

## Studies in Malesian Gentianaceae III: *Cyrtophyllum* reapplied to the *Fagraea fragrans* alliance

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**ABSTRACT.** *Cyrtophyllum* Reinw., one of several distinct lineages among the *Fagraea* complex, is the correct genus to which five species of Southeast Asian trees should be assigned, including the widespread *F. fragrans*. *Cyrtophyllum minutiflorum* K.M.Wong is a new species described here. Two new combinations are made: *C. caudatum* (Ridl.) K.M.Wong and *C. wallichianum* (Benth.) M.Sugumaran & K.M.Wong.

**Keywords.** *Cyrtophyllum*, *Fagraea fragrans*, Gentianaceae, Malesia, Potalieae, Potaliinae, Southeast Asia

### Introduction

The results of a molecular phylogenetic study of the *Fagraea* complex (Sugumaran & Wong 2012) demonstrated the distinctness of a number of generic lineages from *Fagraea* Thunb. s.s. (Wong & Sugumaran 2012). Among these, *Cyrtophyllum* Reinw. and *Picrophloeus* Blume were readily distinguished from *Fagraea* s.s., *Limahlania* K.M.Wong & M.Sugumaran and *Utania* G.Don because the first two genera have flowers with conspicuously exerted styles (typically more than 40% of their length) and filaments (greater than 70% of their length) (Sugumaran & Wong 2012). Also, *Cyrtophyllum* and *Picrophloeus* frequently have cymes bearing numerous small flowers (corollas narrow, the mouth often not more than 10 mm wide), compared to the other genera, which typically have larger flowers (corollas typically much wider) in variable numbers. However, *Cyrtophyllum* has axillary cymes and Aubréville's tree architectural model, whereas *Picrophloeus* and the other three genera all have terminal cymes and consistently other architectural models (Scarrone's in *Picrophloeus* and *Fagraea* s.s., Fagerlind's in *Limahlania*, Roux's in *Utania*) (Sugumaran & Wong 2012; Wong & Sugumaran 2012).

The history of *Cyrtophyllum* is interesting. Ridley (1893) had used the name *C. fragrans* (Roxb.) DC. Later, he described an allied species under *Fagraea*, but nevertheless appreciated (Ridley 1918) that this genus name was available for the alliance of trees that was quite different from *Fagraea*: "It would probably be best to

keep up the genus *Cyrtophyllum* for the Tembusu trees which differ so much from the epiphytic true *Fagraeas* with their fleshy leaves and flowers, and included stamens, from the tall trees with their leaves and flowers and long projecting stamens. The genus *Cyrtophyllum* would thus contain *C. fragrans*..., *C. giganteum*..., *C. wallichii*..., *C. caudatum*..." In his *Flora of the Malay Peninsula* (Ridley 1923), he adopted *Cyrtophyllum* for this group of species. Burkill (1935), on the other hand, took the broad view as Blume (1838) did, and, under *Fagraea*, stated: "*Cyrtophyllum*... which some botanists separate, is not really distinct, and is united here." The uncertainties have found their way as different taxonomic approaches throughout this period, viz., as a section of *Fagraea* (Blume 1838); as a subgenus of *Fagraea* (Miquel 1857); and more recently as Blume's section again but with more discordant elements thrown in (Leenhouts 1962; see also Wong & Sugau 1996).

Here we provide a revision of *Cyrtophyllum*, which includes the well-known tree species in Southeast Asia, *C. fragrans* (synonym *Fagraea fragrans* Roxb.).

### *Cyrtophyllum* Reinw.

in Hornschuch, Syll. Pl. Nov. 2 (1825) 8; Blume, Bijdr. Fl. Ned. Ind. (1826) 1022; Ridley, Fl. Malay. Pen. 2 (1923) 421; Wong & Sugumaran, Gard. Bull. Sing. 64 (2012) 490. TYPE SPECIES: *C. peregrinum* Reinw. (= *C. fragrans* (Roxb.) DC.).

*Fagraea* sect. *Cyrtophyllum* (Reinw.) Blume, Rumphia 2 (1838) 34 *pro parte* excl. *F. speciosum*; Leenhouts, Fl. Males. I, 6 (1962) 303 *pro parte* excl. *F. elliptica* & *F. umbelliflora*; Wong & Sugau, Sandakania 8 (1996) 7 *pro parte* excl. *F. elliptica*. – *Fagraea* sect. *Parviflorae* Benth., J. Linn. Soc. Bot. 1 (1857) 100 *pro parte* quoad *C. peregrinum*. – *Fagraea* subg. *Cyrtophyllum* (Reinw.) Miq., Fl. Ind. Bat. 2 (1857) 375 *pro parte* excl. *F. sumatrana*.

Medium-sized to large trees usually more than 3 m and some reaching 25–30 m tall. **Trunk** monopodial with episodic growth; developing wave-like sympodial branch systems or 'terminalian' branching with successively higher orders of outwardly directed, then upturned, (indeterminate) branch segments (plagiotropy by apposition) (Aubréville's architectural model *vide* Hallé et al. 1978). Trunk bark becoming fissured in older trees. Vegetative **shoot apices** with light yellowish resin. Leaf arrangement on branches decussate; leaf margin entire; **petiolar sheaths** of a leaf pair fused and forming a shallow cup-like ochrea that loosely clasps the stem; petiolar base auricles absent. **Inflorescence** axillary, a few- to many-flowered and few- to multi-branched cyme, basal branches nearly as long as or longer than rachis. **Flowers** bisexual, small, up to 10 mm wide at the corolla mouth; calyx lobes 5; corolla white to creamy white, corolla lobes 5, overlapping to the right; stamens 5, typically two thirds or more exsert, anthers versatile, sagittate; style typically one third or more exsert; stigma capitate (knob-like). **Fruits** small, subglobose to slightly ellipsoid, up to about 10 mm in diameter; colour at maturity yellow-orange to bright red; with small amounts

of translucent sticky latex in fruit epidermis and fruit wall; epidermis separating as a thin translucent film from pericarp (fruit surface appearing crinkled on herbarium specimen). **Seeds** numerous; placentation axile; polygonal; surface areolate.

*Distribution and diversity.* Bengal, Burma, Thailand, Indo-China, Andaman Islands, Malay Peninsula, Sumatra, Java, Borneo, Mindoro, Balabac, Palawan, Celebes and north-west New Guinea. Five species known.

*Habitat.* Lowland forests.

