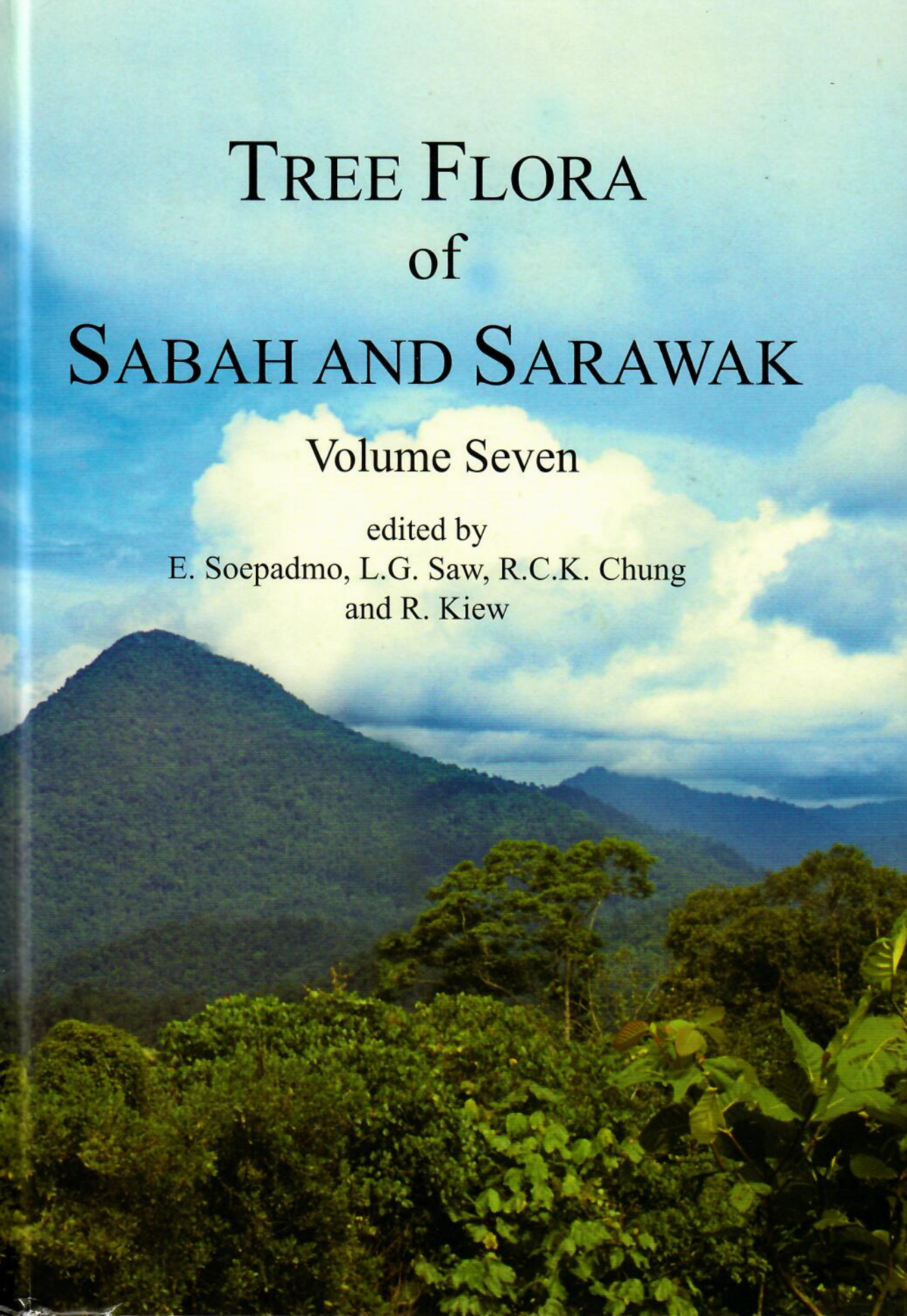
# TREE FLORA of SABAH AND SARAWAK

## Volume Seven

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



# Tree Flora of Sabah and Sarawak

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**THE GOVERNMENT OF MALAYSIA UNDER THE NINTH MALAYSIAN PLAN**

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

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Front cover: Hill mixed dipterocarp and lower montane forests enroute to the Usun Apau Plateau in Belaga district, Sarawak. (Photograph by E. Soepadmo.)

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

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# MYRTACEAE *s.l.*

**P.S. Ashton**

Arnold Arboretum, Harvard University Herbaria, Cambridge, Massachusetts, U.S.A. and Royal Botanic Gardens, Kew, U.K.

De Jussieu, Gen. Pl. (1789) 322, *nom. cons.*; Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1081; A. de Candolle, Prodr. 3 (1828) 207; Schauer, Monogr. Myrt. Xerocarp. (1841) 1; Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 66; Miquel, Fl. Ind. Bat. 1, 1 (1855) 394; Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 462; Niedenzu *in* Engler & Prantl, Nat. Planzenfam. 3, 7 (1898) 57; King, J. As. Soc. Beng. 70, 2 (1901) 66; Merrill, EB (1921) 423; Ridley, FMP 1 (1922) 712; Merrill, Enum. Philip. Pl. 3 (1923) 154; Masamune, EPB (1942) 520; Backer & Bakhuizen *f.*, FJ 1 (1964) 333; Kochummen, TFM 3 (1978) 169; J.A.R. Anderson, CLTS (1980) 272; Ashton *in* Dassanayake & Fosberg (eds.), Rev. Handb. Fl. Ceylon 2 (1981) 403; Johnson & Briggs, Ann. Missouri Bot. Gard. 71 (1985) 700; Tobe & Raven, Amer. J. Bot. 74 (1987) 197, Bull. Bot. Acad. Sin. 31 (1990) 119; Turner, Gard. Bull. Sing. 47, 2 (1996) 370; Coode *et al.* (eds.), CLBD (1996) 233; Conti & Sytsma, Amer. J. Bot. 83 (1996) 221; Corner, WSTM 4th. edition 2 (1997) 570; Argent *et al.* (eds.), MNDT-CK (1997) 463; Wilson *et al.*, Amer. J. Bot. 88 (2001) 2013; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 778; Craven *et al.*, Floribunda 2, 4 (2003) 89; Beaman & C. Anderson, PMK 5 (2004) 206; Sytsma *et al.*, Int. J. Pl. Sci. 165, 4, Suppl. (2004) S 85; Wilson *et al.*, Pl. Syst. Evol. 251 (2005) 3; Lucas *et al.*, Pl. Syst. Evol. 251 (2005) 35, Taxon 56, 4 (2007) 1105; Lucas *in* Heywood *et al.*, Flow. Pl. Fam. World (2007) 225; Chen & Craven, Fl. China 13 (2007) 321; Biffin *et al*., Ann. Bot. 106 (2010) 79; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 212.

