

CLETHRACEAE (H. Sleumer, Leyden)

1. CLETHRA

LINNÉ, Gen. Pl. ed. 5 (1754) 188; Sp. Pl. (1753) 396; SLEUM. Bot. Jahrb. 87 (1967) 55. — Fig. 1–5.

Trees or shrubs, evergreen (Mal. *spp.*); leaf-scars large. *Leaves* crowded towards the end of the shoots, spiral, simple, exstipulate, serrate with glandular teeth, often with an apical gland, more rarely entire; nerves a little decurrent along the midrib, both midrib and nerves \pm impressed above, \pm prominent beneath. Indumentum of branchlets, leaves and inflorescences consisting of simple, and/or long, fascicled and \pm patent, and/or minor, \pm depressed stellate hairs. *Flowers* bisexual, regular, 5(–6)-merous. Inflorescences sometimes simple solitary terminal racemes, but mostly consisting of a terminal raceme and several lower approximate racemes, each of the latter from the axil of a \pm reduced or caducous leaf, thus forming together a panicle-, fascicle- or umbel-like inflorescence; bracts mostly caducous during anthesis, rarely subsistent. *Calyx lobes* 5(–6), persistent, quincuncially imbricate, united at the base only. *Petals* 5(–6), generally free, sometimes cohering to some degree, alternate with the calyx lobes, rather early caducous, generally sweet-scented. *Stamens* 10(–12) in 2 whorls of 5(–6), the outer whorl opposite the petals, the inner one opposite the calyx lobes; filaments adnate to the corolla at the extreme base; anthers dorsifixed, overturned outwards in bud, erect in anthesis, introrse, upper part of cells \pm divergent, opening with apical, slit-like pores; pollen grains single, tricolporate, psilate. *Ovary* superior, 3-celled, with axile placentation; ovules ∞ , small, anatropous; style simple, mostly shortly, very rarely hardly divided into three apical lobes, sometimes more deeply so and trifid, each lobe stigmatic at the top. *Fruit* a 3-valved, loculicidal capsule, the septae of which become loose from the persistent central axis, subtended or \pm enclosed at maturity by the persistent calyx. *Seeds* ∞ , small, subovoid to irregularly angular or subtrigonal, with a foveolate-reticulate testa (all Mal. *spp.*). Endosperm fleshy. Embryo cylindrical.

Distribution. A small, monogeneric family in the *Ericales*, of (sub)tropical Asiatic-Malesian, and temperate and tropical American distribution, and with 1 *sp.* in Macaronesia (Madeira, and formerly in Teneriffe).

Of the total of 64 *spp.*, 2 temperate *spp.* are found in North America (*C. alnifolia* L. and its *var. pubescens* AIT., and *C. acuminata* МІСНХ), 38 *spp.* inhabit (sub)tropical America (Cuba-Jamaica-Central America, in S. America in the Mt Roraima area and in Trinidad, in the Andes from Venezuela to SE. Bolivia and NW. Argentina, and a small separate area in SE. Brazil), 10 *spp.* are found in SE. Asia (Upper Burma, SW., Central and SE. China, Japan, Indo-China).

In Malesia 13 *spp.*, of which 2 in the Malay Peninsula, 1 in Sumatra, 1 in Java, 3 in the Lesser Sunda Islands, 4 in the Philippines, 3 in Borneo, 2 in Celebes, 1 in the Moluccas, and 4 in New Guinea. Fig. 2.

Ecology. *Clethra* occurs mainly in the lower and upper montane primary (and also secondary) forest. As to climate, the genus prefers the wet montane tropical and subtropical zone, though it extends far into the northern temperate zone, in North America to about 45°, in Japan to about 42° N, whilst its southern limit is about 29° S in SE. Brazil. As the majority of the *Ericales*, *Clethras* have preference for acid soils. They occur in Malesia from sea-level to about 3000 m; and up to c. 3800 m in Szechuan and Yunnan, and in the Andes. They are light-demanding, remain sterile in dense forest, and flower in forest borders with open vegetation or exclusively in the latter, also in light secondary plant communities.

Dispersal. Nothing is known about the dispersal of *Clethras*. The rather small, deeply impressed-reticulate and light seeds of the Malesian *spp.* point to dispersal by wind.

Anatomy. DEN BERGER, Determinatietabel van Malesië, Veenman, Wageningen (1941) 31 (hand

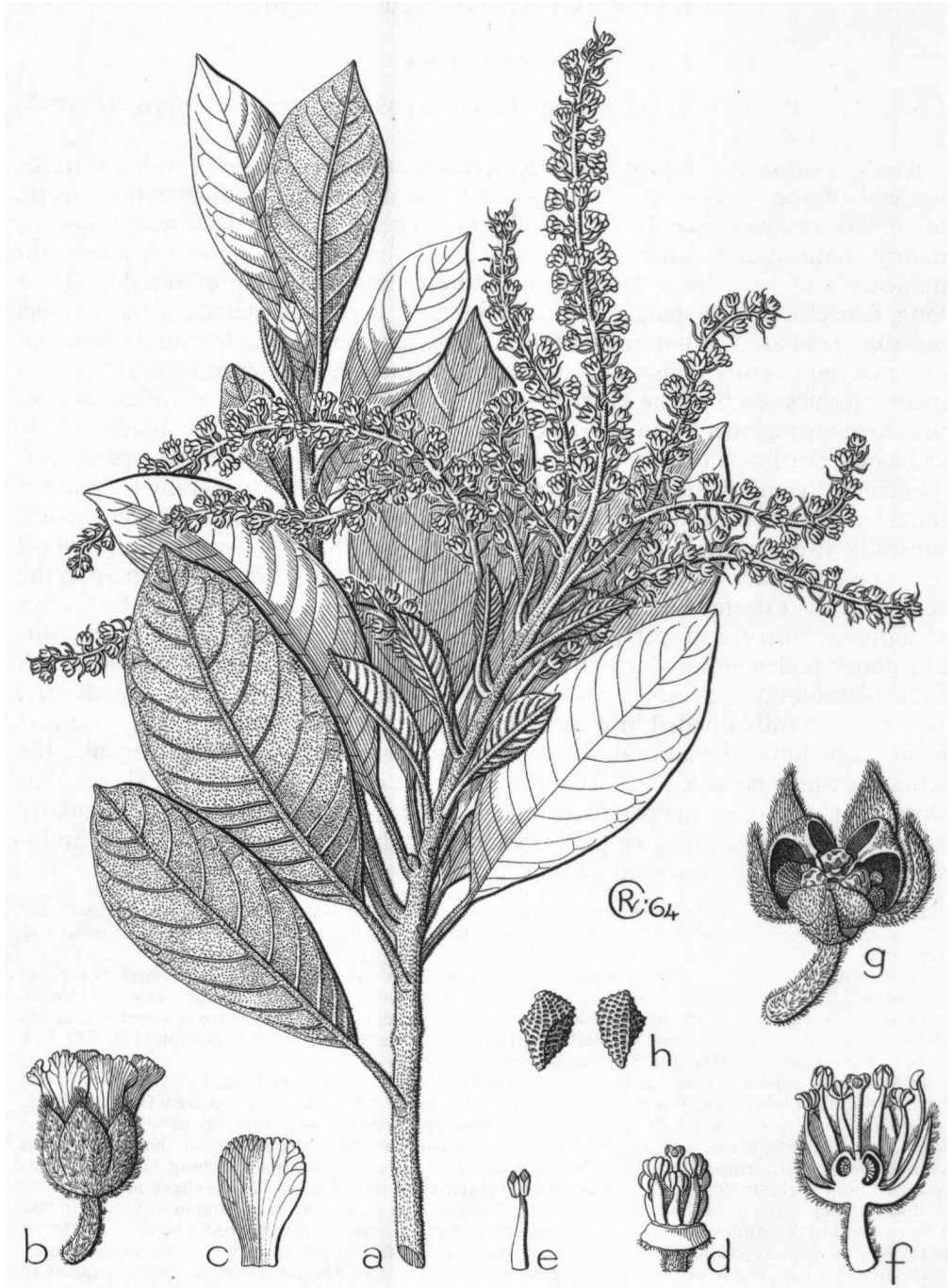


Fig. 1. *Clethra pachyphylla* MERR. a. Habit, $\times 2\frac{1}{2}$, b. flower, $\times 4$, c. petal, $\times 4$, d. stamens in bud stage, $\times 4$, e. stamens at full anthesis, $\times 4$, f. longitudinal section of flower, $\times 4$, g. fruit, $\times 4$, h. seeds, $\times 8$ (a-f CHEW, CORNER & STANTON 1845, g-h SINCLAIR 9082).

