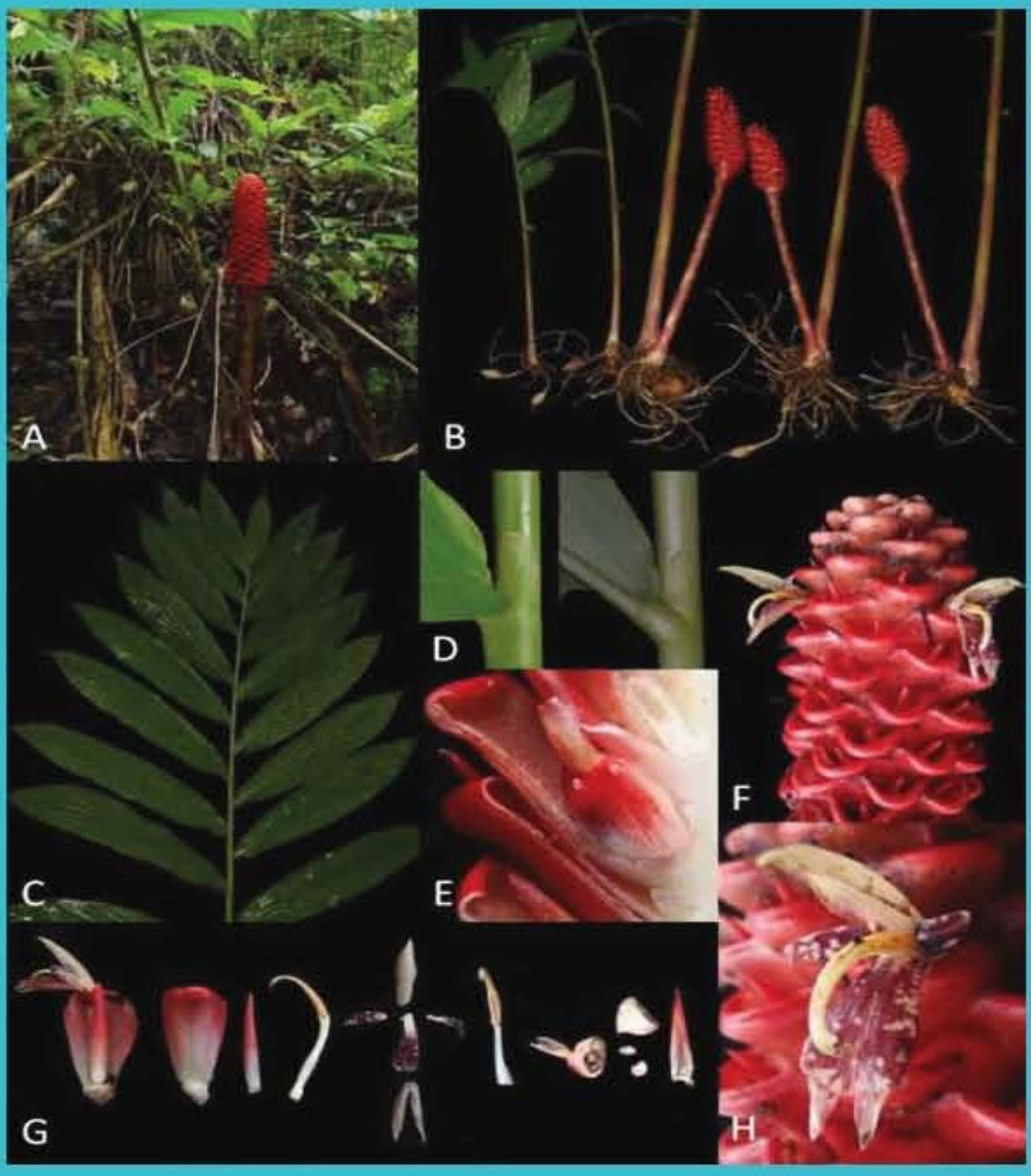
REINWARDTIA

A JOURNAL ON TAXONOMIC BOTANY, PLANT SOCIOLOGY AND ECOLOGY

ISSN 0034 – 365 X | E-ISSN 2337 - 8824



2015 14 (2)

REINWARDTIA

A JOURNAL ON TAXONOMIC BOTANY, PLANT SOCIOLOGY AND ECOLOGY

Vol. 14(2): 249-324, December 23, 2015

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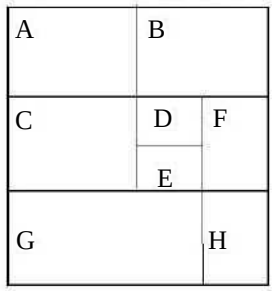

Cover images: *Zingiber engganoensis* Ardiyani. A. Habit B. Leafy shoot and the inflorescence showing rhizomes, roots and root-tuber C. Leaves D. Ligule and swollen petiole E. Dissection of inflorescence showing fruit F. Spike and flowers G. Dissection of flowers and fruits showing bract, bracteole, two lateral staminodes, two petal lobes, labellum, and the four appendages of the anther H. Flower. Source of materials: E190 (BO). Photo credits: B, C, D by Arief Supriatna. A, E, F, G, H by Marlina Ardiyani.

The Editors would like to thank all reviewers of volume 14(2):

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REINWARDTIA
Vol 14, No 2, pp: 287 – 295

CHIONANTHUS (OLEACEAE) IN SULAWESI, INDONESIA, INCLUDING THREE NEW SPECIES

Received April 06, 2015; accepted May 08, 2015

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ABSTRACT
KIEW, R. 2015. *Chionanthus* (Oleaceae) in Sulawesi, Indonesia, including three new species. *Reinwardtia* 14(2): 287 – 295. — The genus *Chionanthus* (Oleaceae) in Sulawesi is revised. Nine species are described of which *C. kostermansii* Kiew, *C. sordidus* Kiew and *C. sulawesicus* Kiew are new species. Four species are endemic, C. *celebicus* Koord., *C. sordidus*, *C. stenurus* (Merr.) Kiew and *C. sulawesicus.* The geographic range of *C. cordulatus* Koord. extends to Borneo and Mollucas, while *C. kostermansii* also occurs in Sumbawa and Flores, and the range of *C. rupicolus* (Lingelsh.) Kiew extends to Sumbawa, Mollucas, New Guinea and the Bismarck Archipelago. *Chionanthus polygamus* (Roxb.) Kiew and *C. ramiflorus* Roxb. are both widespread species, the former from Sumatra to New Guinea and the latter from continental Asia to the Solomon Islands. A key to identify the species is provided. *Chionanthus gigantifolius* Koord. remains incompletely known.

Key words: *Chionanthus*, distribution, endemic, key, new species, Sulawesi.