Evergreen trees or shrubs, often (if large) with low stout buttresses and sometimes stilt roots; mostly sympodially branched, sometimes monopodially so, with astringent phenol-rich sap, generally aromatic, rich with oil glands in green tissues. **Bark** smooth to variously flaky. **Twig** pith with internal phloem. **Leaves** simple, opposite, decussate, spiral or alternate, without stipules or stipules rudimentary; blades generally leathery, mostly with pits above and gland dots or pimples beneath, variously senescing coppery red or yellow then drying grey-, red-, coppery- or olive-brown; more or less petiolate, the petiole without knee, with generally sharp or flanged edges continuing down from base of blade; venation mostly pinnate, brochidodromous, main lateral veins unequal with the main ones almost always uniting with a more or less prominent, looped intramarginal vein; intercostal venation reticulate. **Inflorescences** paniculate, racemose, sometimes cymose, reduced to congested flower-clusters or to a few-flowered structure or flowers solitary, usually terminal or axillary, occasionally rami- or cauli-florous; bracts and bracteoles caducous, paired, linear to ovate. **Flowers** bisexual (in Borneo), radially symmetrical, 4–5-merous, generally shortly pedicellate, often on prominent peduncle; hypanthium (= calyx and receptacle) generally more or less cupping the petals and stamens that are borne on a rim around or above the ovary; calyx lobes more or less distinct, basally imbricate in flower or sometimes united over the corolla into a snuffer-like cap (calyptra) and splitting at anthesis; petals generally present, often large and colourful (white, pink or sometimes yellow), usually gland-dotted; stamens generally many and forming a fluffy brush at anthesis, free or clustered, opposite petals or sepals, filaments slender or columnar, anthers yellow, dorsifixed and versatile, usually small, dehiscing laterally (in Borneo); ovary semi-inferior or sometimes inferior, 1–5-locular (in Borneo), placentation axile, each locule with 1–many anatropous or campylotropous ovules, style 1, columnar usually exceeding stamens at

anthesis, stigma small. **Fruit** crowned with a ring of persistent calyx lobes, or a rim following their loss, a 1- or few-seeded berry, or capsule with generally many small winged seeds. **Seeds:** embryo of monosporic *Polygonum*-type, eventually without endosperm; cotyledons various.

**Distribution.** About 120 genera, with 4000–5000 species, distributed throughout the tropics and areas with a Mediterranean climate, particularly in Australasia. Fourteen indigenous genera with 205 species (including 8 not fully described species of *Syzygium*) are recorded in Sabah and Sarawak.

**Ecology.** Although there are species in almost every type of habitat, including that on brackish soils, in Borneo Myrtaceae *s.l.* is particularly a family of acid organic soils. Some species are known to be ectotrophic mycorrhizal, a symbiosis which favours direct nutrient uptake through entry of fallen leaves and dissolution of cell walls by fungal hyphae. Fungal decomposition is favoured over bacterial in acid soils, and the leathery phenolic-rich leaves of this family both favours fungal breakdown and enhances leaching of the mineral soil. A remarkable 9 species or subspecies are local endemics on ultramafic rocks in Sabah which, though exceptionally rich in bases, often carry an organic surface soil of high acidity with a flora similar to that of *kerangas* on sand podsols. More information is given under the species descriptions. In Sabah, Bt. Tawai FR is particularly rich in endemic species, subspecies and ecotypes, usually sisters of others which in several cases grow nearby. This ultramafic area is of highest priority for conservation and offers unique opportunities for phylogenetic and other research. Members of this family are predominantly successional, though they comprise among the most abundant 10 families in Bornean primary forests. Few are shade tolerant and the family often becomes the leading one, in both numbers and basal area, in secondary forests especially on degraded soils.

The fluffy colourful flowers with many stamens attract bees, and in some species a variety of other insects which may successfully effecting pollination. A few species, e.g. *Syzygium malaccense* in Borneo, are visited by nectariferous bats and birds. In several predominantly understorey species of *Syzygium* the number of stamens is reduced to 15 or less, as occurs in *Garcinia* L. (Guttiferae/Clusiaceae) and *Stemonoporus* Thwaites (Dipterocarpaceae). Their pollination biology is unknown, but apomixis through adventive embryogenesis has been demonstrated in some other species.

The berry fruits vary in size: the larger fruits are dispersed by primates and the smaller ones by birds, squirrels and other arboreal vertebrates. The seeds of Bornean species with capsular fruits are winged, small and presumably dispersed by wind. It is curious too that there appears to be no higher local endemism, in our relatively windless climate, among species with capsules than those with berries. Indeed, the capsule-bearing montane *Leptospermum javanicum* and *Xanthomyrtus flavida* have successfully crossed Wallace's Line.

**Uses.** The family is best known worldwide for the spice cloves (*cengkeh*), which are the flower buds of *Syzygium aromaticum*, now widely cultivated in the seasonal wet tropics but of Moluccan provenance. Another spice, allspice (*Pimenta dioica* (L.) Merr.), originating in the Caribbean and cultivated now in the seasonal dry tropics, is used in curries and with fish preservatives. Several yield the comestible fruits including the *jambu* (*Syzygium aqueum*, *S. cumini* (L.) Skeels, *S. jambos*, *S. malaccense* and *S. samarangense*), guava or *jambu batu* (*Psidium guajava*) and surinam cherry (*Eugenia uniflora* L.). The fragrant leaves of some species (e.g., *Syzygium polyanthum*; the *daun salam*) are sun-dried and used in preparing

*sambals* and as a flavouring agent in several SE Asian dishes. (PROSEA 2 (1991) 165–167, 292–298; PROSEA 13 (1999) 176–180, 211–218, 218–219).

The timbers of the Australasian genus *Eucalyptus* are well known and many species (e.g., *E. camadulensis* Dehnh., *E. citriodora* Hook., *E. deglupta* Blume, *E. grandis* N.Hill *ex* Maiden, *E. robusta* J.E.Smith, *E. saligna* J.E.Smith and *E. torelliana* F.Muell.) are widely planted throughout the tropics, though only in a small scale in Sabah and Sarawak. The indigenous species of Myrtaceae in Borneo yield poor quality not durable timber that is used, nevertheless, as filler in plywood. The tannin-rich bark of several *Syzygium* species, the *samak*, was formerly used for tanning fishing nets, thereby increasing their durability. The volatile oil obtained from the foliage of *Melaleuca cajuputi* is still used in South Asia as stimulant and tonic, and has been used in the treatment of asthma. The attractive fluffy flowers and foliage of Myrtaceae, notably that of *Myrtus communis* L. in the Mediterranean and several species of *Eucalyptus*, *Melaleuca* and some *Syzygium* (e.g. *S. grande*), has led to their use as ornamental trees. Their successional ecology recommends them for early revegetation of degraded and fire-prone lands (PROSEA 5, 1 (1994) 200–211; 5, 2 (1995) 440–474; PROSEA 13 (1999) 126–135).

**Notes.** Myrtaceae *s.l.* are a well defined family, both morphologically and on molecular evidence, within the Order Myrtales (Conti & Sytsma *op. cit.* 1996; B. Bremer *et al.*, Bot. J. Linn. Soc. 141 (2003) 399, *ibid.* 161 (2009) 113). In Borneo, the species are recognised by their leaves that are usually with distinct intramarginal veins and petiole without a knee, usually lack of stipules, the presence of prominent gland-dots on blade beneath and pits above, the frequently aromatic smell of their living tissues, and by their astringent sap which discolours knife blades black.

The family as currently circumscribed consists of Myrtaceae *s.s.*, and the small families Psiloxylaceae and Heteropyxilaceae endemic to the Mascarene Islands in the Indian Ocean and southern Africa respectively. De Candolle (*op. cit.* 1828) early recognised two major tribes within Myrtaceae *s.s.*, consisting of those genera with capsular and those with berry fruits, and a smaller tribe containing those genera with hard indehiscent fruits, among which is *Osbornia*. Schauer (*op. cit.* 1841) reduced the tribes to two. The current classification, based on both morphological and molecular evidence (Wilson *et al. op. cit.* 2005) recognises two subfamilies (Myrtoideae and Psiloxyloideae) in the Myrtaceae *s.l.*, of which the Myrtoideae contain 17 tribes. Ten of these tribes are represented in Borneo, of which one (Eucalypteae) is exotic; they are diagnosed in the following key to tribes and genera.