lens, wood); DEN BERGER & BIANCHI, Tectona 24 (1931) 894-903 (wood); HARA, Bot. Mag. Tokyo 70 (1957) 108-114 and J. Fac. Sc. Un. Tokyo, Sect. 3, Bot. 7 (1958) 367-450 (shoot apex and leaf histogenesis); LEMESLE, Bull. Soc. Pharm. Bordeaux 104 (1965) 37-48 (localization of tanniferous substances); LEMESLE & DUPUY, C. R. Ac. Sc. Paris 263 (1966) 250-253 (tannins and mucilaginous substances); SUDO, Identification of Japanese Hardwoods, Bull. Govt. Exp. Stat. Meguro 118 (1959); UPHOF, HUMMEL & STAESCHE, Plant Hairs, in Handb. Pflanzenanat. IV, 5 (1962). For general surveys of older literature see SOLEREDER, Syst. Anat. Dicot. Stuttgart (1899) 541-551 and *ibid.* (1908) 195-197 (under *Ericaceae*), and METCALFE & CHALK, Anat. Dicot. 2, Oxford (1950) 836-839.

The wood shows primitive characters such as narrow solitary vessels with scalariform vessel perforations, fibre-tracheids, apotracheal parenchyma which is diffuse or arranged in short uniseriate bands and heterogeneous rays of two sizes. The petiole is supplied with a strongly incurved to closed vascular strand. Hairs occur as multicellular stellate and uniseriate types. Stomata mainly paracytic. Crystals solitary and clustered. Secretory tanniferous cells are present in the parenchymatous tissues of petiole and stem. METCALFE & CHALK (*l.c.*) state that *Clethra* has many anatomical features in common with *Ericaceae*. — P. BAAS.

Pollination. The flowers are protandrous. The pollen is shed at least partly before the flowers are open and the stigmas are receptive.

Galls. DOCTERS VAN LEEUWEN (*Zoocecid. Neth. Ind.* 1926, 439, fig. 825 & 826) mentions leaf-galls on *C. sumatrana* from the Petani ravine near Medan, caused by a Psyllid and a gall mite. On the leaves of *C. canescens* in N. Celebes (Minahasa) globular galls are found.

Uses. Temperate species of *Clethra*, mainly from North America, Madeira and Japan, much less from China, are cultivated as ornamentals in many parts of the world. Not a single species from Malesia so far has been introduced in Botanic Gardens.

Phytochemistry. Leucoanthocyanins, caffeic acid, flavonols, taraxeron and ursolic acid are known to occur in species of *Clethra* (HEGNAUER, Chemotax. d. Pfl. 3, 1964, 432-433; TANABE *c.s.* J. Pharm. Soc. Japan 86, 1966, 441). This spectrum of phytoconstituents is compatible with the generally accepted relationship between *Clethraceae* and *Ericaceae*. — R. HEGNAUER.

Taxonomy. A monograph of the genus has been published by the author (Bot. Jahrb. 87, 1967, 36-175, pl. 1). In this work it was shown, that the North American and the Asiatic-Malesian species of *Clethra* belong to *sect. Clethra* by their subovoid to subtrigonal and impressedly reticulate seeds, whilst the Central and South American species and *C. arborea* in Madeira form a second section, *Cuel-laria*, distinguished by flat and variously winged seeds.

For the determination of *Clethras* close observation of the indumentum with a lens is necessary. There are (i) simple, mostly rather long, appressed or patent hairs, (ii) fascicled, \pm obliquely erect, generally elongated hairs, (iii) stellate hairs of generally small size and \pm flattish. On most *Clethras* a combination of 2 or all 3 types of hairs is found, but their density may differ greatly on the various organs, resulting in a fine tomentellous, a thicker tomentulose or tomentose to villous tomentum of white to greyish, pale ferruginous to dark rusty and even rufous colour. Besides the various kinds of hairs, the discrimination of species is based on floral characters. Collectors should try to collect flowering material and (sterile) branchlets with young, not yet glabrate leaves from the same specimen, and abstain from collecting sterile or fruiting material.

KEY TO THE SPECIES

1. Filaments hairy.
 2. Filaments hirsutulous. Style elongate in fruit (up to 12 mm) 1. *C. sumatrana*
 2. Filaments laxly set with long hairs. Style a little or hardly elongate in fruit (up to 7 mm).
 3. Leaves subcoriaceous, practically glabrous in mature state. Inflorescence dilutely rusty-tomentellous in all parts 2. *C. hendersonii*
 3. Leaves coriaceous, still densely stellate-hairy along midrib and primary nerves in mature state beneath. Inflorescence rusty-villous in all parts. 3. *C. symingtonii*
1. Filaments glabrous.
 4. Younger, not yet glabrate leaves (which still show the full quality and quantity of the tomentum) laxly to more densely hairy only on midrib, nerves and veins, and glabrous on the intervenium beneath, mature ones glabrescent, or leaves glabrous from the beginning.
 5. Lateral nerves (15-)17-20(-23) pairs, \pm approximate to each other. 4. *C. javanica*
 5. Lateral nerves 10-12(-14, rarely up to 15) pairs, more distant from each other. 5. *C. canescens*
 4. Younger, not yet glabrate leaves tomentellous to tomentose all over the undersurface, mature ones but slightly or tardily glabrescent.
 6. Younger leaves \pm appressedly tomentellous on the intervenium beneath, *i.e.* covered there exclusively with minute, \pm flattish stellate hairs.
 7. Younger leaves densely covered with minute stellate hairs on the whole undersurface in a coherent layer, and besides more laxly set with stellate-fascicled and darker (generally rusty) hairs on nerves, veins and veinlets 6. *C. kebarensis*
 7. Younger leaves on the undersurface set with dense minute stellate hairs, which form a coherent pale layer, other larger and/or darker stellate-fascicled hairs very few, or mostly absent.

- 8. Leaves regularly serrate in the upper 2/3, with (15-)17-20 pairs of lateral nerves.
- 8. Leaves subserrate to entire, with 10-14 (rarely up to 15) pairs of lateral nerves.
- 9. Petals 2-2.2(-2.5) mm. 8. *C. tomentella*
- 9. Petals (3.5-)4(-5) mm. 9. *C. arfakana*
- 6. Younger leaves ± erectly tomentulose or tomentose on the intervenium beneath, i.e. covered there with minute and more coarse stellate (suberect), or with minute stellate and coarse (± erect) fascicled hairs.
- 10. Racemes generally more slender and elongate (flowers ± laxly arranged), and tomentellous by minor stellate, rather flattish hairs. 10. *C. longispicata*
- 10. Racemes generally more robust and shorter (flowers ± densely arranged) and tomentulose to tomentose by a combination of minor stellate and robust, ± erect fascicled hairs.
- 11. Pedicels 1-2 mm at anthesis. Style 1-1.5 mm at anthesis, hardly 2 mm in fruit. Lateral nerves of leaves ± inarching before the margin 11. *C. papuana*
- 11. Pedicels 2-3(-5) mm at anthesis. Style 2.5-3 mm at anthesis, 3-4 mm in fruit. Lateral nerves of leaves ± excurrent along the margin.
- 12. Ovary tomentose by long erect hairs. 12. *C. pulgarensis*
- 12. Ovary tomentulose by short hairs. 13. *C. pachyphylla*

1. *Clethra sumatrana* J. J. S. Ic. Bog. 4, 1 (1910) t. 319; MERR. Philip. J. Sc. 14 (1919) 248; DOCT. v. LEEUWEN, Zoococcid. Neth. Ind. (1926) 439, f. 825 & 826; METCALFE & CHALK, Anat. Dicot. 2 (1950) 838, f. 192, F-G (anat.); SLEUM. Bot. Jahrb. 87 (1967) 77. — *C. pulcherrima* RIDL. J. Mal. Br. R. As. Soc. n. 87 (1923) 75; MERR. Contr. Arn. Arb. 8 (1934) 121. — *C. longipedicellata* MERR. Pap. Mich. Ac. Sc. 19 (1934) 179. — *C. pubifolia* MERR. l.c. 180; BURRET, Notizbl. Berl.-Dahl. 15 (1940) 188, in text.

