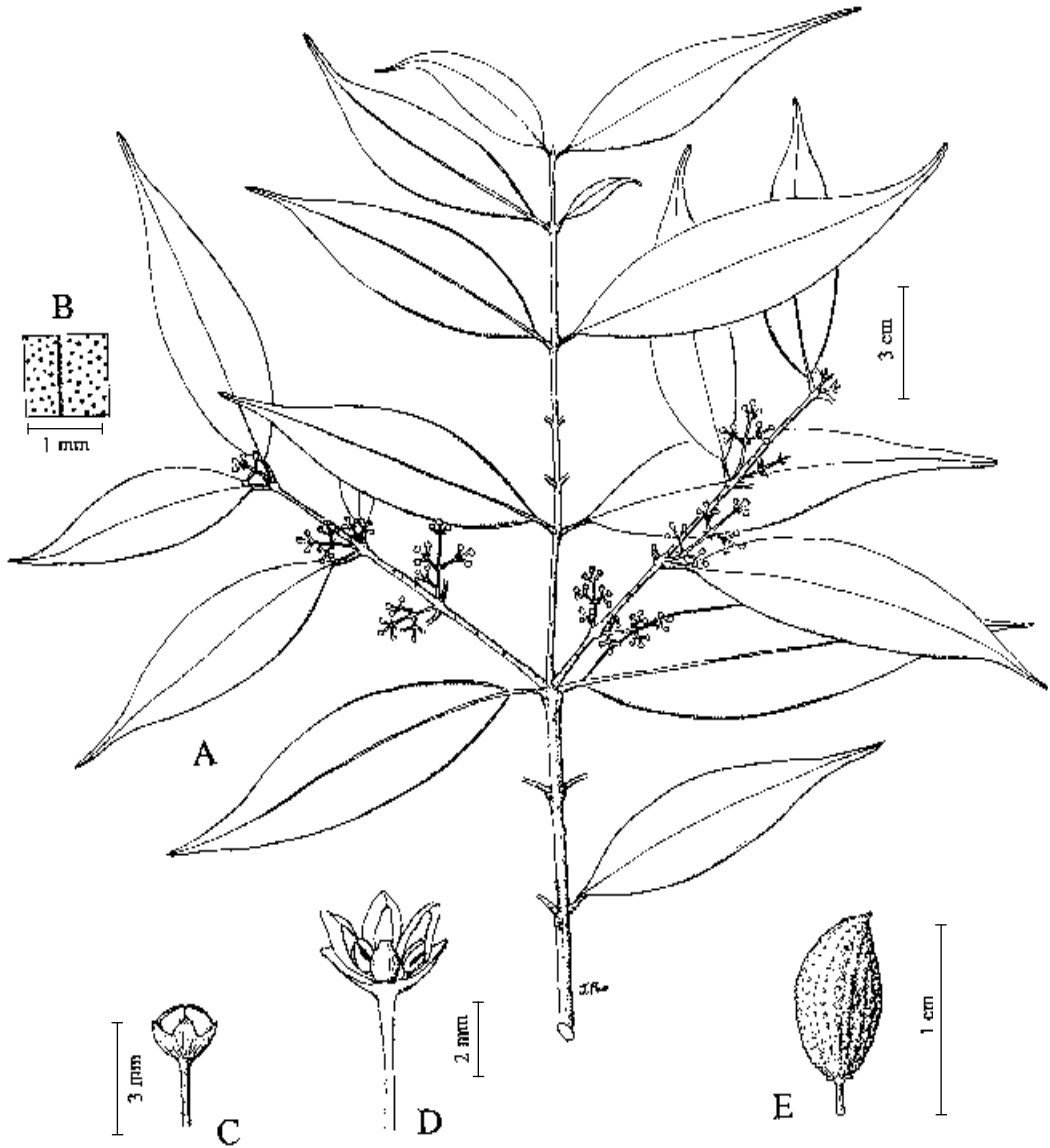


Fig. 1. *Chionanthus balgooyiana*. A, flowering leafy twig; B, detail of upper leaf surface; C, flower bud; D, open flower with one calyx lobe and one corolla lobe removed; E, young fruit. (A–D from S 34896, E from S 38039.)

Tree to 13 m and 25 cm diameter. **Bark** brown, minutely fissured; inner bark yellowish pink. **Sapwood** pinkish. **Twigs** slender, round in cross-section, glabrous, older twigs drying pale grey, nodes flattened, lenticels conspicuous in young green twigs, disappearing with age, leaf scars large, horseshoe-shaped. **Leaves** subcoriaceous, glabrous, drying grey-green above and fawn beneath; narrowly obovate, (17.5–)27(–28) × (6–)8(–10) cm, base tapered, margin slightly recurved, apex acuminate, acumen 1–2 cm long; midrib impressed above, prominent beneath; lateral veins 9–11(–15) pairs, impressed or plane above, conspicuous beneath, marginal vein conspicuous and 2–3 mm from margin; petiole 1.75–2.5 cm long, thickened, deeply grooved above, drying brown. **Inflorescences** c. 1 cm long, glabrous. **Flowers** unknown. **Infructescences** (young) racemose panicle, solitary, axillary, 2–3 cm long, lowest branch c. 1.5 cm long, upper branch c. 0.5 cm long; peduncle 2–5 mm long; bracts scarious. **Fruits** ellipsoid, c. 3 × 1.5 cm, not curved, superficially 4-ridged, apex acute or rounded, base truncate, immature fruits blue green, drying with white bloom; stalk thickened; pericarp rough, c. 1.5 mm thick but not woody when dry. **Seeds** endospermous.

Distribution. Endemic to Borneo. In Sabah, known from Lahad Datu, Pitas, Ranau, Sandakan, and Tenom districts (e.g., *SAN 12142*, *SAN 35605*, *SAN 72028*, *SAN 92435*, *SAN 120061*, and *SAN 132640*). In Sarawak, recorded from Ulu Sg. Berar, G. Mulu (e.g., *S 39633*).

Ecology. Lowland mixed dipterocarp forest, often in flat swampy (fresh water) lands, at c. 20 m altitude.

3. *Chionanthus callophyllus* Blume (Greek, *calos* = beautiful; *phullon* = leaf)

Mus. Bot. Lugd. Bat. 1 (1850) 319; Kiew, Gard. Bull. Sing. 37 (1984) 210, *l.c.* (1989) 287. **Lectotype** (Kiew, 1984): *Korthals s.n.* (= *RHL Sheet No. 908158933*), Borneo, without locality (hololectotype L). **Synonyms:** *Linociera paludosa* King & Gamble, J. As. Soc. Beng. 74, 2 (1906) 268, Merrill, EB (1921) 489, Ridley *l.c.* (1923) 316, Masamune *l.c.* 612; *Olea platycarpa* King & Gamble *l.c.* 271; *C. platycarpus* (King & Gamble) Kiew, Malay. For. 42 (1979) 272, *l.c.* (1981) 149.

Tree or shrub, 3–30 m tall, to 30 cm diameter. **Bark** rough or scaly, white, grey or brown; inner bark orange-brown to red. **Sapwood** white or yellow. **Twigs** stout, round in cross-section, drying white, nodes flattened with large horseshoe-shaped leaf scars, glabrous, lenticellate. **Leaves** clustered at ends of twigs, slightly subcoriaceous, glabrous, drying grey or pale brown; obovate to oblong-lanceolate, 23–38 × 7–13 cm, base tapered or cuneate, margin slightly recurved, apex rounded to shortly acuminate; midrib plane above; lateral veins 8–13 pairs, impressed above, obscure beneath, marginal vein 3–5 mm from margin; petiole 1.5–3 cm long, stout, drying reddish brown. **Inflorescences** ramiflorous, occasionally axillary, fascicled, paniculate with first order branching, 2–2.5 cm long, glabrous, lowest branch 3–6 mm long; peduncle 3–5 mm long; bracts scarious, ovate-acute, c. 4 mm long, glabrous, persistent. **Flowers** sessile, bisexual, pale green or white, sometimes tinged purple or creamy yellow with a brown centre; buds pointed; calyx c. 2.5 mm long, divided c. halfway, lobes acute, glabrous, margin sometimes ciliate; corolla c. 5 mm long, divided almost to base, lobes narrowly linear, twisted at anthesis; stamens with broad filament c. 0.5 mm long, attached at base of corolla, anthers oblong, c. 0.5 mm long; ovary globose, c. 1 mm long, glabrous, stigma bilobed. **Infructescences** 1.5–3.5 cm long, thickened. **Fruits** ovoid, up to 2.5 × 2 cm, smooth, not curved, base flattened, apex acute; pericarp purple,

drying with white bloom, *c.* 1 mm thick, leathery; stalk 3–10 mm long. **Seeds** albuminous.

Distribution. Thailand, Sumatra, Peninsular Malaysia, and Borneo (Sabah and Kalimantan). In Sabah, not common, collected several times from Sandakan district and once from Tenom district (e.g., *SAN 35605*, *SAN 72028* and *SAN 79917*).

Ecology. Lowland mixed dipterocarp and swamp forests, commonly on hill slopes, at altitudes to 500 m.

4. ***Chionanthus cordulatus*** Koorders

(Latin, *cordulatus* = shallowly heart-shaped at base; referring to the leaf blade)

Meded's Lands Plant. 19 (1898) 527 & 638. **Type:** *Koorders 19592*, Sulawesi, Minahasa, Manado (BO, L).

Small tree or shrub to 15 m tall and 30 cm diameter; once recorded as a climber (*Carr SFN 26728*). **Bark** greenish; inner bark pink-yellow. **Sapwood** yellowish. **Twigs** moderately slender, round in cross-section, drying white, nodes slightly flattened, lenticellate, glabrous. **Leaves** chartaceous, glabrous, drying green-brown to light chestnut-brown; slightly obovate to ovate, (16–)22(–36) × (6–)8(–13) cm, *base cordate*, margin not recurved, apex acuminate or sometimes acute, acumen to 1.5 cm long; midrib and lateral veins plane above, prominent beneath; lateral veins (9–)12(–17) pairs, marginal vein 2–3 mm from margin; petiole (0.4–)0.8(–1.5) cm long, thickened, drying white. **Inflorescences** ramiflorous or axillary, 3 or more fascicled together, racemose with 3–6 pairs of flowers or racemose panicle, 1–4 cm long, lowest branch to 1 cm long; flowers well spaced, pubescent; peduncle 3–5 mm long; bracts scarious, acute, 2–3 × 1.5 mm, densely pubescent, persistent. **Flowers** bisexual, white or yellowish green; buds pointed; pedicel 1–2 mm long; calyx *c.* 0.5 mm long, divided *c.* halfway, lobes acute, minutely pubescent; corolla 6–8 mm long, divided almost to base, lobes narrowly linear, straight or twisted at anthesis; stamens sessile, anther oblong, *c.* 0.7 mm long; ovary globose, *c.* 1 mm diameter, glabrous, stigma capitate. **Infructescences** thickened. **Fruits** ovoid, *c.* 2.75 × 2.25 cm, apex rounded; pericarp greyish green, rough with brown warts, *c.* 2 mm thick, leathery; stalk *c.* 5 mm long and 2 mm thick. **Seeds** albuminous.

Distribution. Borneo (Sabah and E Kalimantan), NE Sulawesi and N Maluku. In Sabah, known from Keningau, Ranau, Tambunan, and Tenom districts (e.g., *SAN 114151*, *SAN 116582*, *SAN 120257*, *SAN 122437*, and *SFN 26728*). In Kalimantan, recorded from Berau (e.g., *Kostermans 21416*).

Ecology. Lowland forest usually by rivers but also from hillsides, at altitudes to 930 m.

5. ***Chionanthus crispus*** Kiew

(Latin, *crispus* = curled; alluding the strongly twisted petals at anthesis)

Malay. For. 44 (1981) 153; Coode *et al.* (eds.) *l.c.* 247. **Type:** *Ahmad SAN 47649*, Borneo, Sabah, Lahad Datu district, Tabawan Is. (holotype SAN; isotypes KEP, L).

Tree to 30 m tall and 60 cm diameter; flowering at 3 m tall; bole shortly buttressed or fluted. **Bark** grey, smooth or lenticellate; inner bark orange. **Sapwood** ochre. **Twigs** slender, *round in cross-section*, drying white, nodes flattened, glabrous, lenticels inconspicuous. **Leaves** *coriaceous*, glabrous, *drying dull and plane above*, grey-green or sometimes brownish green beneath; *oblong-ovate*, occasionally rotund, 7–13 × 2.5–5.5 cm, *base rounded* or *cuneate*, margin slightly recurved, *apex cuspidate*, acumen 1–2 cm long; midrib plane or slightly impressed above, slightly prominent beneath; *lateral veins* 6–9 pairs, *plane and obscure on both surfaces*, marginal vein 1–2 mm from margin; *intercostal venation obscure*; *petiole* 0.5–0.7 cm long, not thickened, *drying black*, densely pubescent. **Inflorescences** axillary and solitary, *racemose* with 3–4 spaced pairs of opposite flowers, 0.5–1.5 cm long; peduncle *c.* 1 mm long, ferruginous; bracts scarious, *c.* 2 mm long, pubescent, persistent. **Flowers** bisexual, white or purple; buds pointed; sessile or with pedicel to 1 mm long; calyx *c.* 2 mm long, divided almost to base, lobes acute, pubescent, margin ciliate; corolla 5–6 mm long, divided almost to base, lobes narrowly linear, strongly twisted and recurved at anthesis; stamens subsessile, attached at base of corolla, anthers oblong; ovary ovoid, *c.* 1 mm long, glabrous, stigma bilobed. **Fruits** (?immature) ovoid, 1–1.2 × 0.8 cm, *smooth, not curved*, apex rounded; pericarp drying thin and brittle. **Seeds** unknown.

Distribution. Endemic to Borneo (Sabah and Brunei only). In Sabah, known from islands in the south (Tabawan, Timbun Mata and Pababag Is.; e.g., *SAN 63917* and *SAN 68539*) and inland from ultrabasic soils at Lahad Datu district (Bt. Silam; e.g., *SAN 57285*), Ranau district (Bt. Hampuan; e.g., *SAN 56566* and *SAN 64136*) as well as from Sandakan district (Bt. Senilakan; e.g., *SAN 51240* and *SAN 53214*). In Brunei, recorded from Tutong district (e.g., *Coode 6854*).

Ecology. Primary forest, usually on sandy or ultrabasic soils, at altitudes to 850 m.

6. *Chionanthus curvicarpus* Kiew

(Latin, *curvi-* = curved, Greek, *karpos* = fruit; with curved fruits)

Gard. Bull. Sing. 37 (1984) 211; Coode *et al.* (eds.) *l.c.* 247; Argent *et al.* (eds.) *l.c.* 487. **Type:** *Aban SAN 35826*, Borneo, Sabah, Tawau district, Gading (holotype SAN; isotypes K, KEP, L). **Synonyms:** *Linociera cuspidata* auct. non (Blume) Knobl.: Merrill *l.c.* (1921) 488, *l.c.* (1929) 249, Masamune *l.c.* 612, Anderson *l.c.* 285; *Chionanthus cuspidatus* auct. non Blume: Kiew *l.c.* (1980) 372, *l.c.* (1981) 152.

Tree or shrub to 23 m tall and 30 cm diameter; bole to 10 m tall, occasionally fluted or with short buttresses. **Bark** smooth, whitish grey or brown; inner bark pale yellow. **Sapwood** whitish. **Twigs** moderately slender, *quadrangular in cross-section*, drying white, lenticels inconspicuous, nodes flattened, glabrous. **Leaves** chartaceous, glabrous, drying pale grey; oblong-lanceolate to narrowly lanceolate, 10–20(–28) × 3–8.5 cm, *base tapering* or *cuneate*, margin not recurved, apex acuminate or acute, acumen *c.* 1 cm long; midrib and veins plane or slightly impressed above, prominent beneath; lateral veins (8–)10–11(–15) pairs, marginal vein 2–4 mm from margin; petiole 0.7–1 cm long, not thickened, drying brown. **Inflorescences** axillary, solitary or fascicled, shortly branched racemose panicle, 1–2.5(–6) cm long, branches 3–5(–11) mm long, glabrous; flowers distant; peduncle 3–5(–7) mm long; bracts scarious, ovate, *c.* 1 mm long, glabrous, persistent. **Flowers** bisexual, yellowish (sometimes yellowish green or greenish white); buds pointed; pedicel 1–2 mm long; calyx *c.* 1 mm long, divided more than halfway, lobes acute, sparsely pubescent, margin ciliate; corolla 2–4 mm long, divided almost to base, lobes narrowly linear, twisted at anthesis; stamens subsessile, attached to base of corolla, anthers *c.* 1 mm long,

oblong; ovary ovoid, *c.* 1 mm long, glabrous, stigma capitate. **Infructescences** thickened, 2–3 cm long. **Fruits** ellipsoid, *c.* 2.5 × 1.7 cm, *curved and longitudinally ridged*, acutely narrowed to base, apex rounded and apiculate; pericarp smooth, green even when mature, drying *c.* 1 mm thick, leathery; stalk 4–8 mm long. **Seeds** albuminous.