Myrtaceae *s.l.*, in the Order Myrtales, are now recognised as core dicotyledonous angiosperms, paired with Geraniales in a major group known as Malvids. Its basal taxa are Gondwanan, currently Australasian but for the isolated *Psiloxylon* Thou. *ex* Tul. of Mauritius and Reunion, and *Heteropyxis* Harv. of central and southern Africa (Tobe & Raven *op. cit.* 1987 & 1990; Sytsma *et al. op. cit.* 2004; Wilson *et al. op. cit.* 2005). Molecular evidence points to a south warm temperate Gondwanan origin and early diversification with subsequent periodic long-distance dispersal, consistent with their modern distribution (Wilson *et al. op. cit.* 2005; Sytsma *et al. op. cit.* 2004; Lucas *et al. op. cit.* 2005). A recent molecular phylogenetic study (Biffin *et al. op. cit.* 2010) recognises, among our genera, *Osbornia* to have become early isolated; and all genera with dry winged seeds, except *Tristaniopsis,* to have early diverged into a separate group from the fleshy fruited genera. The fleshy fruited genera *Syzygium* in the Old World, and *Eugenia* in the New World, appear to have undergone their exceptional diversification, unmatched in any dry seeded genus, after invading the tropical rain forest.

Myrtaceae mostly share the same diploid chromosome number, 2n = 22. Polyploidy appears to be uncommon, and is mostly recorded among cultivated fruit trees: *Syzygium jambos*, 2n = 28–*c.* 42 and some *Psidium* species, 2n = 88 (Atchison, Amer. J. Bot. 34 (1947) 159).

## Key to the tribes/genera

(based on overall morphology)

1. Fruit hard but indehiscent. Calyx 8-lobed.....Tribe OSBORNEAE P.G.Wilson (**6. Osbornia**)
   Fruit a berry or capsule. Calyx 4–5-lobed.....2

2. Fruit a berry.....3
   Fruit a capsule.....10

3. Monopodially branched treelets. Inflorescence cymose. Flowers (petals) yellow; stamens *c.* 20; ovary generally 3-locular.....Tribe TRISTANIEAE P.G.Wilson (**14. Xanthomyrtus**)
   Sympodially, sylleptically branched trees. Inflorescence racemose or reduced to congested flower-clusters or to few-flowered clusters or flowers solitary. Flowers (petals) white or pink; stamens usually many (occasionally reduced to 10); ovary generally 2-locular.....4

4. Vascular supply to ovary axile. Seeds 1(–2) per fruit, occasionally more. Shoots sylleptically branched.....Tribe SYZYGIEAE P.G.Wilson (**10. Syzygium**)
   Vascular supply to ovary trans-septal. Seeds few per fruit or more often numerous. Shoots generally proleptically branched: Tribe MYRTEAE DC.....5

5. Seeds 1–2 per fruit, rarely more.....6
   Seeds more than 5 per fruit.....7

6. Ovary 4–5-locular.....**2. Decaspermum**
   Ovary 2-locular.....**3. Eugenia**

7. Leaf blades 3-veined at base; intramarginal veins as prominent as the midrib, unlooped.....8
   Leaf not as above, pinnately veined.....9

8. Flowers solitary. Seeds many per fruit.....**8. Rhodomyrtus**
   Flowers in clusters. Seeds usually less than 10 per fruit.....**7. Rhodamnia**

9. Anthers with prominent oblong appendages. Leaf venation obscure.....**12. Uromyrtus**
   Anthers without prominent oblong appendages. Leaf venation prominent.....
   **Psidium** L.

   (Probably derived from the Greek word *sidion* = plant with a fruit likes that of a small pomegranate, *Punica granatum* L., Lythraceae)

   Sp. Pl. (1753) 472, Gen. Pl. (1772) 615; Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1092; A. de Candolle, Prodr. 3 (1828) 232; Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 70; Miquel, Fl. Ind. Bat. 1, 1 (1855) 468; Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1879) 467; Niedenzu *in* Engler & Prantl, Nat. Pflanzenfam. 3, 7 (1898) 67; Backer & Bakhuizen *f.*, FJ 1 (1964) 334; Ashton *in* Dassanayake & Fosberg (eds.), Rev. Handb. Fl. Ceylon 2 (1981) 406; Corner, WSTM 4th. edition 2 (1997) 595; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 803; Beaman & C.

Anderson, PMK 5 (2004) 210; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 251.

Small trees or shrubs with drooping branches. Twigs sharply 4-angular in cross-section. Leaves simple, opposite, petiolate; blades with prominent intramarginal veins. Flowers in axillary clusters of 1–3, large; hypanthium campanulate or urceolate; calyx lobes (sepals) 4–5; corolla lobes (petals) 4–5, large and broad, white; stamens many, free, in many whorls, anthers ellipsoid, basifixed, locules parallel, longitudinally dehiscent; ovary inferior or adnate to the hypanthium, 4–5-locular, each locule with many ovules, style linear, stigma expanded. Fruit a globose to pyriform berry, fleshy, many-seeded, apex with persistent calyx lobes. Seeds: testa hard; embryo curved; hypocotyl long; cotyledons short.

About 100–150 species native of tropical and subtropical America. A few species, e.g., *P. guajava* L., have been introduced and widely cultivated as a fruit tree since 1526 to SE Asia and other tropical and subtropical countries. In Borneo, *P. guajava* is commonly planted in orchards and villages and has become naturalised and established as an occasional rheophyte on shingle banks of major river tributaries, e.g., the Rejang river in Sarawak. In Peninsular Malaysia and elsewhere in SE Asia, a number of improved seedless varieties are grown in large scale commercial plantations.

10. Shrubs or small trees with opposite needle-like or narrowly strap-shaped leaves. Embryo with minute cotyledons on a slender neck appressed to a massive hypocotyls: Tribe CHAMELAUCIEAE DC.....11
    Tall canopy or open land trees or exotic plantation trees with spirally arranged leaves. Embryo not as above.....12

11. Erect shrub more often tree with pendant twigs. Leaves needle-like, rigid, apex sharp, gland-dotted beneath, mostly in clusters on short, lax, pendent twigs. Stamens in pairs... .....**1. Baeckea**
    Prostrate shrub or treelet with rigid spreading twigs. Leaves linear or narrowly strap-shaped, curved, blunt, not clustered, not visibly gland-dotted. Stamens in threes..... .....**9. Seorsus**

12. Inflorescences spike-like. Leaf with many slender parallel veins, without midrib..... .....Tribe MELALEUCINEAE DC. (**5. Melaleuca**)
    Inflorescences paniculate, racemose or cymose, or flowers clustered or solitary. Leaf not as above.....13

13. Flowers solitary. Leaves minute; veins obscure..... .....Tribe LEPTOSPERMINEAE Nied. (**4. Leptospermum**)
    Flowers in distinct inflorescences. Leaves larger, pinnately veined.....14

14. Flowers with snuffer-like perianth (*cf.* Fig. 13H); stamens many, in (4 or)5 fascicles borne on a distinct collar. Juvenile leaves distinct, opposite: Tribe EUCALYPTEAE (Benth.) P.G.Wilson (Exotic).....

    **Eucalyptus** L'Hér.

    (Greek, *eu* = well, *kaluptos* = covered; referring to the calyptra formed by the sepals and/or petals).

    Sert. Angl. 18 (1789) *t.* 20; Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1101; A. de Candolle, Prodr. 3 (1828) 216; Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 83; Miquel, Fl. Ind. Bat. 1, 1 (1855) 398; Merrill, Enum. Philip. Pl. 3 (1923) 183; Backer & Bakhuizen *f.*, FJ 1 (1964) 348; Chippendale, Fl. Austral. 19 (1988) 1; Lamb, PROSEA 5, 1 (1994) 200; Corner,

WSTM 4th. edition 2 (1997) 573; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 793; Chen & Craven, Fl. China 13 (2007) 321; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 259.