Much-branched shrub, or tree with erect or crooked trunk and a dense crown, (3-)5-15 (rarely up to 25) m; bark whitish. Branchlets stoutish, younger parts covered with a rusty stellate tomentum maybe mixed with simple hairs, early glabrescent. *Leaves* lanceolate to oblong- or obovate-elliptic, apex shortly acutely acuminate, base cuneate, thin-coriaceous, young ones covered with a thick tomentum of rusty to rufous shorter stellate and longer fascicled hairs at least on midrib and nerves, older ones mostly rather persistently so by both or but one type of these hairs on the entire undersurface or only on midrib, nerves and maybe veins, generally distantly serrate with callose teeth especially in the upper part of the lamina, rarely subentire or entire, reddish when young, dark green at maturity, 4-11(-15) by (1.5-)2-4.5(-8) cm, nerves in 8-13 pairs, curved-spreading, slightly raised beneath as are the transverse veins, reticulation not conspicuous in general; petiole 6-12(-15, rarely up to 30) mm. *Racemes* elongate, erect-ascending, 8-30 cm, usually solitary and terminal, more rarely also from the axil of 2 or 3 upper leaves, the latter mostly normal in size and ± persistent, rarely reduced and caducous during anthesis, covered by the same, but generally more dense and more persistent indumentum found in the branchlets and leaves. Pedicels rather slender, 3-10 mm (in fruit 10-20 mm), bracts lanceolate-linear, caducous, 8-15 by 1-2.5 mm. *Calyx lobes* subovate or ovate-oblong, subacute, rusty-tomentellous or -tomentose in the upper part inside and all over outside, the fascicled hairs few to numerous, (4-)5-6(-8)

by 2-3 mm. *Petals* obovate, erose-crenulate at apex, glabrous, white-creamy to pinkish, (5-)6-7 (-9) by 4-5(-6) mm. Filaments linear, glabrous at both ends, longish and subappressedly hirsutulous between, 4-5 mm; anthers oblong, 1.5-2(-2.5) mm, base extended into an acute triangular appendix. *Ovary* subappressed-hirsute; style slender, glabrous or with a few hairs at the very base, 6-7 mm at anthesis, 8-12 mm in later stages, apex thickened and very shortly trilobed at anthesis, rarely more deeply so in fruit. *Capsule* subglobose, hirsutulous, 4-5 mm ø. *Seeds* sub-obovoid-oblong or subtrigonus, variously compressed, c. 1.5 mm.

Distr. *Malesia*: Sumatra (Atjeh, Eastcoast, Tapanuli, in the Westcoast Res. only at Brani near Bukit Tinggi).

Ecol. In primary and secondary forest, also in *Pinus merkusii* forest, (390-)900-3000(-3300?) m. *Fl. fr.* Jan.-Dec.

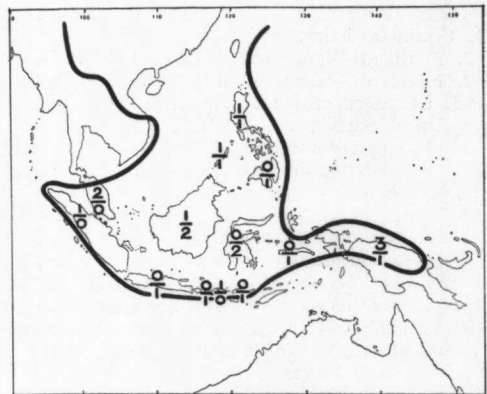


Fig. 2. Distribution of *Clethra* in Malesia and adjacent SE. Asia. The number above the hyphen indicates the number of endemic species, that below the hyphen the number of non-endemic species in each island or district.



Fig. 3. *Clethra hendersonii* SLEUM., Mt Berembán, 1720 m, Malay Peninsula, Cameron Highlands (SLEUMER 4675) (SLEUMER, 1963).

Vern. *Kumbawang*, Karo, *bodi-bodi*, *boli-boli*, *darik-darik*, *hau si martadjau*, *simar darih-darih*, Toba.

2. *Clethra hendersonii* SLEUM. Bot. Jahrb. 87 (1967) 79. — *C. canescens* (non REINW. ex BL.) RIDL. J. Fed. Mal. St. Mus. 6 (1915) 158. — Fig. 3.

Slender, small or medium-sized, few-branched tree; bark rather smooth, greyish, minutely longitudinally fissured. Branchlets rather slender, dilutely rusty-stellate-tomentellous distally. *Leaves*

elliptic-oblong or elliptic, sometimes subovate-elliptic, apex shortly acuminate, base cuneate and slightly inequilateral, subcoriaceous, dark green and dull above, paler and shining below, flush reddish, denticulate-serrulate, 8–10(–12) by 4–5.5(–6) cm, young ones stellate-puberulous, early glabrate above, set with sparse simple hairs at midrib and moreover \pm laxly with small stellate hairs at midrib, nerves and veins below, mature ones finally glabrous, nerves (10–)11–13 pairs, curved-ascendent, raised beneath, reticulation faint; petiole rather slender, 1.5–2.2 cm. *Racemes* 2

or 3(-5), subdensely set with flowers, up to 22 cm, tomentellous by rusty-brownish simple and paler stellate hairs in all parts. Pedicels rather robust and 3-4 mm (in fruit 6-7 mm), bracts subulate, 3-4 mm, caducous. *Calyx lobes* oblong, 4-5 by 2 mm. *Petals* obovate, apex erose, spreading, white, slightly fragrant, glabrous on both faces, sparsely fimbriate, (5-)6-7 by (3-)4-5 mm. Filaments laxly set with longish hairs, 5(-6) mm; anthers narrowly obcordate, base acute, 1.8 mm. *Ovary* subsericeous-tomentose; style glabrous, shortly trilobed, 5-6 mm in anthesis, 7 mm in fruit. *Capsule* depressed-globose, 4 by 5 mm, subtended by the spreading sepals, *Seeds* oblong-ovoid, c. 1.5 mm.

Distr. *Malesia*: Malay Peninsula (Pahang: Cameron Highlands and Mt Tahan; Selangor: Mt Nuang).

Ecol. Scattered in forest, often on ridges or summits, 1340-1740 m. *Fl.* April-July.

3. *Clethra symingtonii* SLEUM. Bot. Jahrb. 87 (1967) 80.

Shrub. Tips of branchlets and innovations shortly rufous-villous. *Leaves* elliptic-oblong, apex shortly subacutely attenuate, base cuneate, very base sometimes obtuse, slightly inequilateral, coriaceous, young ones early glabrate above, ± densely set with rather large stellate hairs on midrib, nerves and veins beneath as are the petioles, mature ones persistently so, 6-9 by (2.5-)3-4 cm, glandular-subseriate-denticulate in the upper, entire in the lower part, nerves in 9-10 pairs excurrent along the edge, well-raised beneath, veins transverse and prominent beneath, reticulation visible; petiole 2-3 cm. *Racemes* terminal and from the upper 3 or 4 axils (which are mostly defoliate in flowering time) close together forming a panicle, all over with a rusty, almost villous tomentum of numerous longer crisp fasciated and shorter stellate hairs; rachis robust. Pedicels thickish, 2-3 mm (in fruit 5-6 mm), bracts subulate, caducous, 3 mm. *Calyx lobes* oblong, c. 5 by 2.5 mm. *Petals* obovate, apparently cup-like converging, quite glabrous, white, scented, 6 by 3 mm. Filaments laxly long-hairy; anthers narrow-obcordate, base acute, 2 mm. *Ovary* densely set with erect hairs; style subappressedly hairy in its lower third, glabrous for the rest, 5 mm (in fruit 6 mm), stigma shortly 3-lobed. *Capsule* subglobose, c. 4 mm ø.