ABSTRAK
KIEW, R. 2015. Marga *Chionanthus* (Oleaceae) di Sulawesi, Indonesia, termasuk didalamnya tiga jenis baru. *Reinwardtia* 14(2): 287 – 295. — Marga *Chionanthus* (Oleaceae) di Sulawesi telah direvisi. Sembilan jenis telah dipertelakan, tiga diantaranya, *C. kostermansii* Kiew, *C. sordidus* Kiew dan *C. sulawesicus* Kiew merupakan jenis baru. Empat jenis diantaranya merupakan jenis endemik, C. *celebicus* Koord., *C. sordidus*, *C. stenurus* (Merr.) Kiew dan *C. sulawesicus.* Wilayah geografi dari *C. cordulatus* Koord. meluas hingga ke Borneo dan Maluku, sementara *C. kostermansii* ditemukan di Sumbawa dan Flores, selain itu wilayah geografi *C. rupicolus* (Lingelsh.) Kiew melebar hingga Sumbawa, Maluku, Papua Nugini dan Kepulauan Bismark. *Chionanthus polygamus* (Roxb.) Kiew dan *C. ramiflorus* Roxb. mempunyai wilayah persebaran yang luas, *C. polygamus* dapat ditemukan dari Sumatera hingga Papua Nugini dan *C. ramiflorus* mulai dari daratan Asia hingga Kepulauan Solomon. Kunci identifikasi jenis juga disajikan. Status jenis *Chionanthus gigantifolius* Koord. masih belum diketahui sepenuhnya.

Kata kunci: *Chionanthus*, distribusi, endemik, jenis baru, kunci, Sulawesi.

INTRODUCTION

Chionanthus with about 100 species worldwide is most biodiverse in Malesia but is widespread in the tropics and subtropics from Asia to Madagascar and Africa with a few species in the Americas. Most are small to medium-sized trees recognised by their opposite, exstipulate leaves with an entire margin. The petiole often dries black. The flowers are small with four, white or yellow, narrow petals less than 1 cm long. The two stamens and superior ovary are characters of the family. The fruits are usually drupes with a fleshy layer that ripens deep purple or black but sometimes the outer layer is hard, brown and has a rough surface. *Chionanthus* fruits are very variable in size and shape and are important in species identification. *Chionanthus* occupies a wide range of habitats from lowland to montane forest, with some species in coastal or swamp forest or on substrates, such as limestone or ultramafic rock.

Nine species are known from Sulawesi. Two are widespread species, *Chionanthus polygamus* (Roxb.) Kiew and *C. ramiflorus* Roxb., one *C. rupicolus* (Lingelsh.) Kiew is a new record for a species formerly known only from New Guinea; *C. cordulatus* Koord. also occurs in Borneo (Sabah and E Kalimantan) and N Maluku, and *C. kostermansii* Kiew occurs in Sumbawa and Flores. Four species, *C. celebicus* Koorders, *C. sordidus* Kiew, *C. sulawesicus* Kiew and *C. stenurus* (Merr.) Kiew are endemic in Sulawesi.

Recently Sulawesi has been the focus of several expeditions, so a key to and description of these nine species is presented here to encourage collection and identification of *Chionanthus* specimens. Considering the diverse biogeographic origins of the flora, the different climatic regions, and diversity of substrate, no doubt further new species can be expected.

Key to *Chionanthus* species in Sulawesi

1a. Leaf base cuneate, the very base cordate ……...*C. cordulatus*
b. Leaf base not cordate ……2
2a. Inflorescence paniculate ……...3
b. Inflorescence racemose ……6
3a. Calyx grey hairy; fruits pear-shaped, apex pointed ……..*C. polygamus*
b. Calyx if hairy not grey; fruit globose or

ovoid, apex rounded ……4
4 a. Axillary buds large and globose; lamina narrowly lanceolate, subcoriaceous, 2.3–4 cm wide, veins plane beneath; fruit globose, 1.1 cm long ……...*C. rupicolus*
b. Axillary buds small and pointed; lamina lanceolate or oblong-lanceolate, membranous, 4–10.5 cm wide, veins prominent beneath; fruit ellipsoid or ovoid, 1.6–2 cm long ……...5
5 a. Lamina lanceolate, apex acute, drying chestnut brown, veins black beneath; petiole 1–1.5 cm, thickened; inflorescence with second order branching; fruit ovoid 1.6 × 1.4 cm, pedicel not conspicuously thickened ……. *C. celebicus*
b. Lamina oblong to lanceolate, apex acuminate, drying kaki or greenish brown, veins prominent beneath; petiole 1.5–3 cm, not thickened; inflorescence with third order branching; fruit ellipsoid, 2 × 1 cm, pedicel conspicuously thickened ……... *C. ramiflorus*
6 a. Lamina narrowly lanceolate, more than three times longer than wide ……..7
b. Lamina narrowly ovate or broadly elliptic, less than three times longer than wide ……...8
7 a. Veins prominent beneath, 7–8(–10) pairs; inflorescence 1–2.3 cm long; fruits 2.2 × 1.8 cm, surface flakey with distant warts ……... *C. sordidus*
b. Veins plane beneath, (8–)11–12 pairs, Inflorescence 0.3–1 cm long; fruit less than 2 cm long and surface not flakey with distant warts ……..*C. stenurus*
8 a. Lamina narrowly ovate, coriaceous, petiole not thickened, drying black; fruit ellipsoid, smooth, sometimes with a white bloom ……. ...*C. kostermansii*
b. Lamina broadly elliptic, subcoriaceous, petiole thickened, drying whitish; fruit ovoid without a whitish bloom. ……. *C. sulawesicus*

TAXONOMY

1. CHIONANTHUS CELEBICUS Koord.

Chionanthus celebicus Koord., Meded. Lands Plantentuin. 19 (1898) 526, 637; Koorders-Schumacher, Systematisches Verzeichnis der zum Herbar Koorders (1914) 104. — Type: N. Celebes, Minahasa, Ratahan *Koorders 18382β* (holo L), *18382* iso BO).