Vernacular name. Sabah—*mak ulat* (Dusun-Kaingaran).

Distribution. Sumatra, Peninsular Malaysia and Borneo (Sabah, Sarawak, Brunei, C and SE Kalimantan). In Sabah, common throughout (e.g., *SAN 24871*, *SAN 36484*, *SAN 56153*, *SAN 75309*, and *SAN 83970*). In Sarawak, occasional (G. Murut, G. Mulu, Kapit, and Kelabit Highlands; e.g., *Geh & Syamsuri 960*, *Nooteboom & Chai 1740*, *S 20212* and *S 48010*). In Brunei, recorded from Belalong and Temburong districts (e.g., *BRUN 997*, *Dransfield JD 7317* and *Wong WKM 1394*). Also occurs in E Kalimantan (e.g., *McDonald & Ismail 3621* and *Kostermans 10590*).

Ecology. Lowland primary or old secondary forest and riverine forest, usually at altitudes to 1000 m.

7. *Chionanthus evenius* (Stapf) Kiew (Latin, *even* = even; referring to the leaf surface)

Malay. For. 42 (1979) 268, *l.c.* (1980) 374, *l.c.* (1981) 159, *l.c.* (1989) 288; Coode *et al.* (eds.) *l.c.* 247. **Basionym:** *Linociera evenia* Stapf, Kew Bull. (1915) 116, Merrill *l.c.* (1921) 488, Masamune *l.c.* 612, Anderson *l.c.* 285. **Type:** *Beccari PB 3301*, Borneo, Sarawak (holotype K).

Tree to 50 m tall and 30 cm diameter; bole shortly buttressed. **Bark** grey and smooth, falling in small, thin flakes; inner bark granular, sticky, yellow-brown. **Sapwood** white or pale pink. **Twigs** stout, *round in cross-section*, drying pale grey, nodes flattened, glabrous, lenticels conspicuous. **Leaves** *thickly coriaceous*, glabrous, drying grey above, orange and *rugose beneath*; *obovate to oblong-lanceolate*, 8–18(–28) × 4–5.5(–7) cm, *base strongly tapering*, margin recurved, apex acute to apiculate; midrib slightly impressed above; *lateral veins* 8–12 pairs, plane above, *obscure beneath*, marginal vein obscure; *petiole* 1–2.5(–5) cm long, slightly thickened, *drying black*. **Inflorescences** axillary, solitary, *paniculate* with distantly spaced short branches, 2.5–11 cm long, lowest branch 0.75–1.5(–3) cm long; flowers in clusters of 5–8 at tips of branches, pubescent; peduncle slender, 1.5–3.5 cm long; bracts foliaceous, spatulate, to 5 mm long, sparsely pubescent, persistent. **Flowers** sessile, bisexual, pinkish white, buds pointed; calyx *c.* 1 mm long, divided to base, lobes acute, densely pubescent; corolla *c.* 3 mm long, divided almost to base, lobes narrowly linear, more or less straight at anthesis; stamens with filament *c.* 0.5 mm long, attached at base of corolla, anthers *c.* 1 mm long, oblong, connective apiculate; ovary ovoid, *c.* 1 mm long, glabrous, stigma slightly bilobed. **Infructescences** thickened, 5–14 cm long. **Fruits** *narrowly ellipsoid*, 3.5–4.5 × 2–2.5 cm, *smooth, not curved*, apex narrowed, base rounded, creamy or light brown on drying; epicarp *c.* 1 mm thick; mesocarp 2–3 mm thick and leathery; endocarp *c.* 2 mm thick and woody; stalk enlarged, *c.* 5 mm long and 4 mm thick. **Seeds** albuminous.

Vernacular name. Sarawak—*sapah hutan* (preferred name).

Distribution. Sumatra, Peninsular Malaysia and Borneo (Sabah, Sarawak, Brunei, and Kalimantan). In Sabah, known only from Beaufort district (e.g., *SAN 80319*). In Sarawak, recorded from G. Penrissen, Setapok FR, Baram and Kayangeran (e.g., *Egon 340*, *Jacobs 5015*, *S 2887*, *S 4914*, and *S 30580*). In Brunei, known from Belalong area (e.g., *Coode 6479* and *S 5888*), and in Kalimantan from W Kutei.

Ecology. Freshwater or peat swamp forest in lowlands, once reported from mossy forest at c. 1400 m altitude (G. Penrissen).

8. *Chionanthus globosus* (Kiew) Kiew

(Latin, *globosus* = spherical; referring to the fruit)

TFSS 4, App. (2002) 352. **Basionym:** *C. elaeocarpus* (Stapf) Kiew var. *globosus* Kiew *l.c.* (1980) 374, *l.c.* (1981) 150. **Type:** *Chai S 35338*, Borneo, Sarawak, Kelabit Highlands (holotype SAR; isotype K).

Tree, 20–42 m tall, to 60 cm diameter; bole smooth, sometimes with buttresses 1.5–5 m tall. **Bark** almost smooth. **Sapwood** cream. **Twigs** stout, *round in cross-section*, drying blackish, ultimate twigs flattened, glabrous, lenticellate. **Leaves** *thickly coriaceous*, glabrous, drying dull, dark green-brown above, fawn and *smooth beneath* with lateral veins darker than leaf blade; *obovate*, 10–17 × 5–8 cm, *base strongly tapering*, margin strongly recurved, apex acute or with short acumen c. 3 mm long; midrib slightly raised above and prominent beneath; *lateral veins* 7–12 pairs, plane above, *prominent beneath*, marginal vein obscure; *petiole* 2.5–3.5 cm long, *drying black*. **Inflorescences** axillary, solitary, *paniculate* with third to fourth order branching, 1–9 cm long; rachis strongly flattened, lowest branch 1–2 cm long; flowers crowded at tips of branches, glabrous; peduncle stout, 1–6 cm long; bracts foliaceous, spatulate, 4–15 × 6 mm, pubescent, persistent. **Flowers** sessile, bisexual, white; buds pointed; calyx divided c. halfway, c. 1 mm long, lobes acute, pubescent; corolla divided almost to base, c. 4 mm long, lobes oblong, more or less straight at anthesis; stamens sessile, epipetalous, anthers yellow, c. 1 mm long, oblong; ovary ovoid, c. 1 mm long, glabrous, stigma capitate. **Infructescences** thickened, to 11 cm long, bearing 1–3 fruits. **Fruits** *globose*, to 2–2.5 cm diameter, *smooth, not curved*, green drying black; pericarp 3–5 mm thick, leathery; stalk c. 5 mm long. **Seeds** albuminous.

Distribution. Endemic to Borneo. Known from Sipitang district in Sabah (e.g., *SAN 16715* and *SAN 16745*), Belaga, Kapit, Lawas, Limbang, and Marudi districts in Sarawak (e.g., *S 26013*, *S 32225*, *S 34818*, *S 35338*, and *Zainuddin et al. AZ 5616*), and W Kutei in CE Kalimantan (e.g., *Endert 3134*, *Endert 3634*, *Endert 4308*, and *Endert 4436*).

Ecology. Usually in forest on mountain ridges, occasionally in *kerangas* forest, at 200–1300 m altitude.

Notes. Pickles (*S 3592*) records the fruits as edible.

9. *Chionanthus havilandii* Kiew

(J.D. Haviland, 1857–1901, First Sarawak Medical Officer, plant and insect collector)

Malay. For. 43 (1980) 375. **Type:** *Haviland 1873*, Borneo, Sarawak, Rejang (holotype SAR; isotype SING).

Tree to 20 m and 35 cm diameter, flowering at *c.* 2 m tall. **Bark** smooth, whitish. **Twigs** white, slender, *round in cross-section*, glabrous, slightly flattened at nodes, lenticellate. **Leaves** *coriaceous*, glabrous, *dull and plane above*, reddish brown beneath; broadly lanceolate to oblong, 5.5–10 × 3–7 cm, *base rounded* sometimes *cuneate*, margin finely recurved, *apex bluntly rounded into an acumen c. 1 cm long*; midrib slightly impressed above, prominent beneath; lateral veins 6–8 pairs, plane and obscure above, concolorous with leaf blade and slightly prominent beneath, marginal vein 2–4 mm from margin; *intercostal venation obscure*; *petiole* 0.5–1.5 cm long, not thickened, *drying black*. **Inflorescences** axillary or extra-axillary, 1–3 per axil, *racemose*, unbranched, with 3–4 pairs of opposite flowers, 1–1.5(–3) cm long; peduncle 2–3 mm long, glabrous; bracts scarious, ovate, 1–1.5 mm long. **Flowers** bisexual, yellow or white, somewhat fragrant; pedicel 1–1.5 mm long; calyx *c.* 1.5 mm long, shallowly lobed, lobes ovate, glabrous; corolla 5–5.5 mm long, free to base, lobes oblong-linear, induplicate, straight at anthesis; stamens with filament *c.* 0.5 mm long, anther oblong, *c.* 1 mm long; ovary ovoid, *c.* 1 mm long, glabrous, stigma capitate. **Fruits** ovoid, *c.* 2.5 × 1.75 cm, *not curved, longitudinally ridged*, green drying light brown; pericarp leathery, 2–3 mm thick when dry; endocarp brittle. **Seeds** endospermous.

Distribution. Endemic to Borneo and known only from Sarawak (e.g., *Egon A 837, Haviland 894, Haviland 1754, Haviland 3041, Haviland 1873, S 140, S 9042, and S 34210*).

Ecology. In swamp and *kerangas* forest, besides streams.

10. *Chionanthus kinabaluensis* Kiew

(of G. Kinabalu, Sabah)

TFSS 4, App. (2002) 352. **Type:** *Clemens 29348–30229* (p. 0189 Oleaceae), Borneo, Sabah, Tenompok, G. Kinabalu (holotype SING; isotype SING).

Tree. **Twigs** slender, *round in cross-section*, glabrous, strongly flattened at nodes, drying brown, lenticels conspicuous. **Leaves** *coriaceous*, glabrous, drying *dull pale brown and plane above*, paler chestnut-brown beneath, with midrib, lateral and intercostal veins darker; lanceolate, 9.5–12 × 3.5–5.25 cm, *base cuneate*, margin finely recurved, apex cuspidate, acumen to 1.25 cm long; midrib slightly raised above, plane beneath; lateral veins 7–9 pairs, plane and obscure above, slightly prominent beneath, *intercostal venation reticulate, conspicuous and darker than leaf blade beneath*, marginal vein 1–2 mm from margin; *petiole* 0.8–1 cm long, not thickened, *drying black*. **Inflorescences** and **flowers** unknown. **Infructescences** axillary, solitary, glabrous, *racemose*, 2–3.5 cm long; peduncle 0.4–1 cm long; pedicel *c.* 4 mm long, thickened. **Fruits** slightly obovoid, 1.4–1.5 × 1–1.3 cm, *smooth, not curved, (?immature) green with purple cheeks*; pericarp *c.* 1 mm thick; endocarp woody. **Seeds** unknown.

Distribution. Endemic to Borneo and known only from G. Kinabalu in Sabah (e.g., *Clemens 29348–30229*).

Ecology. Montane forest.

11. *Chionanthus leopoldi* Kiew

Fig. 2.

(Leopold Madani, senior research assistant, Sandakan Herbarium)

TFSS 4, App. (2002) 353. **Type:** *Leopold & Taha SAN 83546*, Borneo, Sabah, Mile 87.5 Telupid Road (holotype SAN; isotypes K, KEP, L, SAR, SING).

Small tree to 13 m tall and 30 cm diameter; bole to 10 m tall. **Bark** greyish, lenticellate; inner bark dark brown. **Sapwood** reddish or pale green. **Twigs** moderately stout, *round in cross-section*, glabrous, lenticellate, nodes slightly flattened, drying whitish. **Leaves** *thickly coriaceous*, glabrous, dull olive-brown above, rich chestnut-brown beneath with veins slightly paler than leaf blade; *broadly elliptic*, $(14-21(-24) \times (6.5-7.5(-9)$ cm, *base rounded* sometimes slightly unequal, margin recurved, apex acuminate, acumen (1-)2.5 cm long; midrib slightly raised above, plane beneath; *lateral veins 7(-8) pairs, plane and obscure above*, plane or slightly prominent beneath, marginal vein 2-5 mm from margin; intercostal venation usually obscure; *petiole 1.5-2 cm long*, slightly thickened, *drying black* and wrinkled transversely. **Inflorescences** axillary, *panicle with first order branching*, solitary, *c. 3.5 cm long*, with *c. 4 regularly spaced sparsely pubescent flowers*, lowest branch 1-1.25 cm long, glabrous; peduncle 0.5-1 cm long; bracts linear 1-3 mm long, pubescent, persistent. **Flowers** bisexual, pale greenish; pedicel 1-3 mm long; calyx *c. 1 mm long*, divided less than halfway, very sparsely pubescent, lobes acute, margin slightly ciliate; corolla 3-4 mm long, glabrous, lobes narrowly linear, scarcely joined in pairs at base, margin involute, apex acute, more or less straight at anthesis; stamens sessile attached at base of corolla, anther subglobose, *c. 0.6 mm long*, connective not apiculate; ovary narrowly ovoid, *c. 1 mm long*, glabrous, stigma slightly bilobed. **Infructescences** 2-6 cm long, slightly thickened. **Fruits** *globose, 1.6-1.8 cm diameter, smooth, not curved*, ripening purple with white spots or red-brown; pericarp *c. 0.75 mm thick*; endocarp thin and brittle. **Seeds** endospermous.

Distribution. Endemic to Borneo and known only from Kinabatangan and Labuk Sugut districts in Sabah (e.g., *SAN 83544*, *SAN 85682*, *SAN 93967*, *SAN 125946*, and *SAN 133958*).

Ecology. In mixed dipterocarp forest on hill slopes or ridges, at 100-700 m altitude.

12. *Chionanthus lucens* Kiew

(Latin, *lucens* = polished; referring to the leaf surface)

Malay. For. 44 (1981) 154. **Type:** *Mujing SAN 40652*, Borneo, Sabah, Tawau (holotype SAN; isotypes KEP, L).