Distr. *Malesia*: Malay Peninsula (Perak: G. Kerbau For. Res.), once found.

Ecol. On open ridge top, 1830 m, not common. *Fl. fr.* July.

4. *Clethra javanica* TURCZ. Bull. Soc. Nat. Moscou 36, ii (1863) 232; KOORD. Album Natuurmonum. Ned. Ind. ser. 1 (1918) 3, pl. 9 (phot.); Bull. Jard. Bot. Btzg III, 1 (1919) 148, t. 10; BACK. Bekn. Fl. Java (em. ed.) 7 (1948) fam. 161, p. 1; BACK. & BAKH. f. Fl. Java 2 (1965) 178; SLEUM. Bot. Jahrb. 87 (1967) 83. — *C. canescens* (non REINW. ex BL.) MIQ. Fl. Ind. Bat. 2 (1859) 1056, p.p.; KOORD. Jungh. Gedenkb. (1910) 184;

Exk. Fl. Java 3 (1912) 1, p.p.; BACK. Bull. Jard. Bot. Btzg II, 12 (1913) 11; J. J. S. in K. & V. Bijdr. 13 (1914) 85, as to descr. — *C. sp.* ZOLL. Syst. Verz. 2 (1854) 138, p.p.

var. javanica.

Small tree, 3-6(-10) m, trunk up to 15 cm ø, often crooked, or much branched shrub, 2-5 m; branches up to 5 cm ø. Branchlets rather robust, covered distally with a rusty hirsute or almost lanate tomentum as are the petioles. *Leaves* lanceolate to oblong-elliptic, sometimes partly obovate in the same specimen, apex shortly acuminate, base cuneate, subcoriaceous, dark green, shining and glabrous above, much paler beneath, and set there still towards the maturity with both longish simple or fasciated rufous and fewer minor stellate hairs on midrib and nerves, whereas the veins bear only scattered stellate hairs and the intervenium is glabrous, finally glabrescent, (5-)6-10(-13) by 2.5-4(-6) cm, rather regularly and deeply (1.5-2 mm) serrate, nerves (15-)17-20(-23) pairs, spreading, ± approximate and subparallel, rather straight from the midrib and partly forked before the edge, ± sharply prominent beneath, veins transverse, ± raised beneath too; petiole robust, 1(-1.5) cm. *Racemes* panicle or subumbellate, rachis and pedicels covered with a floccose and rusty, almost hirsutulous tomentum, 5-10(-14) cm, flowers rather densely arranged, subpatent. Pedicels rather thickish, 3-5(-6) mm, bracts subulate, 2-4(-6) mm, caducous. *Calyx lobes* ovate-oblong, subacute, dorsally a little keeled and stellate-tomentellous, fimbriate, (4-)4.5-6 by 2.5 mm. *Petals* obovate, apex slightly erose, thin, glabrous, white or pinkish, (5-)6-7 by c. 3 mm. Filaments glabrous, 2.5 mm; anthers obcordate, base subacute, 1.3 mm. *Ovary* shortly rufous-hirsutulous; style glabrous, 3-3.5 mm, apex shortly trilobed. *Capsule* subglobose, 2.5-3 mm ø, pedicel elongate to 10 mm, style slender, 3.5-4 mm. *Seeds* ovoid, subtrigonal or variously compressed, 0.5-0.8 mm.

Distr. *Malesia*: East Java (Mt Jang).

Ecol. In mixed primary forest edges, 1830-2300 m. *Fl. fr.* April-Oct.

var. lombokensis SLEUM. Bot. Jahrb. 87 (1967) 84. — *C. canescens* (non REINW. ex BL.) MIQ. Fl. Ind. Bat. (1859) 1056, p.p. — *C. sp.* ZOLL. Syst. Verz. 2 (1854) 138, p.p.

Leaves very similar to those of *var. javanica*, but thinner, young ones on the undersurface sparsely clothed with fasciated hairs at midrib and nerves, and with stellate ones at the veins, becoming almost completely glabrous at maturity, up to 15 by 5 cm, more deeply (up to 4 mm) and more irregularly serrate.

Distr. *Malesia*: Lesser Sunda Islands (Lombok), in montane forest and *Casuarina* bush of Mt Rindjani, 1700-2400 m.

Ecol. On dry soil of volcanic debris. *Fl.* June-Aug.

5. *Clethra canescens* REINW. ex BL. Bijdr. (1826) 863; G. DON, Gen. Syst. 3 (1834) 842; MIQ. Fl. Ind. Bat. 2 (1859) 1056, p.p.; Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 41; KOORD. Minah. (1898) 515; SARASIN, Reisen Celebes 1 (1905) 29, in text.; J. J. S. Ic. Bog. 4 (1910) 61, t. 318; KOORD.-SCHUM. Syst. Verz. 3 (1914) 100; KOORD. Bull. Jard. Bot. Btzg III, 1 (1919) 148, in text.; *ibid.* III, 2 (1920) 255; VON MALM in Fedde, Rep. 34 (1934) 284; SLEUM. Bot. Jahrb. 87 (1967) 85.

KEY TO THE VARIETIES

1. Racemes and pedicels \pm robust. Petals 3–4 mm.
2. Leaves early glabrescent; nerves starting from the midrib at an \pm acute angle.
 1. *var. canescens*
 2. Leaves with more persistent minute rusty stellate hairs underneath; nerves starting from the midrib at \pm right angles.
 2. *var. luzonica*
1. Racemes and pedicels slender or almost so.
3. Leaves underneath on midrib, nerves and veins more laxly to rather densely clothed with subsistent rather large stellate hairs. Petals 3–4 mm. 3. *var. clementis*
3. Leaves underneath on midrib and nerves, rarely on veins, laxly set with fascicled and/or minute stellate hairs, early glabrescent, or young ones already subglabrous.
4. Racemes generally elongate, rather dense-flowered. Petals 2–3 mm. 4. *var. novoguineensis*
4. Racemes generally short, rather lax-flowered. Petals (3–)4 mm. 5. *var. ledermannii*

1. *var. canescens*.

Tree up to 20 m, bole up to 40 cm ϕ , covered with greyish bark; at higher altitudes a shrub, 2–5 m. Branchlets covered with a woolly-floccose rufescent, later greyish tomentum at the tips. *Leaves* elliptic or obovate-elliptic, apex shortly subacutely acuminate, base cuneate, thin-coriaceous, entire below, regularly serrate with callose teeth c. 1 mm long, younger ones glabrous above, \pm densely set with minute stellate \pm rusty hairs on midrib, nerves, veins and veinlets, and with sparse, longer simple or fascicled hairs on the midrib beneath, glabrous on the intervenium beneath, mature ones glabrescent, generally (4–)5–8(–11) by (2–)2.5–4 cm, at higher altitudes constantly smaller, (2.5–)3–5(–6) by (1–)1.5–2 cm, nerves 10–12 (rarely up to 15) curved-ascending pairs, which rather distinctly inarch before the edge, veins slightly prominent, veinlets rather inconspicuous beneath; petiole \pm robust, 0.6–1.2(–1.5) cm. *Racemes* few to several, forming an erect panicle, all over covered with a floccose-lanate, \pm rusty or finally greyish tomentum, 6–12(–16) cm, the numerous flowers rather laxly set along the thickish rachis. *Pedicels* robust, (3–)4–5 mm at anthesis, up to 6 mm in fruit, bract subulate, up to 6 mm, caducous. *Calyx lobes* ovate-oblong, rather abruptly acuminate, long-ciliate, pale rusty-floccose dorsally, 3–4 mm. *Petals* obovate, crenulate all along the margin,

glabrous, white (or suffused with red initially), with a rather unpleasant smell, 3–4 by c. 2 mm. Filaments glabrous, c. 2.5 mm; anthers broad-obovate, base almost mucronate, 0.8 mm. *Ovary* villous; style glabrous, 3–3.5 mm (in fruit 3.5–4 mm), very shortly trilobed. *Capsule* subglobose, tomentulose, 2.5 mm ϕ . *Seeds* irregularly ovoid-angular, 0.8–1 mm.

