

# TREE FLORA of SABAH AND SARAWAK

Volume Two

edited by  
E. Soepadmo, K.M. Wong and L.G. Saw



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TREE FLORA  
of  
SABAH AND SARAWAK

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**GOVERNMENT OF MALAYSIA**



**INTERNATIONAL TROPICAL TIMBER ORGANIZATION**



**OVERSEAS DEVELOPMENT ADMINISTRATION, U.K.**

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E. Soepadmo, K.M. Wong and L.G. Saw

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## CRYPTERONIACEAE

J.T. Pereira

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Merrill, EB (1921) 452; Masamune, EPB (1942) 545; Backer & Bakhuizen *f.*, FJ 1 (1965) 257; van Beusekom-Osinga & van Beusekom, Blumea 22 (1975) 255; Shea in Cockburn, TS 1 (1976) 72; van Beusekom-Osinga, FM 1, 8 (1977) 187; Anderson, CLTS (1980) 164; Keating, Ann. Missouri Bot. Gard. 71, 3 (1984) 801; van Vliet & Baas, Ann. Missouri Bot. Gard. 71, 3 (1984) 783; Patel *et al.*, Ann. Missouri Bot. Gard. 71, 3 (1984) 858; Corner, WSTM 3rd ed. 1 (1988) 222; Ng, TFM 4 (1989) 78; Whitmore, Tantra & Sutisna CLK 2, 1 (1990) 50; Mentink & Baas, Blumea 37 (1992) 189.

Trees. Twigs with swollen nodes marked by a transverse line, internodes finely ridged or winged. **Leaves** simple, opposite, pinnately veined; stipules absent (except in saplings). **Inflorescences** terminal and axillary panicles, few- to many-branched. **Flowers** bisexual or unisexual (plant dioecious), radially symmetrical, 4–5-merous; sepals valvate, triangular, persistent or caducous; petals present or absent (in *Crypteronia*), if present, valvate or rarely imbricate, alternate with the sepals, in bud hood-shaped and enveloping the stamens, caducous; stamens inflexed in bud, persistent or caducous, in one or two epipetalous whorls, filaments sometimes very short, connective broadly to narrowly divergent, conduplicate or not, sometimes with a dorsal tubercle or a large outgrowth, anthers adnate, linear to suborbicular, lengthwise dehiscent, introrse; ovary superior or inferior, 2–4(–5)-carpellate, 1–6-locular, septa not or rarely only partly connate, style terminal, terete, mostly persistent, stigmas capitate to punctate, ovules inserted horizontally or vertically on the septum, 1 to many per locule, anatropous, placentation parietal, septal or basal. **Fruit** a chartaceous to woody capsule, subglobose to ellipsoid, impressed at the septum, loculicidally dehiscent into 2–6 valves, sometimes with persistent style and stigma at the apex (*Crypteronia*). **Seeds** 1 to many, compressed-ellipsoid, located basally, apically, centrally or laterally within its membranous wing; raphe running freely within the wing; embryo straight.

**Distribution.** Three genera with about 12 species, distributed in tropical SE Asia and Malesia. In Sabah and Sarawak, three genera with 10 species.

**Ecology.** Frequent in lowland to lower montane forest, up to about 1500 m. The monotypic *Dactylocladus* is confined to peat swamp forest.

**Taxonomy.** The definition, delimitation and systematic position of Crypteroniaceae in the order Myrtales is controversial. In the earlier system of classification (Bentham & Hooker *f.*, Gen. Pl. 1 (1862) 782), the genus *Crypteronia* on which the family was founded, was originally placed under Lythraceae. A. De Candolle (Prodr. 16 (1868) 677), assigned this genus to its own family, the Crypteroniaceae, a decision accepted by Hutchinson (Fam. Fl. Pl. 1 (1959) 167; Gen. Fl. Pl. 2 (1967)

33), and also by Cronquist (Int. Syst. Class. Fl. Pl. (1981) 633). Niedenzu (in Engler & Prantl, Nat. Pfl. Fam. 3, 7 (1898), however, placed *Crypteronia* in the tribe Crypteronioideae of the Blattiaceae (= Sonneratiaceae).

Van Beusekom-Osinga & van Beusekom (*l.c.*), and van Beusekom-Osinga (*l.c.*), recognized 5 genera in the family, namely *Alzatea* (confined to Peru and Bolivia), *Axinandra*, *Crypteronia* and *Dactylocladus* (in tropical SE Asia and Malesia), and *Rhynchocalyx* (restricted to tropical S Africa). Van Vliet (Blumea 27 (1981) 395) and Thorne (in Young & Seigler (eds.), Phytochemistry and angiosperm phylogeny (1981) 227) proposed the inclusion of Crypteroniaceae as a subfamily in the Melastomataceae, a suggestion not accepted by Mentink & Baas (Blumea 37 (1992) 216). Johnson & Briggs (Ann. Missouri Bot. Gard. 71, 3 (1985) 732) excluded *Rhynchocalyx* from the Crypteroniaceae and assigned it to its own family, the Rhynchocalycaceae. Concurrently, Graham (Ann. Missouri Bot. Gard. 73, 3 (1985) 775) segregated *Alzatea* from Crypteroniaceae and placed it in its own family, the Alzateaceae.

Brummitt (Vasc. Pl. Fam. & Gen. (1992) 549), in agreeing with the concepts of Graham and Johnson & Briggs, recognized Crypteroniaceae as a well-defined family comprising *Axinandra*, *Crypteronia*, and *Dactylocladus*. In the present account, Brummitt's delimitation of the Crypteroniaceae is followed.

### Key to genera

1. Leaf apex typically obtuse, rarely acute; intercostal veins almost invisible on both surfaces. Functional stamens very short, 0.5–1 mm long. Plants typically of peat swamp forest.....**3. Dactylocladus**  
 Leaf apex acute, acuminate to caudate or cuspidate; intercostal veins typically prominent on one or both sides of the leaf. Functional stamens longer, 1.5–4 mm long. Plants of other habitats.....**2**
2. Flower subtended by 1 bract; petals absent; stamens or staminodes as many as sepals, persistent; ovary superior, 2–4-locular, ovules many per locule. Fruits small, chartaceous, typically with persistent style and stigma. Seeds many.....**2. Crypteronia**  
 Flower subtended by 3 bracts, the two lateral ones often tiny; petals present; stamens twice as many as sepals or petals, non persistent; ovary inferior, (4–)6-locular, ovules 1 or 2 per locule. Fruits large, woody, style and stigma caducous. Seeds few.....**1. Axinandra**

## 1. AXINANDRA Thwaite

(Greek, *axine* = axe, *andros* = male; the hatchet-shaped stamens)

In Hooker, J. Bot. 6 (1854) 66; Ridley, FMP 1 (1922) 821; van Beusekom-Osinga & van Beusekom, Blumea 22 (1975) 262; van Beusekom-Osinga, FM 1, 8 (1977) 187; Ng, TFM 4 (1989) 78; Whitmore, Tantra & Sutisna, CLK 2, 1 (1990) 50. **Synonyms:** *Axinandra* sect. *Naxiandra* Baill., Adansonia 12 (1876) 85; *Naxinandra* (Baill.) Krasser in Engler & Prantl, Nat. Pfl. Fam. 3, 7 (1893) 197.