#### Key to *Cyrtophyllum* species

- 1a. Inflorescence branching to just 1, rarely 2, orders. Corolla tubes 10–25 mm long; stamens with filaments 16–38 mm long; styles 14–55 mm long ..... 2
- b. Inflorescence branching to 2–4 orders. Corolla tubes not exceeding 10 mm long; stamens with filaments 7–17 mm long; styles 9–22 mm long ..... 3
- 2a. Leaf apex caudate. Calyx 2.5–3 mm across, corolla tube subcylindric (not conspicuously flared in its upper part), 10–12 mm long. (Borneo) ..... *C. caudatum*
- b. Leaf apex acuminate. Calyx 3–4 mm across, corolla tube infundibular (flared in its upper part), 12–25 mm long. (Malay Peninsula) ..... *C. wallichianum*
- 3a. Corolla tube infundibular (flared in the upper half), larger (lower narrowed part of corolla 1.5–2(–2.5) mm wide); leaf secondary veins flat or slightly raised on the upper leaf surface in dried material ..... *C. fragrans*
- b. Corolla tube subcylindric (not noticeably flared in the upper part), smaller (lower narrowed part of corolla 1–1.5 mm wide); leaf secondary veins flat to frequently sunken on the upper leaf surface in dried material ..... 4
- 4a. Leaves chartaceous, margin conspicuously wavy (more conspicuously so in fresh material), secondary veins forking towards the leaf margin but not forming conspicuous loops; pedicels 3–5 mm long (flowers distinctly pedicellate); corolla tube 7–8 mm long; style 12–22 mm long. (Widespread across Malesia.) ..... *C. giganteum*
- b. Leaves coriaceous, margin plane, secondary veins forming distinct loops towards the margin; pedicels 0–1 mm long (flowers sessile); corolla tube 4–5 mm long; style 9–10 mm long. (Restricted to Borneo.) ..... *C. minutiflorum*

**1. *Cyrtophyllum caudatum*** (Ridl.) K.M.Wong, **comb. nov.** — *Fagraea caudata* Ridl., J. Str. Br. Roy. As. Soc. 79 (1918) 97; Merr., J. Str. Br. Roy. As. Soc. Sp. No. (1921) 491; Wong & Sugau, Sandakania 8 (1996) 8; Coode et al. Checkl. Fl. Pl. Gymn. Brunei (1996) 174. TYPE: *Lobb s.n.*, 1853, ‘Borneo’ (Sarawak) (holo K).

*Fagraea fragrans* auctt. non Roxb., Leenhouts, Fl. Males. I, 6 (1962) 304 *pro parte*, Ashton, Manual Non-Dipt. Trees Sarawak 2 (1988) 310 *pro parte*, quoad *F. caudata* in syn.

**Tree**, 6–7 m tall, perhaps bigger; trunk to 2.5 cm diameter or more; **bark** smooth, dark brown. **Leaves** elliptic to slightly oblanceolate; (4–)7–9(–11) cm long, (1.5–)2.5–3.5(–4) cm wide; base cuneate; apex caudate, 1–1.5 cm long; margin plane when fresh and in dried specimens; coriaceous; upper and lower surfaces smooth; midrib prominent below, sunken above; secondary veins 7–9 pairs, upper side faint and immersed in the blade, lower side faint to very slightly sunken or even prominent; tertiary veins faint to inconspicuous; petioles 0.8–2.2 cm long, 1.5–2 mm thick, petiolar sheaths of a leaf pair fused and forming a shallow cup-like ochrea that tightly clasps the stem; petiolar base auricles absent. **Inflorescence** a few-flowered cyme 5–9.5 cm long; peduncle 2.5–6 cm long, 1(–1.5) mm thick; with just a single level (tier) of branching on the main axis, typically not rebranched. **Flower** pedicel 5–10 mm long, c. 1 mm thick; **calyx** (from the base to the lobe apices) 3.5–4 mm long, glabrous, calyx cup 2.5–3 mm wide, calyx lobes erect, 1–1.5 mm long, 1–1.5 mm wide, margins glabrous; **corolla** tube subcylindric, 10–12 mm long, 1.5–2 mm wide near the base, inside glabrous to minutely papillate; corolla lobes broad-ovate to subobovate, 5–6 mm long, 4–5 mm wide; **stamens** inserted at the uppermost third of the corolla tube; filaments 16–18 mm long, exert 11–12 mm in the open flower; anthers not seen; **style** 14–15 mm long, protruding 11–13 mm from the corolla mouth in the open flower; **stigma** c. 0.3 mm across. **Infructescence** peduncle 4–7.5 cm long, 1–1.5 mm thick. **Fruits** (immature) to 5–6 mm across; the base loosely to tightly clasped by the calyx lobes. **Seeds** not examined.

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

**Habitat.** Hills and ridges in lowland mixed dipterocarp forest.

**Specimens examined:** BORNEO. **Brunei.** Belait, Batu Patam, along ridge north of summit, Wong WKM 1060 (BRUN, K, SING). **Sarawak.** Beccari 2956 (K); 1st Div. Gunung Santubong South, Bujang S. 12999 (K, L, SAR, SING); Bako N.P., Lintang path, Chai S. 19707 (A, BO, K, KEP, L, MEL, MOSC, SAN, SAR, SING), Bukit Gondol, Ilias S. 17908 (A, BO, K, KEP, L, SAN, SAR, SING), Md. Shah P. 5647 (A, K, L, SAR, SING); Lobb s.n. 1853 (holo K); 1st Div. Mt. Matang, near Valombrosa, M. & J. Clemens 7783 (K); Mt Mike Low LYW 213 (KLU); Bintulu, Nyabau F.R., Brunig S. 12050 (SAR); Lambir N.P., Sg. Jangkang, Mokhtar et al. S. 47187 (K, KEP, L, MO, SAN, SAR); Kuching, Ulu Sg. Rayu, Yakup S. 7716 (SAR, SING); Kelaung F.R., sine coll. S. 7431 (SAR).

Ridley (1918) observed that the species he was describing under *Fagraea*, when appropriately transferred to *Cyrtophyllum*, should be *C. caudatum*, although that combination was not effected.