Distr. Malesia: Celebes, Lesser Sunda Islands (Flores); slightly different forms in the Moluccas (Buru, Ceram and Ambon).

Ecol. A tree in mountain forest or forest edge, ascending into more open summit vegetation and shrub-like there, sometimes on volcanic tuff, rather common locally, (1160–)1400–2800(–3000) m. *Fl. fr.* Jan.–Dec.

Vern. Kaju parang, M, *madausip*, Ts. (Minahasa), *pitjisan djabong*, Makassar.

2. *var. luzonica* (MERR.) SLEUM. Bot. Jahrb. 87 (1967) 88. — *C. luzonica* MERR. Publ. Gov. Lab. Philip. n. 29 (1905) 38; Philip. J. Sc. 5 (1910) Bot. 371; En. Philip. 3 (1923) 242.

Leaves elliptic, more rarely oblong-elliptic, apex shortly subacutely acuminate, sometimes more obtuse, base broadly cuneate to obtuse, subcoriaceous, younger ones laxly set with minute stellate hairs above, densely clothed with rather small floccose stellate hairs on the prominent midrib and nerves, and more laxly so on the veins beneath, glabrous on the intervenium, moreover sparsely set with longer simple or fascicled hairs on midrib and nerves beneath, mature ones glabrescent first above, tardily beneath, subentire or minutely (rarely more deeply) serrate, (3.5–)4–7(–10) by (1.5–)2–4(–5) cm, nerves 10–12(–14) pairs, curved, rather approximate, \pm parallel and anastomosing; petiole rather robust, 0.3–1(–1.3) cm. *Racemes* panicled or almost umbellate, 3–6(–11) cm, covered with a tomentum of small dark-rusty stellate floccose hairs; flowers \pm dense along the thickish rachis. *Pedicels* robust, 1(–2) mm, slightly accrescent in fruit, bract subulate, caducous, 3–4 mm. *Petals* white or cream, irregularly erose at apex, 3–3.5 mm.

Distr. Malesia: Philippines (Luzon: Mountain Prov.; Isabela Prov.).

Ecol. In montane *Pinus insularis*, *Quercus* or *Podocarpus* forest, also in mossy forest or in shrubby summit vegetation, 1220–2250(–2700?) m, rather common locally. *Fl. fr.* Jan.–Dec.

Vern. Amog, kamueg, Ig., *apiit*, Bon.

3. *var. clementis* (MERR.) SLEUM. Bot. Jahrb. 87 (1967) 86. — *C. clementis* MERR. Philip. J. Sc. 13 (1918) Bot. 104; En. Born. (1921) 460. — *C. canescens* (non REINW. ex BL. s. str.) STAPF, Trans. Linn. Soc. Bot. 4 (1894) 198; GIBBS, J. Linn. Soc. Bot. 42 (1914) 105.

Leaves oblong-lanceolate to oblong, apex acutely acuminate, base cuneate-attenuate, thinly subcoriaceous, younger ones first stellate-hairy, early glabrescent above, \pm densely set with fascicled and stellate, rather coarse hairs at midrib and nerves beneath, laxly or hardly so at the veins,

intervenium glabrous, mature ones quite glabrous and a little shining above, glabrescent first at the veins, more tardily so at midrib and nerves beneath, subtire or shallowly glandular-serrate, (6-)7-14 by (1.5-)2-3(-3.5-4) cm, nerves (10-)12-14 pairs, curved-ascending towards the edge, rather indistinctly inarching there, prominent beneath, veins but slightly raised beneath; petiole slender, 1-1.5(-2) cm. *Racemes* paniced, slender, 10-20 cm, covered with a dilutely rusty tomentum of both smaller and larger stellate and/or fascicled hairs; flowers rather densely arranged along the robust rachis. Pedicels slender, 1-2 mm (in fruit c. 3 mm). *Petals* erose-fimbriate at apex, 3-4 mm.

Distr. *Malesia*: Borneo.

Ecol. Generally in mountain (also mossy) forest or on forest edges, rarely in lowland (apparently secondary) forest, locally common, especially on Mt Kinabalu, (30-)700-1200(-1830) m. *Fl. fr.* Jan.-Dec.

Vern. *Kalintuhan, mitindike, Dusun.*

4. *var. novoguineensis* (KANEH. & HATUS.) SLEUM. Bot. Jahrb. 87 (1967) 90. — *C. longispicata* J. J. S. *var. novoguineensis* KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 474, f. 3. — *C. lancifolia* TURCZ. Bull. Soc. Nat. Moscou 36, ii (1863) 231; MERR. Philip. J. Sc. 1 (1906) Suppl. 111; *ibid.* 2 (1907) Bot. 292; En. Philip. 3 (1923) 242. — *C. alnifolia* (non L.) BLANCO, Fl. Filip. ed. 2 (1845) 259; ed. 3, 2 (1878) 117; MERR. Sp. Blanc. (1918) 297. — *C. canescens* (non REINW. ex BL. s. str.) F.-VILL. Novis. App. (1880) 121; VIDAL, Sinopsis Atlas (1883) 30, t. 60, f. B; Phan. Cuming. Philip. (1885) 123; Rev. Pl. Vasc. Filip. (1886) 172; MERR. En Philip. 3 (1923) 242. — *C. williamsii* C. B. ROB. Bull. Torr. Bot. Cl. 35 (1908) 73, 75. — *C. castanea* ELM. Leaf. Philip. Bot. 9 (1934) 3182.

Leaves lanceolate to oblong, apex shortly subacutely acuminate, base \pm cuneate, younger ones glabrous above, more densely or laxly set with longish simple or fascicled, \pm appressed pale rusty hairs on midrib and nerves, \pm laxly and minutely stellate-hairy on veins beneath, mature ones gradually glabrescent, finally sometimes quite glabrous, shortly or rarely more deeply and distantly serrate in the upper part, occasionally subtire, (4-)5-10 (-14, rarely -17) by (1.5-)2-3.5(-4.5, very rarely -8) cm, nerves (8-)10-14 (rarely -16) pairs, curved-ascending, \pm joined before the edge, raised beneath, veins often obscure though a fine reticulation is visible; petiole rather slender, 0.5-1(-1.8) cm. *Racemes* paniced, (4-)6-15(-24) cm, flowers rather dense along the \pm slender rachis, covered with a tomentum of longer, fascicled rusty and minor pale stellate hairs (rarely only with the latter ones). Pedicels generally rather slender, rarely more robust, 1-2 mm (in fruit 2-3 mm). *Petals* irregularly erose-crenulate mainly at apex, (2-)2.5(-3) mm.

Distr. *Malesia*: SE. Celebes, Philippines (Batan Is, Luzon, Mindoro, Samar, Leyte, Biliran, Negros, Mindanao, Catanduanes), NW. New Guinea.

Ecol. In the Philippines and in Celebes in mountain (also mossy) forest, mainly on ridges and peaks, (400-)700-2100 m, in New Guinea in open beach forest and in savannah-like thickets on dry hill (300 m) near the coast, presumably mainly in secondary vegetation. *Fl. fr.* Jan.-Dec.