Trees. **Leaves:** *apex acuminate to caudate or cuspidate*; midrib flattened above, prominent beneath; lateral veins ascending and joining to form looped marginal veins, *intercostal veins*

*prominent on one or both sides*, glabrous. **Inflorescences** terminal or axillary, erect, few-branched; axes more or less angular; *bracts triangular*; *bracteoles 3 per flower, the two lateral ones often tiny*. **Flowers** *bisexual*, receptacle pubescent in flower, glabrous in fruit; sepals (4–)5, caducous in fruit; petals, (4–)5, flimsy, *valvate-connate or imbricate-conduplicate* or imbricate-contorted, more or less connate or coherent and dropping simultaneously as a unit; stamens (8–)10, 1.5–3.5 mm long, caducous, filaments terete to more or less flattened, connective divergent, with distinct dorsal tubercle, anthers broadly linear at apex; *ovary inferior*, (2–)3-carpellate, (4–)6-locular, glabrous, *ovules 1 or 2 per locule, inserted basally to the septum*, style (subulate-)terete, sometimes protruding from mature buds, glabrous, caducous in fruit, stigmas punctate. **Fruits** large, woody, globose to ellipsoid, splitting into 2–6 valves in the apical part that protrudes from the enlarged receptacle; receptacle with distinct encircling rim; valves triangular, coarse, glabrous. **Seeds** few, depressed-ellipsoid, located basally and obliquely in the narrowly oblong wing; raphe running along the embryo.

**Distribution.** Four species, distributed from Sri Lanka to Peninsular Malaysia and Borneo. In Sabah, only *A. coriacea* is recorded, whereas in Sarawak, *A. alata* and *A. beccariana* are known.

**Ecology.** Lowland to lower montane forest to 1200 m.

### Key to *Axinandra* species

1. Internodes winged. Leaves oblong; lateral veins 12–14 pairs. Bracteoles of median flowers 1–1.5 mm long.....**1. A. alata**  
Internodes not winged. Leaves elliptic, ovate-elliptic to ovate; lateral veins 6–12 pairs. Bracteoles of median flowers, 0.25–1 mm long.....2
2. Leaves coriaceous to subcoriaceous; acumen obtuse; intercostal veins prominent and distinctly reticulate on both sides. Inflorescences 2.5–5 cm long; ultimate branches 1.5–4 cm long; main axis 1–2 mm thick; bracts 0.25–1 mm long.....**3. A. coriacea**  
Leaves chartaceous; acumen acute; intercostal veins obscure and faintly reticulate on both sides. Inflorescences 5–20 cm long; ultimate branches 4.5–7 cm long; main axis 0.3–0.5 mm thick; bracts 1–4 mm long.....**2. A. beccariana**

#### 1. *Axinandra alata* Baill.

(Latin, *alatus* = furnished with wing-like extensions; the internodes)

*Adansonia* 12 (1876) 86; Merrill, *EB* (1921) 452; Masamune, *EPB* (1942) 545; van Beusekom-Osinga & van Beusekom *l.c.* 263; van Beusekom-Osinga *l.c.* 187. **Type:** *Beccari PB 3651*, Borneo, Sarawak (holotype FI; isotypes K, P).

Tree. Twigs glabrous; *internodes* terete at base, *becoming acutely quadrangular upwards with 4 gradually widening wings towards the nodes*; wings 1–3 mm wide, ending in acute, often upward-curved processes. **Leaves** drying brown-green above, brown below, chartaceous; *oblong*, 5–10 x 3–5 cm; base rounded, apex cuspidate, acumen 0.3–0.7 cm long; midrib flattened on the upper leaf surface, raised on the lower surface, *lateral veins 12–14 pairs*, distinctly looping towards the margin,

flattened above, raised below, intercostal veins prominent on both surfaces, distinctly reticulate, glabrous; petioles 3–5 mm long, 1–2 mm thick, glabrous. **Inflorescences** axillary, 8–15 cm long, main axes 1–1.2 mm thick, ultimate branches 5–7 cm long, rachis pubescent; bracts *c.* 1 mm long, sparsely pubescent, caducous; *bracteoles of median flowers 1–1.5 mm long*, narrowly triangular, densely hairy, persistent; pedicels 1–2 mm long, *c.* 0.5 mm thick, pubescent. **Flowers:** sepals 0.5–0.8 x 1–1.5 mm, triangular, glabrous inside, pubescent outside; petals 3.5–4 x 1–1.5 mm; filaments 1.5–2 mm long; styles 3–5 mm long, protruding from mature buds. **Fruits** not seen.

**Distribution.** Endemic to Borneo (Sarawak only), very uncommon and only known from the type.

## 2. *Axinandra beccariana* Baill.

(Odoardo Beccari, 1843–1920, Italian explorer and botanist)

*l.c.* 85; Merrill *l.c.* 452; Ridley *l.c.* 826; Masamune *l.c.* 545; van Beusekom-Osinga & van Beusekom *l.c.* 263; van Beusekom-Osinga *l.c.* 187; Ng *l.c.* 78. **Type:** *Beccari PB 3458*, Borneo, Sarawak (holotype FI; isotypes K, P). **Synonyms:** *A. maingayi* C.B. Clarke in Hooker *f.*, Fl. Br. Ind. 2 (1879) 581; *A. borneensis* Bakhuizen *f.*, Rec. Trav. Bot. Neerl. 40 (1943) preprint 332.

Tree. Twigs glabrous to minutely pubescent; *internodes not winged*. **Leaves** glabrous, drying green-brown on both surfaces, *chartaceous*; *elliptic to ovate*, 5–10 x 2–5 cm; base cuneate, apex acuminate to acute, acumen 0.3–0.5 cm long, *tip acute*; midrib flattened on the upper leaf surface, raised on the lower leaf surface, *lateral veins 8–12 pairs*, looping towards the margin, flattened above, slightly raised below, *intercostal veins obscure and faintly reticulate on both sides*, glabrous; petioles 5–8 mm long, 1–2 mm thick. **Inflorescences** axillary to terminal, *5–20 cm long*, *main axes 0.3–0.5 mm thick*, *ultimate branches 4.5–7 cm long*, rachis sparsely pubescent to glabrous; *bracts 1–4 mm long*, subglabrous, persistent, *bracteoles of median flowers 0.5–1 mm long*, narrowly triangular to triangular; pedicels 1–2.5 mm long, *c.* 0.5 mm thick. **Flowers:** sepals *c.* 0.5 x 1 mm, triangular, glabrous inside, subglabrous to glabrous outside; petals *c.* 3 x 1 mm; filaments 1–1.5 mm long; styles *c.* 2 mm long, hardly or not protruding from mature buds. **Fruits** 1.5–2 x 1–1.5 cm; valves *c.* 0.8 cm long. **Seeds** not seen.

**Distribution.** Peninsular Malaysia (one collection, *Maingay 65412*, from Melaka) and Borneo (known from Sarawak only).