**2. *Cyrtophyllum fragrans* (Roxb.) DC.**, Prod. 9 (1845) 31; Ridley, Trans. Linn. Soc. Lond. 2nd ser. Bot. 3 (1893) 323. — *Fagraea fragrans* Roxb. [Hort. Beng. (1814) 84, *nom. nud.*], Fl. Ind. ed. Wall., 2 (1824) 32; Don, Gard. Dict. 4 (1837) 68; Blume, Mus. Bot. 1 (1850) 172; Benth., J. Linn. Soc. Bot. 1 (1857) 100; Miq., Fl. Ind. Bat. 2 (1857) 375; Kurz, For. Fl. Brit. Burm. 2 (1877) 205; Clarke in Hooker f., Fl. Brit. India 4 (1883) 85; Ahern, Compil. Timber Tree Philip. Isl. (1901) 88, pl.; Koord. & Val., Bijdr. 9 (1903) 86; Ridley, J. Str. Br. Roy. As. Soc. 50 (1908) 121; Elm., Leaf. Philip. Bot. 2 (1909) 597; Dop, Fl. Gén. I.-C. 4 (1914) 177; Merrill, J. Str. Br. Roy. As. Soc. Sp. No. (1921) 492; Cammerl., Bull. Jard. Bot. Btzg. III, 5 (1923) 318; Foxw., Mal. For. Rec. 3 (1927) 157; Corner, Wayside Trees Malaya (1940) 424; Kerr in Craib, Fl. Siam. En. 3 (1951) 55; Browne, For. Trees Sar. & Brun. (1955) 244, t. 32; Smythies, Common Sarawak Trees (1965) 87; Kochummen, Tree Fl. Malaya 2 (1973) 273; Cockburn, Trees Sabah 1 (1976) 211; Wong & Sugau, Sandakania 8 (1996) 11; Coode et al. Checkl. Fl. Pl. Gymn. Brunei (1996) 174. — *Willughbeia fragrans* (Roxb.) Spreng. Syst. Veg. 4 (1827) Cur. Post. 71. TYPE: *Hunter*, Wallich Cat. no. 1597E, “Pullo Penang” (holo K).

*Cyrtophyllum peregrinum* Reinw. in Hornschuch, Syll. Pl. Nov. 2 (1825) 9; Blume, Bijdr. Fl. Ned. Ind. (1826) 1022; DC., Prod. 9 (1845) 31; Ridley, Fl. Malay. Pen. 2 (1923) 421; Holttum, Gard. Bull. S.S. 5 (1931) 189. — *Fagraea peregrina* Blume, Rumphia 2 (1838) 34, t. 80; Mus. Bot. 1 (1850) 172. LECTOTYPE (Wong & Sugumaran 2012): *Reinwardt s.n.*, Java (L sheet no. 908.127-246 & barcode L0005030).

*Fagraea cochinchinensis* A. Chev., Cat. Pl. Jard. Bot. Saigon 33 (1919) 66, *pro specim.*, Merrill, Enum. Philip. Fl. Pl. 3 (1923) 314, *pro specim.*, *non basionym Aidia cochinchinensis* Lour., Fl. Cochinch. 1 (1790) 143.

*Fagraea fragrans auctt. non* Roxb.: King & Gamble, J. As. Soc. Beng. 74 (2) (1908) 611 *pro parte*, excl. *Derry* 272; Leenhouts, Fl. Males. I, 6 (1962) 304 *pro parte*, Ashton, Manual Non-Dipt. Trees Sarawak 2 (1988) 310 *pro parte*, excl. *F. caudata* Ridl., *F. gigantea* Ridl., *F. speciosa sensu* Ridl. *non* Blume, *F. sororia* J.J.Sm., *F. wallichiana* Benth., *F. lanceolata* Wall. in syn.; Kochummen, Tree Fl. Malaya 2 (1973) 273 *pro parte*, excl. *Cyrtophyllum lanceolatum*, *Fagraea wallichiana* in syn.; Griffin & Parnell, Fl. Thailand 6 (3): 198 *pro parte*, excl. *C. giganteum* Ridl. in syn.

**Tree**, rarely to just 3–4 m tall, more often big, to 30 m tall; trunk to over 1 m in diameter; **bark** deeply and ruggedly fissured, grey-brown to dark brown. **Leaves** elliptic; (5.5–)7.5–11(–13) cm long, (2–)3.5–4.5(–5.3) cm wide; base cuneate; apex short-cuspidate to caudate; (3–)5–8(–9) mm long; margin plane when fresh (in dried specimens sometimes slightly wavy); chartaceous to thin-coriaceous; upper and lower surfaces smooth; midrib prominent below, flat to slightly raised above; secondary veins (7–)9–12 pairs, upper side faint and immersed in the blade, lower side faint to very slightly prominent; tertiary veins faint to inconspicuous; petioles 1–1.3(–1.6) cm

long, 1–1.5 mm thick. **Inflorescence** (3.5–)4–7(–7.7) cm long; peduncle (2.8–)3–3.5 cm long, 1–1.5 mm thick; with (2–)3(–4) levels (tiers) of branching on the main axis, the branch tiers (2–)3–5(–6) mm apart, lowest tier typically branched to 2(–3) orders. **Flower** pedicel (3–)5–8(–11) mm long, 0.5(–1) mm thick; **calyx** (from the base to the lobe apices) (1.5–)2–2.5 mm long, glabrous, calyx cup (1.5–)2–2.5(–3) mm wide, calyx lobes erect, 1–1.5(–2) mm long, 1–1.5(–2) mm wide, margins glabrous; **corolla** tube somewhat infundibular, (4–)6–8 mm long, lower narrowed part 1.5–2(–2.5) mm wide, upper flared part (3–)4–6(–7) mm wide at the top, the lower narrowed tubular part nearly as long as the upper flared part, inside glabrous to minutely papillate; corolla lobes broad-ovate to subobovate, (3–)4–6 mm long, 2–3(–4) mm wide; **stamens** inserted at the middle of the upper flared part of the corolla tube; filaments (10–)12–16(–17) mm long, exert (8–)10–12(–13) mm in the open flower; anthers 1–1.5 mm long, 0.5–1 mm wide, each anther sac somewhat narrowly ellipsoid; **style** (14–)18–22 mm long, protruding (8–)10–12(–14) mm from the corolla mouth in the open flower; **stigma** c. 0.5 mm across, lobes 2, low and rounded, parting to present two slightly raised, hemispherical, papillate inner surfaces when receptive, not recurving. **Infructescence** peduncle (2.5–)3.5–5(–6.2) cm long, 1–2 mm thick. **Fruit** when mature to 4–6 mm across; the base loosely to tightly clasped by the calyx lobes. **Seeds** 0.5–1 mm across.