Vern. *Alibuñog, C. Bis., kalyapi, kayat-buntót, Bag., kamog, Ilk., kamueg, Ig., malaklak, Tag., maratuñgau, Ibn., tagobahi, P. Bis., mayaorin, Batan.*

5. *var. ledermannii* (SCHLTR) SLEUM. Bot. Jahrb. 87 (1967) 87. — *C. papuana* SCHLTR, Bot. Jahrb. 52 (1915) 219, non J. J. S. 1914. — *C. ledermannii* SCHLTR, *ibid.* 55 (1918) 194.

Leaves lanceolate-elliptic to lanceolate, apex acutely acuminate, base cuneate, thin-subcoriaceous, younger and submature ones glabrous above, set with sparse rather coarse rufescent simple or fascicled and/or finer stellate hairs on midrib and nerves, hardly at veins beneath, intervenium glabrous, mature ones almost completely glabrous, rather sharply serrate in the upper part, 5-8(-11) by 2-3(-4) cm, nerves 12-14(-15) pairs, \pm curved, subparallel, rather indistinctly inarching before the edge, prominent beneath, veins \pm obscure; petiole rather slender, (0.7-)1-1.5 cm. *Racemes* paniced, all over covered with a very short tomentum of brownish to greyish stellate hairs, in which a few larger fascicled hairs occur, rather lax-flowered, 5-12 cm. Pedicels rather slender, 2-3 mm (in fruit 3-3.5 mm). *Petals* erose-crenulate, (3-)4 mm.

Distr. *Malesia*: E. New Guinea (Sepik Distr.; Western Highlands).

Ecol. In mountain (also mossy) forest, and in greewoods, (200-)400-1830 m. *Fl.* June-Sept.

Vern. *Talelpi, Wapi* (Torricelli Mts).

6. *Clethra kebarensis* SLEUM. Bot. Jahrb. 87 (1967) 92. — Fig. 4.

Laxly branched shrub or treelet, 2-3(-6) m, trunk often blackish, 4-10 cm \varnothing . Branchlets distally ferruginous-tomentellous. *Leaves* obovate-oblong or -elliptic, more rarely oblong, apex \pm shortly subacutely acuminate, base cuneate, rarely obtuse or even rounded in the same specimen, subcoriaceous to firmly chartaceous, young ones very laxly stellate-hairy above, subdensely covered beneath with short, fascicled rusty hairs at midrib, and all over the under-surface with very dense minute stellate hairs, which form a pale coherent layer, moreover nerves and especially veins and veinlets set with darker rusty stellate-fascicled, tardily evanescent hairs so to say on top of the pale layer mentioned above, mature leaves dark green above, yellowish rusty beneath, early glabrescent above, tardily so beneath, generally shortly to very shortly subserrate- or crenate-dentate, (4-)6-9 by (2-)2.5-4(-5.5) cm, nerves in 14-16(-17) pairs, slightly curved or rather straight from the midrib, rather obscurely inarching, prominent below, veins but slightly raised; petiole 9-14 by c. 1 mm. *Racemes* 3-6, \pm fascicled, partly branched below, erect,

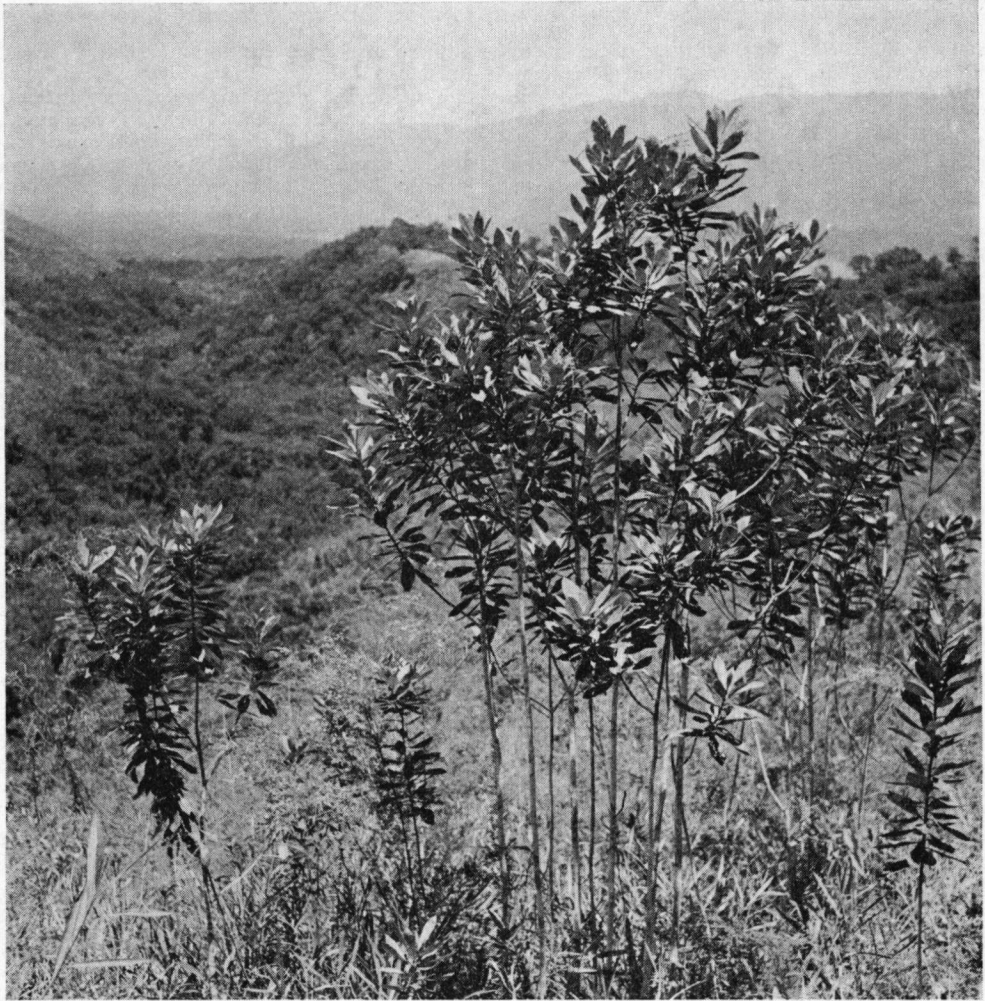


Fig. 4. *Clethra kebarensis* SLEUM., Kebar Valley, Nerto, 700 m, NW. New Guinea (VAN ROYEN & SLEUMER 6841) (SLEUMER, 1961).

dense-flowered, 6–12 cm, covered with a short, almost villous, rusty (finally greyish) pubescence of fascicled and stellate hairs; rachis rather robust. Pedicels thickish, 1–1.5 mm at anthesis, subtending bracts subovate-subulate, 2 mm, persistent for a while. *Calyx lobes* ovate, subacuminate, 2–2.5 mm. *Petals* obovate-spathulate, often connate or coherent in the lower part, crenulate, glabrous, white or cream, (2.5–)3–3.5 by c. 1.5 mm. Filaments dilated downwards, glabrous, 2(–2.5) mm; anthers obcordate, c. 0.6 mm. *Ovary* rusty-tomentulose; style glabrous, 1.2–1.5 mm (in fruit to 2.5 mm). *Capsule* subglobose, c. 3 mm ϕ . *Seeds* subtrigonus-ovoid, 0.8 mm.

Distr. *Malesia*: New Guinea (Vogelkop Peninsula).

Ecol. In patches of shrubberies within grassland or fern thickets of *Gleichenia*, or in forest edges, not rarely in periodically burned vegetation, fairly common locally, sometimes forming pure loose stands on sandy or clayey soil, 700–1200 (–1950) m. *Fl. fr.* Jan.–Dec.

7. *Clethra sumbawaensis* SLEUM. Bot. Jahrb. 87 (1967) 94.