**Ecology.** Lowland forest.

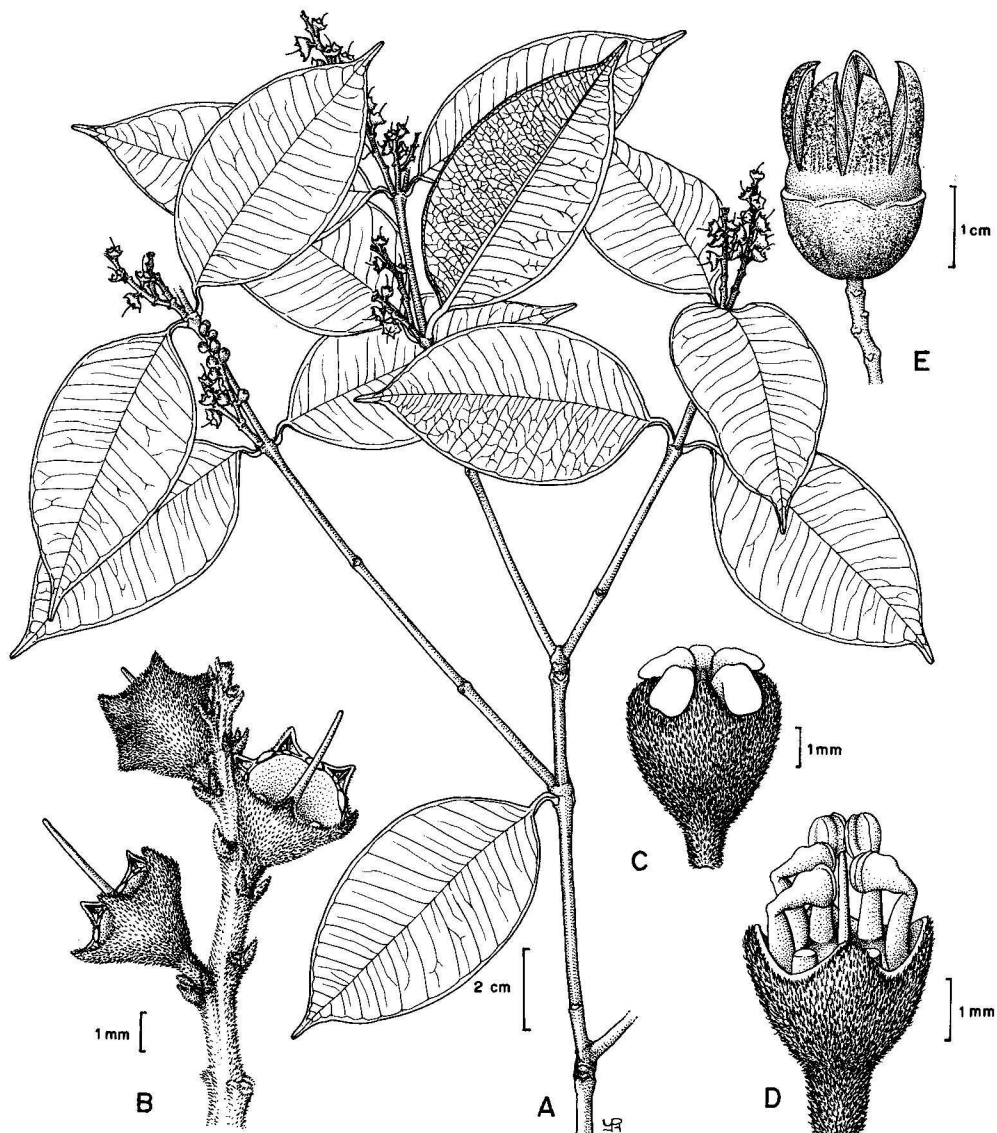
## 3. *Axinandra coriacea* Baill.

(Latin, *coriaceus* = leathery; the leaves)

Fig. 1.

*l.c.* 85; Merrill *l.c.* 452; van Beusekom-Osinga & van Beusekom *l.c.* 264; van Beusekom-Osinga *l.c.* 187. **Lectotype** (van Beusekom-Osinga & van Beusekom, 1975): *Beccari PB 2622* Borneo, Sarawak (FI; isolectotypes K, P).

Tree to 55 m tall, 90 cm diameter; buttresses to 2 m tall and 0.5 m wide. **Bark** grey-brown, smooth to flaky; inner bark pale brown to red-brown. **Sapwood** whitish to brown. Twigs glabrous to sparsely



**Fig. 1.** *Axinandra coriacea*. A, flowering leafy twig; B, old flowers with petals and stamens fallen off; C, mature flower bud with style protruding; D, mature open flower with petals fallen off, showing style and stamens; E, fruit. (A–B from *S.* 39235, C–D after FM 1, 8 (1977) 187, fig. 11, E from *S.* 37302.)

hairy; *internodes not winged*. **Leaves** drying greenish to dark brown above, brown below, *coriaceous to subcoriaceous*, glabrous above, sparsely hairy to glabrous below; elliptic to ovate-elliptic, 5–15 x 1.5–7 cm; base cuneate to rounded, apex acuminate to caudate, acumen 0.5–1 cm long, *tip obtuse*; midrib flattened on the upper leaf surface, raised on the lower leaf surface, *lateral veins 6–12 pairs*, looping towards the margin, flattened above, slightly raised below, *intercostal veins prominent and distinctly reticulate on both sides*; petioles 3–7 mm long, 1–2 mm thick, glabrous or sparsely hairy. **Inflorescences** axillary to terminal, 2.5–5 cm long, *main axes 1–2 mm thick*, angular, *ultimate branches 1.5–4 cm long*, rachis densely pubescent; *bracts 0.25–1 mm long*, subglabrous, *bracteoles of median flowers 0.25–1 mm long*, triangular; pedicels 1–2 mm long, *c.* 1 mm thick. **Flowers:** sepals 0.5–1 x 1–1.5 mm, triangular, glabrous inside, densely to sparsely pubescent outside; petals *c.* 6 x 1.5 mm; filaments 1.5–2 mm long; styles 3–5 mm long, protruding from mature buds. **Fruits** 1.2–4 x 1–3 cm; valves 5–6, 0.5–1.7 x 0.3–0.7 cm. **Seeds:** wings broadly obtuse at apex.

**Distribution.** Endemic to Borneo (Sabah, Sarawak and Kalimantan).

**Ecology.** In lowland to lower montane forest up to 1200 m. In Sabah, it is recorded mainly in forest on ultramafic soil (Mt. Silam, Bidu-Bidu Hills, Bukit Kiabau, etc.), whereas in Sarawak it is found in mixed dipterocarp and *kerangas* forests, up to 1200 m.

## 2. CRYPTERONIA Blume

(Greek, *kruptos* = hidden, *eros* = love; probably alluding to the small flowers)

Bijdr. Fl. Ned. Ind. (1826) 1151; Ridley, FMP 1 (1922) 821; Keng, OFMSP (1969) 151; van Beusekom-Osinga & van Beusekom, Blumea 22 (1975) 258; Shea in Cockburn, TS 1 (1976) 73; van Beusekom-Osinga, FM 1, 8 (1977) 191; Anderson, CLTS (1980) 164; Corner, WSTM 3rd ed. 1 (1988) 222; Whitmore, Tantra & Sutisna, CLK 1 (1989) 51; Ng, TFM 4 (1989) 79; Pereira & Wong, Sandakania 6 (1995) 41. **Synonyms:** *Henslowia* (*non* Blume) Wall., Pl. As. Rar. 3 (1831) 13, t. 221; *Quilamum* Blanco, Fl. Filip. 1 (1837) 851.