Trees or shrubs. Bark variable. Leaves polymorphic; juvenile leaves opposite, shortly petiolate or sessile, blades often glaucous or beset with glandular trichomes; adult leaves alternate, petiolate, lateral veins numerous, intramarginal veins present. Inflorescences axillary or clustered into terminal or axillary panicles comprising umbelliform condensed dichasia. Flowers bisexual; hypanthium campanulate, obconical or subglobose; sepals not distinct; petals connate forming calyptra that is deciduous at anthesis; stamens many, usually free, in several whorls with the outer whorl usually sterile; ovary half-inferior, adnate to hypanthium, 2–7-locular, each locule with many ovules. Fruits capsular; capsule entirely or partially included in the expanded hypanthium; disc often well-developed. Seeds many, ovoid or angular; testa rigid, sometimes developed into wings.

About 500 species mainly confined to Australia; about 20 species occurring in Eastern Malesia (the Philippines, Sulawesi, Maluku and Papua New Guinea). In Sabah and Sarawak, few species have been introduced and unsuccessfully grown on trial basis in forest plantations.

Perianth members free; stamen fascicles not borne on a raised collar. Juvenile leaves not morphologically distinct, spirally arranged.....15

15. Stamens 5, or in 5 fascicles each of 5–10 stamens. Oil ducts absent. Scroll-barked trees with equal leaf base.....Tribe KANIEAE Engl. (**11. Tristaniopsis**)
Stamens many in 5 fascicles. Oil ducts present. Flaky barked trees with prominently unequal leaf base.....Tribe LOPHOSTEMONEAE P.G.Wilson (**13. Whiteodendron**)

## Field key to the genera

1. Leaves linear, strap-shaped or needle-like……2
Leaves laminar……...3

2. Branchlets rigid. Leaf blade curved, blunt, without visible gland dots beneath…….
……..**9. Seorsus**
Branchlets flexible, hanging. Leaf blade rigid, sharp, gland dots visible beneath……..
……..**1. Baeckea**

3. Leaves alternate or spiral, at least in mature trees……4
Leaves always opposite, decussate or subopposite……...8

4. Twisted mountain trees with leaves mostly less than 2 cm long……..**4. Leptospermum**
Lowland or mountain trees with leaves mostly more than 4 cm long……..5

5. Forest canopy trees with rust-brown shaggily flaky bark. Leaves prominently asymmetrical, with short stout petiole……...**13. Whiteodendron**
Grassland or forest canopy trees with shaggy or scroll-flaked bark. Leaves of forest canopy trees symmetrical……..6

6. Grassland trees. Leaves sickle-shaped, parallelly veined. Inflorescences spike-like…….
……..…….**5. Melaleuca**

Forest canopy or exotic plantation trees. Leaves pinnately veined. Inflorescences not as above……7

7. Juvenile leaves opposite; blades of mature leaves asymmetrical, blue-green with faint or obscure venation, drying milky. Exotic trees……..**Eucalyptus** (see p. 91 above)
Juvenile leaves spiral; blades symmetrical, green, olive-green or brown, with distinct veins. Native forest trees……**11. Tristaniopsis**

8. Leaf 3-veined at base; intramarginal veins equally prominent as the midrib……...9
Leaf pinnately veined; intramarginal veins less prominent than the midrib……...10

9. Young plant parts woolly pubescent. Leaves with blunt apex, dull beneath. Flowers (petals) pink……**8. Rhodomyrtus**
Young plant parts short-pubescent. Leaves with acuminate apex, more or less silvery beneath. Flower (petals) white……**7. Rhodamnia**

10. Leaves minute. Twigs round in cross-section……11
Leaves larger, if minute, borne on quadrangular or winged twigs……12

11. Twigs warty. Flower (petals) yellow……...**14. Xanthomyrtus**
Twigs smooth. Flowers (petals) white-pink towards base……..
……...……..**2. Decaspermum (**in part; ***D. vitis-idaea*****)**

12. Sea-shore and estuary tree with small notched obovate leaves and 8-lobed calyx…….
……...……..**6. Osbornia**
Inland trees or, if of sea-shore, with elliptic or ovate leaves and 4–5-lobed calyx…….13

13. Trees sympodially branched. Twigs sylleptic with the apical and subterminal axillary shoots expanding almost equally……14
Trees not as above. Terminal shoots expanding first and longer than the axillary shoots.……...……..……15

14. Twisted tree of rocky shores. Leaf lateral veins 7 pairs; blades wrinkled on drying……..
……..……..**3. Eugenia**
Inland tree or, if coastal, the leaves with more than 7 pairs of lateral veins; blades mostly not wrinkled on drying……**10. Syzygium**

15. Twig narrowly winged in cross-section. Leaf venation prominent beneath……...
……..……**Psidium** (see p. 90 above)
Twig round in cross-section. Leaf venation obscure or hardly raised beneath……...16

16. Leaves densely pitted above……..**2. Decaspermum** (in part)
Leaves not pitted above……..**12. Uromyrtus**

# 1. **BAECKEA** L.

(Abraham Bäck, 1713–1795, senior physician to the King of Sweden, amateur botanist and friend of Linnaeus)

Sp. Pl. (1753) 491; A. de Candolle, Prodr. 3 (1828) 229; Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 69; Miquel, Fl. Ind. Bat. 1, 1 (1855) 405; Bentham *in* Bentham & Hooker *f.*, Gen. Pl. 1, 2 (1865) 692; Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 463; Niedenzu *in* Engler & Prantl, Nat. Pflanzenfam. 3, 7 (1898) 98; King, J. As. Soc. Beng. 70, 2 (1901) 68; Ridley, FMP 1 (1922) 712; Kochummen, TFM 3 (1978) 170; J.A.R. Anderson, CLTS (1980) 272; Corner, WSTM 4th. edition 2 (1997) 572 ("*Baeckia*"); Bean, Telopea 7, 3 (1997) 245; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 782; Beaman & C. Anderson, PMK 5 (2004) 206; Chen & Craven, Fl. China 13 (2007) 329; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 263.

*Small* glabrous *trees and shrubs*. **Twigs** (branchlets) *flexible*. **Leaves** generally opposite, small; *blades needle-like*, *rigid*, *apex sharp*, *gland-dots visible beneath*. **Flower** small, pedicellate or rarely subsessile; hypanthium turbinate or hemispherical; *perianth 5-merous*; sepal margins scarious; petals white or pink; *stamens* 5–10 or many, *in pairs opposite petals*, 1-seriate, filaments filiform or flat; ovary semi-inferior, adnate to the hypanthium, with flat or convex top, 2–3-locular, style in a pit, filiform, stigma capitate or peltate, ovules 2 or many per locule, 2-seriate or in a ring around a peltate placenta. **Fruits** *capsular*, included within hypanthium and more or less adnate to it, loculicidally dehiscent. **Seeds** 1–3 or many per locule, kidney-shaped, more or less angular; testa thin or thick; *embryo with tiny cotyledons and long stout radicle*.

**Distribution.** About 14 species, from China to Australia and New Caledonia, mostly Australasian. One species in Sabah and Sarawak.

## **Baeckea frutescens** L. Fig. 1, Plate 4A.

(Latin, *frutescens* = shrubby; referring to the habit)

Sp. Pl. (1753) 358; A. de Candolle *op. cit.* 229; Blume *op. cit.* (1850) 69; Miquel *op. cit.* (1855) 406; Duthie *in* Hooker *f. op. cit.* 463; King *op. cit.* 68; Merrill, EB (1921) 436; Ridley *op. cit.* (1922) 712; Masamune, EPB (1942) 520; Kochummen *op. cit.* 170; J.A.R. Anderson *op. cit.* 272; Turner, Gard. Bull. Sing. 47, 2 (1996) 370; Corner *op. cit.* 572; Bean *op. cit.* 248; Parnell & Chantaranothai *op. cit.* 782; Beaman & C. Anderson *op. cit.* 206; Chen & Craven *op. cit.* 330. **Type:** *Osbeck s.n.*, China, Guangzhou, Guangdong prov. (LINN). **Heterotypic synonym:** *Baeckea cumingiana* Schauer *in* Walpers, Repert. Bot. Syst. 2 (1843) 920; *B. sumatrana* Blume *op. cit.* (1850) 406.