**Distribution.** Principally a mainland SE Asia and W Malesian species: Bengal, Andaman Islands, Burma, Thailand, Indo-China (Laos, Vietnam, Cambodia), Malay Peninsula, Sumatra, Java, Borneo, SW Philippines (the Palawan chain from Balabac NW through Palawan, Culion and Busuanga, and continuing into Mindoro); also Celebes.

**Habitat.** One of our most commonly encountered trees in West Malesia, *Cyrtophyllum fragrans* establishes easily in open areas and secondary forests including along roadsides. It grows easily on sandy sites, including around sandy tailings of former tin-mines in the Malay Peninsula. It is less commonly found in lowland high forest, but easily encountered in *kerangas* (tropical heath forest) vegetation and coastal or beach forest.

**Specimens examined:** BORNEO. **Brunei.** Belait, Anduki F.R., *Anderson S. 4941* (SAR), Andulau, Taman Rekreasi Hutan Sungai Liang, *Sugumaran et al. SM 227* (KLU), Sungai Liang, *Hussain HUS 30* (BRUN, SING). **Kalimantan.** Bandjermasin, *Boschwezen 2176* (BO); Sanggau, Pengoedang, *Neth. Ind. For. Service bb 29174* (SING); Sentarum Wildlife Reserve, far north-west corner of Danau, Sungei Seriang, *Giesen 140* (K), western border of Danau, Nanga Kenelang, *Giesen 148* (K); Sungai Kenara, *Hallier 1359* (P, SING). **Sabah.** “N Borneo”, *Vilamil 300* (P); Beaufort, *Cuadra Nbfd A 1377* (K, SING); Gaya Island F.R., *Kuripin SAN 28778* (SING), Gaya island (south), *Aban SAN 57839* (SAN); Jesselton, *Wood 2557* (SING); Kimanis, *Bayak Nbfd 2114* (K); Kota Belud, Kampung Lantige & Abai R. F.R., *Kandilis 7118* (SING); Kuala Penyu, Road to Pantai Tanjung Aru, *Rimi et al. SPN 06605* (KEP); Mempakul, Bangawan, *Abubakar Nbfd 4111* (K, SING); Papar, Mandahan, *Dewol & Termiji SAN 80011* (SAN, SING), *Talip Bidin SAN 80685* (KEP, SAN, SING); Sandakan, below

Mr. Fox House, 50 ft, *Jali SAN 65627* (SAN, SING); Sandakan, below Sabah Hotel, *Sam SAN 25509* (SAN, SING); Sandakan, Chinese Cemetery, *Chow & Aban SAN 75925* (SAN, SING); Sandakan, Elopura, *Agama A 2102* (SING), *Cuadra A 2218* (SING), Darby road, *Cuadra A 3197* (K, SING); Sandakan, Ernestina Road, *Meijer SAN 24941* (SAN, SING); Sandakan, Jalan Kapok, *Clemente 4963* (SING); Sandakan, Leila F.R., 300 ft, *Leopold & Termiji SAN 76680* (SAN, SING); Sandakan, Mile  $\frac{1}{4}$  Derby road, *Aban Gibot SAN 75916* (KEP, SAN); Sandakan, Taman Rimba Sport Complex, *Dewol SAN 105553* (SAN, SING). **Sarawak.** *Beccari 3428* (K); *J. & M.S. Clemens 22561* (P: barcode P03976237); Kuching, Museum Garden, *Mamit S. 33492* (SAR); Kuching, Taman Budaya, *Yahud et al., S. 57555* (K, KEP, L, MO, SAN, SAR); Simunjan, Balai Ringin P.F., *Stipni Bin Dollah S. 303* (SAR, SING), *1705* (SAR); Sadong, Ulu Gunong, *Omar 64* (SING).

BURMA. **Martaban.** *Wallich Cat. no. 1597a* (GDC: barcode G00134008), *Wallich Cat. no. 1597b* (P: barcode P00349660), *Wallich s.n.* (P: barcode P00349658). **Tenasserim & Andamans.** *Helper 3735* (P: barcode P00349659).

CAMBODIA. *Bejaud 740* (P: barcode P00349636); Dam ta trau, *Poilane 14071* (P: barcode P00349651). **Kompong Thom.** Prey Krabey, reserve Sambo Spieu, *Magnen s.n.* 1909 (P: barcode P00349640). **Kompong Spen.** entre Pum Love & Pum Rong, *Poilane 17553* (P: barcode P00349652). Siem Reap. Phnom Kulen, *Martin 221* (P: barcode 00349644).

CELEBES. **Boni.** *Heyne 2863* (BO). **Malili.** 25 m, *Neth. Ind. For. Service Cel/IV-86* (SING), *Cel/IV-136* (SING), *Cel/IV-137* (SING), Tabarano, *Neth. Ind. For. Service bb 32356* (SING). **Moena.** Wapai, *Neth. Ind. For. Service bb 21738* (P: barcode P03976230). **Manado.** Kolonodale, 400 m, *Neth. Ind. For. Service bb 31525* (SING). **Moena.** Makoemoro?, 25 m, *Neth. Ind. For. Service bb 26302* (SING), *bb 26303* (SING).

INDIA. *Roxburgh s.n.* (BR: barcode BR0000006912710).

JAVA. *sine coll.* no date (L); *Blume s.n.* (GDC: barcode G00134012); *Korthals s.n.* (L: barcode L0005029); *Reinwardt, s.n.* (L sheet no. 908.127-246 & barcode L0005030). **Batavia.** Bodjong, *Bakhuizen v/d Brink 6354* (SING); Bodjong Ejot, *Bakhuizen v/d Brink 6354* (P: barcode P03976232); Buitenzorg, *Hallier 202* (BO), *Welter s.n.* (SING), Moera Enim, *Teysmann 4019* (BO). **Semarang.** Ngarengan kult., *Kalshoven s.n.* (BO). **Soerabaja.** Insel Bawean, Tambak, *Teysmann 1767* (BO).

LAOS. **Banthat** a 12 km de Savannakhet, *Poilane 16384* (P: barcode P00330715), mare a 20 km de Savannakhet, *Vidal 1752* (P: barcode P00330717).

MOLUCCAS. *Smith s.n.* 1796-1805 (BM: barcode 001053465).