Tree to 10(–20) m tall, bole to 20 cm diam. Bark grey or dark brown, more or less smooth. Twigs moderately slender, drying greyish brown, lenticellate, finely pubescent, nodes flattened. *Leaf:* petiole 1–1.5 cm long, slightly thickened, drying black; lamina lanceolate, glabrous, (16.5–) 20.5(–28) × (4–)6.5(–8.5) cm, membranous, base acute, margin recurved, apex acute or sometimes shortly acuminate, drying chestnut-brown; midrib flat above; lateral veins (10–)12–13 pairs, slightly impressed above, midrib and veins prominent and finely pubescent beneath, marginal vein obscure, *ca.* 3 mm from margin. *Inflorescence* paniculate with second order branching, axillary, solitary or sometimes with 2 per axil, 1.5–5 cm long of which peduncle is (0.5–)2–3 cm long, densely pubescent, lowest branch 0.5–2 cm long, flowers crowded at the tips of the branches; bracts scarious, *ca.* 2 mm long, densely pubescent, persistent; pedicel 1–2 mm long. *Flowers* bisexual, fragrant. *Calyx ca.* 1.5 mm long, divided almost halfway, lobes acute, pubescent, margin ciliate. *Corolla* yellow, 2–4 mm long, divided almost to base, lobes narrowly linear, twisted at anthesis. *Stamens* 2 or sometimes 4, sessile, attached to base of corolla; anthers *ca.* 1 mm long, oblong, orange. *Ovary* globose, less than 1 mm long, glabrous, stigma bilobed, red. *Infructescences* to 6 cm long; pedicel slightly thickened, *ca.* 3 × 2 mm long. *Fruit* globose at maturity, *ca.* 1.6 × 1.4 cm; apex rounded, pericarp smooth, woody, on drying *ca.* 2 mm thick. *Seed* with endosperm.

Distribution. Endemic in Sulawesi.

Ecology. Secondary forest including *Eucalyptus deglupta* forest, from 100-1450 m altitude. Trees are found in flower and fruit at the same time but there are insufficient collections to judge whether flowering and fruiting is aseasonal.

Etymology. Named for its provenance, Sulawesi was formerly known as the Celebes.

Notes. It is the only *Chionanthus* species that has been found to sometimes have four instead of two stamens. Within the Malesian region, the only other species of Oleaceae where this has been recorded is *Osmanthus scortichinii* King & Gamble. In its leaves that dry chestnut brown, it resembles *C. pluriflorus* (Knobl.) Kiew from Borneo but its smaller, smooth fruits with a white bloom are very different from the large, verruculose ones of *C. pluriflorus*.

Specimens examined. SULAWESI. Sulawesi Utara (N. Sulawesi). Bogani Nani Wartabone NP: Ilanga River *Burley et al. 3676* (K), *3992* (KEP); Toraut Dam *de Vogel & Vermeulen 6567* (K, KEP, L). Minahasa: Loempias [Lumpias] *Boschproefst.* (*Netherlands Indies Forest Service*) *bb 14542* (L), Ratahan *Koorders 18382β* (L, holo), *18382* (BO, iso). Without locality *Koorders 18378* (BO, L), *18379* (L), *18384* (BO, L), *Wullur 83* (BO). – Sulawesi Tengah (C. Sulawesi). Lore Lindu NP: Sopu Valley *van Balgooy 3514* (BO, K, L), *3538* (BO, K, L); Tongoa *Johansson et al. 211* (K, L); Wuasa *Brambach et al. 1502* (B, BO, CEB,

GOET, K, KEP, L). – Sulawesi Selatan (S. Sulawesi). Malili area: Oesoe [Usu] *Boschproefst.* (*NIFS*) *Cel/II-310* (K, L). Makassar area. Bonthain *Boschproefst.* (*NIFS*) *Cel/I-55* (L). – Sulawesi Tenggara (SE. Sulawesi). Kendari: Poendidaka [Pondidaha] *Kjellberg 1206* (BO).

2. CHIONANTHUS CORDULATUS Koord.

Chionanthus cordulatus Koord. Meded. Lands Plantentuin. 19 (1898) 527, 638; Koorders-Schumacher, Systematisches Verzeichnis der zum Herbar Koorders (1914) 104; Kiew, Tree Flora Sabah & Sarawak 4 (2002) 138; Kessler *et al*., Checklist Woody Plants of Sulawesi, Indonesia. Blumea, Suppl. 14 (2002) 100. — Type: N. Celebes, Minahasa, Ratahan *Koorders 19592* (lecto BO, here selected; iso L).

Small tree to 2–5(–15) m tall, bole to 30 cm diam. Bark greenish, inner bark pink-yellow. Sapwood yellowish. Twigs moderately slender, drying white, glabrous, lenticellate, nodes slightly flattened. *Leaf*: petiole (0.4–)0.8(–1.5) cm long, thickened, drying white; lamina slightly obovate to oval, chartaceous, glabrous, (16–)22(–36) × (6–)8(–13) cm, narrowing to cordate base, margin not recurved, apex acuminate or sometimes acute, acumen to 1.5 cm long, drying greenish-brown to light chestnut brown; midrib and lateral veins flat above and prominent beneath; lateral veins (9–)12(–17) pairs, marginal vein 2–3 mm from margin. *Inflorescence* ramiflorus or axillary, 3 or more fascicled together, racemose with 3-6 pairs of well-spaced flowers or racemose panicle with lowest branch to 1 cm long, pubescent, 1–4 cm long of which peduncle is 3–5 mm; bracts scarious, acute, 2–3 × 1.5 mm long, densely pubescent, persistent. Pedicel 1–2 mm long. *Flowers* bisexual. *Calyx ca.* 0.5 mm long, divided almost halfway, lobes acute, minutely pubescent. *Corolla* white, sometimes yellowish green, 6–8 mm long, divided almost to base, lobes narrowly linear, straight or twisted at anthesis. *Stamens* sessile; anthers oblong, *ca.* 0.7 mm long. *Ovary* globose, *ca.* 1 mm long, glabrous, stigma capitate. *Inflorescences* [from Bornean specimens] ramiflorus or axillary, 3 or more fascicled together, racemose with 3-6 pairs of flowers or a racemose panicle, 1–4 cm long, lowest branch to 1 cm long; flowers well-spaced, pubescent; peduncle 3–5 mm long. *Infructescences* thickened; fruit stalk 5 × 2 mm. *Fruit* ovoid, 2.7 × 2.3 cm, apex rounded; pericarp greyish green, rough with brown warts, on drying 2 mm thick, leathery. *Seed* with endosperm.

Distribution. Borneo (Sabah and East Kalimantan), North-East Sulawesi and North Maluku (Obi and Bacan Is.).

Ecology. Lowland forest by rivers or on hillsides, limestone (where it is sometimes very common) or in montane forest at 1150 m altitude.

Etymology. Appositely named for its cordate leaf base being the only *Chionanthus* species in Malesia with this character.

Notes. It is more common in Borneo. It is a distinctive species with thin, papery leaves with a cordate base. Its fruits are borne on old twigs *ca.* 5 mm thick as well as in the leaf axils.

Other specimens. *Koorders 18387β, 18735β, 19616β* and *19569β* (cited by Koorders-Schumacher, Systematisches Verzeichnis der zum Herbar Koorders (1914) 104.