Tree, 9-18 m tall, to 25 cm diameter. **Bark** whitish, lenticellate to scaly; inner bark yellow or reddish. **Sapwood** yellowish, pale reddish or greyish. **Twigs** moderately slender, *round in cross-section*, white to pale grey-brown, nodes slightly flattened, lenticels inconspicuous, glabrous. **Leaves** *subcoriaceous*, sparsely pubescent to glabrous, drying greyish brown, *wrinkled and conspicuously glossy above*; *oblong* or *broadly elliptic*, $(9-11.5-15.5(-18.5) \times (2.75-5-6.5)$ cm, *base rounded* and decurrent, margin slightly recurved, apex cuspidate, acumen to 1.5 cm long;

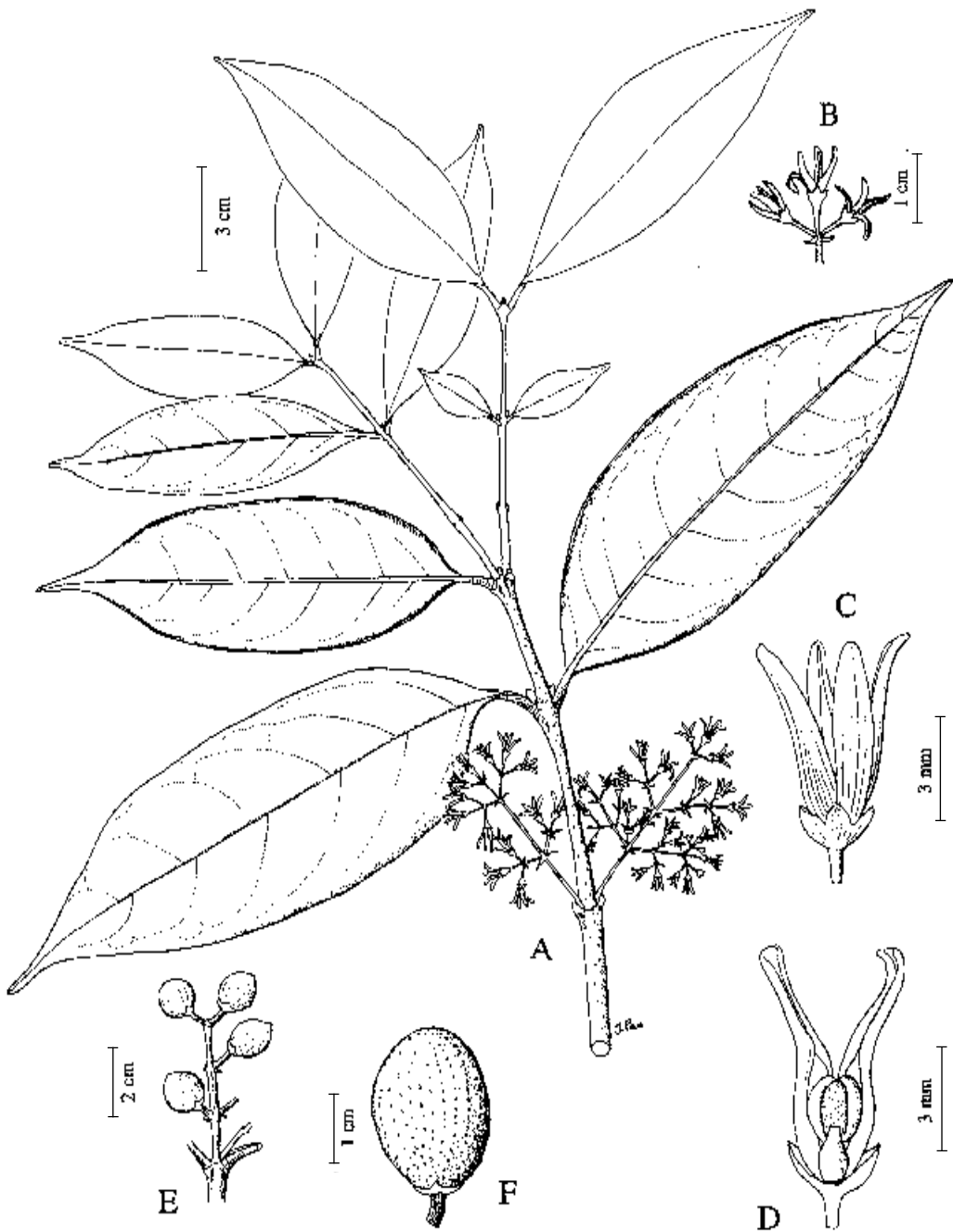


Fig. 2. *Chionanthus leopoldi*. A, flowering leafy twig; B, distal portion of inflorescence; C, open flower; D, open flower with two calyx lobes, two corolla lobes and one stamen removed; E, infructescence; F, fruit. (A–D from SAN 125946, E–F from SAN 85682.)

midrib slightly impressed above, plane beneath; lateral veins 5–7(–9) pairs, slightly impressed above, plane beneath, marginal vein (2–)3–5 mm from margin; *petiole* 0.5–1.5 cm long, not thickened, *drying black*. **Inflorescences** axillary, solitary, *racemose* with pairs of opposite flowers or *once branched panicle*, (0.75–)2–2.5 cm long, lowest branch 4–5 mm long; flowers spaced, finely pubescent; peduncle *c.* 5 mm long; bracts foliaceous, spatulate, 1–4 mm long, pubescent, persistent. **Flowers** *bisexual*, light green or yellow; buds pointed; pedicel 1–2 mm long; calyx *c.* 1 mm long, divided almost to base, lobes acute, finely pubescent or glabrous; corolla *c.* 2 mm long, divided to base, lobes narrowly linear, straight, glabrous; stamens sessile, inserted at base of corolla tube, anthers oblong, less 1 mm long; ovary conical, *c.* 1 mm long, stigma sessile, bilobed. **Infructescences** thickened, 1.5–2.5 cm long. **Fruits** ovoid, 1.2–1.5 × 0.9 cm, *smooth, not curved*, apex pointed; stalk 3–7 mm long, *c.* 2 mm thick; endocarp *c.* 1 mm thick, brittle. **Seeds** albuminous.

Vernacular name. Sarawak—*bokol* (Land Dayak).

Distribution. Peninsular Malaysia and Borneo (Sabah, Sarawak and E Kalimantan). In Sabah, known from Tawau district (e.g., *SAN 32997*, *SAN 40652* and *SAN 134079*). In Sarawak, recorded from Bau and Bintulu districts (e.g., *S 24551*, *S 47578*, *S 48202*, and *S 50174*). In Kalimantan, known from Balikpapan area (e.g., *Ambri & Arifin AA 78*) and E Kutei (e.g., *Leighton s.n.*).

Ecology. Rare, in primary and secondary mixed dipterocarp forest on flatland or hillsides, at altitudes to 750 m.

13. *Chionanthus macrocarpus* Blume

(Greek, *makro* = large, *karpos* = fruit; with large fruits)

Mus. Bot. Lugd. Bat. 1 (1850) 319; Kiew, Gard. Bull. Sing. 37 (1984) 209. **Lectotype** (Kiew, 1984): *Blume s.n.* (= *RHL Sheet No. 908161219*), Java (hololectotype L). **Synonyms:** *Chionanthus insignis* Miq., Fl. Ind. Bat. Suppl. (1862) 559; *Linociera macrocarpa* (Blume) Knob., Bot. Centralbl. 61 (1895) 87, King & Gamble *l.c.* 267, Backer & Bakhuizen *f.*, FJ 2 (1965) 214, Anderson *l.c.* 285; *L. elaeocarpa* Stapf *l.c.* 115, Merrill *l.c.* (1921) 488, Masamune *l.c.* 612; *C. elaeocarpus* (Stapf) Kiew, Malay. For. 42 (1979) 267, *l.c.* (1980) 373, exclusive var. *globosus* Kiew, *l.c.* (1981) 150, exclusive var. *globosus* Kiew.

Tree, 10–30 m tall, to 60 cm diameter; bole smooth or sometimes with buttresses to 2 m high. **Bark** almost smooth. **Sapwood** white. **Twigs** stout, *round in cross-section*, drying grey-brown or white, nodes strongly flattened, glabrous, lenticellate. **Leaves** *coriaceous* sometimes *subcoriaceous*, glabrous, drying dull reddish or dark brown on both surfaces, lateral veins darker than leaf blade beneath; *obovate*, 15–30 × 5–10 cm, *base tapering*, margin recurved, apex acute (sometimes with an acumen to 7 mm long); midrib plane above and prominent beneath; lateral veins 11–19 pairs, plane or sometimes impressed above, slightly prominent beneath, marginal vein obscure; *intercostal venation obscure*; *petiole* 1.5–3 cm long, slightly thickened, *drying black*. **Inflorescences** axillary, solitary, *paniculate* with third to fourth order branching, 5–11 cm long, lowest branch 1–2 cm long; flowers crowded at tips of branches, glabrous; *peduncle* stout, *less than half the length of inflorescence*, slightly flattened; bracts foliaceous, spatulate, 6–15 × 4–6 mm, pubescent, persistent. **Flowers** sessile, *bisexual*, white; *buds pointed*; calyx *c.* 1 mm long, divided *c.* halfway, lobes acute, pubescent; corolla divided almost to base, 3–4 mm

long, lobes oblong, more or less straight at anthesis; stamens sessile, epipetalous, anthers yellow, c. 1 mm long, oblong; ovary ovoid, c. 1 mm long, glabrous, stigma bilobed. **Infructescences** thickened, c. 12 cm long, bearing 1–3 fruits. **Fruits** oblong-ellipsoid, to 4.5 × 2.5 cm, smooth (sometimes slightly angled), *not curved*, base rounded, bluish green when fresh, drying brick red to brownish yellow to golden brown sometimes with glaucous bloom; *pericarp* 3–5 mm thick, leathery; stalk thickened, 10–15 mm long, c. 6 mm thick. **Seeds** albuminous.

Vernacular names. Sarawak—*kayu bura* (Kelabit), *kerdam* (Melanau).

Distribution. Sumatra, Peninsular Malaysia, Borneo (Sabah, Sarawak and Kalimantan), and Java. In Sabah, known from G. Kinabalu (e.g., *Carr SFN 20789*). In Sarawak, recorded from Kuching district (e.g., *Haviland 2298* and *Omar 351*). Also occurs in Kalimantan (e.g., *Kostermans 7561* and *Kostermans 7569*).

Ecology. Lowland to hill primary mixed dipterocarp forest, at altitudes to 1700 m.

14. *Chionanthus pachyphyllus* (Merr.) Kiew

(Greek, *pachy-* = thick, *phullon* = leaf; with thick leaf)

Malay. For. 43 (1980) 381; Coode *et al.* (eds.) *l.c.* 247. **Basionym:** *Linociera pachyphylla* Merr., J. Arn. Arb. 35 (1954) 150. **Type:** *Native Collector 584*, Borneo, Sarawak, without locality (holotype K; isotype L).

Tree or shrub to 22 m tall and 20 cm diameter. **Bark** light brown, smooth; inner bark brown. **Sapwood** brown or yellow. **Twigs** stout, *round in cross-section*, drying grey or light reddish brown, nodes strongly flattened and bearing large and conspicuous horseshoe-shaped leaf scars, subpubescent or glabrous. **Leaves** *thickly coriaceous*, glabrous, minutely punctate beneath, drying chestnut-brown or greenish brown and slightly glossy above and chestnut-brown beneath; *broadly elliptic*, sometimes *narrowly lanceolate*, (16–)21–24(–30) × 5.5–9(–13) cm, *base rounded* sometimes *cuneate*, apex acuminate or acute, acumen to 1.5 cm long, margin slightly recurved; midrib plane above, prominent beneath; *lateral veins* (8–)10–12(–14) pairs, *deeply impressed above*, prominent beneath, marginal vein 1–2 mm from margin; *petiole* 1–2 cm long, stout, thickened, *drying black*. **Inflorescences** axillary, solitary or fascicled, *panicle with second order branching*, in bud 1–2.5 cm long, *in flower* 3–7 cm long, lowest branch c. 3 cm long; *flowers spaced, sparsely pubescent*; peduncle c. 0.5 cm long; bracts scarious, ovate, c. 3 mm long, tomentose, caducous. **Flowers** bisexual, yellow; pedicel to 1 mm long; buds pointed; calyx c. 1.5 mm long, divided halfway, lobes acute, more or less glabrous; corolla 4–5 mm long, divided to base except where joined in pairs for c. 1 mm, fleshy, lobes narrowly linear, twisted at anthesis; stamens inserted at base of corolla, filament c. 0.5 mm long, anthers c. 1 mm long, oblong, white; ovary ovoid, c. 1 mm long, glabrous, stigma capitate. **Infructescences** thickened, to 7 cm long. **Fruits** *globose*, c. 1.5 cm diameter, *smooth, not curved*, apex rounded; pericarp brownish green, ripening dark purple, drying c. 0.5 mm thick, leathery; stalk c. 5 mm long and 3 mm thick. **Seeds** albuminous.

Distribution. Endemic to Borneo (Sabah, Sarawak and Brunei). In Sabah, recorded from Kota Belud (G. Kinabalu), Sandakan and Sipitang districts (e.g., *SAN 83645*). In Sarawak, known

from Kuching (G. Penrissen), Lawas, Limbang, and Marudi (G. Mulu) districts (e.g., *S* 32870, *S* 40746 and *S* 47687). In Brunei, recorded from Temburong district (e.g., *Coode* 6620).

Ecology. In hill mixed dipterocarp to lower montane forest on sandstone, and in *kerangas* forest, at altitudes to 1500 m.

15. *Chionanthus palustris* Kiew

(Latin, *palustris* = swampy; referring to the natural habitat of the species)

Malay. For. 43 (1980) 382. **Type:** *Anderson S* 3282, Borneo, Sarawak, Baram (holotype SAR).

Shrub or tree, 3–17 m tall, to 15 cm diameter; bole with small stilt roots to 1 m tall. **Bark** light brown, smooth or rough and scaly. **Twigs** moderately slender, *round in cross-section*, drying dark grey, nodes flattened, lenticels inconspicuous, glabrous. **Leaves** *thickly coriaceous*, glabrous, drying pale greenish or reddish brown on both surfaces; broadly elliptic to lanceolate, 7–14 × 3–6.5 cm, *base abruptly rounded or cuneate*, margin not recurved, apex abruptly caudate, acumen to 2 cm long; midrib impressed above and plane beneath; lateral veins 6–10 pairs, obscure and plane above, slightly impressed beneath, marginal vein 2–3 mm from margin; *petiole 0.5–0.7 cm long*, not thickened, *drying black*. **Inflorescences** axillary or extra-axillary, solitary, *condensed raceme* with 2–3 pairs of flowers, *c. 0.5 cm long*; peduncle *c. 2 mm long*; flowers crowded, sparsely pubescent; bracts scarious, ovate, *c. 2 mm long*, pubescent. **Flowers** bisexual, yellowish green; buds pointed; pedicel to 1 mm long, uppermost flowers sessile; calyx *c. 1 mm*, divided almost halfway, lobes acute, sparsely pubescent; corolla *c. 6 mm long*, divided almost to base, lobes narrowly linear, twisted at anthesis; stamens sessile, joined at base of corolla, anthers *c. 1 mm long*, broadly oblong; ovary ovoid, *c. 1.5 mm long*, glabrous, stigma bilobed. **Infructescences** thickened, to 1 cm long. **Fruits** globose, 1.5–2 cm diameter, *smooth, not curved*, apex rounded; pericarp cream-coloured, drying thin and brittle, *c. 1 mm thick*. **Seeds** albuminous.

Vernacular name. Sarawak—*ubah mata* (Malay).

Distribution. Endemic to Borneo (Sarawak and Brunei). In Sarawak, known from Kuching, Lawas, Marudi, and Sarikei districts (e.g., *Haviland* 2167, *S* 26622, *S* 26779, *S* 27834, and *S* 30703). In Brunei, recorded from Andulau and Badas FR (e.g., *S* 1059, *S* 2041 and *Sands* 5929).

Ecology. Lowland peat swamp, mixed swamp, *kerangas* and *alan* forests.

16. *Chionanthus plurifloroides* Kiew

(Latin, *-oides* = resembling; resembling *C. pluriflorus*)

TFSS 4, App. (2002) 353. **Type:** *Kulip & Goh SAN* 137038, Borneo, Sabah, Kinabatangan district, Tongod, G. Tingkar Waterfall (holotype SAN; isotype KEP).

Small tree to 17 m and 30 cm diameter; bole to 10 m tall, sometimes with buttresses *c. 1 m high*. **Bark** yellowish grey or dark brown, pustulate or smooth, *c. 2 mm thick*. **Sapwood** white. **Twigs** slender, *round in cross-section*, drying pale brown, lenticels not conspicuous; young

twigs, petiole and bracteoles minutely rusty pubescent. **Leaves** *subcoriaceous* to *chartaceous*, dull and plane above, drying dark chestnut-brown on both surfaces with lateral veins darker than leaf blade beneath; oblong to lanceolate, (12–)17(–20) × (4.25–)5.5(–6.75) cm, widest at the middle, base rounded, sometimes slightly cuneate, margin not recurved, apex acuminate to cuspidate, acumen to 1 cm long; midrib and veins plane above, prominent beneath; lateral veins (7–)8(–11) pairs, marginal vein 2–3 mm from margin; intercostal venation obscure; *petiole* (0.7–)0.8(–1.4) cm long, slightly thickened, drying black. **Inflorescences** axillary, panicle of cymes with first order branching at base and 3–4 regularly spaced pairs of flowers above, 2–4 cm long, lowest branch c. 1.5 cm long; peduncle 3–4 mm long; bracteoles scarious, 1–2 mm long, persistent. **Flowers** *bisexual*, yellow-green; pedicel to 1 mm long; calyx c. 1 mm long, divided almost to base, lobes acute, glabrous with sparsely ciliate margin; corolla c. 4 mm long, glabrous, narrowly linear, margin involute, apex acute, scarcely joined in pairs at base, twisted at anthesis to expose stamens; anthers sessile, joined at base of corolla, ellipsoid, c. 1 × 0.4 mm, connective slightly apiculate; ovary globose, c. 1.25 mm long, glabrous, stigma slightly bilobed. **Infructescences** thickened. **Fruits** globose, c. 1.5 × 1.4 cm, smooth, not curved, blue green; pericarp c. 2 mm thick; endocarp woody, c. 1 mm thick; stalk thickened. **Seeds** endospermous.

Vernacular name. Sabah and Sarawak—*obah putih* (Malay).

Distribution. Endemic to Borneo (Sabah, Sarawak and Kalimantan). In Sabah, common in the southern half (e.g., *Elmer 20332*, *SAN A 2064*, *SAN 16828*, *SAN 66094*, *SAN 81412*, and *SAN 124515*). In Sarawak, known from G. Lesong (e.g., *S 43242*). In Kalimantan, recorded from G. Tepian Lobang (e.g., *Kostermans 5321*).