Treelet, 4–8 m. Branchlets distally clad with a rusty rather scabrid pubescence. *Leaves* elliptic-oblong or elliptic, apex \pm shortly and acutely acuminate, base cuneate, thin-coriaceous, younger and submature ones glabrous above, subdensely set with longish simple and fascicled (or stellate) rusty hairs along midrib and nerves, sparsely so

on the veins beneath, moreover beneath all over the undersurface with a dense thin layer of minute stellate and pale (or here and there rusty), finally greyish hairs, apparently very tardily glabrescent, serrate in the upper $\frac{2}{3}$, (5)–6–9 by 2–4 cm, nerves (15–)17–20 pairs, rather straight and subparallel, in part forked distally, reticulately dissolving before the edge, raised beneath, veins transverse, slightly prominent beneath, veinlets obscure; petiole 1–1.5(–2) cm. *Racemes* rather numerous, condensed to a panicle, 5–8(–10) cm; rachis stoutish, covered with a floccose rusty kind of wool. Pedicels rather slender, with a short stellate pubescence as are the sepals, 3–4 mm, bracts subulate, tomentulose, 8–10 mm, caducous after anthesis. *Calyx lobes* ovate-acuminate, less hairy at the fimbriate margin, glabrous inside, 3 mm. *Petals* obovate, thin, white, fragrant, glabrous, minutely fimbriate-crenulate \pm all along the margin, 5 by c. 2.5 mm. Filaments glabrous, 2 mm; anthers broadly obovate, base apiculate, 1 mm. *Ovary* tomentose; style slenderly columnar, glabrous, 4–4.5 mm, shortly 3-lobed.

Distr. *Malesia*: Lesser Sunda Islands (Sumbawa: Mt Batulante; Flores: Mt Ranaka).

Ecol. In forest, (900–)1600–2400 m, on andesite soil. *Fl.* April, Oct.

8. *Clethra tomentella* ROLFE ex DUNN, Kew Bull. (1922) 185; MERR. En Philip. 3 (1923) 243; SLEUM. Bot. Jahrb. 87 (1967) 94.

Small tree or shrub. Branchlets rather slender, tips grey-tomentellous. *Leaves* lanceolate to elliptic-oblong, or oblanceolate, apex \pm shortly subacutely acuminate, base attenuate, firmly chartaceous, subentire or sometimes sparsely very shortly serrate-dentate in the upper part, younger and submature ones glabrous above, appressedly greyish-stellate-tomentellous all over beneath, mature ones glabrescent tardily, first on the intervenium, finally also almost completely along midrib and nerves, 6–9(–11) by (2–)2.5–3(–3.5) cm, nerves (10–)12–14(–15) pairs, prominent beneath, reticulation visible only in the already glabrate parts; petiole rather slender, (5–)6–10(–12) mm. *Racemes* several, paniced, laxly or more densely set with flowers, 7–14(–20) cm, covered with a short, greyish or rusty-stellate tomentum; rachis slender. Pedicels slender, c. 2 mm (c. 3 mm in fruit), bracts subulate-linear, 3–5 mm, caducous in the beginning of anthesis. *Calyx lobes* ovate-acuminate, glabrous inside in part, 1.5–2 mm. *Petals* obovate-spathulate, minutely erose apically, glabrous, white, 2–2.2(–2.5) mm. Filaments dilated towards the base, glabrous, 1 mm; anthers obovate, hardly $\frac{1}{2}$ mm. *Ovary* tomentellous; style thickish, glabrous, 1 mm, very shortly 3-lobed. *Capsule* subglobose, 2.5 mm ϕ . *Seeds* subtrigonus-ovoid, 0.7–1 mm.

Distr. *Malesia*: Philippines (Luzon: Mountain Prov. to Batangas).

Ecol. Scattered in thickets or forests on slopes, chiefly on ridges in mossy forest, 600–1800 m. *Fl.* fr. May–Sept.

Vern. *Amog*, *kamug*, *kamung*, *Ig.*, *ayusan*, Tag.

9. *Clethra arfakana* SLEUM. Bot. Jahrb. 87 (1967) 95.

Shrub or erect treelet, 2–3 m, much branched. Branchlets slender, tips rusty-tomentellous. *Leaves* obovate-oblong or -elliptic, apex shortly acutely acuminate, base cuneate, slightly inequilateral, subcoriaceous to firmly chartaceous, flush reddish, younger and mature ones dark green and glabrous above, whitish greyish below, i.e. except the sparsely hairy or subglabrous midrib and nerves covered by a short tomentum of minute stellate hairs, very tardily glabrescent, (sub)entire or shallowly dentate, (2–)3–4.5 by (1–)1.3–2 cm, more deeply dentate and up to 7.5 by 3 cm in not flowering new shoots, nerves in 10–12 pairs, \pm straight from the midrib, curved upwards, slightly prominent beneath; petiole 5–8(–10) mm. *Racemes* several, paniced, 5–7(–8) cm, rather lax-flowered, pale-rusty stellate-tomentellous in all outer parts; rachis slender. Pedicels slender, 2–3 mm, basal bracts early fugacious. *Calyx lobes* ovate-oblong, long-ciliate, 3 by 1.5 mm. *Petals* obovate-spathulate, sometimes coherent at the base, glabrous, white, shortly erose-fimbriate all along the edge, (3.5–)4(–5) by 2–2.5 mm. Filaments dilated towards the base, glabrous, 2.5 mm; anthers obovate, about 0.5 mm. *Ovary* almost hirsute; style glabrous, 1.8 mm at anthesis, hardly accrescent in fruit. *Capsule* subglobose, 2.5–3 mm ϕ . *Seeds* oval to subtrigonus, c. 1 mm.

Distr. *Malesia*: New Guinea (Vogelkop Peninsula: Arfak Mts around the Anggi Lakes).

Ecol. In edge of *Nothofagus-Myrtaceae*-forest or in more open heath formation within devastated montane forest, 2000–2600 m, common locally. *Fl.* fr. Jan.

10. *Clethra longispicata* J. J. S. Bull. Jard. Bot. Btzg III, 4 (1922) 240; SLEUM. Bot. Jahrb. 87 (1967) 96. — *C. elongata* J. J. S. Bull. Jard. Bot. Btzg III, 1 (1920) 398, t. 47, non RUSBY, 1907.

Shrub or treelet, up to 5(–12) m, trunk up to 10 cm ϕ , bark green, with shallow pale brown flakes. Branchlets and petioles rusty to greyish tomentellous. *Leaves* oblong-lanceolate to elliptic-oblong, more rarely elliptic, apex rather shortly acuminate and subacute, base cuneate, rarely almost obtuse, inequilateral, subcoriaceous, younger ones glabrous above, covered all over beneath by a coherent tomentum of minor stellate cinnameous to greyish hairs, and of larger stellate hairs so to speak on top of that layer, mature ones tardily glabrescent beneath, furthermore sometimes with sparse fasciated hairs on the midrib beneath, (4.5–)6–11 by (1.7–)2–3.5(–4) cm, callose-denticulate or subentire, nerves 10–12(–14) pairs, generally starting at an acute angle, curved-ascending towards the edge, a little impressed above, prominent beneath, veins distinctly, veinlets rather inconspicuously raised beneath; petiole 0.6–1.3(–1.6) cm. *Racemes* paniced, rather slender, (15–)20–30(–35) cm, laxly many-flowered, with a short stellate tomentum, in which also some fasciated hairs may be found. Pedicels slender or almost so, 2–3 mm (to 4 mm in fruit),



Fig. 5. *Clethra papuana* J. J. S., Kebar Valley, Mt Nettoti, 1900 m, NW. New Guinea (VAN ROYEN & SLEUMER 7449) (SLEUMER, 1961).

bracts subulate, caducous. *Calyx lobes* narrowly ovate-subdeltoid, 1.5–2(–2.5) mm. *Petals* partly connate at base, broadly spatulate, crenulate, glabrous, white, scented, c. 3 by 1.5 mm. Filaments glabrous, 1.5 mm; anthers obcordate, 0.5 mm. *Ovary* appressedly hairy; style glabrous, c. 1.7 mm (to 2 mm in fruit), very shortly 3-lobed. *Capsule* subglobose, c. 2.5 mm \varnothing . *Seeds* convex-ovoid, 0.7 mm.