3. **Chionanthus kostermansii Kiew**, *spec. nov.*

— Type: W. Sumbawa, Mt Batulante *Kostermans 18626*, 1 May 1961 (holo BO (fruits); iso K, L).

Diagnosis. The combination of its coriaceous, lanceolate leaves that dry grey above and chestnut brown below and its smooth, ellipsoid fruits to 2 × 1.6 cm that often dry with a white bloom distinguish *Chionanthus kostermansii* from other species. Among *Chionanthus* species in Sulawesi, it most resembles *C. sulawesicus* in its racemose inflorescence and broader not narrowly lanceolate leaves but it is different in its narrowly ovate leaves to 13 × 4.5 cm (not broadly elliptic to slightly oblanceolate and to 16.5 × 7 cm), its longer inflorescence 1–1.5 cm long (not 0.3–1 cm long), and ellipsoid fruit to 20 mm long, 14 mm diam. (not broadly ovoid, to 22 mm long and 18 mm diam.).

Tree to 25 m tall, bole to 30 cm diam., with small buttresses, flowering at 8 m tall with a bole 15 cm diam. Bark smooth, whitish grey, inner bark pale brown. Twigs slender, drying grey-white, lenticels not conspicuous, nodes flattened, glabrous. *Leaf*: petiole 0.7–1.3 cm, not thickened, drying black; lamina coriaceous, glabrous, lanceolate to narrowly ovate, (8–)10.5(–13) × (2.5–)3.7(–6) cm, drying greyish-green above and chestnut brown beneath, slightly glossy above, base rounded, margin slightly recurved, apex acuminate, acumen to 1 cm long; midrib raised above, prominent beneath, lateral veins (5–)7–8(–9) pairs, plane above and beneath, marginal veins 2–3 mm from margin. *Inflorescence* axillary, racemose, solitary, 1–1.5 cm long, minutely pubescent, with *ca.* 5 pairs of flowers, flowers spaced, peduncle 1–2 mm long; bracts scarious, ovate, *ca.* 2 mm long, persistent, minutely pubescent; lowermost pedicels 3 mm long, uppermost 1.5 mm. *Flowers* bisexual. *Calyx ca.* 1 mm long, divided *ca.* halfway, lobes acute, pubescent, margin ciliate. *Corolla* white, 3 mm long, divided almost to base, narrowly linear,

fleshy, more or less straight at anthesis. *Stamens* subsessile, attached at base; anthers broadly oblong, 1 mm long. *Ovary* ovoid, 2 mm long, glabrous; stigma bilobed. *Infructescence* thickened, 2–4 cm long, pedicels *ca.* 7 mm long, 2 mm thick. *Fruit* broadly ellipsoid, apex rounded, to 2 × 1.6 cm; pericarp pale greenish red with thin bittersweet juicy pulp (*Kostermanns 19133*), smooth, often drying with a white bloom, *ca.* 2 mm thick, leathery. *Seed* with endosperm.

Distribution. Sulawesi, W. Sumbawa and Flores. Kostermans called the W. Sumbawa locality 'Batulante', but Wiriadinata *et al.* (2013) refer to it as Batu Linting "Batu lante".

Ecology. Kostermans (1965) reported that in W. Sumbawa it is very common in transition forest intermediate between dry deciduous lowland forest up to *ca.* 800 m and in the evergreen, moist, semi-wet submontane forest above 800 m on andesite or granitic soil. His collections in April, May and November bear fruits, only the November collections have flowers as well. In Flores, it was collected at 1000 m altitude.

Etymology. It is named for 'Dok' A.J.G.H. Kostermans, whose botanical exploration of Gunung Linting [Batulante], W. Sumbawa, discovered this species.

Notes. Although common in W. Sumbawa, *Chionanthus kostermansii* is known from a single collection each from Flores and Sulawesi (habitats not recorded). Within Malesia, *Chionanthus* is most poorly represented in the Lesser Sunda Islands. For Sumbawa, apart from *C. kostermansii*, there is a single collection of *C. rupicolus* (Lingelsh.) Kiew (*Kostermans 19169*) and several of *C. ramiflorus*, a tree of seashores that is widespread from India to Australia. On the other hand, *Olea* (*Olea paniculata* R. Br. in particular, as well as *O. rubrovenia* (Elmer) Kiew) is well represented in dry deciduous forest (Kostermans, 1965). The same is true for Flores where *Olea* is common but apart from the single collection of *C. kostermansii*, the only other species of *Chionanthus* recorded is *C. ramiflorus*. Recently, Wiriadinata *et al.* (2013) reported that *C. polygamus* is a component of the tall forest canopy on the Mt Pasak complex of which Batu Linting is one peak. It is possible that these specimens belong to *C. kostermansii*.

Specimens examined. SULAWESI. Sulawesi Selatan (S Sulawesi). Malili area: Oesoe [Usu] *Boschproefst.* (*NIFS*) *Cel/II 363.* W. SUMBAWA. Mt Batulante April 1961 - *Kostermans 18310* (BO, K, L), *18313* (BO, L), *18324* (BO, K, L), *18442* (BO, K, L), May 1961 – *18626* (BO, K, L, type), Nov 1961-*19133* (BO, K, L). FLORES. Waezebo village *Schmutz 3548* (BO, L).

4. CHIONANTHUS POLYGAMUS (Roxb.) Kiew

Chionanthus polygamus (Roxb.) Kiew, Tree Flora of Sabah & Sarawak 4, App. (2002) 350, *ibid* 151, fig. 4. **Basionym:** *Samara polygama* Roxb., Fl. Ind. 1 (1820) 435, *ibid*. 2nd ed. 1 (1832) 414. — Type: Maluku *Roxburgh 2603* (BM). **Homotypic synonyms:** *Ardisia polygama* (Roxb.) A.DC., Prod. 8 (1844) 138; *Linociera polygama* (Roxb.) S. Moore, J. Bot. (London) 51 (1913) 216. **Heterotypic synonyms:** *Chionanthus laxiflorus* Blume, Mus. Bot. Lugd. Bat. 1 (1850) 319; Kiew, Malay. For. 42 (1979) 270, *ibid*. 43 (1980) 377, *ibid*. 44 (1981) 151, Tree Flora Malaya 4 (1989) 287, Coode *et al*. (eds.) Checklist Flowering Plants and Gymnosperms of Brunei Darussalam (1996) 247, Argent *et al*. (eds.) Manual Larger and More Important Non-Dipterocarp Trees of Central Kalimantan, Indonesia 2 (1997) 489, Kessler *et al*., Checklist Woody Plants of Sulawesi, Indonesia. Blumea, Suppl. 14 (2002) 100; *Linociera laxiflora* (Blume) Knoblauch, Bot. Centralbl. 61 (1895) 87. Type: — Borneo, Martapuera *Korthals s.n.* (holo L, iso K).