PENINSULAR MALAYSIA. **Johor.** Johore Bharu, *Carrick 1406* (SING). **Kedah.** *Rahim KEP 12386* (SING). **Melaka.** Merlimau, *Alvins s.n.* (SING), *Derry 53* (SING). **Negeri Sembilan.** *Cubitt 706* (SING); *Forest Dept. 697* (SING); Angsi Forest Reserve, *Othman KEP 23732* (KEP); Bahau Reserve, *Mat Deris 654* (SING); Port Dickson, Blue Lagoon, *Bremer 1819* (KLU), Cape Rachado F.R., roadside to Light House, *Tsou 207* (NY); Seremban, *Bain 18856* (KEP). **Pahang.** *Ridley 1028* (SING); Kuantan, *Abdul Rahman FMS 4172* (SING), *Mahamud FMS 3729* (SING), *Mohd Soh 15735* (SING); Muazam Shah-Menchali main road, *Sugumaran et al. SM 212*, leafy branch only (KLU); Pulau Berhala, *Burn-Murdoch SFN 303* (SING). **Penang.** *Askey FMS 2554* (SING); "Pullo Penang", *Hunter, Wallich Cat. no. 1597E*, (holo K), *Wallich Cat. no. 1597c* (GDC: barcode G00134009); Sungai Pinang, *Ogata 10344* (KEP); Tasek Gelugor, *Fyfe 29321* (SING); Tulloh (*sic!* = Teluk) Bahang, *Curtis 314* (SING), *Curtis s.n.* 1893 (SING), v 1892 (SING), vii 1892 (SING). **Perak.** Pangkor Island, Telok Nipah, *Chin 3137* (KLU). **Selangor.** Gombak, Klang Gates Quartz Ridge, *Daniel Lee et al. s.n.*, leafy branch only (KLU); Kepong, Forest Research Institute, *Vethevelu FRI 29649* (KEP, SING); Kuala Lumpur, *Ramli KEP 94100* (KEP), Government Hill, *Kalong 17463* (SING), Circular

Road, *Omar* 7425 (SING), University of Malaya campus, *Tan Bee Cheok s.n.* (KLU), *Zakiah Hassan s.n.* (KLU). **Terengganu.** Kemaman, *Osman FMS* 26996, FB, FL, 13 vii 1971 (KEP). PHILIPPINES. **Mindoro.** *Merritt* 8842 (PNH, US?). **Palawan.** *Curran Bur. For.* 4501 (PNH, US?); Aborlan, Iraan Mountains, *Sulit* 12512 (SING); Palawan, *Cenabre* 29990 (SING); Taytay, *Merrill* 1202 (SING), *Roque* 30274 (SING).

SINGAPORE. *Cantley's Collector s.n.* (SING); Botanic Gardens, *Henderson* 1329 (SING); Nature Reserves Sector 17, *Turner et al. NRS* 269 (SING); Pulau Pawai, *Sidek S* 99 (SING); Surrounding reservoir, *Cantley's Collector s.n.* (SING!).

SUMATRA. **Palembang.** *Endert* 881 (SING), Moesi-Oeloe, *Endert* 160 (BO), 161 (BO). **Riau islands.** Pulau Kundor, *Teruya* 1624 (SING).

THAILAND. **Bangkok.** *Marcan* 707 (SING). **Krabi.** Krabi-Trang Road, *Weerachai Nanakorn WN* 514 (SING); Jurin?, *Kerr* 8232 (SING). **Surat Thani.** *Prsundej et al.* 249 (KLU); Ko Pha-ngan, *Phromdet* 25 (P: barcode P00349653). **Narathiwat.** Bacho, *Sangkhachand* 184 (P: barcode P00349654); Sungai Padi, *Bourke s.n.* 1924 (P: barcode P00349655). Trat. Taphan Hin, *Geesink* 6490 (P: barcode P00349656).

VIETNAM. *Harmand* 804 (P: barcode P00349666). **Minh Hai.** Iles de Poulo Condor, *Harmand* 873 (P: barcode P00349668), *Pierre* 3699 (P: barcode P00349677). **Tourane.** Quang-Nam, Da-Nang, *J. & M.S. Clemens* 3862 (P: barcode P00349662). **Lam Dong.** Dalat & environs, *Squires* 889 (P: barcode P00349680). Long. Quang Tri, *Chevalier* 41189 (P: barcode P00349663).

A drawing of this species by William Hunter, collector of the type specimen, is on display in the Penang Museum and a picture of this work is found in Gardner et al. (2011: 116). In the past, two other species found in the Malay Peninsula, namely, *C. giganteum* and *C. wallichianum* have been confused with *C. fragrans*. These two species are not as common as *C. fragrans*; for differences, see under those species.

Burkill (1935) used the name *Fagraea cochinchinensis* A.Chev. for this species, but apparently this had been based on *Aidia cochinchinensis* Lour. (a name dating from 1790; Rubiaceae) and was therefore in the first instance misapplied to material of *F. fragrans* (Leenhouts 1962). Arguably, both taxa have some resemblance in their paired leaves and branched cymes of small, cream-coloured to white flowers with exserted styles and stamens.

Holttum (1935) has given an account of the flowering of this species in Singapore, which is gregarious (many or nearly all trees in a population with synchronised flowering). It has two flowering seasons, the main one around mid-year and another towards year's end, the flowers opening several weeks following the bud stage. At such times, it may be appreciated how different nomenclatural systems may converge on an essential trait, for the species epithet in the latinised scientific name refers to fragrant flowers, and its Malay name, *tembusu*, could well allude to the conspicuous sweet-and-sour scent that transpires into more than a hint of fermentation (Malay: *busu*, unpleasantly odourous). Apparently, the flowers last several days even though the stamens are spent after the first day of bloom, thus sustaining and intensifying the perfumed aura around the tree. The fruits, which take a few months to mature to an attractive yellow to red, are probably mainly dispersed by birds or bats (Corner 1940). Of this tree, Ridley (1893: 323) observes that "it is difficult to say whether the tree is more beautiful when covered with flowers or fruits."



**3. *Cyrtophyllum giganteum*** (Ridl.) Ridl., Fl. Malay. Pen. 2 (1923) 421. — *Fagraea gigantea* Ridl., J. Str. Br. R. As. Soc. 79 (1918) 98; Foxw., Mal. For. Rec. 3 (1927) 157; Burkill, Dict. (1935) 995; Corner, Wayside Trees Malaya (1940) 425; Browne, For. Trees Sar. & Brun. (1955) 245. Kochummen, Tree Fl. Malaya 2 (1973) 273; Cockburn, Trees Sabah 1 (1976) 211; Wong & Sugau, Sandakania 8 (1996) 11; Coode et al. Checkl. Fl. Pl. Gymn. Brunei (1996) 174. LECTOTYPE (Wong & Sugau 1996): *Ridley 8921*, Singapore, Garden Jungle (SING).