Medium-sized to large trees; buttresses sometimes present. Twigs with nodes somewhat swollen, glabrous to pubescent. *Stipules absent or very small*. **Leaves** coriaceous, subcoriaceous to chartaceous, *apex acute, acuminate to caudate*; midrib flattened or sunken above, lateral veins distinctly to vaguely looping, *intercostal veins prominent on one or both sides*, glabrous to pubescent. **Inflorescences** terminal and/or axillary panicles, branching 1–3 orders, many-flowered; *bracts 1 per flower*. **Flowers** *bisexual or unisexual* (only in *C. paniculata*); sepals persistent even in fruit; *petals absent*; stamens or staminodes 5, as many as sepals, persistent, *functional stamens 1.5–4 mm long*, glabrous, filaments flattened, connective tissue divergent, anthers apically or laterally attached to the connective; *ovary superior, 2–4-locular, ovules many per locule*, inserted horizontally or vertically (basally) to the septum, style terete, glabrous to hairy, stigmas capitate to punctate. **Fruits** *small*, hardly larger than the flowers, *chartaceous, typically with persistent styles and stigmas*, subglobose to ovoid-ellipsoid, impressed at the septa, *splitting loculicidally into 2–4 valves, styles and stigmas adhering at apex*. **Seeds** *many*, tiny, ovoid-ellipsoid, inserted on the septum or at the base of the septum; wing membranous, acute to obtuse at base or apex; raphe running closely along the embryo.

**Distribution.** Seven species with 2 varieties, distributed in tropical and subtropical SE Asia from Assam to Bengal, Myanmar, Thailand, Indo-China and Malesia. In Sabah and Sarawak, six species are recorded.

**Ecology.** Lowland to lower montane forest, up to about 1500 m.

### Key to *Crypteronia* species

1. Leaf intercostal veins obscure on both sides. Flowers unisexual (plants dioecious); ovary 2-locular. Seeds inserted on the septum, the membranous wing with a broadly rectangular base and a tapered or acute apex.....**6. *C. paniculata*** (var. ***paniculata***)  
Leaf intercostal veins prominent on one or both sides. Flowers bisexual; ovary 3–4-locular. Seeds inserted at the base of the septum; the membranous seed wing with a tapered or acute to narrowly rectangular or obtuse base and a broadly obtuse to acute apex.....2
2. Midrib distinctly sunken on the upper leaf surface. Inflorescence bracts 2.5–9 mm long.....**1. *C. borneensis***  
Midrib flat on the upper leaf surface. Inflorescence bracts 0.5–1.5 mm long.....3
3. Leaves oblong to ovate-oblong; lateral veins 10–20 pairs. Inflorescences branching to the 3rd order, rarely to only the 2nd order; main axis 3–5 mm thick.....**5. *C. macrophylla***  
Leaves narrowly elliptic, elliptic to ovate-elliptic; lateral veins typically not more than 10 pairs. Inflorescences branching to the 1st or 2nd order (typically to the 1st order); main axis 1–3 mm thick.....4
4. Leaf apex acuminate to caudate, acumen 0.5–1.8 cm long; leaf base distinctly cuneate; intercostal veins distinctly reticulate to tessellate. Petioles slender, only 1–1.5 mm thick. Ovary glabrous. Fruits ellipsoid.....**2. *C. elegans***  
Leaf apex shortly acute, acumen if present shorter, 0.1–0.4 cm long; leaf base cordate to rounded; intercostal veins sparsely reticulate. Petioles thicker, 2–7 mm thick. Ovary sparsely to densely minutely papillose to pubescent. Fruits subglobose to ovoid.....5
5. Inflorescences with ultimate branches (15–)20–40 cm long; main axis 2–3 mm thick; pedicels 0.1–0.5 mm long, densely pubescent. Sepals broadly spread open in the mature flower, sparsely to densely pubescent outside. Styles sparsely pubescent at base, glabrous at upper part. Seed wing tapered at apex.....**4. *C. griffithii***  
Inflorescences with ultimate branches not more than 20 cm long; main axis slender, 1–2 mm thick; pedicels 1–1.5 mm long, glabrous. Sepals connate, forming a dome-shaped structure even in the mature flower, glabrous outside. Styles glabrous throughout. Seed wing broadly obtuse at apex.....**3. *C. glabriflora***

#### 1. *Crypteronia borneensis* J.T. Pereira & Wong (of Borneo)

Sandakania 6 (1995) 45. **Type:** *Tarmiji & Talib SAN 90941*, Borneo, Sabah, Beaufort (holotype SAN; isotype K).

Medium-sized tree to 25 m tall, 45 cm diameter. **Bark** greyish brown, smooth; inner bark brown to greyish. **Sapwood** yellowish white to brown. Twigs glabrous. **Leaves** drying dark brown to green-brown on both sides, coriaceous to subcoriaceous; broadly ovate, ovate-elliptic to elliptic, 10–26 x 4–20 cm; base cordate, rounded to cuneate, apex acute to acuminate, acumen 0.5–1.0 cm long; *midrib distinctly sunken on the upper surface*, distinctly raised on the lower leaf surface, lateral veins 8–15 pairs, distinctly looping towards the margin, sunken to flattened above, distinctly raised below, *intercostal veins obscure above, prominent below*, laxly reticulate, glabrous; petioles 0.5–2 cm long, 2–5 mm thick, glabrous. **Inflorescences** terminal or in the axils of fallen leaves on older branches, 14–25 cm long, branching to the 2nd or 3rd order, main axis 2–4 mm thick, ultimate branches 5–15 cm long, rachis pubescent; *bracts 2.5–9 mm long*, triangular, subglabrous, persistent. **Flowers** *bisexual*, bracteoles (0.5–) 1–2 mm long, narrowly triangular to subulate, sparsely hairy, persistent; pedicels 0.5–2 mm long, *c.* 0.5 mm thick, minutely papillose or pubescent; sepals triangular, densely tomentose inside, minutely papillose or tomentose outside, 0.5–1.5 x 0.5–1.5 mm; stamens 1.5–2.5 mm long, filaments 1–2 mm long, anthers 0.25–0.5 x 0.2–0.8 mm; *ovary 3(–4)-locular*, 1–2 mm across, styles 1–3.5 mm long, minutely densely papillose or tomentose, stigmas capitate. **Fruits** subglobose, papillose to densely tomentose. **Seeds** *inserted at the base of the septum; wing broadly obtuse at apex, tapered or acute at base.*

**Vernacular name.** Sabah—*tampasu* (Dusun).

**Distribution.** Endemic to Borneo (Sabah, Sarawak and Brunei).

**Ecology.** In lowland primary mixed dipterocarp forest, on clay-rich, well-drained alluvium and sandy soils, to *c.* 600 m. Frequently near river banks.

## 2. *Crypteronia elegans* J.T. Pereira & Wong

(Latin, *elegans* = elegant; the inflorescences)

Sandakania 6 (1995) 48. **Type:** *Paie S. 36393*, Borneo Sarawak, 7th Division, Kapit, Bukit Bakar (holotype SAN; isotypes K, KEP, L, MO, SAR).

Medium-sized tree to 27 m tall, 75 cm diameter; buttresses to 1.5 m tall and 1.5 m wide. **Bark** reddish brown to blackish, flaky; inner bark red with deep yellow. **Sapwood** orange- straw-coloured. Twigs glabrous. **Leaves** drying dark brown to brown on both sides, subcoriaceous; *narrowly elliptic*, 7–12 x 2–5 cm; *base cuneate, apex acuminate to caudate, acumen 0.5–1.8 cm long; midrib flattened on the upper leaf surface*, raised on the lower leaf surface, *lateral veins 8–10 pairs*, looping towards the margin, flattened at both sides, *intercostal veins prominent and distinctly reticulate or tessellate on both sides*, glabrous; petioles 1–2 cm long, *1–1.5 mm thick*. **Inflorescences** terminal and axillary, up to 24 cm long, *branching to the 1st or 2nd order, main axis 1–2 mm thick*, ultimate branches 7–18 cm long, rachis puberulose; bracts 0.5–1 mm long, early caducous. **Flowers** *bisexual*; bracteoles 0.5–1.5 mm, narrowly triangular, usually caducous; pedicels 0.5–1.5 mm long, *c.* 0.5 mm thick, puberulose; sepals triangular, sparsely puberulose outside, densely puberulose inside, 0.5–1 x 0.75–1 mm; stamens 1.5–2.5 mm long, filaments 1–2 mm long, anthers *c.* 0.5 mm across; *ovary 3-locular*, 1.5–2 mm across, styles 1–3 mm long, *glabrous*, stigmas punctate. **Fruits** *ellipsoid*, glabrous to subglabrous. **Seeds** *inserted at the base of the septum; wing tapered at base and apex.*

**Distribution.** Endemic to Borneo (Sarawak and Brunei); not yet recorded for Sabah. In Sarawak, recorded at Kelabit Highlands and Bukit Bakar, Kapit, while in Brunei, it is found in the Temburong District.