Shrub or small tree to 5 m tall, with pendent branches. **Twigs** *c.* 0.5 mm diameter apically, much branched, round in cross-section, pale rust-brown, early splitting beneath leaf bases forming sometimes whitish flanges; soon bearing axillary short shoots forming leaf clusters. **Leaves** opposite (occasionally subopposite or even alternate); blades needle-like, triangular in cross-section, drying dull olive-brown with more or less prominent pits above and gland-dots beneath, base tapering into *c.* 1 mm indistinct petiole attached to the apex of twig flange; venation obscure. **Flowers** axillary, solitary but often clustered by shortening of internodes, subsessile; pedicels *c.* 2 mm long; hypanthium cup-shaped, faintly wavy; sepals 5, ovate-deltoid, *c.* 1 × 1 mm, hyaline; petals cream-pink at base, elliptic; stamens pale yellow, usually in pairs opposite petals; ovary 2-locular, each locule with many ovules, style short cylindrical. **Fruits** capsular, urn-shaped, to 3 mm long, to 3 mm diameter, with *c.* 3 mm wide apical crown of erect calyx lobes, ripening reddish brown.

**Vernacular names.** Sabah—*tagai* or *berungis* (Kadazan), *tuturun atap* (Malay), *rempah rempah* (Malay). Sarawak—*cucor atap* (Malay).

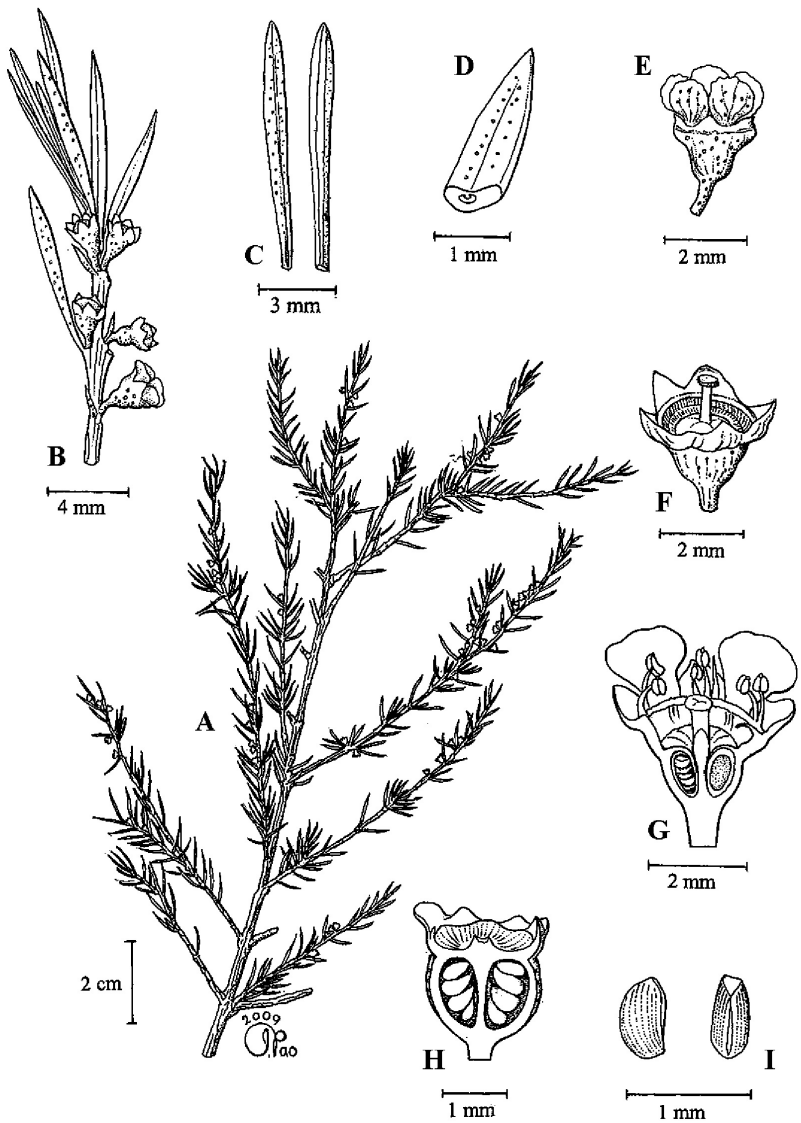


**Fig. 1.** *Baeckea frutescens*. A, leafy twigs with axillary flowers; B, distal part of flowering leafy twig; C, adaxial and abaxial views of leaf blades; D, section of leaf blade; E, open flower; F, open flower with the petals removed; G, longitudinal section of open flower; H, longitudinal section of young fruit; I, abaxial and adaxial views of seeds. (A–G from *SAN 103360*; H–I from *SAN 96285*.)

**Distribution.** Widespread from S China to Thailand, Sumatra, Peninsular Malaysia, Borneo, Sulawesi, New Guinea and Australia (Queensland and New South Wales). In Sabah, recorded from Beaufort, Keningau, Kota Kinabalu, Kudat, Sandakan, Sipitang, Tambunan, Tawau and Tuaran districts. (e.g., *SAN A 3617*, *SAN 80381*, *SAN 102627*, *SAN 111729* and *SAN 122330*), and in Sarawak from Kuching, Lawas, Marudi and Simunjan districts (e.g., *Purseglove 4891*, *Jacobs 5497*, *S 21505*, *S 34629* and *S 47032*). Also known in Kalimantan (e.g., *Afriastini 431*, *Ambriansyah AA 997*, *Winkler 3400* and *Dransfield 4321*).

**Ecology.** Mainly confined to vegetation on dry sandy and rocky costal bluffs, occasionally also in peatswamp, lower and upper montane forests.

**Uses.** According to Burkill (EPMP (1966) 282), the timber is hard and durable; the leaves can be boiled to make a refreshing tea, while dried and mixed with other ingredients in a powder, they can be rubbed on the stomach for painful menstruation or childbirth.

## 2. **DECASPERMUM** J.R.Forst. & G.Forst.

(Greek, *deca-* = 10, *spermum* = seed; referring to the 10-seeded fruits)

Char. Gen. Pl. 2nd. edition (1776) 73, *t.* 37; Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 469; Niedenzu *in* Engler & Prantl, Nat. Pflanzenfam. 3, 7 (1898) 69; King, J. As. Soc. Beng. 70, 2 (1901) 75; Merrill, EB (1921) 424; Ridley, FMP 1 (1922) 717; Merrill, Enum. Philip. Pl. 3 (1923) 155; Masamune, EPB (1942) 521; Backer & Bakhuizen *f.*, FJ 1 (1964) 335; Kochummen, TFM 3 (1978) 171; Scott, Kew Bull. 34 (1979) 59, *ibid*. 35 (1980) 403; J.A.R. Anderson, CLTS (1980) 272; Turner, Gard. Bull. Sing. 47, 2 (1996) 370; Corner, WSTM 4th. edition 2 (1997) 572; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 790; Beaman & C. Anderson, PMK 5 (2004) 207; Chen & Craven, Fl. China 13 (2007) 332; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 246. **Synonym:** *Nelitris* Gaertn., Fruct. Sem. Pl. 1 (1788) 134, *t.* 27, Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1098, A. de Candolle, Prodr. 3 (1828) 231, Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 72, Miquel, Fl. Ind. Bat. 1, 1 (1855) 470, Bentham *in* Bentham & Hooker *f.*, Gen. Pl. 1, 2 (1865) 716.