Tree, 12–20(–32.5) m tall, to 40 cm diam., bole rarely buttressed, flowering at 4 m. Bark grey; inner bark orange-brown. Sapwood white or pale ochre. Twigs slender, drying pale grey, glabrous, lenticellate, nodes flattened. *Leaf*: petiole 0.5–1.5 cm long, not thickened, drying black; lamina lanceolate (to slightly obovate), coriaceous, glabrous, (5–)8–12(–17) × 1.5–6.5 cm, base cuneate to slightly rounded, margin not recurved, apex acuminate to cuspidate, acumen to 1.5 cm long, rarely apiculate, drying slightly glossy and greyish green, sometimes brownish above; midrib and veins flat above, obscure or puckering along veins on drying; midrib slightly prominent beneath; lateral veins (5–)7–11(–13) pairs, plane beneath, marginal vein 1–2 mm from margin. *Inflorescence* axillary or extra-axillary, solitary or fascicled, many-flowered panicle with second and third order branching, (1.5–)3–6.5 cm long of which peduncle is (1–)4–7 cm long, finely pubescent, lowermost branch *ca.* 3 cm long, branches with 6–10 flowers clustered at the tips; bracts scarious, ovate 1–2 mm long, minutely pubescent, persistent. *Flowers* polygamous, yellow-green or creamy white; buds pointed; pedicel 0–1 mm long. *Bisexual flowers*: *Calyx ca.* 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 oblong, less than 1 mm long. *Ovary* ovoid, *ca.* 1.5 mm long, glabrous, stigma bilobed. *Male flowers*: buds less than 1 mm across and pedicel strongly reflexed, other characters similar to bisexual flowers but without vestige of ovary. *Infructescences* not thickened. *Fruit* pear-shaped, to 1.2 × 0.8 cm; pericarp

smooth, ripening purplish red or bluish black; on drying *ca.* 0.3 mm thick, thin and brittle, fruit stalk 1–5 mm. *Seed* with endosperm.

Distribution. Sumatra, Peninsular Malaysia, Borneo, Sulawesi, Moluccas and New Guinea.

Ecology. Primary or disturbed forest, often in swamp forest below 500 m altitude, in Borneo often in *kerangas* forest up to altitudes of 1950 m. In Central Sulawesi, it is one of the co-dominant trees in montane Fagaceae-Myrtaceae forest at 1400 m (Culmsee & Pitopang, 2009) and about 2000 m elevation (van Balgooy & Tantra, 1986).

Etymology. Having both unisexual and bisexual flowers.

Notes. Its pear-shaped fruits with a pointed apex are unique among Malesian *Chionanthus*. The polygamous condition is also unusual among *Chionanthus* species but it is also seen in *C. rupicolus* and *C. macrobotrys* (Merr.) Kiew, the latter from Borneo and the Philippines. Its male flowers are minute.

Specimens examined. SULAWESI. Sulawesi Tengah (C. Sulawesi). Lore Lindu NP: Bariri *Brambach et al. 0831* (BO, CEB, GOET, KEP, L); Mt Dali *Culmsee r2166* (BO, CEB, GOET, KEP, L); Mt Roroka Timbu [Rorekautimbu] *van Balgooy 3190* (BO, K), *3401* (BO, K), *Tantra 1580* (BO), *1582* (BO); Soroakes *van Balgooy 3859* (BO, K); Watukilo *Brambach et al. 0317* (B, BO, CEB, GOET, K, KEP, L), *0620* (CEB, GOET, KEP); Wuasa *Brambach et al. 1604* (CEB, GOET, KEP); Tongoa *Johansson et al. 329* (K); — Sulawesi Selatan (S. Sulawesi). Malili area: Wawoendoela [Wawundula] *Kjellberg 2306* (BO). Tana Toraja: Todjamboe [Tojambu] *Kjellberg 1834* (BO). MALUKU. *Roxburgh 2603* (BM, type).

5. CHIONANTHUS RAMIFLORUS Roxb.

Chionanthus ramiflorus Roxb., Fl. Ind. 2nd ed. 1 (1832) 107; Kiew, Malay. For. 42 (1979) 274, *ibid*. 43 (1980) 388, *ibid*. 44 (1981) 150, Tree Flora Malaya 4 (1989) 289; Coode *et al.* (eds.) Checklist Flowering Plants and Gymnosperms of Brunei Darulssalam (1996) 248; Kiew, Tree Flora Sabah & Sarawak 4 (2002) 155; Kessler *et al*., Checklist Woody Plants of Sulawesi, Indonesia. Blumea, Suppl. 14 (2002) 101. — Type: Wight Icon. No. 734. **Homotypic synonym:** *Linociera ramiflora* (Roxb.) Wall. *ex* A.DC. Prodr. 8 (1844) 297; Backer & Bakhuizen *f*. Flora Java 2 (1965) 214.

Tree to 21 m tall, bole to 30 cm diam. Bark grey-brown, smooth, lenticellate; inner bark brown. Sapwood whitish yellow. Twigs slender, drying white or light grey, glabrous, lenticels conspicuous, nodes flattened. *Leaf*: petiole 1.5–3 cm long, not thickened, drying black; lamina oblong-lanceolate, elliptic or obovate, chartaceous or subcoriaceous, glossy above, glabrous, (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, drying green-brown on both surfaces; midrib impressed above, prominent beneath; lateral veins 8-12 pairs, plane above, prominent beneath, marginal vein *ca.* 2 mm from margin, intercostal venation conspicuous. *Inflorescence* axillary, solitary, paniculate with second and third order branching and 3-6 distant branches, (0.5–)3–13 cm long of which peduncle is 1.5–3.3 cm long, lowest branch (0.5–)1.5–3(–5) cm long, flowers spaced, glabrous; bracts foliaceous, spathulate, 3–15 mm long, glabrous, persistent. Pedicel 1–3 mm long. *Flowers* bisexual, fragrant, buds rounded. *Calyx* less than 1 mm long, divided almost to the base, lobes acute, glabrous. *Corolla* white or pale yellow, 2–3 mm long, lobes oblong, divided almost to base where joined in pairs for a quarter of their length, more or less straight at anthesis. *Stamens* sessile; anthers yellow, *ca.* 1 mm long, oblong. *Ovary* ovoid, *ca.* 1 mm long, glabrous, stigma bilobed. *Infructescences* to 12 cm long and thickened; pedicel 3–5 mm long. *Fruit* ellipsoid at maturity, 2(–4) × 1(–2) cm, apex blunt or apiculate, often galled; pericarp smooth, ripening purple-black, drying thin and brittle, fruit stalk 2–5 mm long, conspicuously swollen. *Seed* without endosperm, cotyledons fleshy.