*Fagraea sororia* J.J.Sm. ex Cammerl., Bull. Jard. Bot. Btzg. III, 5 (1923) 319, pl. 5; Heyne, Nutt. Pl. (1927) 1270. LECTOTYPE (Wong & Sugau 1996): *Endert 44E IP 515*, Sumatra, Palembang (L; isolecto BO, K, SING).

*Fagraea fragrans auctt. non* Roxb.: King & Gamble, J. As. Soc. Beng. 74 (2) (1908) 611 *pro parte, quoad Derry 272*; Leenhouts, Fl. Males. I, 6 (1962) 304 *pro parte*, Ashton, Manual Non-Dipt. Trees Sarawak 2 (1988) 310 *pro parte, quoad Cyrtophyllum giganteum* Ridl., *F. gigantea* Ridl., *F. sororia* J.J.Sm., *F. speciosa* (non Blume) Ridl. in syn.

*Fagraea speciosa auct. non* Blume: Ridley, J. Str. Br. R. As. Soc. 50 (1908) 122.

**Tree**, rarely to just 3–4 m tall, more often big, to 30 m tall or more; trunk to over 1 m in diameter; **bark** closely and finely fissured, grey-brown to dark brown. **Leaves** elliptic; (4.4–)5–7(–7.5) cm long, (1.8–)2.2–3(–3.2) cm wide; base cuneate; apex short-cuspidate to caudate; 4–6 mm long; margin conspicuously wavy when fresh and in dried specimens; chartaceous; upper and lower surfaces smooth; midrib prominent below, flat to sunken above; secondary veins 4–6 pairs, upper side faint and immersed in the blade, lower side faint to very slightly prominent; tertiary veins faint to inconspicuous; petioles (0.8–)1–1.5(–2.3) cm long, 1–1.5 mm thick. **Inflorescence** (3.5–)5–6.5(–7.5) cm long; peduncle 3.5–5(–5.5) cm long, 1–1.5 mm thick; with 4–5 levels (tiers) of branching on the main axis, the branch tiers (5–)6–10(–12) mm apart, lowest tier typically branched to (2–)3 orders. **Flower** pedicel 3–5 mm long, 0.3–0.5 mm thick; calyx (from the base to the lobe apices) 1.5–2 mm long, glabrous, calyx cup 1.5–2 mm wide, calyx lobes erect, 1–1.5 mm long, 1–1.5 mm wide, margins glabrous; **corolla** tube subcylindric, 7–8 mm long, 1–1.5 mm wide near the base, upper part very gradually and slightly wider, inside glabrous to minutely papillate; corolla lobes broad-ovate to subobovate, 3–4 mm long, 2–2.5(–3.5) mm wide; **stamens** inserted at the uppermost third of the corolla tube; filaments 13–15 mm long, exert 12–13 mm in the open flower; anthers 1–1.5 mm long, 0.5–0.8 mm wide, each anther sac somewhat narrowly ellipsoid; **style** (12–)18–22 mm long, protruding (5–)12–14 mm from the corolla mouth in the open flower; **stigma** c. 0.5 mm across, lobes 2, low and rounded, parting to present two slightly raised, hemispherical, papillate inner surfaces when receptive, not recurving. **Infructescence** peduncle (2.5–)3–4(–4.8) cm long, 1–1.5 mm thick. **Fruit** when mature to 4–6(–7) mm across; the base tightly clasped by the calyx lobes. **Seeds** 1–2 mm across.

*Distribution.* Malay Peninsula, Sumatra, Borneo.

*Habitat.* Lowland mixed dipterocarp forest.

*Specimens examined:* BORNEO. **Brunei.** Belalong, Ulu Ropan, 2000–2500 ft, *Ashton BRUN 5275* (BRUN, K, SING); Tutong, Ulu Tutong, 150 ft, *Ashton BRUN 908* (BRUN, K, SING). **Kalimantan.** East Kutai, Sangkulirang district, Kerajaan River region, *Kostermans 34793* (BO, K, L), Sungai Kerajaan, 40 m, *Kostermans 5804* (BO, SING), Sungai Susuk, 40 m, *Kostermans 5693* (BO, K, SING); Muara Teweh, Popas?, *Neth. Ind. For. Service bb 27769* (SING); Nunukan Island, *Kostermans 8612* (BO, SING), 8955 (BO, SING); S.-O. Borneo, Horyoep?, *Winkler 2468* (SING); Sanggau, Bindang, *Neth. Ind. For. Service bb 28143* (BO, K, SING). **Sabah.** Keningau, Nabawan, *Dewol & Karim SAN 78059* (K, L, SAN, SAR, SING); Sandakan, *Patrick SAN 25509* (KLU, SAN), Batu Sapi road, Meijer *SAN 24942* (K, KEP, L, SAN, SAR); Tawau, Apas Road, *Brand SAN 21500* (SAN, SING), Kawa Road, *Jaswir & Aban SAN 26277* (BO, K, KEP, L, SAN, SING), Table Estate, 200 ft, *Wood SAN 16650* (SAN, SING). **Sarawak.** Baram, Melinau Gorge (4°10'N, 114°55'E), 1000 ft, *Chew CWL 444* (K, SING), Ulu Sungai Melinau Paku, *Anderson 4085* (K, L, SAN, SAR, SING); Kuching, Bukit Hujan, *Omar 353* (K, SING); Lawas, Mt Bugoh ridge, *Smythies BRUN 812* (K); Limbang, Ulu Medamit, 900 ft, *Chai, Wright & Othman S. 32335* (K, L, SAR, SING); Miri, S. Ukong, 10 m, *Othman S. 21394* (SING).

PENINSULAR MALAYSIA. *sine coll.* 16711 (KEP); **Johor.** Ulu Endau, Labis F.R., Sungai Jasin, *Ogata KEP 110427* (KEP). **Melaka.** Air Keroh Botanical Garden, *Sugumaran & Lee SM 193*, leaves and stem bark (KLU), *SM 194*, leaves only (KLU); Bukit Saliokor?, *Derry 272* (SING). **Negeri Sembilan.** Kuala Kelawang, Triang F.R., *Lau & Jalil FRI 18249* (KEP). **Pahang.** Kuantan, *Mohd Soh FMS 15750* (SING), *Rahman 15738* (SING). **Selangor.** Ayer Hitam F.R., *sine coll.* *KEP 55873*, leaves only (KEP); Kajang, Bangi Reserve, *Foxworthy 10289* (SING); Sungai Buluh F.R., *Walton FMS 30770* (KEP). SINGAPORE. **Singapore.** Garden Jungle, *Ridley 8921* (lecto SING).