Trees or sometimes shrubs. **Twigs** *smooth*, *round or quadrangular in cross-section*, hairy or sometimes glabrous. Stipules small, linear, fugaceous. **Leaves** *laminar*, *opposite*, *pinnately veined with an intramarginal vein*; *intercostal veins obscure*; distinctly petiolate, *distinctly pitted above*, obscurely gland-dotted beneath. **Flowers** small, bisexual or sometimes male, solitary and axillary or in terminal or subterminal racemes or in 3-flowered dichasia; bracts and bracteoles small, deciduous; *perianth* (*3–*)*4–5-merous*; hypanthium not exceeding ovary, spherical to urn-shaped in bud, calyx lobes distinct, persisting in fruit; petals small but prominent; stamens many, free, filaments slender, anther spherical dehiscing by a longitudinal slit, connective with terminal gland; *ovary inferior*, (*3–*)*4–5*(*–12*)*-locular*, each locule with 2–4 collateral ovules, style filiform slender, stigma small. **Fruit** a juicy, spherical ribbed berry. **Seeds** 2 per locule; testa hard; embryo horseshoe-shaped with long radicle and short cotyledons.

**Distribution.** About 25 species, throughout tropical Asia to the Pacific. Nine species in Asia and Malesia, two in Borneo.

## Key to *Decaspermum* species

Small lowland tree with sparsely branched twigs bearing larger (6 × 2.5 cm) papery leaves and slender, racemose inflorescences……..**1. D. parviflorum**

Shrubby mountain tree with densely branched twigs bearing smaller (2 × 0.8 cm) leathery leaves and axillary, 3-flowered dichasia, subtended by reduced leaves……..**2. D. vitis-idaea**

## 1. **Decaspermum parviflorum** (Lam.) A.J.Scott Fig. 2.

(Latin, *parvus* = small, *flos* = flower; referring to the size of flower)

Kew Bull. 34 (1979) 66, *ibid.* 35 (1980) 409; Parnell & Lughadha, Kew Bull. 47, 4 (1992) 703; Turner *op. cit.* (1996) 370; Parnell & Chantaranothai *op. cit.* 791; Beaman & C. Anderson *op. cit.* 207; Chen & Craven *op. cit.* 334. **Basionym:** *Eugenia parviflora* Lam., Encycl. 3 (1789) 200. **Type:** '*Sonnerat'* (probably *Commerson*) *s.n.*, Java (holotype P-LA; isotype P-JU 13911). **Homotypic synonyms:** *Myrtus parviflora* (Lam.) Spreng., Syst. Veg. 2 (1825) 486, *Nelitris parviflora* (Lam.) Blume *op. cit.* (1850) 74, *incl.* var. *venulosa*, *Decaspermum fruticosum* var. *parviflorum* (Lam.) Amsh. *in* Backer, Beknop. Fl. Java 4B (1944) 98. **Heterotypic synonyms:** *Nelitris paniculata* Lindl., Coll. Bot. (1821) 16; *N. confinis* Blume *op. cit.* (1850) 74, *incl.* var. *venulosa*; *N. lucida* Blume *op. cit.* (1850) 74; *N. pubescens* Miq., Anal. Bot. Ind. 1 (1850) 15, *op. cit.* (1855) 475; *Decaspermum paniculatum* (Lindl.) Kurz, J. As. Soc. Beng. Sc. 46 (1877) 61, *incl.* var. *genuina*, var. *thyrsoidea*, Stapf, FMK (1894) 150, Ridley *op. cit.* (1922) 717; *D. fruticosum auct. non* J.R.Forst. & G.Forst. (1876): Merrill *op. cit.* (1921) 424, Masamune *op. cit.* 521, J.A.R. Anderson *op. cit.* 272. (For further synonyms, *cf.* Scott *op. cit.* (1980) 409).

Small tree to 6 m tall. **Bark** smooth grey-brown. Exposed living parts at first densely silvery-grey downy, the hairs ascending, persisting on twigs to bark formation, also on leaf midrib throughout and petiole, panicle, and exposed parts of flower buds. **Twigs** 1–2 mm diameter, slender, round in cross-section, pink-brown, eventually flaking. **Leaves** *papery*, drying rust-brown and wrinkling, minutely very densely black dotted beneath, pitted above; *blades* ovate-lanceolate, *1.5–9 × 0.5–5 cm*, becoming smaller towards ends of flowering twigs, base wedge-shaped terminating abruptly at the petiole, apex acuminate, acumen slender, to 15 mm long; lateral veins elevated throughout, more so beneath, unequal, main ones *c*. 5 pairs, very slender, the intermediate veins not reaching the intramarginal vein; intercostal venation lax, elevated beneath, obscure above; intramarginal vein 2–3 mm within margin, looped; petioles slender, *c*. 4 mm long. **Inflorescences** *racemose*, mostly terminal, *to 7 cm long*; rachis *very slender*, straight, round in cross-section; bracts prominent, elliptic, to 4 × 2 mm, persisting to flowering. **Flowers:** hypanthium subglobose, *c*. 2 mm across, with 4–5, *c*. 1 × 1 mm deltoid subacute calyx lobes loosely spreading around the base of the domed corolla; stamens many, exserting to 3 mm long; style somewhat longer; ovary 4–5-locular, style longer than 3 mm. **Fruit** a spherical berry to 4 mm diameter, glabrous, purplish black, with crown of persisting calyx lobes.

**Vernacular names.** Sabah—*baduk baduk* (Brunei), *badukan* or *bawing* (Dusun), *belau belau* (Kedayan), *beliaduk*, *barik*, *tegiras* or *belau baduk* (Bajau), *mapaduk* (Dusun Patatan). Sarawak—*ubah nipat* (Iban).

**Distribution.** NE India and S China throughout Myanmar, Indo-China, Malesia and Micronesia. In Sabah widespread and most frequently collected in all states (e.g., *Dransfield 6349*, *SAN 17201*, *SAN 27224*, *FD FMS 36470*, *SAN 74574*, *SAN 103110*, *SAN 115658*, *SAN 139164* and *SAN 143178*). In Sarawak, however, apparently more locally distributed