**Ecology.** In lowland mixed dipterocarp forest and secondary forest, to 1100 m, mainly on low hills and ridges.

### 3. *Crypteronia glabriflora* J.T. Pereira & Wong

Fig. 2.

(Latin, *glaber* = without hair, *florus* = flowers)

Sandakania 6 (1995) 50. **Type:** *Dransfield JD 7225*, Brunei, Temburong, Bukit Belalong (holotype SAN; isotypes BRUN, K, KEP).

Tree to 20 m tall, 40 cm diameter. **Bark** reddish brown, cracking; inner bark reddish. **Sapwood** pale yellowish brown. Twigs glabrous. **Leaves** drying dark brown to brown above, pale brown below, coriaceous; *ovate-elliptic to elliptic*, 7–20 x 3–8 cm; *base cordate to rounded, apex shortly acute, acumen 0.1–0.4 cm long; midrib flattened on the upper leaf surface, slightly raised on the lower leaf surface, lateral veins 8–10 pairs, looping towards the margin, flattened above, flattened to slightly raised below, intercostal veins prominent and laxly reticulate on both sides*, glabrous; petioles 0.4–1 cm long, 2–3 mm thick, glabrous. **Inflorescences** terminal and in the axils of fallen leaves on older branches, 12–20 cm long, *branching to the 1st or 2nd order, main axis 1–2 mm thick, ultimate branches 5–20 cm long, rachis puberulose; bracts 0.5–1 mm long, triangular, glabrous, caducous*. **Flowers** *bisexual*; bracteoles 0.5–1 mm long, narrowly triangular, pubescent, persistent; *pedicels 1–1.5 mm long, c. 0.5 mm thick, glabrous; sepals triangular, connate, forming a dome-like structure even in the mature flower, glabrous on both sides, slightly hairy at margin below, 1–1.5 x 1–1.5 mm; stamens 3–4 mm long, filaments 2.5–3.5 mm long, anthers c. 0.5 mm across; ovary 3-locular, 1–1.5 mm across, densely minutely papillose, styles 2–4.5 mm long, glabrous, stigmas punctate*. **Fruits** *subglobose, minutely papillose*. **Seeds** *inserted at the base of the septum; wing broadly obtuse at apex, narrowly obtuse at base*.

**Distribution.** Endemic to Borneo (Sarawak and Brunei only); not yet recorded in Sabah. In Sarawak, it occurs on Mt. Pagon, Limbang and in Brunei in the Temburong District.

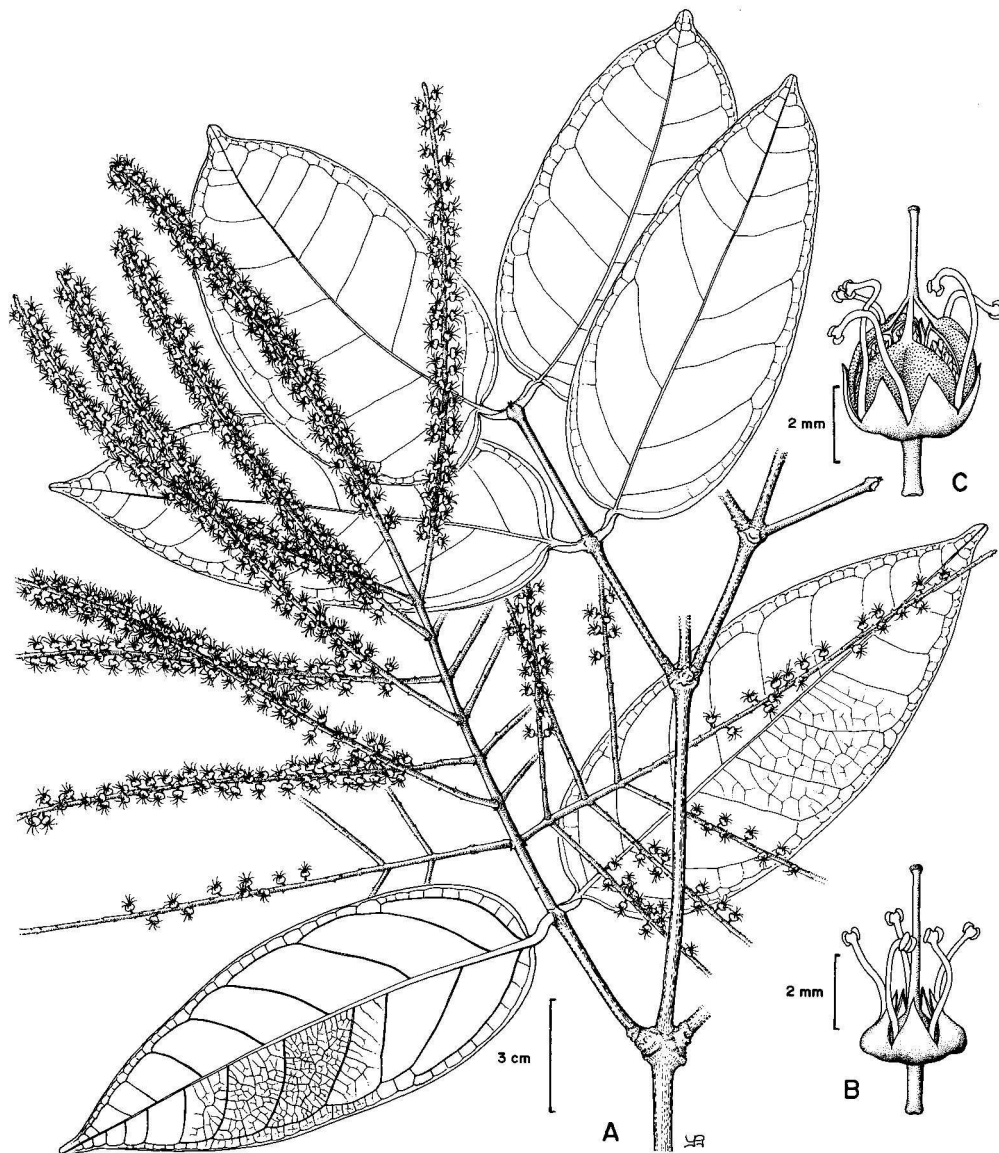
**Ecology.** Mixed dipterocarp forest to 820 m, on clay soil overlying sandstone.