Ecology. Mixed dipterocarp forest, at altitudes to 600 m. In Kalimantan occur on coral limestone.

17. *Chionanthus pluriflorus* (Knohl.) Kiew

Fig. 3.

(Latin, *pluri-* = many, *florus* = flower; referring to the many-flowered inflorescence)

Malay. For. 43 (1980) 384, *l.c.* (1981) 151; Kessler & Sidiyasa, TBSA-EK (1994) 188; Coode *et al.* (eds.) *l.c.* 247; Argent *et al.* (eds.) *l.c.* 481. **Basionym:** *Linociera pluriflora* Knohl. *l.c.* 130, Merrill *l.c.* (1921) 489, Fisher, Kew Bull. (1933) 181, Masamune *l.c.* 612, Anderson *l.c.* 285. **Type:** *Beccari PB 915*, Borneo, Sarawak (holotype K). **Synonym:** *Linociera verruculosa* Merr., Philip. J. Sci. Bot. 13 (1913) 119, *l.c.* (1921) 489, Masamune *l.c.* 489.

Tree, 10–25(–60) m tall, to 60 cm diameter, flowering at c. 3 m tall; bole occasionally with short buttresses or stilt roots. **Bark** smooth, greenish; inner bark yellow. **Sapwood** white. **Twigs** moderately stout, round in cross-section, white, grey or pale brown, nodes strongly flattened, lenticels inconspicuous, glabrous or sparsely pubescent. **Leaves** *chartaceous* sometimes *subcoriaceous*, glabrous or rarely densely pubescent, drying dull grey-green and plane above, chestnut-brown with lateral veins darker than leaf blade beneath; lanceolate sometimes broadly so, (12–)15–20(–30) × 4.5–6.5(–9.5) cm, base cuneate, margin not recurved, apex acuminate or acute; midrib and veins plane or slightly impressed above, prominent beneath; lateral veins 7–14

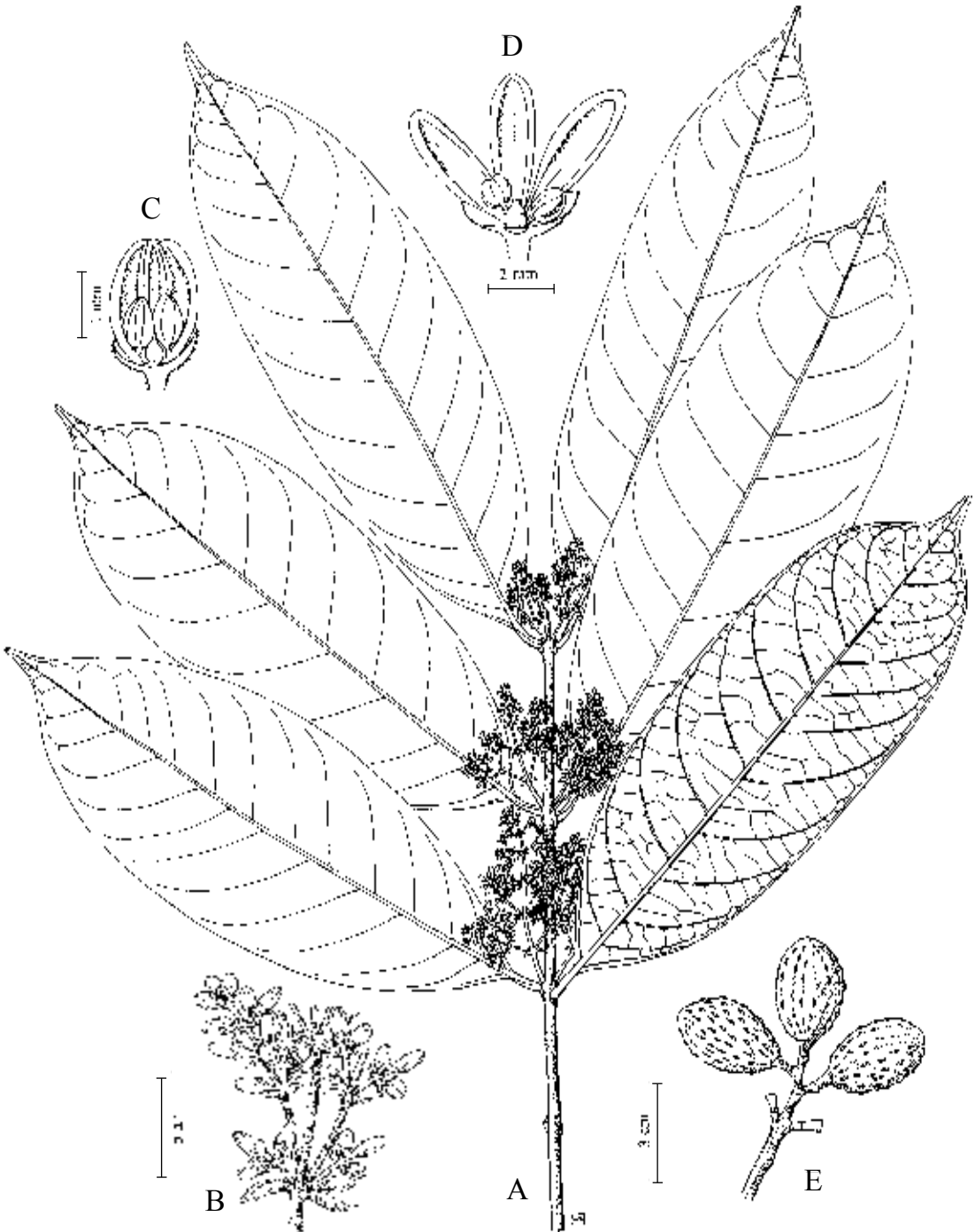


Fig. 3. *Chionanthus pluriflorus*. A, flowering leafy twig; B, part of inflorescence; C, longitudinal section of flower bud with two calyx lobes and one corolla lobe removed; D, longitudinal section of open flower with two calyx lobes and one corolla lobe removed; E, infructescence. (A–D from SAN 32274, E from S 31147.)

pairs, marginal vein 1–2 mm from margin; *petiole* 0.5–1.5 cm long, not thickened, *drying black*. **Inflorescences** axillary or extra-axillary, often fasciated, *panicle with second order branching*, 4.5–7(–21) cm long, with 3–4 branches, lowest branch 2–5.5 cm long; *flowers crowded at tips of branches*, pubescent; peduncle 0.5–2 cm long; bracts foliaceous, spatulate, *c.* 8 × 2 mm long, minutely pubescent. **Flowers** *bisexual*, subsessile or with pedicel to 1 mm long, yellow or yellowish green; *buds pointed*; faintly fragrant; calyx *c.* 1 mm long, divided *c.* halfway, lobes acute, pubescent, margin ciliate; corolla 3–3.5 mm long, divided almost to base, lobes narrowly linear, fleshy, more or less straight at anthesis; stamens filaments *c.* 0.3 mm long, joined at base of corolla, anthers less than 1 mm long, broadly oblong; ovary ovoid, less 1 mm long, glabrous, stigma bilobed. **Infructescences** thickened, to 10.5 cm long. **Fruits** ellipsoid, to 2.6 × 1.9 cm, *not curved*, apex rounded, *prominently pimply (verrucose)*, green (even when ripe); *pericarp drying c. 2 mm thick*; endocarp *c.* 1 mm thick and woody; stalk to 7 mm long, *c.* 4 mm thick. **Seeds** albuminous.

Vernacular names. Sarawak—*bekeraiah* (Kayan), *bukar* (Murut), *kuku mendo*, *mok*, *muak* (Iban).

Distribution. Endemic to Borneo (Sabah, Sarawak and Brunei). In Sabah, common and widespread (e.g., *SAN 39899*, *SAN 55806*, *SAN 60180*, *SAN 68361*, and *SAN 117569*). In Sarawak, recorded from Bintulu, Kuching, Lawas, Marudi, and Sibuh districts (e.g., *Beccari PB 915*, *Haviland 3038*, *S 16294*, *S 31147*, *S 35772*, and *S 50432*). In Brunei, known from Belait and Tutong districts (e.g., *BRUN 5640* and *Coode 6366*).

Ecology. Primary lowland and hill mixed dipterocarp forest, frequently on river banks or in swamp forest, from sea level to 1500 m.

Uses. The green fruit is reported as edible by the Murut.

18. *Chionanthus polycephalus* Kiew

(Greek, *poly-* = many, *cephalus* = head; referring to the tight balls of flowers on the inflorescence branches)

Malay. For. 43 (1980) 386. **Type:** *Anderson & Chai S 32158*, Borneo, Sarawak, Bau district, Bt. Jebong (holotype SAR; isotypes L, SING).

Tree to 20 m tall and 25 cm diameter. **Bark** dark grey, rough and slightly fissured. **Twigs** moderately stout, *round in cross-section*, drying dark grey, nodes flattened with prominent horseshoe-shaped leaf scars, lenticellate, glabrous. **Leaves** *thickly coriaceous*, glabrous, drying reddish brown and sometimes slightly glossy above; *lanceolate*, 9–14 × 3–6 cm, *base rounded*, margin sometimes recurved, apex acuminate, acumen to 1 cm long; midrib slightly impressed above and plane beneath; lateral veins 8–15 pairs, plane above, obscure beneath; *petiole* 1–1.5 cm long, not thickened, *drying wrinkled and black*. **Inflorescences** axillary or extra-axillary, solitary, *paniculate*, 2.5–4 cm long, first order branches 0.5–1 cm long terminating in *tight clusters of 3–10 flowers, densely rusty brown hairy*; peduncle *c.* 5 mm long; bracts foliaceous, thick, *c.* 6 × 2 mm, densely pubescent, persistent. **Flowers** sessile, *bisexual*, creamy-white; buds pointed; calyx *c.* 2 mm long, with fleshy base, divided *c.* halfway, lobes acute, densely pubescent; corolla *c.* 5 mm long, divided almost to base, lobes narrowly linear, joined in pairs

for *c.* 1 mm, twisted at anthesis; stamens sessile, anthers oblong, *c.* 1 mm long; ovary narrowly ovoid, *c.* 1 mm long, glabrous, stigma bilobed. **Infructescences** thickened, *c.* 2 cm long. **Fruits** ovoid, *c.* 2.5 × 1.7 cm, smooth, not curved, apex apiculate; pericarp yellowish, drying *c.* 1 mm thick, leathery; stalk swollen, 7–9 mm long, *c.* 3 mm thick. **Seeds** albuminous.

Distribution. Endemic to Borneo. Known only in Sarawak from Kuching district (e.g., *Haviland s.n.*) and Bt. Bidi and Bt. Jebat in Bau district (e.g., *S 32158*).

Ecology. Confined to limestone hill forest.

19. *Chionanthus polygamus* (Roxb.) Kiew

Fig. 4.

(Latin, *polygamus* = having both unisexual and bisexual flowers)

TFSS 4, App. (2002) 354. **Basionym:** *Samara polygama* Roxb., Fl. Ind. 1 (1820) 435, *ibid.* 2nd. edition 1 (1832) 414. **Type:** *Roxburgh 2603*, Maluku (BM). **Synonyms:** *Ardisia polygama* (Roxb.) A.DC, Prod. 8 (1844) 138; *Linociera polygama* (Roxb.) S.Moore, J. Bot. (London) 51 (1913) 216; *Chionanthus laxiflorus* Blume *l.c.* 319, Kiew, Malay. For. 42 (1979) 270, *l.c.* (1980) 377, *l.c.* (1981) 151, *l.c.* (1989) 287, Coode *et al.* (eds.) *l.c.* 247, Argent *et al.* (eds.) *l.c.* 489; *L. laxiflora* (Blume) Knobl. *l.c.* 87, Merrill *l.c.* (1921) 488, Masamune *l.c.* 612, Anderson *l.c.* 285.

Tree, 12–20(–30) m tall, to 40 cm diameter; flowering at *c.* 4 m tall; bole rarely buttressed. **Bark** grey; inner bark orange-brown. **Sapwood** white or pale ochre. **Twigs** slender, *round in cross-section*, drying pale grey, nodes flattened, glabrous, lenticellate. **Leaves** coriaceous, glabrous, drying slightly glossy and greyish green sometimes brownish above; *lanceolate* (to slightly obovate), (5–)8–12(–17) × 1.5–6.5 cm, *base cuneate* or *slightly rounded*, margin not recurved, apex acuminate to cuspidate, acumen to 1.5 cm long, rarely apiculate; midrib and veins plane above, obscure or puckering along veins on drying; midrib slightly prominent beneath; lateral veins (5–)7–11(–13) pairs, plane beneath, marginal veins 1–2 mm from margin; *petiole* 0.5–1.5 cm long, not thickened, *drying black*, glabrous. **Inflorescences** axillary or extra-axillary, solitary or fascicled, *many-flowered panicle* with second and third order branching, (1.5–)3–6.5 cm, finely pubescent, lowermost branch *c.* 3 cm long, branches with 6–10 flowers clustered at the tips; peduncle (1–)4–7 mm long; bracts scarious, ovate, 1–2 mm long, persistent, minutely pubescent. **Flowers** *polygamous*, yellow-green or creamy white; buds pointed; pedicel 0–1 mm long. **Bisexual flowers:** *calyx* *c.* 1 mm long, divided about halfway, lobes acute, *densely grey hairy*; corolla 1–3 mm long, divided almost to base, lobes narrowly linear, twisted at anthesis; stamens subsessile, anthers less than 1 mm long, oblong; ovary ovoid, *c.* 1.5 mm long, glabrous, stigma bilobed. **Male flowers:** buds less than 1 mm across and strongly reflexed, other characters similar to bisexual flowers but without vestige of ovary. **Infructescences** not thickened. **Fruits** *pear-shaped*, to 1.2 × 0.8 cm, smooth, not curved; pericarp purplish red or bluish black; endocarp drying thin and brittle, *c.* 0.3 mm thick; stalk 1–5 mm long. **Seeds** albuminous.

Vernacular names. Sabah—*balit tangan* (Dusun), *kayu rambis* (Sungei Kinabatangan). Sarawak—*borah serang* (Kelabit).