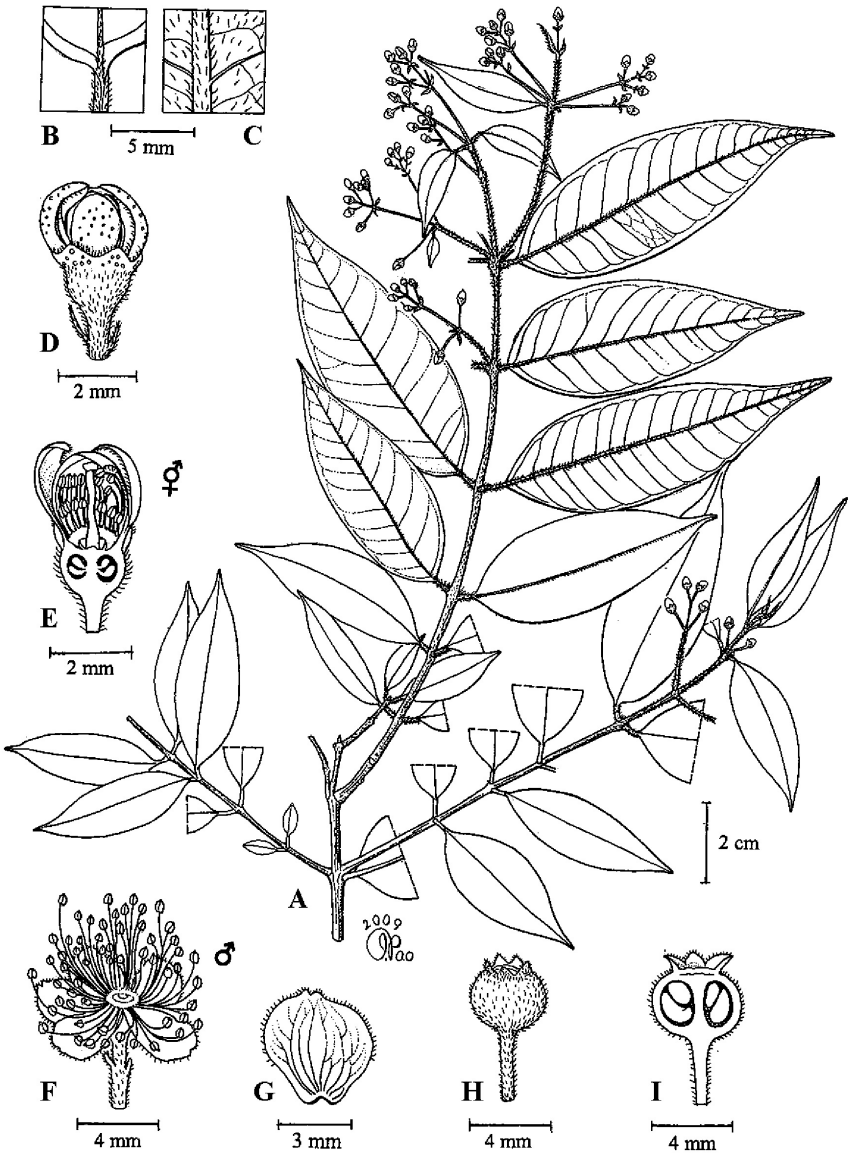


**Fig. 2.** *Decaspermum parviflorum*. A, flowering leafy twig; B, indumentum of basal part of upper leaf surface; C, indumentum of lower leaf surface; D, expanding bisexual flower bud; E, expanding bisexual flower bud in longitudinal section; F, male flower at anthesis; G, adaxial surface of petal; H, young fruit; I, young fruit in longitudinal section. (A–E from *S 79989*, F–G from *SAN 117906*, H–I from *SAN 84426.*)

and mainly occurring on limestone summits in Bau, Kuching, Limbang, Marudi, Miri, Serian and Tatau districts (e.g., *Nooteboom 1778*, *S 30942*, *S 38606*, *S 51072* and *S 51203*). Also known in E and S Kalimantan (e.g., *Endert 2354*, *Kessler 2381* and *Kostermans 5965*), but not yet recorded from Brunei.

**Ecology.** In Borneo, mainly occur in secondary forest on degraded lands, and in short stature woodlands on ultramafic and limestone substrates, at altitudes up to 1600 m.

**Uses.** Burkill states that the wood was used for making small objects including tool handles, and for firewood; the leaves and shoots are astringent and added in small quantity as a seasoning; while the fruits have been eaten in Sumatra and Java.

**Notes.** As so often, the ultramafic G. Silam form (*Dransfield 6349*) has a distinctly more leathery leaf, as do some limestone collections. Kevan & Lack (Biol. J. Linn. Soc. 25 (1985) 319) observed *Decaspermum parviflorum* in Sulawesi. They found individuals with bisexual or purely staminate flowers in equal proportion in populations. The pollen of bisexual flowers proved sterile. Little nectar is secreted, the pollen acting as the lure for the bee pollinators.

## 2. **Decaspermum vitis-idaea** Stapf Plate 4B.

(alluding the habit of the species that resembles the boreal blueberry *Vaccinium vitis-idaea*, Ericaceae)

FMK (1894) 150; Merrill *op. cit.* (1921) 425; Masamune *op. cit.* 521; Scott *op. cit.* (1980) 405; Beaman & C. Anderson *op. cit.* 208. **Type:** *Haviland 1261*, Borneo, Sabah, Mt. Kinabalu (holotype K). **Heterotypic synonym:** *Decaspermum microphyllum* Merr., Philip. J. Sci. 18 (1921) 289.

Shrub or small tree to 5 m tall, with twisted trunk and dense small-leaved crown. Parts at first silvery-grey downy pubescent with the hairs ascending, persisting on twigs until bark formation, petioles, midrib beneath, inflorescences and exposed parts of flowers and fruits. **Twigs** *c*. 1 mm diameter, round in cross-section, much-branched and with short internodes, bark grey-brown, becoming fibrous and cracked but hardly flaking. **Leaves** *leathery*, more or less shiny, drying rust-brown beneath, grey-brown above, without glands dots beneath, densely pitted above; *blades* elliptic to lanceolate, *0.4–2 × 0.2–0.8 cm*, base broadly wedge-shaped to rounded, abruptly ending at the petiole, margin narrowly recurved, apex obtuse, acute or sometimes subacuminate; venation obscure; petioles *c.* 1 mm long. **Flowers** *in 3-flowered*, *axillary dichasia*; peduncles slender, to 5 mm long, subtended by reduced leaves; buds urn-shaped, to 3 mm long, to 2 mm diameter; sepals strap-shaped, *c.* 3 × 1 mm, erect, subglabrous; petals round, white with pink tinge; stamens *c.* 20, pink; ovary 4–5-locular, style *c.* 3 mm long. **Fruits** spherical, *c.* 4 mm diameter, ripening black, bearing a persistent crown of erect calyx lobes. **Seeds** 7–8.

**Distribution.** Borneo, the Philippines (Mindanao) and Sulawesi. In Borneo, restricted to Mt. Kinabalu and neighbouring mountains (e.g., *RSNB 4506*, *Beaman 7981*, *Clemens 30939*, *SAN 34627*, *SAN 48100* and *SAN 110074*).

**Ecology.** Common on landslips and other large gaps in lower montane oak-laurel forest at 1700–2300 m altitude, and in ultramafic shrubland at altitudes to 2600 m.

# 3. **EUGENIA** L.

(Prince Eugene of Savoy, 1663–1735, patron of the arts and sciences)

Sp. Pl. (1753) 470, Gen. Pl. ed. 5 (1754) 211; A. de Candolle, Prodr. 3 (1828) 237; Merrill & Perry, Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 140; Merrill, Philip. J. Sci. 79, 4 (1950) 355; Backer & Bakhuizen *f.*, FJ 1 (1964) 337; Scott, Kew Bull. 34 (1980) 473; Ashton *in* Dassanayake & Fosberg (eds.), Rev. Handb. Fl. Ceylon 2 (1981) 408; Kostermans, Quart. Journ. Taiwan Mus. 34 (1982) 158; Hyland, Austr. J. Bot. Suppl. Series 9 (1983) 28; Chantaranothai & Parnell, Thai For. Bull. (Botany) 21 (1994) 21; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 798; Chen & Craven, Fl. China 13 (2007) 331; Wilson, Gard. Bull. Sing. 60, 2 (2009) 401; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 252. **Synonym:** *Jossinia* Comm. *ex* DC. *op. cit.* 237, Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 119, Merrill *op. cit.* (1950) 356.

Shrubs or small trees. **Twigs** pubescent when young, becoming glabrous when older. **Leaves** *opposite*, petiolate; *blades laminar*, *pinnately veined*, *drying wrinkled*, gland-dotted beneath; *lateral veins to 7 pairs*; intramarginal veins visible. **Inflorescences** axillary, *flowers solitary*, *fascicled* or *rarely in triads*; peduncles pubescent; bracts pubescent, persistent. **Flowers** *4-merous*; buds usually turbinate; hypanthium not or hardly extending beyond ovary; sepals free rounded, sparsely pubescent; petals more or less orbicular, gland-dotted, with ciliate margins; *stamens many*, borne on a disc surrounding the style on top of ovary; *ovary 2-locular*, ovules several to many in each locule, radiating from a centrally located axile placenta, style as long as or slightly longer than stamens, stigma not dilated. **Fruit** *a fleshy berry*, bearing persistent sepals. **Seeds** *1*(or *2*); embryo homogenous, cotyledons of uniform texture, only partly free.