### 4. *Crypteronia griffithii* C.B. Clarke

(W. Griffith, 1810–1845, physician and botanist in India and Malaya)

In Hooker *f.*, Fl. Br. Ind. 2 (1879) 574; Ridley *l.c.* 822; van Beusekom-Osinga & van Beusekom *l.c.* 260; van Beusekom-Osinga *l.c.* 196; Corner *l.c.* 222; Ng *l.c.* 80; Whitmore, Tantra & Sutisna *l.c.* 51. **Type:** *Griffith 2513*, Malacca (holotype K; isotype L).

Medium-sized to large tree to 40 m tall, 70 cm diameter; buttresses to 0.6 m tall and 0.6 m wide. **Bark** brownish to grey, smooth to fissured or flaky; inner bark brown to red. **Sapwood** white to yellow or pale brown. Twigs glabrous. **Leaves** drying green-brown to brown or dark brown on both sides, coriaceous; *elliptic to ovate-elliptic*, 9–40 x 4–15 cm; *base cordate to rounded, apex shortly acute*,



**Fig. 2.** *Crypteronia glabriflora*. A, flowering leafy twig; B, mature open flower; C, young fruit with the stamens still persistent. (All from *Dranfield JD 7225*.)

*acumen 0.1–0.4 cm long; midrib flattened on the upper leaf surface, raised on the lower leaf surface, lateral veins 8–10(–14) pairs, flattened above, raised below, looping towards the margin, intercostal veins prominent and laxly reticulate beneath, glabrous; petioles 0.5–1.5 cm long, 3–7 mm thick, glabrous. Inflorescences in the axils of fallen leaves on older branches, 20–45 cm long, branching to the 1st or 2nd order, main axis 2–3 mm thick, ultimate branches (15–)20–40 cm long, rachis densely pubescent; bracts 0.5–1 mm long, triangular, hairy, persistent to caducous. Flowers bisexual; bracteoles 0.5–1 mm long, triangular with slender tip; pedicels 0.1–0.5 mm long, 0.5–1 mm thick, densely pubescent; sepals triangular, broadly spread open in the mature flower, densely to sparsely pubescent on both sides, 1–2 x 1–1.5 mm; stamens 2–3.5 mm long, filaments 1.5–3 mm long, anthers c. 0.5 mm across; ovary 3-locular, 1.5–2 mm across, sparsely pubescent, styles (2–)3–4 mm long, sparsely pubescent at base, glabrous at upper part, stigmas punctate. Fruits subglobose, sparsely pubescent. Seeds inserted at the base of the septum; wing tapered or acute at apex, narrowly rectangular at base.*

**Vernacular names.** Sabah—*rambai-rambai* (Bajau). Sarawak—*ubah semut* (Iban).

**Distribution.** Myanmar, C Sumatra, Peninsular Malaysia and Borneo. In Sabah and Sarawak, common in most districts; also in Kalimantan.

**Ecology.** Scattered in primary forest, up to 600 m; often on yellow to brown-blackish sandy soil, sometimes on clayey soil. In Peninsular Malaysia and Borneo, the species often forms an association with *Cladomyrma maschwitzii* ants.

**Uses.** The wood has been reported to be durable and used in house-building.

## 5. *Crypteronia macrophylla* Beus.-Osinga

(Greek, *makros* = large, *phullon* = leaves)

Blumea 22 (1975) 261; van Beusekom-Osinga *l.c.* 198; Whitmore, Tantra & Sutisna *l.c.* 51. **Type:** Ashton S. 19372, Borneo, Sarawak, Anap, Ulu Muput Kanan, Bt. Naoung (holotype L; isotypes K, SAN, SAR).

Medium-sized tree to 25 m tall, 60 cm diameter. **Bark** greyish to pale yellowish brown, smooth to flaky; inner bark orange. Twigs glabrous. **Leaves** drying greenish brown above, brown below, coriaceous; *oblong to ovate-oblong*, 18–45 x 8–15 cm; base cordate to slightly rounded, apex acute, *acumen c. 0.5 mm long; midrib flattened on the upper leaf surface, distinctly raised on the lower leaf surface, lateral veins 10–20 pairs, flattened above, raised below, distinctly to vaguely looping towards the margin, intercostal veins prominent and distinctly reticulate to tessellate on both sides, glabrous; petioles 1–1.5 cm long, 2–5 mm thick, glabrous. Inflorescences in the axils of leaves on older nodes, 30–40 cm long, branching to the 2nd or 3rd order, main axis 3–5 mm thick, rachis pubescent; bracts 0.5–1 mm long, triangular, short-hairy, caducous. Flowers bisexual; bracteoles 0.5–1 mm long, narrowly triangular; pedicels 1.5–2 mm long, c. 0.5 mm thick, densely thinly pubescent; sepals triangular, 0.5–1 mm across, pubescent on both surfaces; stamens 1.5–3 mm long, filaments 1–2.5 mm long, anthers 0.5–1 x 0.5–1 mm; ovary (3–)4-locular, 1–2.5 mm across, densely pubescent to thinly tomentose, styles 0.2–3 mm long, densely pubescent, stigmas punctate. Fruits subglobose, pubescent. Seeds inserted at the base of the septum; wing acute at base and apex.*

**Vernacular names.** Sarawak—*bedulang semut, ubah semut, ubah samak* (Iban); *teletang* (Kelabit).

**Distribution.** Endemic to Borneo (Sarawak and Kalimantan only). In Sarawak, known from Anap, Rejang, Kapit, Ulu Melinau, Balleh, Baram and Kuching areas; in Kalimantan, recorded from West Kutei, Pontianak and Sg. Kahayan.

**Ecology.** Primary lowland to hill forest, on clay, igneous, sandstone to basalt soils, to 1200 m, sometimes near river banks. Young branches are often inhabited by ants.

## 6. *Crypteronia paniculata* Blume

(Latin, *paniculatus* = panicle; the inflorescence)

*l.c.* 1151; Ridley *l.c.* 821; van Beusekom-Osinga & van Beusekom *l.c.* 259; van Beusekom-Osinga *l.c.* 194; Anderson *l.c.* 165; Corner *l.c.* 224; Whitmore, Tantra & Sutisna *l.c.* 51; Ng *l.c.* 80. **Type:** *Blume, s.n.*, Java (holotype L).

### var. *paniculata*

Tree to 36 m tall, 105 m diameter; buttresses to 1.5 m tall, 1.2 m wide. **Bark** brown to grey-brown, finely fissured to scaly; inner bark brown. **Sapwood** light brown to yellowish white. Twigs glabrous. **Leaves** drying deep brown to brown-green above and greenish-brown below, chartaceous; ovate-elliptic to elliptic, 6–21 x 3–10(–12) cm; base cuneate to sometimes rounded, apex shortly to narrowly acuminate, acumen 0.2–1.5 cm long; midrib flattened on the upper leaf surface, raised on the lower leaf surface, lateral veins 7–10 pairs, flattened, vaguely looping towards the apex, *intercostal veins obscure on both sides*, laxly reticulate, glabrous; petioles 0.2–0.8 cm long, 1–2 mm thick, glabrous. **Inflorescences** axillary and/or terminal, 9–30 cm long, branches to the 1st or 2nd order, main axis 1–1.5 mm thick, ultimate branches 10–20 cm long, rachis puberulose; bracts *c.* 0.5 mm long, triangular, glabrous, caducous. **Flowers** *unisexual* (plants dioecious); bracteoles (0.5–)1–1.5 mm long, narrowly triangular to subulate, glabrous; pedicels 1–1.5 mm long, *c.* 0.5 mm thick, glabrous; sepals triangular, densely to sparsely puberulose inside, papillose to subglabrous outside, 0.5–1.5 x 0.5–1 mm; males: stamens 2–4 mm long, filaments 1.5–3.5 mm long, anthers *c.* 0.5 x 0.5–1.5 mm; pistillodes 0.5–1 mm long; females: staminodes 0.5–1 mm long; *ovary 2-locular*, 0.5–1.5 mm across, papillose to puberulose, styles (0.8–)1–1.5 mm long, papillose, stigmas capitate. **Fruits** subglobose, slightly impressed at the septum, minutely papillose to puberulose. **Seeds** *inserted on the septum; wing acute or tapered at apex, broadly rectangular at base.*