Distribution. E. India, Indo-China, Taiwan, throughout Malesia to Australia (Queensland) and the Solomon Islands.

Ecology. Primary and secondary forests, frequently in coastal and riverine vegetation at altitudes below 300 m, but occasionally found in lower and upper montane forest at altitudes to 2200 m. In Sulawesi it grows on a variety of substrates, granite, limestone and ultramafic, and in C. Sulawesi it occurs in submontane forest at 1200 m.

Etymology. Flowering on the branches.

Notes. *Chionanthus ramiflorus* is the most common and widespread *Chionanthus* species in Malesia. It often grows in coastal forest and has been collected from all islands in the archipelago.

Specimens examined. SULAWESI. Sulawesi Tengah (C. Sulawesi). Lore Lindu NP: Rompo *Brambach et al. 1184* (CEB, GOET, KEP); Sopu Valley *de Vogel 5602* (K, L). – Sulawesi Selatan (S. Sulawesi). Malili area: Lake Matano van *Balgooy 3681* (K, KEP, L), *Hennipman 5761* (K,

KEP, L), *de Vogel 5922* (K, L), Malili *Sidiyasa 1309* (K, L).

6. CHIONANTHUS RUPICOLUS (Lingelsh.) Kiew

Chionanthus rupicolus (Lingelsh.) Kiew, Blumea 43 (1998) 475; Kessler *et al*., Checklist Woody Plants of Sulawesi, Indonesia. Blumea, Suppl. 14 (2002) 101. **Basionym:** *Linociera rupicola* Lingelsh., Bot. Jahrb. 61 (1927) 9, Nova Guinea 14 (1927) 330, t. 37; Kobuski, J. Arnold Arbor. 21 (1940) 333. —Type: New Guinea, Mt Doorman *Lam 1912* ('192' holo L; iso BO, K). **Heterotypic synonyms:** *Linociera novoguineensis* Lingelsh., Bot. Jahrb. 61 (1927) 9. —Type: New Guinea, Finisterre Range *Schlechter 18198* (holo B+; lecto K, here selected, isolecto A, BM). *Linociera ramiflora* var. *coriacea* Lingels., Nova Guinea 14 (1927) 329. *Linociera ovalis* Knobl., Notizbl. Bot. Gart. Berlin-Dahlem 11 (1934) 1029. — Type: New Guinea *Gjellerup 704* (holo BO).

Shrub or tree 18(–35) m tall, bole to 40 cm diam., rarely with buttresses, flowering at 2 m. Bark grey or grey-brown, rough, fissured and peeling; inner bark light brown mottled amber, turning red-brown on exposure. Sapwood pale yellow reddening on exposure. Twigs moderately slender, drying dark grey, glabrous, lenticellate, nodes slightly flattened, leaf scars prominent and horseshoe-shaped, axillary buds globose, large and conspicuous. *Leaf*: petiole 1–2.5 cm long, not thickened, drying black; lamina narrowly elliptic, sometimes elliptic, subcoriaceous or sometimes coriaceous, glabrous, (5–)9(–18.5) × 2–7.5 cm, base narrowed or cuneate to somewhat decurrent, margin slightly recurved, apex acuminate, acumen to 2 cm long, drying greenish-grey above and reddish brown beneath; midrib flat or impressed above, prominent beneath; lateral veins 5–11 pairs, finely impressed or obscure above, slightly prominent beneath, marginal vein obscure, *ca.* 1 mm from margin. *Inflorescence* axillary, solitary, a lax panicle with third order branching, (2.5–)6–7(–9) cm long of which peduncle is 1.7–3 m long, lower branches 1–2 cm long, twice the length of the upper, glabrous, flowers clustered at the tips of the branches, often produced on new shoots; bracts foliacous, spathulate, 7–10(–20) × 2–4 mm, glabrous, persistent. Pedicel 0-1 mm long. *Flowers* polygamous, fragrant, white or pale yellow, sometimes pale green. *Bisexual flowers*: *calyx ca.* 1 mm long, divided more than halfway, lobes acute, glabrous with ciliate margin. *Corolla* 3–4 mm long, divided almost to base, lobes narrowly linear, twisted at anthesis. *Stamens* subsessile; anthers orange, broadly oblong, *ca.* 1 mm long, connective apiculate. *Ovary* ovoid, *ca.* 1 mm long, glabrous, stigma bilobed. *Male flowers* different in *calyx ca.* 0.5 mm long, divided almost to base; *corolla ca.* 2 mm long; *ovary* totally lacking. *Infructescences* 1.7–9.5 cm long and scarcely thickened; fruit stalk 2–3 × 1 mm long. *Fruit* globose, 0.8–1.1 × 0.7–1.1 cm, apex minutely apiculate; pericarp smooth, reddish ripening deep purple, drying less than 1 mm thick, brittle. *Seed* with endosperm.

Distribution. Sulawesi, Sumbawa, Maluku (Morotai and Obi), New Guinea and Bismarck Archipelago (New Britain and New Ireland).

Ecology. Mossy forest to 2500 m altitude, or in swamps at 2100 m, sometimes in lowlands on river banks or on seashores. In Sulawesi at low altitudes (to 400 m) on limestone or ultramafic substrates.

Etymology. Living in rocky places.

Notes. *Chionanthus rupicolus* is basically a New Guinea species where it is common. It is a variable species. For example, the population at Lake Matano, Sulawesi, has leaves that are particularly narrow, 8–13 × 2.3–4 cm. Besides *C. rupicolus*, another four *Chionanthus* species are known from Maluku, two are widespread species (*C. polygamus* and *C. ramiflorus*), *C. sessiliflorus* (Hemsl.) Kiew is more common in New Guinea and is not known from Sulawesi, while the fifth is *C. cordulatus*.

Specimens examined. SULAWESI. Sulawesi Selatan (S. Sulawesi). Malili area: Lake Matano van *Balgooy 3791* (K, L), *de Vogel 5835* (K, L); Lake Towuti *de Vogel 6325* (K, L), *6328* (K, L). NEW GUINEA. Mt Doorman *Lam 1912* (BO, K, L, type).

7. **Chionanthus sordidus Kiew**, *spec nov*.

Kessler *et al*., Checklist Woody Plants of Sulawesi, Indonesia. Blumea, Suppl. 14 (2002) 101, *nomen*. Type: S. Sulawesi, Bonemaitu, Lake Matano *de Vogel 6244*, 14 July 1979 (holo L; iso K, KEP).