Distr. Malesia: Borneo, Philippines (Palawan) and Central Celebes.

Ecol. Generally in mountain forest, also in secondary vegetation, on clayey ground, (60–) 500–1525 m. *Fl.* Jan.–Dec.

Vern. Pongo, Toradja, lang, Iban, garapoi, Dusun.

11. *Clethra papuana* J. J. S. Nova Guinea 12 (1914) 169, t. 53; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 476; SLEUM. Bot. Jahrb. 87 (1967) 97. — Fig. 5.

var. papuana.

Shrub or treelet, (1–)3–6(–8) m, more rarely a tree up to 15 m, bole up to 10 m by 30 cm. Branchlets at tips rusty subvillous-tomentose. *Leaves* elliptic or obovate-elliptic, sometimes oblong-elliptic, rarely elliptic-lanceolate, apex shortly subacutely acuminate, rarely rather blunt (more acutely acuminate in sterile shoots), base inequilateral, broadly cuneate to subtruncate-obtuse, coriaceous, firm, younger ones with stellate and fascicled hairs mainly along midrib

and nerves above, clothed all over beneath by a dark rusty subvillous tomentum formed by stellate and fascicled hairs, mature ones glabrate above, dark green in the fresh state there, under-surface rusty- to greyish- or (almost silvery-) tomentulose (the large fascicled hairs having mostly disappeared by then), entire or shortly irregularly serrate-dentate (more deeply and sharply serrate in sterile shoots), (4-)5-8(-12) by 2-4 (-5.5) cm, variable in size even in the same specimen, sometimes microphyllous, nerves 12-14 pairs, much spreading, \pm inarching at or a little before the edge, well raised beneath, veins not much conspicuous beneath, reticulation faint; petiole rusty-tomentulose, (1-)1.2-1.6(-1.8) cm. *Racemes* paniced, erect, all over rusty-tomentose, flowers generally densely arranged, rarely up to 15 cm; rachis robust. Pedicels thickish, 1-2 mm (up to 4 mm in fruit), bracts thickish, subulate, caducous. *Calyx lobes* oblong-ovate, 3-3.5(-4) mm. *Petals* not rarely connate or coherent at base, obovate-spathulate, edge slightly erose, white, sometimes pale cream or suffused with red, glabrous, slightly scented, c. 3.5 by 2 mm. Filaments glabrous, hardly 2 mm; anthers \pm obcordate, 0.8 mm. *Ovary* almost villous; style glabrous, shortly trilobed, (1-)1.2-1.5 mm (hardly 2 mm in fruit). *Capsule* subglobose, c. 3 mm \varnothing . *Seeds* ovoid-oblong, irregularly angular, 0.8-1 mm.

Distr. *Malesia*: NW. New Guinea (Vogelkop Peninsula: Kebar Valley and Arfak Mts).

Ecol. In (mossy) *Nothofagus*-Conifer-forest edge or in open heath vegetation on crest, 1800-2600 m. *Fl.* Oct.-Jan.

var. trichostyla SLEUM. Bot. Jahrb. 87 (1967) 98.

Petals (3 mm) laxly hairy along the edge. Style set with a few appressed hairs at base. Otherwise as *var. papuana*.

Distr. *Malesia*: W. New Guinea (Wissel Lakes area), once found.

12. *Clethra pulgarensis* ELM. Leaf. Philip. Bot. 5 (1913) 1757; MERR. En. Philip. 3 (1923) 243; SLEUM. Bot. Jahrb. 87 (1967) 99.

Low, stunted tree, or shrub-like; branches ascending, rigid, covered with brown bark. Branchlets short, rather robust, short-hairy. *Leaves* oblong to subobovate-elliptic, apex shortly attenuate or subacuminate, base broadly cuneate, the very base often obtuse, subcoriaceous, firm, younger ones very densely shortly stellate-hairy above, covered all over beneath with a tomentum of minor and larger stellate, brownish greyish hairs, large fascicled hairs on petiole and midrib below few or absent, mature ones glabrous and a little shining above, rather persistently greyish tomentulose beneath, finely serrate-dentate in the upper part, tips of the serratures usually callose, 5-8 by (2-)2.5-4 cm, midrib bold beneath, nerves in 9-11(-12) pairs, curved, excurrent or divided

along or before the edge, raised beneath, reticulation rather faint; petiole 0.5-1 cm by c. 2 mm. *Racemes* paniced, (8-)10-15 cm, covered with a fulvous-greyish tomentum of stellate and fascicled hairs; rachis stoutish. Pedicels robust, 2-3(-5) mm, bracts subulate, caducous. *Calyx lobes* ovate-oblong, 4-5 by 2(-2.5) mm. *Petals* obovate-spathulate, minutely crenulate at apex, white, glabrous, (4-)5(-6) by c. 2.5 mm. Filaments glabrous, 3 mm; anthers obcordate, 1 mm. *Ovary* longish erect-tomentose; style thickish, glabrous, (2.5-)3 mm (3-4 mm in fruit), shortly 3-lobed. *Capsule* depressed-globose, c. 3 mm \varnothing . *Seeds* oval, 1 mm.

Distr. *Malesia*: Philippines (Palawan), in low woody vegetation on summit of Mt Pulgar near Puerto Princesa, 1200 m. *Fl. fr.* May.

13. *Clethra pachyphylla* MERR. Philip. J. Sc. 13 (1918) Bot. 103; En. Born. (1921) 460; SLEUM. Bot. Jahrb. 87 (1967) 99. — Fig. 1.

Shrub or mostly small tree, 2-4(-10) m high, trunk up to 20 cm \varnothing , laxly branched, branches obliquely ascending to almost horizontal. Branchlets robust, rufous-ferruginous-tomentose at apex. *Leaves* oblong or obovate-oblong, more rarely oblong-elliptic or elliptic, apex shortly subacutely acuminate, base cuneate, coriaceous, firm, younger ones subdensely floccose- or subvillous-stellate-hairy above, all over beneath with a tomentum of minor pale stellate hairs and a more coarse one of major stellate and fascicled, initially rusty, finally greyish hairs, midrib and nerves mainly with major fascicled hairs, entire or more rarely and but in part irregularly serrulate, 4-9(-14) by (2-)2.5-3.5(-4, -5) cm, midrib bold beneath, nerves (9-)10-12(-13) pairs, prominent beneath, curved and \pm excurrent at the edge, veins slightly raised beneath, reticulation more distinct but in \pm mature leaves; petiole 1.2-1.5(-1.8) by 1.5-2 mm. *Racemes* paniced, rather dense-flowered, robust, all over villous or almost so by minor and major stellate and coarse fascicled rusty hairs, 5-10(-12) cm; rachis stout. Pedicels thickish, 2-3(-4) mm, bracts subulate, 4-5(-8) mm, caducous. *Calyx lobes* oblong-ovate, subacuminate, (3.5-)4-5 mm. *Petals* spathulate to spathulate-oblong, irregularly erose or crenulate at apex, white to cream, scented, glabrous, (3-)4(-5) by 2.5-3 mm. Filaments glabrous, 2-2.5 mm; anthers subobovate, 0.8-1 mm. *Ovary* short-tomentulose; style thickish, glabrous, 2.5-3 mm (3.5-4 mm in fruit), shortly 3-lobed. *Capsule* depressed-globose, 3 mm \varnothing . *Seeds* subtrigonal, 1-1.2 mm.

Distr. *Malesia*: NE. Sarawak (Mt Murud area) and North Borneo (Mt Kinabalu).

Ecol. Scattered in *Quercus havilandii* and *Tristania* forest, still not too rare in mossy *Leptospermum-Dacrydium* forest, also in secondary vegetation, (870-)1200-2500(-3050) m, on poor soil. *Fl. fr.* March-Oct.