**Vernacular names.** Sabah—*kinkidon mantok* (Dusun Kadazan). Sarawak—*ubah semut* (Iban).

**Distribution.** Continental SE Asia; from E Bengal to Assam, Andaman Islands, Myanmar, Peninsular Malaysia, Borneo (Sabah, Sarawak, Kalimantan), Sumatra, Java, Lesser Sunda Islands, and the Philippines. In Sabah, more common in the west coast; in Sarawak, recorded in the 1st, 2nd and 7th Divisions. In Kalimantan, documented for W Kutei.

**Ecology.** Frequent in primary and secondary hill forests, on sandy clay soil, to *c.* 1500 m.

**Uses.** The timber is claimed to be hard and durable and is utilized in house-building in W Java and S Sumatra. It is also used in making cart-wheels and also for fuel. In the Philippines, the bark has been used to treat blisters. In Java, the young shoots are eaten as salad.

### 3. DACTYLOCLADUS Oliv.

(Greek, *daktulos* = finger, *klados* = twigs; the branching mode of the twigs)

*jongkong* (Malay)

In Hooker, *Ic Pl.* (1895) *t.* 2351; Merrill, *EB* (1921) 452; Masamune, *EPB* (1942) 547; Brown, *FTSB* (1955) 261; Smythies, *CST* (1965) 89; Burgess, *TBS* (1966) 391; van Beusekom-Osinga & van Beusekom, *Blumea* 22 (1975) 261; van Beusekom-Osinga, *FM* 1, 8 (1977) 199; Anderson, *CLTS* (1980) 165; Whitmore, *Tantra & Sutisna*, *CLK* 1 (1989) 51.

Large trees; without buttresses. Twigs quadrangular, swollen at the nodes. **Leaves** coriaceous, *apex typically obtuse, rarely acute*; midrib thick, flattened on the upper leaf surface, raised on the lower leaf surface, lateral veins vague and flattened on both sides, looping towards the margin, *intercostal veins almost invisible on both surfaces*, glabrous. **Inflorescences** terminal and/or axillary, erect, poorly branched; bracts and bracteoles caducous, minute; pedicels short. **Flowers** *bisexual*; sepals triangular, persistent; petals unguiculate, blades irregularly lobed, suborbicular, pubescent on the margin, enclosing stamens in bud, caducous; *functional stamens 0.5–1 mm long*, persistent, glabrous, anthers oblong to broad-linear, filaments terete; *ovary half-inferior*, lower part adnate to the receptacle, puberulose, (3–)4–5-locular, ovules 3 per locule, basally inserted in between the septa, septa not connate, styles pubescent, persistent, stigmas capitate. **Fruits** broad-ellipsoid, small, pubescent, (3–)4–5-valved. **Seeds** narrow-ellipsoid, flat, situated centrally to the membranous wing, apex obtuse to irregularly shaped, broader than the base; raphe running close to the embryo.

**Distribution.** Monotypic, so far known with certainty from Borneo only. A doubtful record has been reported from Irian Jaya (*cf.* van Beusekom-Osinga *l.c.* 201).

**Ecology.** Common in lowland peat swamp forest.

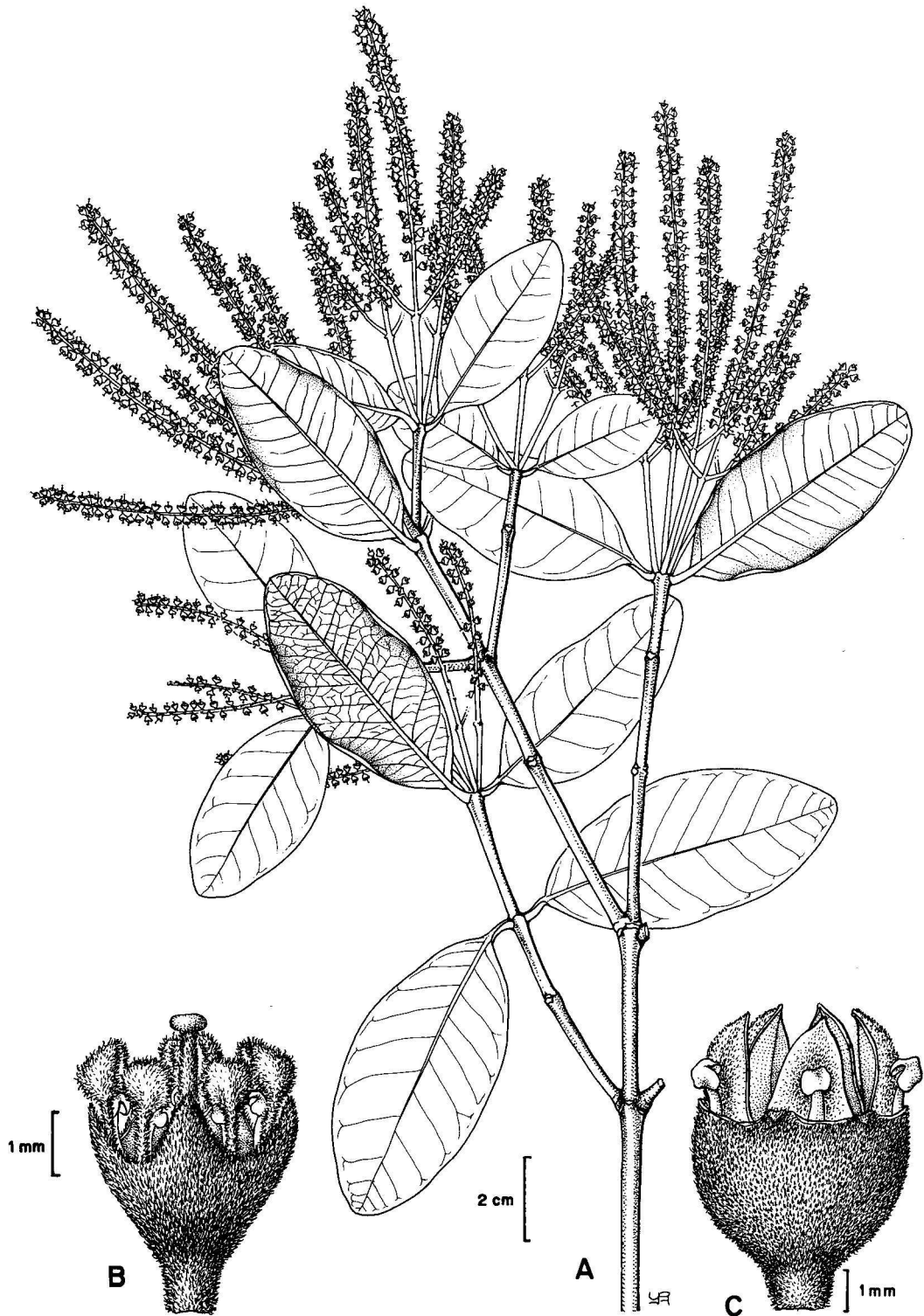
#### **Dactylocladus stenostachys** Oliv.