Distribution. Sumatra, Peninsular Malaysia, Borneo (Sabah, Sarawak, Brunei, and Kalimantan), Sulawesi, Maluku, and New Guinea. In Sabah, common and widespread (e.g., *SAN 19195*, *SAN 28252*, *SAN 49386*, *SAN 65580*, *SAN 84823*, and *SAN 118967*). In Sarawak, widespread but not

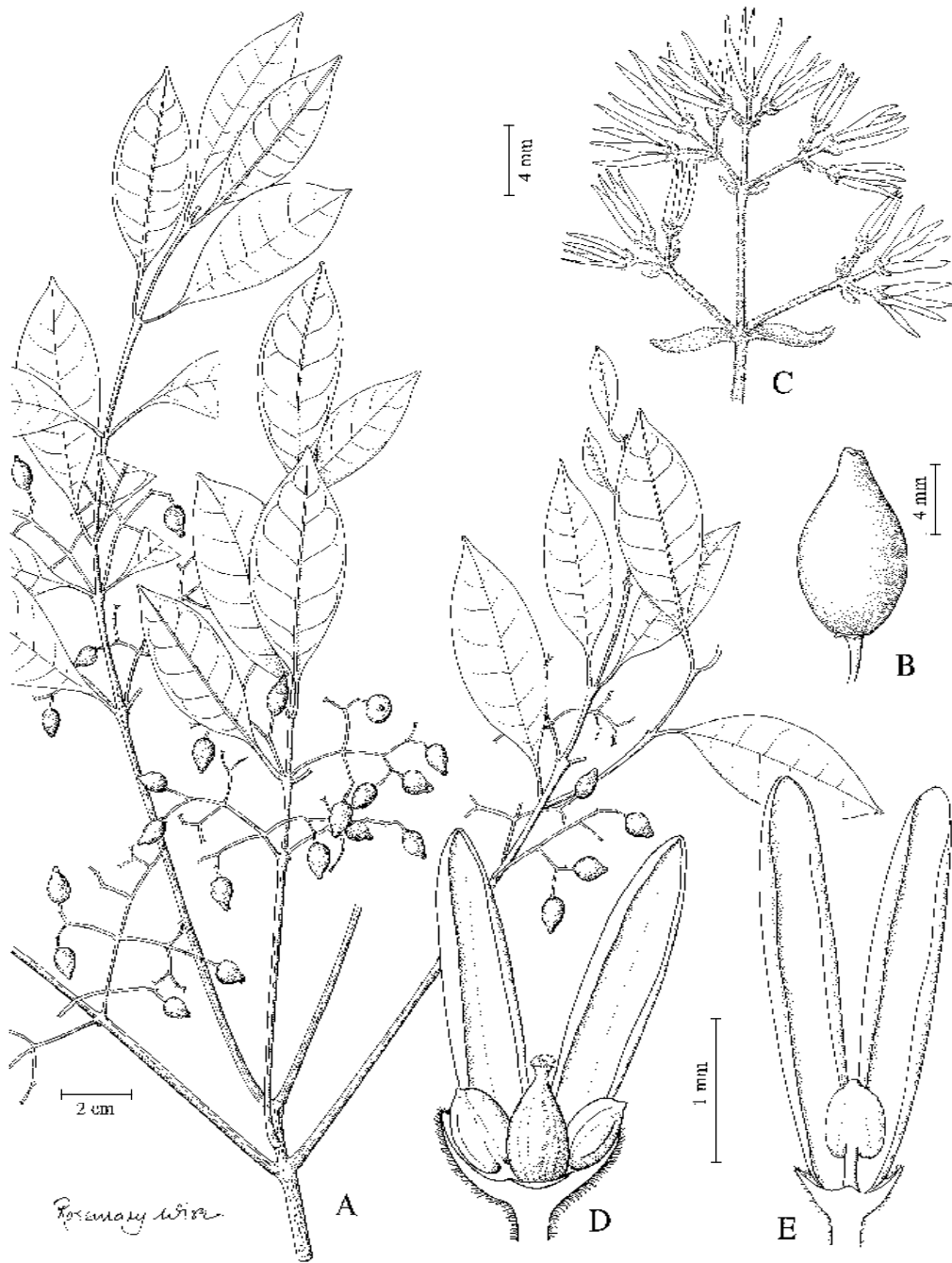


Fig. 4. *Chionanthus polygamus*. A, fruiting leafy twig; B, fruit; C, part of inflorescence; D, longitudinal section of bisexual flower with two calyx lobes and two corolla lobes removed; E, longitudinal section of male flower with two calyx lobes, two corolla lobes and one stamen removed. (A–B from SAN 27505, C–D from SAN 111456, E from SAN A 429.)

as common (e.g., *S* 29027, *S* 32030, *S* 34859, *S* 37588, and *S* 50994). In Brunei, known from Belait, Temburong and Tutong districts (e.g., *BRUN* 220 and *S* 2001). In Kalimantan, recorded from Martapura and W Kutei (e.g., *Korthals s.n.*, *Kostermans* 12911 and *Kostermans* 13036).

Ecology. Primary or disturbed forest. In Sabah often found in forest on sandy soil or in swamp forest usually below 500 m altitude. In Sarawak usually occurs in *kerangas* forest at altitudes to 1400 m.

Uses. In the Kelabit Highlands, the wood is recorded as being used for building construction and the heartwood for carving tobacco pipes.

20. *Chionanthus porcatus* Kiew (Latin, *porcatus* = ridged; referring to the fruit)

Fig. 5.

Malay. For. 43 (1980) 387, *l.c.* (1981) 149. **Type:** *Singh* SAN 28311, Borneo, Sabah, Ranau district, Bt. Kulong (holotype SAN; isotypes KEP, L).

Tree, 7–20(–30) m tall, to 50 cm diameter; bole with buttresses to 4 m tall. **Bark** fissured or scaly, white or dark grey; inner bark greyish or orange-brown. **Sapwood** whitish. **Twigs** stout, *round in cross-section*, drying reddish brown, nodes strongly flattened, lenticels conspicuous, glabrous. **Leaves** *subcoriaceous*, glabrous, drying pale, greenish brown; *obovate*, 15–32 × 4–14 cm, *base tapering* or *narrowly cuneate*, margin slightly recurved, apex acute; midrib and veins plane or slightly impressed above, prominent beneath; lateral veins 11–16(–22) pairs, marginal veins 1–4 mm from margin; *intercostal venation obscure*; *petiole* 2.5–5.5 cm long, not thickened, *drying* black. **Inflorescences** axillary, produced on new shoots, solitary, *paniculate* with third order branching, 4–11 cm long, lowest branch 1–2.5 cm long; flowers clustered at tips of branches, pubescent; *peduncle more than half the length of inflorescences*, flattened, 2.4–8 cm long; bracts foliaceous, spatulate, to 7 × 5 mm, glabrous, persistent. **Flowers** bisexual, greenish yellow or white, fragrant; *buds pointed*; pedicel 0–2 mm long; calyx *c.* 1.5 mm long, fleshy, divided almost to base, lobes acute, pubescent; corolla *c.* 2 mm long, divided almost to base, lobes oblong, more or less straight at anthesis, minutely pubescent; stamens sessile, anthers oblong, *c.* 1 mm long, connective broad; ovary ovoid, *c.* 1.5 mm long, pubescent, stigma bilobed. **Infructescences** thickened, 8–17 cm long. **Fruits** broadly ellipsoid, 4.5–6.5 × 2.5–3.5 cm, *not curved*, with *deep 5 main longitudinal ridges*, based rounded, apex pointed, asymmetric, straight on one side, rounded on the other; *pericarp* black, *c.* 6 mm thick; mesocarp woody; pedicel *c.* 12 × 5 mm. **Seeds** albuminous.

Distribution. Endemic to Borneo (Sabah, Sarawak and SE Kalimantan). In Sabah, known from Keningau, Lahad Datu, Ranau, Sandakan, Tambunan, Tawau, and Tenom districts (e.g., *SAN* 28311, *SAN* 43052, *SAN* 87768, *SAN* 121039, and *SAN* 132636). In Sarawak, recorded only from Bario, Ulu Baram (e.g., *S* 53545 and *S* 53546). In Kalimantan, reported from Sg. Kerajaan and Sg. Menumbang (e.g., *Kostermans* 4963 and *Kostermans* 5879) and NE Pontianak (e.g., *Burley et al.* 2952).

Ecology. Primary, sometimes secondary, lowland forest, frequently on hillsides, at altitudes to 650 m.

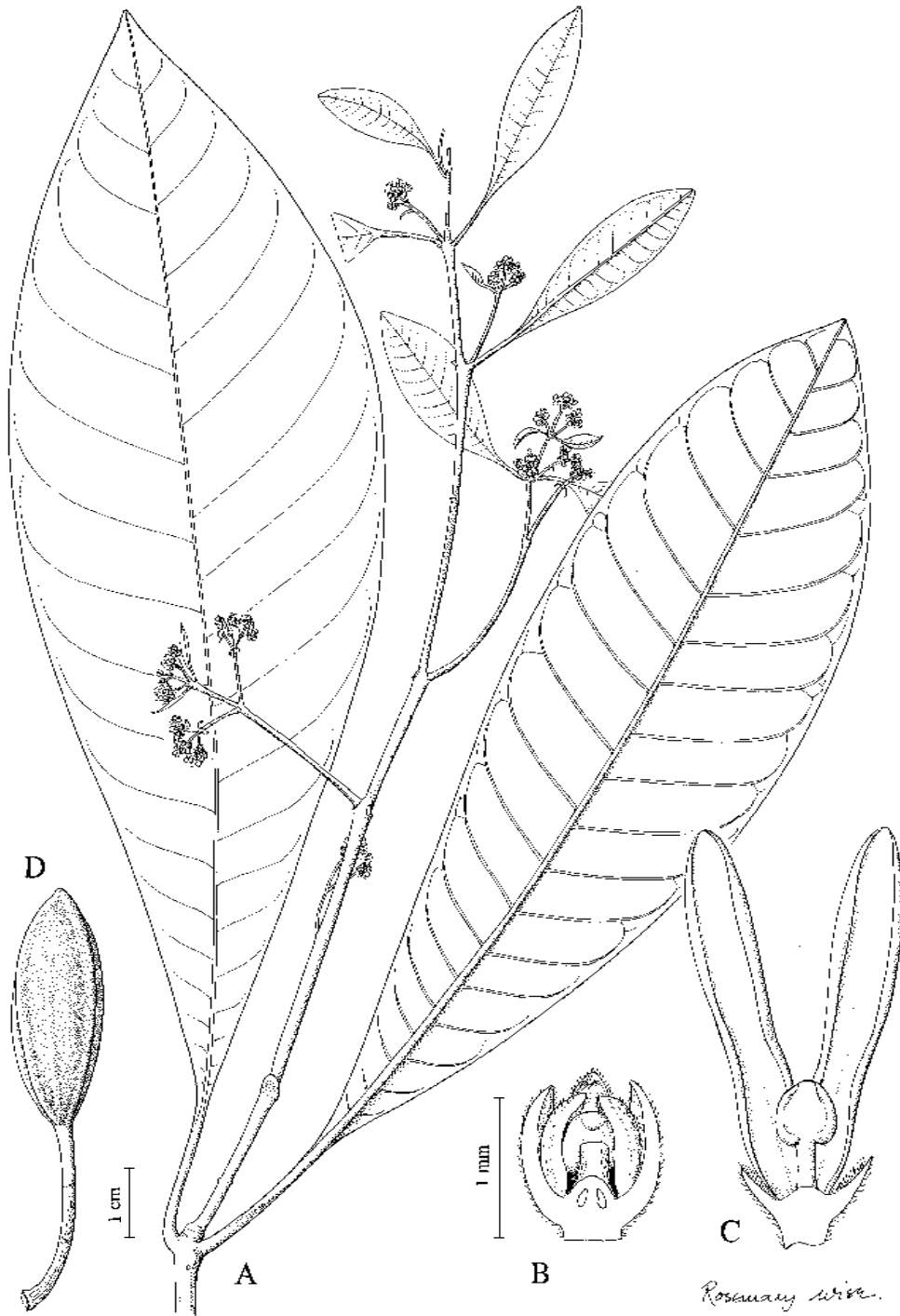


Fig. 5. *Chionanthus porcatus*. A, flowering leafy twig; B, longitudinal section of bisexual flower bud; C, longitudinal section of open male flower; D, fruit. (A–C from SAN 57768, D from SAN 28311.)

21. *Chionanthus pubicalyx* (Ridl.) Kiew

(Latin, *pubi-* = hairy; referring to hairy the calyx)

Malay. For. 44 (1981) 156. **Basionym:** *Linociera pubicalyx* Ridl., Kew Bull. (1934) 122. **Type:** *Haviland 1442*, Borneo, Sabah, Pulau Gaya (holotype K; isotypes SAR, SING).

Tree to 40 m tall and 30 cm diameter, flowering at *c.* 6 m tall; bole occasionally with buttresses *c.* 30 cm high. **Bark** whitish or grey, flaking; inner bark yellow. **Sapwood** white or yellowish, turning pinkish on exposure. **Twigs** slender, *round in cross-section*, dark grey, glabrous, flattened at nodes. **Leaves** *subcoriaceous*, glabrous, *drying dull and plane above, greenish grey or greenish brown with lateral veins slightly darker than leaf blade beneath; broadly elliptic to lanceolate, (6–)13(–15) × (2.5–)5.5 cm, broadest at the middle, base cuneate becoming shortly decurrent, margin finely recurved, apex acuminate to cuspidate, acumen 0.5–1.5 cm long; midrib slightly raised above and prominent beneath; lateral veins 5–9 pairs, plane and obscure above, slightly prominent beneath, marginal veins 2–3 mm from margin; petiole 0.5–1.25 cm long, moderately thickened, drying black.* **Inflorescence** axillary, solitary, *paniculate with first order branching, 1.5–5 cm long, branches in 4–5 tiers, lowermost 1.5–2.5 cm long, upper branches decreasing in length, each with a cluster of 3–4 flowers at the tips, glabrous; peduncle 0.25–0.75 cm long; bracts scale-like, ovate, 1.5–2 mm long, pubescent persistent.* **Flowers** *bisexual*, white or pale yellow, with slight citron fragrance (*Chew et al. 2762*); pedicel (0.5–)1–1.5 mm long; calyx 1–1.5 mm long, divided less than halfway, lobes acute, pubescent; corolla (2–)3–5 mm long, divided almost to base, lobes narrowly linear, involute, apex cucullate, straight at anthesis, glabrous; stamens almost sessile, epipetalous, anther *c.* 1 mm long, apex apiculate; ovary ovoid, stigma capitate or obscurely bilobed. **Infructescences** slightly thickened, to 4 cm long. **Fruits** *ovoid with rounded apex, to 2 × 1.5 cm, or rotund with diameter 1.7 cm, smooth, not curved; pericarp dull purple, brittle, c. 1 mm thick; stalk 1–2 mm long.* **Seed** endospermous.

Distribution. Endemic to Borneo. Common in Sabah (e.g., *Clemens 29397, SAN 28302, SAN 31651, SAN 42097, SAN 87412, and SAN 121740*), infrequent in Sarawak (e.g., *S 40309*) and Brunei (e.g., *SAN 17574*).

Ecology. Primary mixed dipterocarp forest or in disturbed or secondary forest on hill sides or ridges, at altitudes to 1600 m (G. Kinabalu).

22. *Chionanthus ramiflorus* Roxb.

(Latin, *ramiflorus* = flowering on the older branches)

Fl. Ind. 2nd. edition 1 (1832) 107; Kiew, Malay. For. 42 (1979) 274, *l.c.* (1980) 388, *l.c.* (1981) 150, *l.c.* (1989) 289; Corner, WSTM 3rd. edition 2 (1988) 601; Coode *et al.* (eds.) *l.c.* 248. **Type:** *Wight l.c. no. 734.* **Synonyms:** *Linociera ramiflora* (Roxb.) Wall. *ex A.DC.*, Prodr. 8 (1844) 297, Merrill *l.c.* (1921) 489, Masamune *l.c.* 613, Backer & Bakhuizen *f. l.c.* 214, Anderson *l.c.* 285; *Olea pauciflora* Wall. *ex DC. l.c.* 297; *L. pauciflora* (Wall. *ex A.DC.*) C.B. Clarke *in Hooker f.*, Fl. Br. Ind. 3 (1882) 609, King & Gamble *l.c.* 266, Merrill *l.c.* (1921) 489, Ridley *l.c.* (1923) 317, Masamune *l.c.* 612, Corner *l.c.* 601.

Tree to 20 m tall and 30 cm diameter. **Bark** smooth, grey-brown, lenticellate; inner bark brown. **Sapwood** whitish yellow. **Twigs** slender, *round in cross-section*, drying white or light grey, nodes flattened, lenticels conspicuous, glabrous. **Leaves** *chartaceous or subcoriaceous*, glabrous,

drying green-brown on both surfaces, glossy above; oblong-lanceolate, elliptic or obovate, (6.5–)9–15(–29) × (2–)4–7(–10.5) cm, base cuneate, rounded or sometimes decurrent, margin slightly recurved, apex acuminate, rounded or sometimes acute; midrib impressed above; lateral veins 8–12 pairs, plane above, prominent beneath, marginal vein *c.* 2 mm from margin; intercostal venation conspicuous; petiole 1.5–3 cm long, not thickened, drying black. **Inflorescences** axillary, solitary, paniculate with second or third order branching and 3–6 distant branches, (0.5–)3–13 cm long, lowest branch (0.5–)1.5–3(–5) cm long; flowers spaced, glabrous; peduncle 1.5–3.25 cm long; bracts foliaceous, spatulate, 3–15 mm long, glabrous, persistent. **Flowers** bisexual, white or pale yellow, fragrant; pedicel 1–3 mm long; buds rounded; calyx less than 1 mm long, divided almost to base, lobes acute, glabrous; corolla 2–3 mm long, divided almost to base, lobes oblong, joined in pairs for *c.* a quarter of the length, more or less straight at anthesis; stamens sessile, anther oblong, *c.* 1 mm long, yellow; ovary ovoid, *c.* 1 mm long, glabrous, stigma bilobed. **Infructescences** thickened, to 12 cm long. **Fruits** ellipsoid, 2(–4) × 1(–2) cm, smooth, not curved, apex blunt or apiculate, often galled; pericarp purple-black, drying thin and brittle; stalk 2–5 mm long, conspicuously swollen. **Seeds** exalbuminous; cotyledons fleshy.

Distribution. E India, Indo-China, Taiwan, throughout Malesia to Australia (Queensland), and the Solomon Islands. In Borneo, common and widespread. In Sabah, recorded from many localities (e.g., SAN 20672, SAN 44556, SAN 56112, SAN 76234, and SAN 80678). In Sarawak, known from Bau, Kuching, Limbang and Marudi districts (e.g., Haviland 1766, Nooteboom & Chai 2133 and S 41183). Also occurs in Brunei (e.g., Atkins SA 451, BRUN 5143, Simpson DS 2182, and Wong WKM 150) and Kalimantan.