Diagnosis. Among species from Sulawesi, it most resembles *Chionanthus stenurus* in its narrowly lanceolate leaves and racemose inflorescences, but it is distinguished by its longer petioles 7–10 mm long (not 3–5 mm as in *C. stenurus*), longer racemes 10–25 mm long (not 5–12 mm long) and its large ovoid, thicker-walled fruit 2.2 cm long, 1.8 cm diam. (not globose, 1.5–1.8 cm diam.). The fruit surface of *C. sordidus* is distinctive, apart from the distant warts, the whole surface cracks into flakes and unlike the majority of *Chionanthus* species, which are reported to ripen purple-black, it ripens brownish-grey. In its leaves that dry chestnut brown underneath it resembles *C. celebicus* from which it is

immediately distinguished by its narrower leaves more than three times longer than wide and its racemose inflorescence.

Shrub or tree, 2–10 m tall. Twigs slender, white or grey, nodes slightly flattened, glabrous, lenticels conspicuous. *Leaf*: petiole (0.7–)0.8(–1) cm, not thickened, drying black; lamina thinly coriaceous, matt, glabrous, narrow lanceolate, (10.5–)14(–19) × (2.5–)4(–5) cm, base cuneate, margin slightly recurved, apex acute, frequently cuspidate, acumen to 3 cm, drying green-brown or grey-green above, dark chestnut brown beneath; midrib impressed above, prominent beneath; lateral veins 7-8(-10) pairs, plane or slightly impressed above, prominent beneath, marginal vein 2–3 mm from margin. *Inflorescence* axillary, solitary, racemose, with 3-4 spaced pairs of flowers, 1–2.5 cm long, sparsely pubescent; bracts foliaceous, *ca.* 7 × 4 mm, glabrous. *Flower*: corolla and stamens unknown in flowers where corolla has fallen: pedicel 1–2 mm long; *calyx* 1 mm long, divided almost halfway, lobes broadly ovate, glabrous with ciliate margin; *ovary* globose, *ca.* 1 mm long, glabrous, stigma bilobed. *Infructescence* thickened, pedicel to *ca.* 3 mm long, *ca.* 2 mm thick. *Fruits* ovoid, *ca.* 2.2 cm long, *ca.* 1.8 cm diam., apex rounded; pericarp rough, flaking with distant warts, brownish grey, drying *ca.* 2 mm thick, leathery; fruit stalk thickened, *ca.* 2 mm thick. Seed unknown.

Distribution. Endemic in S. Sulawesi (Malili area and near Makassar).

Ecology. Primary lowland forest, sometimes on ultrabasic soil, 100–430 m altitude.

Etymology. The species is named for the rather shabby appearance of its leaves, which dry a dingy green-brown and grey-green and wrinkle along the veins.

Notes. Three species, *Chionanthus rupicolus*, *C. sordidus* and *C. stenurus* recorded from Lake Matano, have narrowly lanceolate, almost stenurous leaves. *Chionanthus rupicolus* is distinct from the other two by its longer petiole (0.7–2 cm long), paniculate inflorescence (2.5–9 cm long) and its smaller, globose fruit, which on drying has a thin brittle pericarp. (Elsewhere in its range, *C. rupicolus* has broader leaves). *Chionanthus sordidus* is distinct from *C. stenurus* by its longer petioles and raceme and fruit characters. In addition, at Lake Matano field notes (where given) indicate that these three species are separated ecologically. *Chionanthus rupicolus* has been collected from low lakeshore vegetation (now rather disturbed), *C. stenurus* from limestone outcrops on the shore of Lake Matano, and *C. sordidus* from ultramafic soil. Van Balgooy & Tantra (1986) report a pronounced difference in the vegetation and flora of ultramafic soil compared with that on limestone, both on the lake shore and inland.

Specimens examined. SULAWESI. Sulawesi Selatan. Malili area: Oesoe [Usu] *Boschproefst* (*NIFS*). *Cel/II-260* (L), *Cel/II-310* (L, K), ; Lake Matano *de Vogel 6244* (KEP, L, type), *Meijer 11436* (L). Makassar area: Lokka, Bonthain *Teysmann* [*Teijsmann*] *13941H.B.* (BO, L).

8. CHIONANTHUS STENURUS (Merr.) Kiew

Chionanthus stenurus (Merr.) Kiew, Blumea 43 (1998) 477; Kessler *et al*., Checklist Woody Plants of Sulawesi, Indonesia. Blumea, Suppl. 14 (2002) 101. **Basionym**: *Linociera stenura* Merr., J. Arnold Arbor. 35 (1954) 151. — Type: Celebes, Malili District, Waraoe *Kjellberg 2120* (holo S; iso A, BO, L).

Treelet to 5 m tall. Twigs slender, drying grey-brown, lenticellate, glabrous, nodes slightly flattened. *Leaf*: petiole 0.3–0.5 cm long, not thickened, drying black or brown; lamina subcoriaceous, glabrous, narrowly lanceolate, (7.5–)10(–15) × 2–4 cm, base cuneate, margin recurved, apex narrowly attenuate to cuspidate, acumen to 2 cm, sometimes glossy above, drying grey-green above; midrib slightly impressed above, prominent beneath; lateral veins (8-)11-12 pairs, flat and obscure above and beneath, marginal vein faint, *ca.* 1 mm from margin. *Inflorescence* axillary, solitary, racemose with 1-4 well-spaced pairs of flowers, glabrous, 0.5–1.2 cm long of which peduncle is 1–2 mm; bracts foliaceous, spathulate, 4–7 × 2–3 mm, glabrous, caducous. Pedicel *ca.* 1 mm long. *Flowers* bisexual. *Calyx ca.* 0.7 mm long, divided almost to base, lobes acute, spreading, glabrous. *Corolla* white, *ca.* 4 mm long, divided almost to base, lobes narrowly linear, twisted at anthesis. *Stamens* subsessile, attached at base of corolla, anther oblong, *ca.* 1 mm long. *Ovary* ovoid, *ca.* 1 mm long, glabrous, stigma bilobed. *Infructescence* thickened, fruit stalk *ca.* 1.5 × 1.5 mm. *Fruits* globose, *ca.* 1.5–1.8 cm diam., apex rounded; pericarp ripening purple, minute rugose, drying leathery, *ca.* 1 mm thick. *Seed* with endosperm.

Distribution. Endemic in Sulawesi in the Malili area.

Ecology. From coastal forest or forest at the edge of lakes, on limestone outcrops or on limestone derived soil, at 50–450 m altitude.

Etymology. The species is named for its narrow leaves with an attenuated narrow apex.

Notes. It is a very distinctive species by its narrow leaves. It appears to be a rare and local species restricted to limestone substrates.