SUMATRA. **Palembang.** *Buurman van Vreeden 77* (BO); *Endert 44E 1P 429* (BO, L), *44E 1P 515* (BO, K, L, SING), *44E 2P 673* (BO, L); Banjoeasin en Koeboestrecken, *Endert 44E 2P 706* (BO, K, L); Lematang Ilir, Semangoes, *Neth. Ind. For. Service bb 32270*, leafy branch only (SING); Medan 19, Bengkalis, *Houtvester s.n.* (BO); Moeara Doea Sh., *Grashoff 400* (BO); Moeara Enim, *Teysmann 3796* (BO, L); Rawas, *Dumas 1550* (BO, K), *Grashoff 1060* (BO, L). **Lampongs.** Kebang, *Teysmann 4210* (BO, L); Tandj-Penang, *Bruinsma 12* (BO). **Upper Riau.** Tenajan, Pakanbaru, *Soepadmo 232* (BO, K, SING).

*Cyrtophyllum giganteum* and *C. fragrans* have very similar flowers that appear only to have consistently different corolla tube widths. However, several vegetative features are very distinctive, such as the distinctively wavy margins in fresh leaves of *C. giganteum* (*C. fragrans* have leaf margins which are generally plane). There are more pairs of secondary veins in *C. fragrans* (7–9(–11)) that form distinct loops towards the leaf margin but in *C. giganteum* there are fewer pairs of secondary veins (4–6) that fork towards the leaf margin and do not form conspicuous loops. The mature tree form is also often distinguishable: *C. giganteum* develops a very straight and columnar bole like many other lowland forest canopy species, whereas *C. fragrans* usually reaches up to only 30 m and typically develops several erect main branches that are as tall as the main trunk. A well-grown *C. fragrans* tree develops a coarse,

reticulately-sinuously ridged and fissured bark, as pictured in Gardner et al. (2011: 117); but that in a mature *C. giganteum* tree, as shown in Plate 35 of Ashton (1988: 313), is regularly and shallowly fissured.

**4. *Cyrtophyllum minutiflorum*** K.M.Wong, **sp. nov.** *C. caudato* Ridley similis sed cymis ramosioribus, floribus minoribus tubis corollae brevioribus (4–5 mm longis) et stylis brevioribus (9–10 mm longis) differt. TYPE: *Burley, Tukirin et al.* 3278, 1–6 Jul 1989, Borneo, West Kalimantan province, G. Bentuang area, 5–10 km north of Masa village, ridge SW of G. Bentuang, 1100 m alt. (holo SING; iso A, BO, K).

**Tree**, documented as 10 m tall; trunk to 15 cm diameter; **bark** texture in mature tree trunk not known. **Leaves** elliptic to slightly lanceolate or oblanceolate; (5–)8–10(–11) cm long, (1–)2–3(–3.5) cm wide; base cuneate; apex acuminate, hardly 0.5 cm long; margin plane in dried specimens; coriaceous; upper and lower surfaces smooth; midrib prominent below, channelled to raised above; secondary veins (4–)5–7 pairs, upper side faint and immersed in the blade, lower side faint to immersed; tertiary veins faint to inconspicuous; petioles (5–)12–18 cm long, 1.5–2 mm thick, petiolar sheaths of a leaf pair fused and forming a shallow cup-like ochrea that tightly clasps the stem; petiolar base auricles absent. **Inflorescence** a few-flowered cyme 8–10 cm long; peduncle 4–4.5 cm long, 1(–1.5) mm thick; with 1(–2) levels (tiers) of branching on the main axis, lowest tier typically branched to 3–4 orders. **Flower** pedicel 0–1 mm long (flowers subsessile), c. 0.5 mm thick; **calyx** (from the base to the lobe apices) c. 1.5 mm long, glabrous, calyx cup c. 1.5 mm wide, calyx lobes erect, c. 0.5 mm long, c. 0.5 mm wide, margins glabrous; **corolla** tube subcylindric, 10–12 mm long, c. 1 mm wide near the base, inside glabrous to minutely papillate; corolla lobes broad-ovate to subobovate, 2.5–3 mm long, c. 2–2.5 mm wide; **stamens** inserted at the uppermost third of the corolla tube; filaments c. 7 mm long, exsert c. 5 mm in the open flower; anthers not seen; **style** 9–10 mm long, protruding c. 4 mm from the corolla mouth in the open flower; **stigma** c. 0.1 mm across. **Infructescence** peduncle 4–5 cm long, 1–1.5 mm thick. **Fruit** (immature) c. 2 mm across; the base loosely to tightly clasped by the calyx lobes. **Seeds** not examined.

**Distribution.** Borneo, W Kalimantan, only known from the type collection.

**Habitat.** On a ridge at the upper limit of Mixed Dipterocarp Forest or its transition to lower montane forest.

**5. *Cyrtophyllum wallichianum*** (Benth.) M.Sugumaran & K.M.Wong, **comb. nov.** — *Fagraea wallichiana* Benth., J. Linn. Soc. Bot. 1 (1857) 98; Clarke in Hooker f., Fl. Brit. Ind. 4 (1883) 85; King & Gamble, J. As. Soc. Beng. 74 (2) (1908) 607; Corner, Ways. Trees Malaya (1940) 426; Wong, Saw & Kochummen, Malayan Nat. J. 41 (1987) 267; Wong & Sugau, Sandakania 8 (1996) 12. — *Fagraea lanceolata* Wall.

[Cat. (1829) no. 1599, *nom. nud.*] Schnizl., Iconogr. 2 (1851) t. 131, f. 1, *nom. illeg.*, non Blume (1826); Miquel, Fl. Ind. Bat. 2 (1857) 376; Burkill, Dict. (1935) 995. — *Cyrtophyllum lanceolatum* (Wall.) DC., Prod. 9 (1845) 31, *nom. illeg.*; Ridley, Fl. Mal. Pen. 2 (1923) 421. TYPE: *Wallich Cat. no. 1599*, Penang (holo K; iso BM, GDC).