Ecology. Primary and secondary forests, frequent in coastal and riverine vegetation at altitudes below 300 m, but occasionally also found in lower and upper montane forests, at altitudes to 2200 m.

Notes. Galls replacing fruits are not infrequent in this species. One type is easily recognisable as a gall as it is composed of disorganised corky abnormal growth; the other type has the appearance of a fruit rather resembling those of *C. polygamus* in the acutely pointed apex. Besides the shape, the galls also differ from normal fruits in being smaller, *c.* 1 × 0.5 cm, brown and somewhat shiny.

23. *Chionanthus rugosus* Kiew

(Latin, *rugosus* = rough and pimply; referring to fruit surface)

Malay. For. 43 (1980) 389, *p.p.* **Type:** Banyeng & Sibat S 27067, Borneo, Sarawak, Semengoh FR (holotype SAR; isotypes A, L).

Tree to 20 m and 10 cm diameter. **Bark** smooth, greyish. **Twigs** slender, round in cross-section, drying white, slightly flattened at nodes, without lenticels, sparsely pubescent when young. **Leaves** subcoriaceous, glabrous, drying dull and plane above, chestnut- or olive-brown on both surfaces; lanceolate, widest at or above the middle, 8–14.5 × 2.5–5 cm, base tapered, margin recurved, apex cuspidate, acumen 1–1.5 cm long; midrib slightly impressed above, prominent beneath; lateral veins 4–7 pairs, slightly impressed above, prominent beneath, marginal vein *c.* 2 mm from margin; intercostal venation obscure; petiole 0.3–0.6 cm long, not thickened, drying black. **Inflorescences** and **flowers** unknown. **Infructescences** axillary or extra-axillary, racemose, 0.3–2 cm long; peduncle to 0.5 cm long, thickened. **Fruits** green (?immature), ovoid,

c. 0.7 × 0.5 cm, rugose, not curved, apex rounded, base narrowed; stalk *c.* 4 mm long and 2 mm thick. **Seeds** unknown.

Distribution. Endemic to Borneo and known only from the Semengoh FR in Sarawak (e.g., S 24925, S 26287 and S 27067).

Ecology. Lowland mixed dipterocarp forest on hill slopes or river banks.

24. *Chionanthus sabahensis* Kiew

(of Sabah, Borneo)

TFSS 4, App. (2002) 354. **Type:** Carr SFN 27170, Borneo, Sabah, G. Kinabalu, Ulu Kinunut (holotype SING).

Tree to 13 m tall and 10 cm diameter. **Bark** smooth, green; inner bark grey-brown. **Sapwood** white. **Twigs** slender, *round in cross-section*, glabrous, flattened at nodes, drying pale brown, sometimes lenticellate. **Leaves** *slightly subcoriaceous*, glabrous, *dull and plane above, drying greenish grey above and green-brown beneath; narrowly lanceolate, 14–21.5 × 3.5–6 cm, widest at the middle, base cuneate* sometimes unequal, margin slightly recurved, *apex acute to acuminate*; midrib impressed above, prominent beneath; *lateral veins* 9–11 pairs, slightly impressed above, *slightly concolorous with leaf blade and prominent beneath*, marginal vein 1–3 mm from margin; intercostal venation obscure; *petiole* 0.75–1.5 cm long, not thickened, *drying black*. **Inflorescences** axillary, solitary, *racemose panicle with first order branching, 7–13 cm long*, lower branches 2–3 cm long with flowers clustered at tips of branches; peduncle 1–2 cm long; bracts scarious, ovate, *c.* 0.75 cm long, minutely pubescent, persistent. **Flowers** *bisexual*, greenish white; pedicel 1–1.5 mm long; calyx *c.* 0.5 mm long, divided *c.* halfway, lobes acute, margin ciliate; corolla and stamens not known; ovary ovoid, *c.* 1 mm long, glabrous, stigma capitate. **Infructescences** thickened, 4–10 cm long. **Fruits** *globose, up to 2.3 cm diameter, smooth, not curved*, ripening cream-green or bright-green; pericarp sometimes with white lenticels, *c.* 1.5 mm thick; endocarp woody; stalk 2–3 × 3 mm. **Seeds** endospermous.

Distribution. Endemic to Borneo and known only from Sabah (e.g., Beaman *et al.* 10447, Clemens 27568, Clemens 28847, Clemens 31588, Price 218, and SAN 41890).

Ecology. Lower montane forest at 1350–2200 m altitude.

25. *Chionanthus spicatus* Blume

(Latin, *spicatus* =bearing a spike; referring to the spicate inflorescence)

Mus. Bot. Lugd. Bat. 1 (1850) 318; Coode *et al.* (eds.) *l.c.* 248. **Type:** Korthals *s.n.* (= RHL Sheet No. 908161119), Borneo, Kalimantan, G. Bataran (holotype L). **Synonyms:** *Linociera spicata* (Blume) Knobl. *l.c.* 87; *L. oligantha* Merr. *l.c.* (1918) 118, *l.c.* (1921) 489, *l.c.* (1929) 249, Masamune *l.c.* 612, Anderson *l.c.* 285; *Chionanthus oliganthus* (Merr.) Kiew *l.c.* (1980) 379, *l.c.* (1981) 152.

Small tree, 3–8(–17) m tall, to 20 cm diameter. **Bark** smooth, greyish; inner bark yellow-orange. **Sapwood** pinkish white. **Twigs** *slender, round in cross-section*, drying white, slightly flattened at nodes, lenticels inconspicuous, glabrous. **Leaves** chartaceous to subcoriaceous, glabrous, *drying*

dull, pale grey-green; narrowly lanceolate to elliptic-oblong, sometimes slightly obovate, 10–17 × 3.5–7 cm, base narrowly cuneate to shortly decurrent, margin not recurved, apex cuspidate (or sometimes acuminate), acumen 1–2 cm long; midrib and lateral veins slightly impressed above, prominent beneath; lateral veins 5–8 pairs, marginal vein 2–5 mm from margin; petiole 0.5–0.7(–1) cm long, thickened, drying fawn. **Inflorescences** axillary or sometimes extra-axillary, solitary or in pairs, racemose with 3–5 pairs of distant flowers, 0.5–1.5 cm long; peduncle 0.2 cm long, glabrous or sparsely pubescent; bracts scarious, ovate, c. 1.5 mm long, pubescent. **Flowers** bisexual, creamy white or yellowish green, sometimes purple inside, fragrant; buds pointed; pedicel to 1 mm long; calyx 0.5–1.5 mm long, divided almost to base, lobes ovate or rounded, glabrous or sparsely pubescent; corolla 4–8(–11) mm long, divided almost to base, lobes narrowly linear, slightly twisted at anthesis; stamens sessile, attached at base of corolla, anther oblong, c. 1 mm long; ovary ovoid, c. 1 mm long, glabrous, stigma bilobed. **Infructescences** thickened, to 2 cm long. **Fruits** globose, c. 1.8 cm diameter, smooth, not curved, apex rounded; pericarp purple-black, 1–2 mm thick; endocarp leathery; stalk c. 3 mm long and 3 mm thick. **Seeds** albuminous.

Vernacular name. Kalimantan—*nginjojo* (Land Dayak).

Distribution. Borneo (Sabah, Sarawak, Brunei, and Kalimantan) and the Philippines. In Sabah, recorded from most districts (e.g., *SAN 16094*, *SAN 16590*, *SAN 54361*, and *SAN 56850*). In Sarawak, known from Bau, G. Buri, G. Pueh, Bt. Mersing, Kelabit Highlands, and Melinau (e.g., *S 36767*, *S 48920*, *S 48986*, and *S 53526*). In Brunei, recorded by two collections (*Dransfield JD 7394* and *Schatz 3252*) from Kuala Belalong Field Study Centre in Temburong district and in Kalimantan known from Bt. Baka NP and Kota Waringin (e.g., *Argent & Amiril 9382*, *Church et al. 158* and *Church et al. 490*).

Ecology. Lowland mixed dipterocarp to lower montane forest, at altitudes to 1500 m, on limestone scree and occasionally in *kerangas* forest.

Incompletely known species

1. *Chionanthus* sp. 1

Tree to 7 m tall. **Twigs** white. **Leaves** drying deep chestnut-brown on both surfaces; broadly lanceolate, to 23 × 11 cm; lateral veins 12–14 pairs, impressed above, prominent beneath; petiole stout, c. 1.25 cm long, drying black. **Inflorescence** a twice branched panicle, c. 2.5 cm long. **Fruits** unknown.

Specimens examined: Borneo, Sarawak, G. Santubong, *Banyeng & Sibat S 21518*; G. Pueh, *Clemens 20115* (previously identified as *C. longipetalus*).

2. *Chionanthus* sp. 2

Tree c. 20 m tall. **Twigs** drying brown. **Leaves** drying pale brown; lanceolate to slightly ovate, 10–16 × 5–6 cm; lateral veins 8–10 pairs, deeply impressed above, prominent beneath; petiole stout, c. 1 cm long, drying black. **Inflorescence** a twice branched panicle, 3.5–6 cm long. Petals c. 4 mm long, twisted on anthesis. **Fruits** unknown.

Specimens examined: Borneo, Sabah, G. Kinabalu, *Chew et al. 286*; Brunei, Bt. Belalong, Wong *WKM 1394*.

3. *Chionanthus* sp. 3

Twigs white. **Leaves** drying chestnut-brown on both surfaces; lanceolate, *c.* 11 × 4.5 cm, apex cuspidate; lateral veins 9–11 pairs, deeply impressed above, prominent beneath; petiole *c.* 0.5 cm long, drying black. **Inflorescence** a short raceme, 1–1.5 cm long. Petals 5–6 mm long, twisted at anthesis. **Fruits** unknown.

Specimens examined: Borneo, Sarawak, Kuching, *Haviland 2167* (previously identified as *C. longipetalus*).

2. *LIGUSTRUM* L.

(Latin name for the privet bush)

Sp. Pl. 1 (1753) 7; Backer & Bakhuizen *f.*, FJ 2 (1965) 215; Kiew, *Blumea* 24 (1978) 143, TFM 4 (1989) 290; Corner, WSTM 3rd. edition 2 (1988) 602.

Shrubs or *small trees*. **Leaves** *simple and entire*, elliptic to more or less ovate, rarely linear. **Inflorescences** *terminal*, sometimes also axillary, paniculate, usually hairy; bracts foliaceous. **Flowers** bisexual, *to 8 mm long*; calyx shortly tubular with 4 small teeth; *corolla tubular with 4 lobes as long or longer than tube*, lobes induplicate-valvate in bud, opening more or less horizontally, white or yellow; stamens with thin filaments, anthers projecting beyond corolla tube; ovary globose, *style 1–2 mm long*, projecting beyond calyx after the corolla has fallen. **Fruits** *fleshy, drupaceous*, with 1 to 3 endospermic, *non-winged* seeds.

Distribution. About 40 species, the majority occur in temperate Asia, extending to Europe and through Malesia to Australia. In Sabah, one species is known.

Ecology. Usually in open places in lowland to montane forest.

Uses. In Europe, the Japanese *L. ovalifolium* Hassk. is a common hedge plant. *L. sinense* Lour. is used for a similar purpose in Asia, for example, it has been planted in the hill stations in Peninsular Malaysia.

Ligustrum glomeratum Blume

Fig. 6.

(Latin, *glomeratum* = collected closely together in a head; referring to the crowded flowers on the tips of inflorescence branches)

Mus. Bot. Lugd. Bat. 1 (1850) 314; Backer & Bakhuizen *f. l.c.* 215; Kiew *l.c.* (1978) 147, *l.c.* (1989) 290. **Lectotype** (Kiew, 1978): *Blume 945*, Java (holotype L).

Shrub or small tree to 15 m tall. **Twigs** pale brown, densely pubescent near apex, lenticellate. **Leaves** chartaceous to subcoriaceous, glossy above, glabrous beneath, or densely hairy on midrib

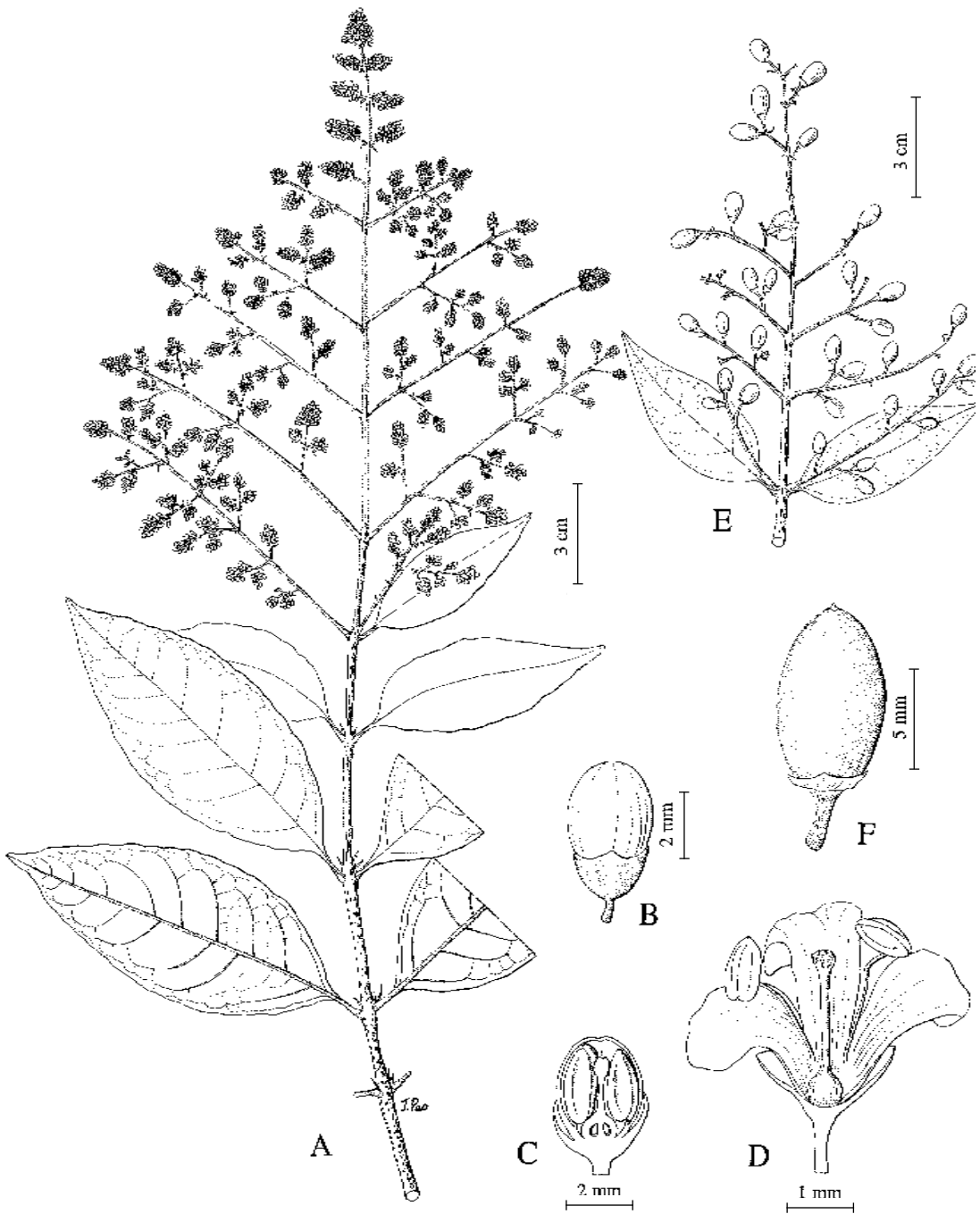


Fig. 6. *Ligustrum glomeratum*. A, flowering leafy twig; B, flower bud; C, longitudinal section of flower bud; D, longitudinal section of flower with one corolla lobe removed; E, infructescence; F, fruit. (A–D from *SAN 123276*, E–F from *SAN 124962*.)

beneath; ovate-lanceolate to oblong, (3–)7–8(–9) × (2–)3.5(–5) cm, base cuneate to decurrent, apex acuminate to cuspidate (rarely obtuse); midrib grooved above; lateral veins conspicuous above and beneath, 6–7 pairs; petiole 0.5–0.9 cm long, glabrous or pubescent. **Inflorescences** pyramidal, 8–17 cm long, with 5–7 tiers of branches, lowest branch 6–10 cm long, branches decreasing in length towards apex, more or less horizontal, pubescent to villous; bracts *c.* 3 cm long. **Flowers** sweetly scented, densely clustered, subsessile or with pedicel to 1 mm long; calyx scarcely lobed, tube *c.* 1 mm long, glabrous; corolla white or yellow, tube *c.* 1 mm long, lobes 1–2(–3) mm long; stamens with filaments *c.* 2 mm long, anthers projecting beyond corolla tube in open flowers; style 1–2 mm long, slender and projecting beyond calyx in open flower. **Fruits** ellipsoid to obovoid, 0.5–0.8 × 0.4–0.5 cm, fleshy, ripening dark purple, tasting bitter sweet, 1(–3)-seeded; stalk 1–5 mm long.