Specimens examined. SULAWESI. Sulawesi Selatan (S.Sulawesi). Malili area: Lake Matano *de Vogel 5792* (K, L), *5892* (K, L); Waraoe [Warau] *Kjellberg 2120* (A, BO, L, S, type); Warare *Kjellberg 3169* (BO).

9. **Chionanthus sulawesicus Kiew**, *spec. nov.*

Kessler *et al*., Checklist Woody Plants of Sulawesi, Indonesia. Blumea, Suppl. 14 (2002) 101, *nomen*. — Type: Sulawesi, Sopu Valley, Lore Lindu National Park, nr. Palu *van Balgooy 3046* 27 April 1979 (holo BO; iso K, L).

Diagnosis. In its leaves, which dry pale greenish -brown, and have thickened petioles, which dry white, and its short racemes, *Chionanthus sulawesicus* most closely resembles *C. sessiliflorus* (Hemsl.) Kiew of Maluku, New Guinea and the Solomon Islands, and *C. spicatus* Blume of Borneo. It is different from these species in its pedicellate flowers that have short corolla lobes compared (not sessile or subsessile flowers with corolla lobes 4–11 mm long). In addition, *C. sessiliflorus* has ellipsoid, ridged fruits up to 7 cm long, while *C. spicatus* has globose fruits with a thin pericarp.

Tree to 25 m tall, bole to 30 cm, without buttresses, flowering at 5 m tall. Bark grey or dark brown, *ca.* 1 mm thick, not fissured but warty with conspicuous lenticels; inner bark yellow brown, *ca.* 10 mm thick. Sapwood brown-yellow. Twigs slender, white, nodes flattened and expanded laterally, glabrous, with conspicuous horseshoe-shaped leaf scars. *Leaf*: petiole 0.5–1 cm long, thickened, drying white; lamina broadly elliptic to slightly oblanceolate, subcoriaceous, glabrous, (8.5–)12(–16.5) × 3–7 cm, base cuneate, margin slightly recurved, apex acuminate, acumen to 1 cm long, drying greenish-brown; midrib impressed above, prominent beneath; lateral veins 7-8(-9) pairs, plane above, prominent beneath, marginal vein 2–4 mm from margin. *Inflorescence* axillary, solitary, racemose with *ca.* 4-5 crowded pairs of flowers, 0.3–1 cm long, glabrous; bracts scarious, acute 2–3 mm long, glabrous with ciliate margin, persistent; pedicel 1–2 mm long. *Flowers* bisexual. *Calyx ca.* 1 mm long, divided almost to the base, lobes acute, glabrous with ciliate margin. *Corolla* yellow, 3–5 mm long, divided almost to base, lobes narrowly linear, fleshy, strongly recurved at anthesis. *Stamens* sessile, attached to base of corolla; *anthers* oblong, less than 1 mm long. *Ovary* ovoid, less than 1 mm long, glabrous, stigma bilobed. *Infructescences* to 2 cm long and thickened; pedicel 3–5 mm long. *Fruit* ovoid becoming globose at maturity, 1.3–3 cm long, 1.1–3 cm diam.; pericarp ripening violet, smooth, on drying 2–3 mm thick, leathery. *Seed* with endosperm.

Distribution. Endemic in Central and South Sulawesi.

Ecology. Riparian or mixed forest on wet or poorly drained alluvial soil, depleted forest on gentle slopes near streams from 200–2200 m altitude. Most collections are from riparian *Eucalyptus deglupta* forest where *C. celebicus* is also found. Ecological enumerations by van Balgooy & Tantra (1986) showed that it is one of the three co-dominant understorey tree species in terms of frequency in mixed forest on flat poorly drained soil. (In that account, this species is referred to as *Chionanthus* sp. 'D'). At higher elevations (above 1700 m altitude), *C. sulawesicus* is replaced by *C. polygamus*, which at about 2000 m is one of the co-dominant species. Trees are found in flower and fruit at the same time but there are insufficient collections to judge whether flowering and fruiting is aseasonal.

Etymology. Named for its provenance, it is endemic in Sulawesi.

Specimens examined. SULAWESI. Sulawesi Utara (N. Sulawesi). Bogani Nani Wartabone NP: Mt Mogogonipa *de Vogel & Vermeulen 6951* (K, KEP, L), *Milliken 995* (K); Ilanga River *Burley et al. 3820* (KEP). – Sulawesi Tengah (C. Sulawesi). Lore Lindu NP: Lake Tambing *Ramadhanil et al. 439* (CEB, K); Mt Dali *Culmsee y2052* (BO, CEB, GOET, KEP, L), *y2086* (CEB, GOET, KEP); Mt Nokilalaki [Lake Lindu] *Meijer 9563* (L); Mt Rorekautimbu *Darnaedi 1623* (K, L); Sopu Valley *de Vogel 5096* (K, L), *5503* (K, L), *5534* (K, L), *5535* (L, K), *5568* (BO, L), *van Balgooy 3046* (BO, K, L, type), *van Balgooy 3068* (BO, K, L); Tongoa *Johansson et al. 552* (K, L). – Sulawesi Selatan (S. Sulawesi). Malili area: Toli-toli *Waturandang 364* (=*Boschproefst.* (*NIFS*) *Cel/V-256*) (BO, L), *373* (=*Boschproefst.* (*NIFS*) *Cel/V-256*) (BO).

EXCLUDED SPECIES

CHIONANTHUS? GIGANTIFOLIUS Koord.

Chionanthus gigantifolius Koord., Meded. Lands Plantentuin 19 (1898) 527, 638; Koorders-Schumacher, Systematisches Verzeichnis der zum Herbar Koorders (1914) 104. — Type: N Celebes, Minahasa, G. Lolomboelan (*Koorders 18573β* (lecto L).

The lectotype is a single very large spathulate leaf, 38 × 11 cm, narrowed to the base. Among the Sulawesi species only *C. cordulatus* approaches it

in leaf size, 16–36 × 6–13 cm, but its leaf narrows to a cordate base. No flowers or fruits were available to Koorders and the question mark is his and indicates his doubt that this is even a species of *Chionanthus*. Since it does not resemble any *Chionanthus* species, it is excluded from the genus.

ACKNOWLEDGEMENTS

I thank the Flora Malesiana Foundation, Universiti Pertanian/Putra Malaysia, and the Flora of Peninsular Malaysia project under the Ministry of Natural Resources and Environment for financial support, and to the Curators of A, BM, BO, GCE, K, L, LAE, SAN, SAR and SING for permission to examine specimens in their care, to Fabian Brambach, whose recent collections spurred me to complete this account and to the anonymous reviewer whose knowledgeable suggestions greatly improved the manuscript.

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