*Fagraea fragrans* *auctt. non* Roxburgh (1824): Kochummen, Tree Fl. Malaya 2 (1973) 273 *pro parte*, *quoad Fagraea wallichiana* Benth. in syn.; Leenhouts, Fl. Males. I, 6 (2) (1962) 304, *pro parte*, Ashton, Manual Non-Dipt. Trees Sarawak 2 (1988) 310 *pro parte*, *quoad Cyrtophyllum lanceolatum* DC., *F. lanceolata* Wall., *F. wallichiana* Benth. in syn.

**Tree**, rarely to just 3–4 m tall, more often bigger, to 25 m tall; trunk to over 1 m in diameter; **bark** fissured, grey-brown to dark brown. **Leaves** narrow to broadly-elliptic to oblanceolate to obovate; (3.4–)6–10(–13) cm long, (1.4–)2–3(–5) cm wide; base cuneate; apex acute to short-cuspidate; 2–5(–1.2) mm long; margin plane when fresh and in dried specimens; thin-coriaceous; upper and lower surfaces smooth; midrib prominent below, sunken above; secondary veins (4–)5–7 pairs, upper side faint to immersed in the blade, lower side faint to very slightly prominent; tertiary veins faint to inconspicuous; petioles (0.3–)0.8–1.2(–1.7) cm long, 1–1.5 mm thick, petiolar sheaths of a leaf pair fused and forming a shallow cup-like ochrea that tightly clasps the stem; petiolar base auricles absent. **Inflorescence** a few-flowered cyme (2.5–)3–6(–7.8) cm long; peduncle (1.9–)2.3–3.5(–5.3) cm long, 1(–1.5) mm thick; with 1(–2) levels (tiers) of branching on the main axis, the branch tiers 10–14 mm apart, lowest tier typically branched to 1(–2) orders. **Flower** pedicel (4–)5–8 mm long, 1–1.5 mm thick; **calyx** (from the base to the lobe apices) (3–)4–5(–6) mm long, glabrous, calyx cup 3–4 mm wide, calyx lobes erect, 2–3 mm long, 2–2.5 mm wide, margins glabrous; **corolla** tube somewhat infundibular, (12–)20–25 mm long, lower narrowed part 1–2 mm wide, upper flared part 6–8(–10) mm wide at the top, the lower narrowed tubular part nearly as long as the upper flared part, inside glabrous to minutely papillate; corolla lobes broad-ovate to subobovate, (5–)7–8 mm long, 3–4.5(–5) mm wide; **stamens** inserted at the lower end of the upper flared part of the corolla; filaments (27–)30–38 mm long, exsert 20–23(–28) mm in the open flower; anthers 1–1.5 mm long, 0.5–1 mm wide, each anther sac somewhat narrowly ellipsoid; **style** (34–)42–45(–55) mm long, protruding 22–25(–30) mm from the corolla mouth in the open flower; **stigma** c. 0.5 mm across, lobes 2, low and rounded, parting to present two slightly raised, hemispherical, papillate inner surfaces when receptive, not recurving. **Infructescence** peduncle 2–2.5(–3) cm long, 1–1.5 mm thick. **Fruit** when mature to 7–9 mm across; the base loosely to tightly clasped by the calyx lobes. **Seeds** 1–1.5 mm across.

**Distribution.** Endemic to the Malay Peninsula.

**Habitat.** Lowland forest on hills and ridges.

**Specimens examined:** PENINSULAR MALAYSIA. **Johor.** Hutan Simpan Labis, Gunung

Beremban, *Wong FRI 30882*, leafy branch only (KEP). **Kedah.** Gunung Jerai, *Kochummen FRI 18086* (KEP, SING), *FRI 29495* (KEP), *KEP 85027*, leafy branch only (KEP), *KEP 94416* (KEP). **Kelantan.** Relai Forest Reserve, *Cockburn FRI 7251* (KEP, SING), *FRI 7280* (KEP, SING), *FRI 7411* (KEP, SING). **Malacca.** *Maingay 1029* (BM, mounted on the same sheet, lower half, as the isotype *Wallich Cat. no. 1599*). **Penang.** *Wallich Cat. no. 1599* (holo K; iso BM, GDC); Govt. Hill, *Curtis s.n.* 1899 (SING), *Ridley 7066* (SING); Moniots Road, *Burkill SFN 3330* (SING), *Curtis 375* (SING); Penang Hill, *Ahmad Shukor AS 91* (SING), *Corner SFN 31597*, leafy branch only (SING), *Low et al. LYW 206*, leafy branch only (KLU), *Nauen s.n.* 1940 (SING), *Samsuri Ahmad SA. 999* (KEP, KLU, SING), *Sidek S. 226* (SING!), *Symington KEP 28043* (SING); Western Hill, *Nauen s.n.* 1940 (SING). **Terengganu.** Ulu Brang, Gunung Padang, *Whitmore FRI 12803* (KEP, SING).

*Cyrtophyllum wallichianum* is generally a smaller tree (up to 25 m tall) of hills and ridges, compared to *C. fragrans*, which can grow taller (up to 30 m tall) but is typically found on gentler terrain in the lowlands. *C. wallichianum* is vegetatively quite similar to *C. fragrans* but the floral characters are different. The inflorescence of *C. wallichianum* is usually less branched, 1(–2) orders, with fewer flowers; that of *C. fragrans* is generally more branched, 2(–3) orders, and so bears more flowers. The corollas of *C. wallichianum* are much bigger, 12–25 mm long, 6–10 mm wide, whereas in *C. fragrans* they are smaller, (4–)6–8 mm long and 1.5–2(–2.5) mm wide.

As noted by Ridley (1918), *F. caudata* (= *C. caudatum*) which occurs only in Borneo (Sarawak and Brunei), closely resembles *C. wallichianum*. *Cyrtophyllum caudatum* differs from *C. wallichianum* in having more coriaceous, lanceolate-caudate leaves and extremely slender peduncles and pedicels, cylindrical corolla tubes and shorter stamens.

### Indeterminate material

A taxon that resembles *C. caudatum* and *C. minutiflorum* in leaf characters, but without flowering or fruiting material, occurs in New Guinea. Its habitat, too, is similar: ridge forest in hilly terrain, only even higher at c. 800 m elevation. This is quite possibly a distinct species.

*Specimens examined:* NEW GUINEA. **Japen Island**, c. 800 m, *Neth. Ind. For. Services bb. 30336* (BO, SING), *bb. 30352* (BO, SING).

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