Distribution. S Thailand, Peninsular Malaysia, Sumatra, Borneo (Sabah), the Philippines, Java, Lesser Sunda Islands, Sulawesi, Maluku, and New Guinea. In Sabah, locally common in Kota Belud, Ranau and Tambunan districts (e.g., *SAN 28544*, *SAN 33070*, *SAN 89464*, *SAN 95525*, and *SAN 116550*).

Ecology. In primary and secondary lowland and hill mixed dipterocarp forest, near rivers or on hill slopes, at altitudes to 1600 m.

3. OLEA L.

(Latin name for olive tree)

Sp. Pl. 1 (1753) 18; King & Gamble, J. As. Soc. Beng. 74, 2 (1906) 269; Ridley, FMP 2 (1923) 318; Backer & Bakhuizen *f.*, FJ 2 (1965) 214; Kiew, Blumea 25 (1979) 307, TFM 4 (1989) 291, Gard. Bull. Sing. 51 (1999) 85; Corner, WSTM 3rd. edition 2 (1988) 603.

Shrubs or small to medium-sized trees. **Twigs** whitish or brown, glabrous, sometimes minutely pubescent. **Leaves** *simple*, *margin entire* or *toothed*, coriaceous, sometimes membranaceous, elliptic-lanceolate to ovate, minutely lepidote. **Inflorescences** paniculate, *axillary* or *ramiflorus*, glabrous or minutely pubescent; bracts foliaceous, small and caducous. **Flowers** 1–5 mm long, *polygamous* or *unisexual*; *buds rounded*; calyx short, tubular, divided *c.* halfway, persistent; *corolla tube as long or slightly longer than lobes*, lobes 4, induplicate-valvate, apex cucullate and scarcely opening, white or yellow, glabrous; stamens 2, attached near base of corolla tube, anthers subsessile, broadly oblong, *c.* 1 mm long; ovary *c.* 2 mm long, *style very short*, *stigma sessile* or *subsessile*, weakly bilobed. **Fruits** *fleshy and drupaceous*; epicarp thin and fleshy; mesocarp and endocarp thin and crustose or bony. **Seeds** *not winged*, with bony or fleshy endocperm.

Distribution. About 30 species; Mediterranean, Africa, Madagascar, E Asia, Malesia, Australia, New Zealand, and Polynesia. In Sabah and Sarawak three (3) species are known.

Ecology. Mostly in primary lowland mixed dipterocarp forest but *Olea rubrovenia* extends to upper montane forest, at altitudes to 3800 m on G. Kinabalu.

Key to *Olea* species

1. Leaf margin entire; lateral veins deep red and conspicuous beneath. Axillary buds large and mammiform.....**3. *O. rubrovenia***
 Leaf margin serrate or subserrate; lateral veins concolourous with leaf blade beneath. Axillary buds small.....**2**
2. Leaves frequently obovate; petiole conspicuously thickened, drying pale fawn. Flowers to 1 mm long. Fruits 0.8–1.5 × 0.5–0.8 cm.....**1. *O. borneensis***
 Leaves lanceolate; petiole not thickened, drying black. Flowers 1.5–2.5 mm long. Fruits to 0.5 cm diameter.....**2. *O. brachiata***

1. *Olea borneensis* Boerlage (of Borneo)

Fig. 7.

Handl. Fl. Ned. Ind. 2 (1899) 332; Kiew, Blumea 25 (1979) 308, *l.c.* (1989) 291, *l.c.* (1999) 89. **Type:** *Korthals s.n.* (= RHL Sheet No. 908155551), Borneo, Kalimantan, without locality (holotype L).

Tree to 25 m tall and 20 cm diameter; clear bole to 5 m tall. **Bark** smooth or scaly, whitish or light grey; inner bark reddish or orange-brown. **Sapwood** white. **Twigs** white, glabrous, flattened at nodes; *axillary buds small*. **Leaves** thinly coriaceous, minutely punctate beneath, drying greyish or brownish green; *frequently obovate*, (7–)14(–17) × 3–8 cm, base cuneate, *margin serrate* or *subserrate in the upper half*, finely recurved, apex broadly acute to shortly acuminate, rarely rounded; midrib slightly impressed above; *lateral veins* 6–9 pairs, ascending, *concolorous with leaf blade beneath*, inconspicuous or slightly impressed above, obscure or slightly prominent beneath, marginal vein *c.* 3 mm from margin; intercostal venation obscure; *petiole* 0.5–1 cm long, *conspicuously thickened*, *drying pale fawn*. **Inflorescences** solitary or fascicled, slender, 1.5–8 cm long, lateral branches 0.5–1.5 cm long, of equal length; flowers distantly spaced, 4–8 per branchlet; peduncle (0.2–)0.5–1.5 cm long; bracts minute. **Flowers** polygamous, *to 1 mm long*; pedicel 1–1.5 mm long; calyx margin sparsely ciliate; corolla whitish or yellowish green, tube twice as long as the cucullate lobes; stamens subsessile, attached halfway on corolla tube, anthers 0.5–0.75 mm long and wide, apex scarcely exposed as the lobes open. **Male flowers** (buds) spherical and minute to 1 mm diameter, calyx lobes acute, corolla 1–2.5 mm long. **Bisexual flowers** with scarcely lobed calyx, corolla *c.* 1.8 mm long, stamens as in male flowers, ovary ellipsoid, *c.* 1 mm long, narrowing abruptly to the slightly bifid minute stigma. **Fruits** broadly ellipsoid to almost globose, 0.8–1.5 × 0.6–0.8 cm, apex rounded, stigma persistent, ripening black; endocarp thin and woody, *c.* 0.5 mm thick. **Seeds** endospermic.

Distribution. Borneo (Sabah and Kalimantan) and the Philippines. In Sabah, common (e.g., *SAN 18808*, *SAN 54929*, *SAN 57438*, *SAN 77236*, and *SAN 90777*). In Kalimantan, known by the type and *bb. 12037* from Martapura.

Ecology. In primary mixed dipterocarp to lower montane forest, frequently on steep slopes and ridges, at altitudes to 1650 m, including on ultramafic soils (Bt. Hampuan, Sabah).

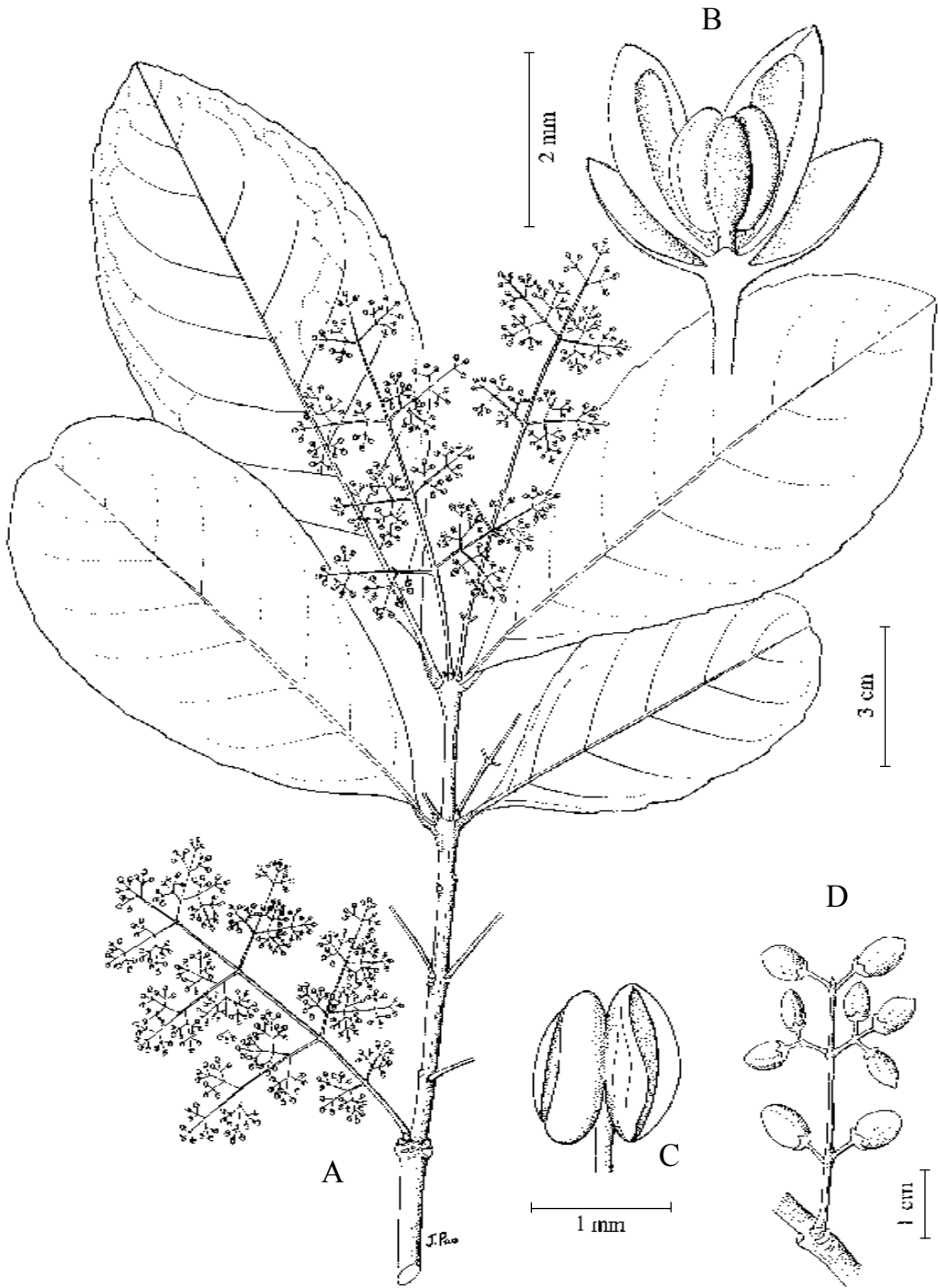


Fig. 7. *Olea borneensis*. A, flowering leafy twig; B, longitudinal section of male flower with two calyx lobes, two corolla lobes and one stamen removed; C, dehiscent stamen; D, infructescence. (A–C from SAN 54929, D from SAN 90777.)

2. *Olea brachiata* (Lour.) Merr.

(Latin, *brachiatus* = branched in a decussate manner; referring to the inflorescence)

Lingn. Agr. Rev. 2 (1925) 127; Kiew, *Blumea* 25 (1979) 308, *l.c.* (1989) 291, *l.c.* (1999) 90; Corner *l.c.* 603.

Basionym: *Tetrapilus brachiatus* Lour., Fl. Cochinchina 2 (1790) 611. **Type:** *Louriero s.n.*, Indo-China (holotype BM). **Synonym:** *O. maritima* Wall. ex G. Don, Gen. Syst. 4 (1838) 49, Anderson *l.c.* 285.

Shrub or small tree to 10 m tall and 5 cm diameter. **Twigs** pale brown, minutely pubescent; *axillary buds small*. **Leaves** subcoriaceous, glabrous, not punctate beneath, drying greyish green; *lanceolate*, (4.5–)8–10(–13) × (2–)3–5(–6) cm, base cuneate or somewhat rounded, margin *serrate or subserrate in upper half*, finely recurved, apex strongly acuminate; midrib impressed above, prominent beneath; *lateral veins* 7–10 pairs, obscure and *concolourous with leaf blade beneath*; *petiole* 5–7 mm long, *not thickened, drying black*, minutely pubescent when young. **Inflorescences** axillary or extra-axillary, 1–3 cm long, trichotomously branched panicle terminating in subumbels of 3–10 flowers, lowest branches 2–5 mm long, minutely pubescent; peduncle 1–1.5 cm long; bracts leafy, narrowly ovate-lanceolate, caducous. **Flowers** unisexual, 1.5–2.5 mm long; pedicel to 3 mm long; calyx *c.* 1 mm long, deeply divided, lobes ovate-acute, minutely pubescent; corolla dull white, 1.5–2.5 mm long, divided about halfway down, lobes elliptic with rounded apex, spreading at anthesis. **Male flowers:** buds globose, 1–1.5 mm long, stamens subsessile, anthers *c.* 1–2 mm long. **Female flowers:** ovary globose, stigma subsessile, broadly and slightly bilobed. **Fruits** globose, *c.* 5 mm diameter, purple-black when ripe; stalk *c.* 2 mm long. **Seeds** endospermic.

Distribution. Indo-China, Thailand, Sumatra, Peninsular Malaysia, Anambas Is., and Borneo (W Sarawak). In Sarawak, rare, found only on rocky shores around G. Santubong (e.g., *Haviland 3040*).

3. *Olea rubrovenia* (Elmer) Kiew

Fig. 8.

(Latin, *rubro* = red, *venia* = veins; referring to the deep red lateral veins)

Gard. Bull. Sing. 51 (1999) 95. **Basionym:** *Linociera rubrovenia* Elmer, Leaf. Philip. Bot. 2 (1909) 586, *ibid.* 5 (1913) 1613; Merrill, Enum Philip. Pl. 3 (1923) 305. **Type:** *Elmer 10224*, the Philippines, Negros Is. (holotype US; isotypes A, K, L). **Synonym:** *Tetrapilus rubrovenius* (Elmer) L.A.S. Johnson, Contrib. N.S.W. Herb. 2 (1957) 408; *Ilex decussata* Heine, Mitt. Bot. Staatsaml. Muenchen 6 (1953) 209; *Olea decussata* (Heine) Kiew, *Blumea* 25 (1979) 309.

Shrub or tree to 30 m tall and 20 cm diameter. **Bark** smooth, whitish; inner bark orangey. **Sapwood** pale yellow. **Twigs** when young green, drying black, older twigs white with scattered lenticels, glabrous; *axillary buds large and mammiform*, leaving a collar of persistent stiff bud scales around origin of new shoots. **Leaves** coriaceous to thickly coriaceous, glabrous and minutely punctate beneath, drying tan or reddish brown; broadly to rarely narrowly elliptic, 7–14(–22) × (2–)3–5.5(–8) cm, base cuneate or rounded, *margin entire* (in coriaceous leaves strongly recurved), apex acute to acuminate, acumen *c.* 1 cm long; midrib impressed above, prominent beneath; *lateral veins* 6–9 pairs, ascending, plane to finely impressed above, *slightly prominent and deep red* (discolorous with leaf blade) *beneath*, marginal veins 1.5–2 mm from margin; *petiole* 0.5–1.2(–2.5) cm long, glabrous, drying black and in thickly coriaceous leaves thick and wrinkled. **Inflorescences** axillary and frequently extra-axillary, glabrous or minutely pubescent, (1.5–)3.5–4(–6) cm long, lowest branch *c.* half the length of inflorescence; peduncle