Fig. 3.

(Greek, *stenos* = narrow, small, *stachys* = spike; the inflorescence)

In Hooker *l.c. t.* 2351; Merrill *l.c.* 452; Masamune *l.c.* 457; Brown *l.c.* 261; Smythies *l.c.* 89; Burgess *l.c.* 391; van Beusekom-Osinga & van Beusekom *l.c.* 262; van Beusekom-Osinga *l.c.* 200; Anderson *l.c.* 165; Whitmore, *Tantra & Sutisna l.c.* 51. **Lectotype** (van Beusekom-Osinga & Beusekom, 1975): *Haviland 2916*, Borneo, Sarawak (K; isolectotype L).

Large tree to 40 m tall, 150 cm diameter; trunk base of big trees developing masses of small adventitious roots; pneumatophores (sharp-pointed aerial roots) yellowish, appearing at the base or around the tree. **Bark** brown to grey, smooth in immature tree, reddish brown, fissured to scaly in mature tree; inner bark yellowish to brown. **Sapwood** yellow to white, with small canal-like



**Fig. 3.** *Dactylocladus stenostachys*. A, flowering leafy twig; B, flower; C, fruit. (A–B from SAN 50096, C from SAN 73145.)

perforations. Twigs glabrous. **Leaves** drying greenish above, brown to greenish below; elliptic, ovate, obovate to spatulate, 3.5–10(–15) x 2–7 cm; base cuneate to slightly rounded; lateral veins 10–15 pairs; petioles 0.1–0.7 cm long, 0.1–0.3 mm thick, glabrous. **Inflorescences** 6–16 cm long, branching to the 1st order, rachis pubescent; bracteoles persistent, triangular, *c.* 0.5 mm long; pedicels 0.25–1 mm long, densely puberulose. **Flowers:** sepals puberulose on both surfaces, *c.* 0.5 x 0.5–1 mm; stamens 0.5–1 mm long, filaments 0.25–0.5 mm long, anthers 0.5–0.8 x 0.5 mm; ovary *c.* 1 mm across, styles 0.5–2 mm long, stigmas capitate. **Fruits** 3–4 mm across; valves 1–2 x 1–1.5 mm. **Seeds** 2–3 mm long, inserted at the base of the septum.

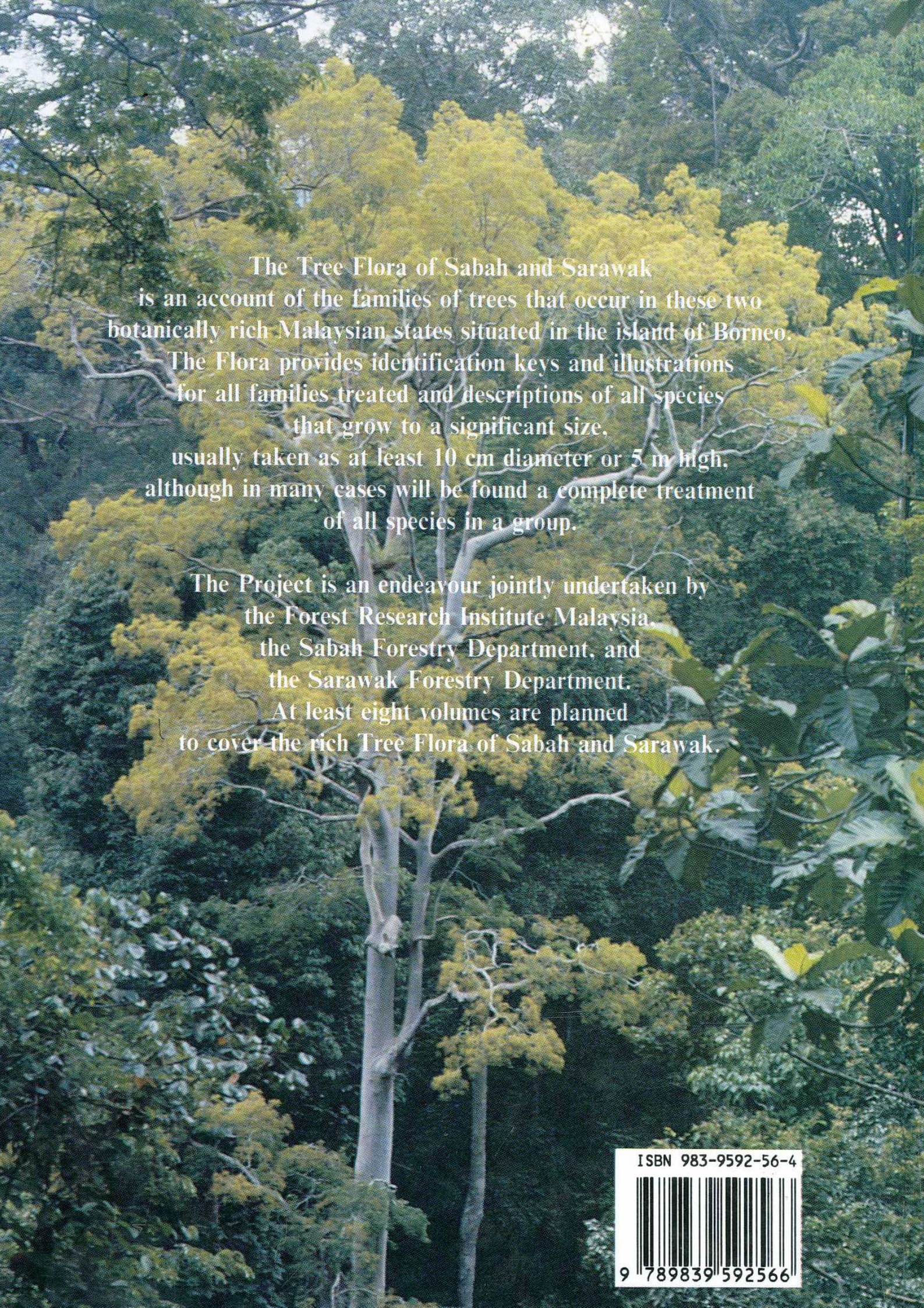
**Vernacular names.** Sabah—*jongkong* (Malay), *medang miang* (Kedayan), *medang tabak* (Brunei Malay), *tanjiong awan* (Malay). Sarawak—*gatal* (Murut), *jongkong* (Malay), *medang jongkong* (Murut), *merebong* (Iban).

**Distribution.** Endemic to Borneo (Sabah, Sarawak, Brunei and Kalimantan).

**Ecology.** Common in all types of peat swamp and mixed swamp forests. Occasionally in *kerangas* forest. In the peat swamp forest, it is common and dominant constituent of the “*padang keruntum*” phasic communities. Flowering and fruiting throughout the year, particularly from May to August.

**Uses.** The timber is moderately hard and moderately heavy, with density ranging from 495 to 610 kg/m<sup>3</sup> air dry. The heartwood is not differentiated from the sapwood and is light brown when fresh and darkening to pink-brown or red-brown. Texture is fine and even, with straight or slightly interlocking grains. The timber is easy to work and produces a smooth and lustrous surface. It is not durable when exposed to weather or in contact with the ground, but suitable for weather-boarding, flooring, partitioning, utility furniture, concrete shuttering, and for veneers in plywood manufacture (Burgess *l.c.*; Wong, DMT (1982) 82).





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