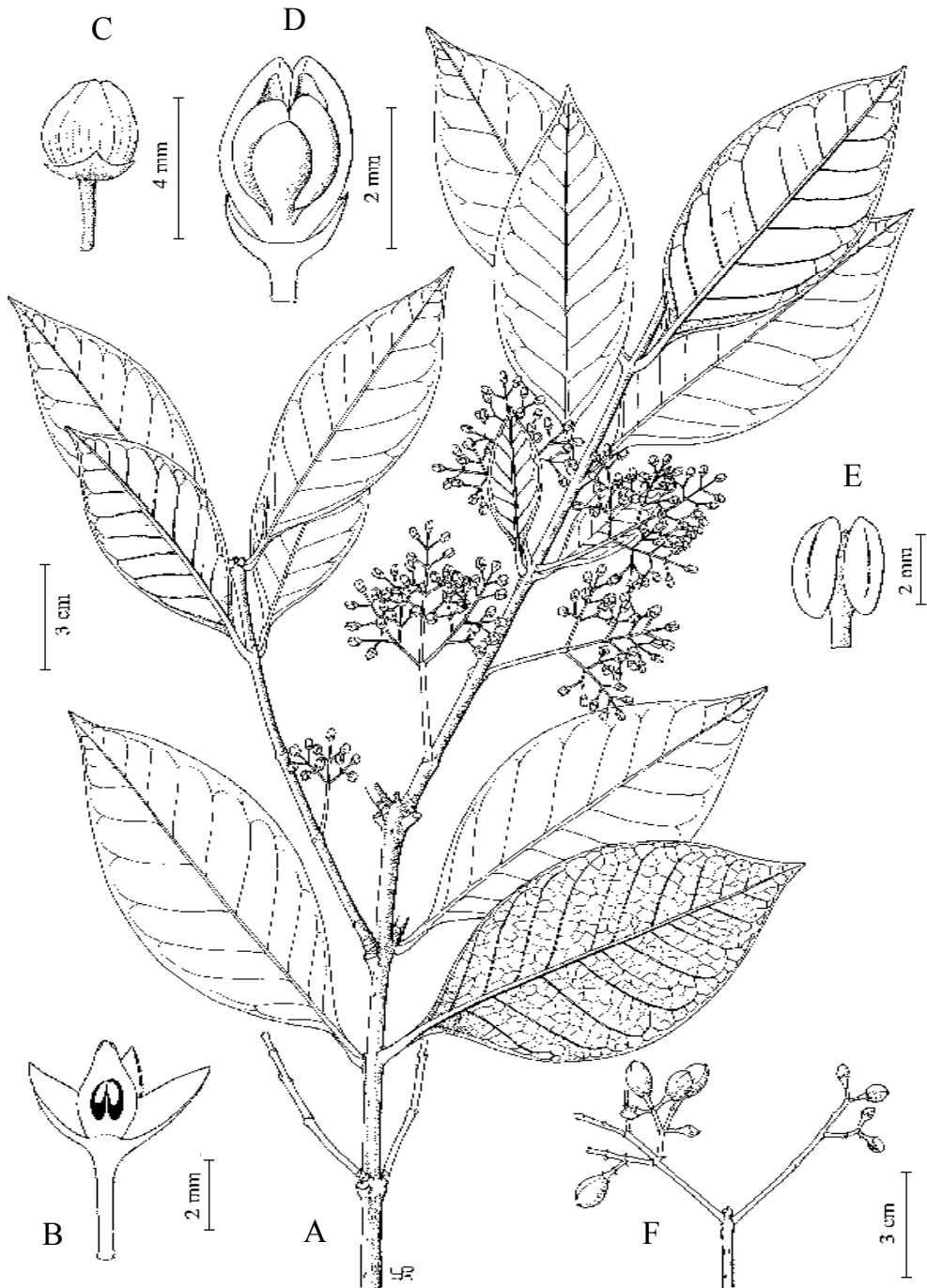


Fig. 8. *Olea rubrovenia*. A, flowering leafy twig; B, longitudinal section of bisexual flower with corolla lobes and stamens removed; C, male flower bud; D, longitudinal section of male flower bud; E, adaxial side of stamen; F, infructescence. (A–B from *RSNB* 939, C–E from *SAN* 123235, F from *SAN* 41831.)

1.5–4 cm long; bracts foliaceous, 7–15 × 3 mm. **Flowers** polygamous; pedicel 1–3 mm long, stout; buds almost globose, *c.* 1.5 mm diameter; calyx *c.* 1 mm long, acute, pubescent with ciliate margin; corolla 1.5–3 mm long, divided for *c.* one third, lobes cucullate, scarcely opening, creamy white or greenish yellow, sweetly scented; stamens subsessile, attached near base of corolla tube, hardly exposed in open flower, anthers *c.* 1 mm long. **Male flowers** frequently spreading. **Bisexual flowers** as for male but with ovary *c.* 2 × 1.3 mm, stigma slightly bilobed. **Fruits** ellipsoid, *c.* 1.5 × 0.5 cm, apex rounded, ripening purple-black; pericarp fleshy; endocarp thin and brittle. **Seeds** endospermic.

Vernacular names. Sarawak—*empala, mok* (Iban).

Distribution. Borneo (Sabah and Sarawak) and the Philippines. In Sabah, known from G. Kinabalu, G. Alab, Tenompok and Crocker Ranges (e.g., *Clemens 28986, RSNB 939, SAN 54207, SAN 65047, SAN 123235, and SAN 132875*). In Sarawak, recorded from Bt. Mersing, G. Dulit, G. Kalulong, G. Mulu, and G. Murut (e.g., *S 22172, S 22516 and S 37066*).

Ecology. Common in lower and upper montane mossy forest at altitudes above 1500 m, particularly on ridges and summits where the trees are shrubby and the leaves are thickly coriaceous. At lower altitudes, the leaves are larger and less coriaceous. Occasionally also occurs in *kerangas* forest (e.g., in Tenompok, Sabah).

4. SCHREBERA Roxb.

(J.C.D. van Schreber, 1739–1810, a German botanist)

Corom. Pl. 2 (1799) 1, 101; Hooker *f.*, Fl. Brit. Ind. 3 (1882) 604.

Trees or shrubs. **Twigs** terete. **Leaves** imparipinnate, 3–7-foliolate; leaflets chartaceous to subcoriaceous, margin entire. **Inflorescences** terminal or axillary, corymbose-paniculate. **Flowers** bisexual, to 20 mm long, heterostylous, white or yellow, with dense brown or purple hairs inside; calyx tubular to campanulate, irregularly 4–8-lobed or obscurely dentate; corolla salverform, tomentose on both sides, tube cylindric, often with dense beard of hairs inside, lobes (4–)6–8, imbricate in bud, spreading at anthesis, apex obtuse; stamens attached near top and included in corolla tube, filaments short, anthers ovate; ovary 2-loculed, style long and filiform, stigma shortly 2-lobed; ovules 4 per locule, pendulous. **Fruits** capsules, pendulous, *thick-walled and woody*, laterally compressed, ellipsoid to obovoid, *splitting into 2 concave parts each with a perpendicular central wall*. **Seeds** 4–8, pendulous, *winged apically and laterally*, endosperm thin or absent.

Distribution. A genus with 27 species, distributed in tropical Africa (24 species), Peru (1 species), India to N Thailand (1 species), and Borneo (1 species).

Schrebera kusnotoi Kosterm.

(Kusnoto Setyodiwiryo, 1911–1981, the first Indonesian Director of the Bogor Botanic Gardens)

Fig. 9.

Reinwardtia 2 (1953) 360; Meijer, Bot. Bull. Herb. Sandakan 10 (1968) 185. **Type:** *Kostermans 5989*, Borneo, Kalimantan, E Kutei, Sangkulirang, G. Sekrat (holotype BO; isotypes K, L, SING).

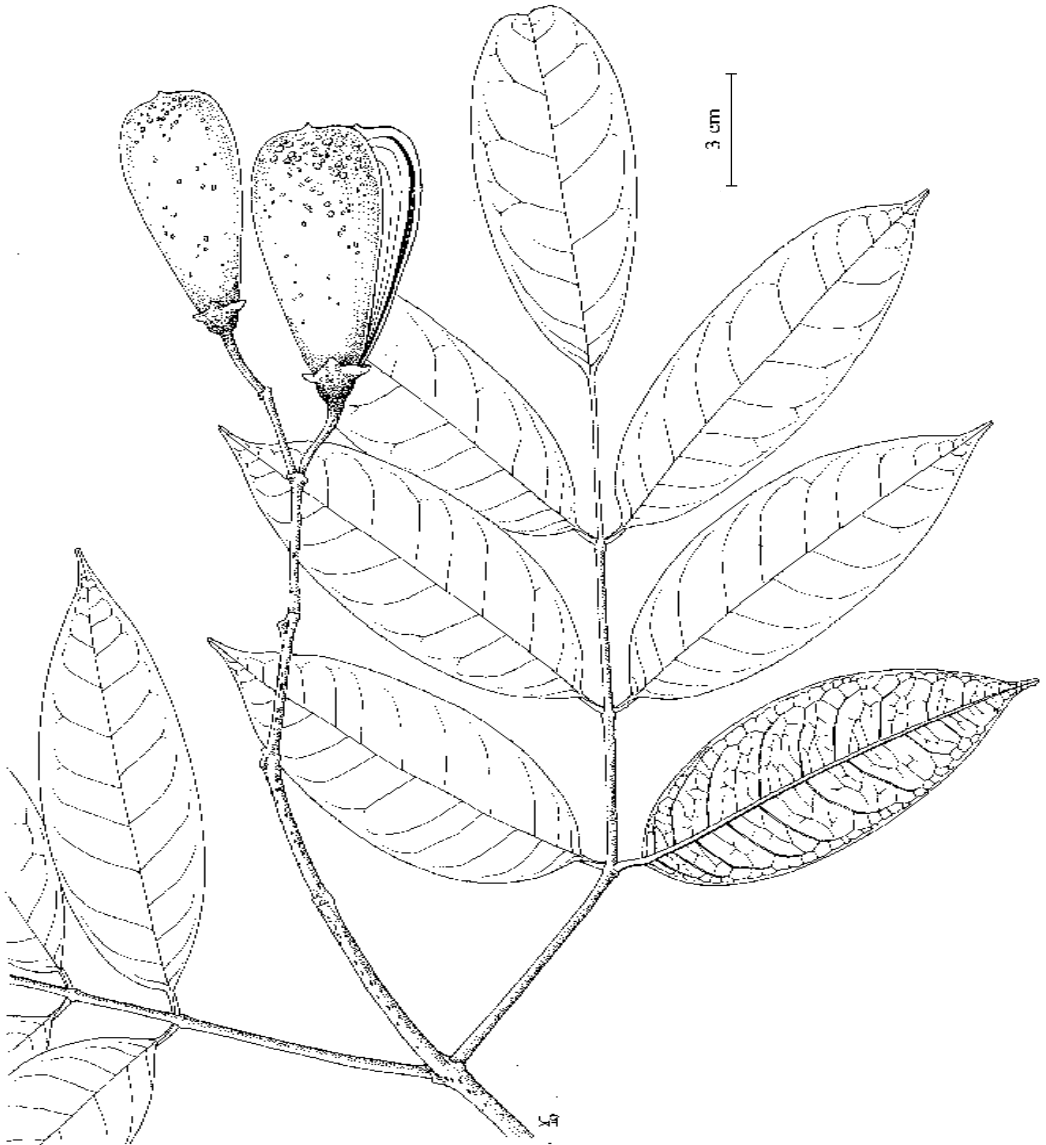
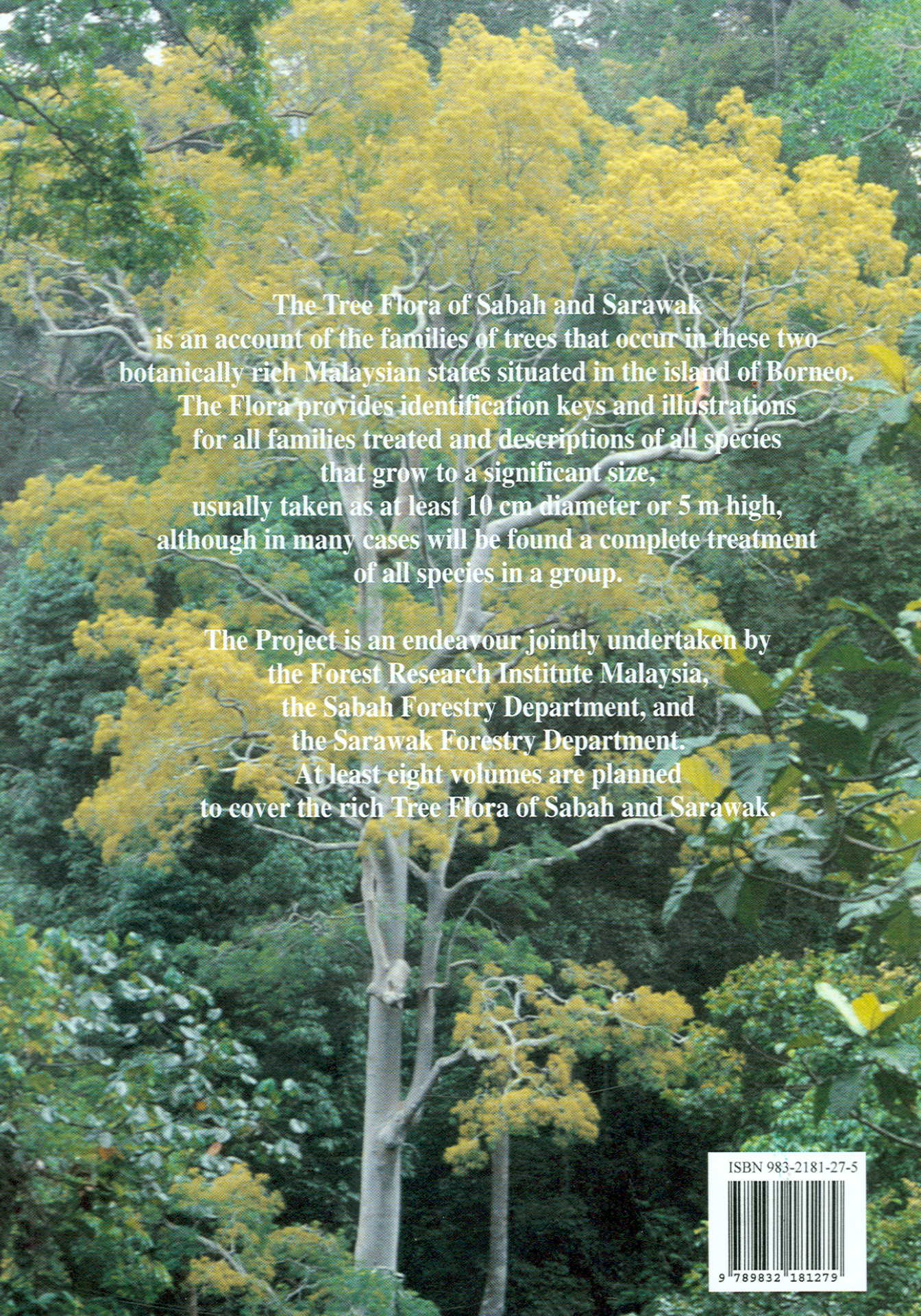


Fig. 9. *Schrebera kusnotoi*. Fruiting leafy twig. (All from *SAN 64150*.)

Tree, 24–45 m tall, to 90 cm diameter; buttresses 1–3 m high. **Bark** whitish or grey, scaling off profusely into 5-cm-long, subquadrangular, irregular flakes. **Sapwood** pale brown; heartwood blackish with paler streaks. **Twigs** thick, flattened at nodes, with prominent leaf scars. **Leaves** clustered at end of twigs, 2–3-jugate; petiole 5–8 cm long, slender but thickened at point of insertion; rachis 8–14 cm long, grooved above. **Leaflets** with petiolules *c.* 1 cm long, slender, grooved above; blade subcoriaceous and glossy above, lanceolate, 6–10 × 1.5–4.5 cm, base acute, usually oblique and decurrent, apex acute to caudate-acuminate with slender acumen *c.* 0.5 cm long; midrib impressed above; lateral veins 8–10 pairs; intercostal veins forming prominent reticulation on both surfaces, glabrous. **Inflorescences** axillary and terminal, to 10 cm long; peduncle stout and glabrous; bracts foliaceous, lanceolate, 5–5 × 1.5–2 mm at base, decreasing in size toward apex, persistent, glabrous or minutely pubescent. **Flowers:** pedicel to 12 mm long; calyx urceolate, *c.* 5–9 mm long, coriaceous, lobes 5–6, ovate, *c.* 2–3 mm long; corolla white, tube almost cylindrical, 7–20 mm long and *c.* 3 mm diameter, minutely and sparsely pilose, lobes 7, obovate-suborbicular, 2–5 × 2–3 mm, stamens with filaments attached to corolla tube, anthers enclosed within the tube, *c.* 1.5 mm long; ovary subglobose, *c.* 1 mm long, style glabrous, stigma large. **Fruits** obovoid, 5–7 cm long, *c.* 1 cm wide at base, expanding to 3.3–2.7 cm long and *c.* 1.5 cm wide toward the flat-topped, minutely apiculate apex; endocarp *c.* 3 mm wide; stalk *c.* 2 cm long. **Seeds** curved, *c.* 1.8 cm long, with apically positioned papery wing *c.* 4 cm long, filling the fruit cavity below.

Distribution. Endemic to Borneo (Sabah and NE Kalimantan). In Sabah, known by two collections from Ranau district (*SAN 20658* and *SAN 64150*), and in Kalimantan recorded from Sangkulirang district (e.g., *bb. 7974* and *Kostermans 5989*).

Ecology. In lowland and hill mixed dipterocarp forest and limestone hill forest, at altitudes to 1600 m.



The Tree Flora of Sabah and Sarawak
is an account of the families of trees that occur in these two
botanically rich Malaysian states situated in the island of Borneo.
The Flora provides identification keys and illustrations
for all families treated and descriptions of all species
that grow to a significant size,
usually taken as at least 10 cm diameter or 5 m high,
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of all species in a group.

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