**Distribution.** About 1000 species, mostly in the New World tropics but well represented in the Mascarene Islands and S Asia, with a very few extending through Malesia to Australia and the western Pacific. One species in Borneo (Sabah).

**Notes.** The distinction of *Eugenia* from *Syzygium* is discussed in the notes following the description of the latter (see p. 126).

## **Eugenia reinwardtiana** (Blume) DC. Fig. 3.

(Caspar George Carl Reinwardt, 1773–1854, the founder and first Director of the Bogor Botanic Gardens, Java, Indonesia)

Prodr. 3 (1828) 267; Kanehira, Fl. Micronesia (1933) 271, fig. 131; Burgess, TBS (1966) 413; St. John, Phytologia 37 (1977) 441; Hyland *op. cit.* 28. **Basionym:** *Myrtus reinwardtiana* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1082. **Type:** *Reinwardt s.n.*, Maluku (Moluccas), Saparua (holotype L Barcode L 0009465). **Homotypic synonym:** *Jossinia reinwardtiana* (Blume) Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 120, Merrill, J. Arn. Arb. 31 (1950) 330. **Heterotypic synonym:** *Eugenia kangeanensis* Valeton, Ic. Bog. 4 (1912) 107, Merrill & Perry *op. cit.* (1939) 140.

Small gnarled low branching tree, to 8 m tall, to 10 cm diameter. **Bark** pale cream-buff, smooth. Young parts, flower buds, and base of fruits rust-brown downy, indumentum early caducous except on fruit; parts otherwise glabrous. **Twigs** 1–2 mm diameter apically, smooth, pale brown, with short internodes. **Leaves** thinly leathery, drying pale dull yellow-brown beneath, slightly glistening greenish brown above; blades broadly elliptic-obovate, 2.5–7.5 × 1–4.5 cm, base wedge-shaped, apex acute to shallowly notched; midrib somewhat raised on both surfaces, wrinkled on drying and sometimes furrowed towards base above;

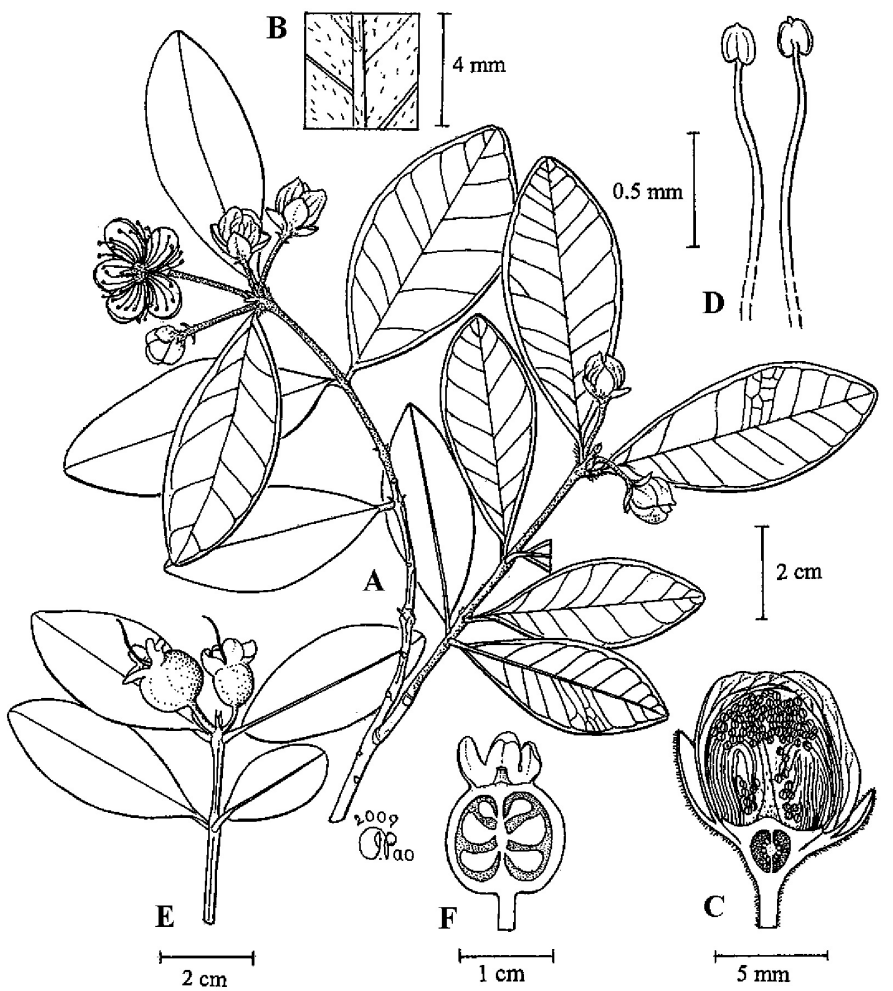


**Fig. 3.** *Eugenia reinwardtiana*. A, flowering leafy twig; B, indumentums on lower leaf surface; C, longitudinal section of mature flower bud; D, stamens; E, fruiting leafy twig; F, longitudinal section of fruit. (A–D from *FD FMS 36687*, E from *FD FMS 44468*, F from *Sugau 363*.)

lateral veins unequal, main ones *c.* 7 pairs, ascending, slender but distinctly elevated usually more so above than beneath; intercostal venation obscure beneath, slender and just evident above; intramarginal veins 1–2 mm within margin, shallowly looped; petioles slender, *c.* 2 mm long. **Flowers** in terminal cymose cluster of threes or axillary and solitary; bracts and bracteoles narrowly triangular, to 2 × 1 mm, ascending; pedicels slender, to 15 mm long; buds spherical, to 7 mm across, tapering at base, pseudostalk obscure; calyx lobes 4, rounded, to 6 × 6 mm, thin, spreading at anthesis; petals more or less orbicular, 3–3.5 mm across, gland-dotted; stamens many, exserting to 11 mm long; style to 12 mm long. **Fruits** spherical-ellipsoid, to 10 mm long, to 14 mm diameter, ripening green, 3-lobed, with persistent *c.* 7 × 6 mm foliose calyx lobes.

**Distribution.** Coastal northern parts of Sabah (e.g., *Sugau 363*, *FD BNB 2344*, *FD BNB 6759*, *Keith 9270*, *FD BNB 9473* and *SAN 102100*) eastwards to New Guinea, Australia, New Caledonia and Polynesia to the Society Islands and Tahiti.

**Ecology.** Locally abundant on rocky headlands, islands and coastlines.

**Notes.** We regard *E. kangeanensis* as merely the local form of a very widespread and locally variable species.

# 4. **LEPTOSPERMUM** J.R.Forst. & G.Forst.

(Greek, *lepto-* = thin, *spermum* = seed)

Char. Gen. Pl. (1776) 71, *t.* 36; Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1100; A. de Candolle, Prodr. 3 (1828) 226; Blume, Mus. Bot. Lugd.-Bat 1 (1850) 68; Miquel, Fl. Ind. Bat. 1, 1 (1855) 403; Bentham *in* Bentham & Hooker *f.*, Gen. Pl., 2, 2 (1862) 963; Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 464; Niedenzu *in* Engler & Prantl, Nat. Pflanzenfam. 3, 7 (1898) 93; King, J. As. Soc. Beng. 70, 2 (1901) 499; Merrill, EB (1921) 436; Ridley, FMP 1 (1922) 713; Merrill, Enum. Philip. Pl. 3 (1923) 184; Masamune, EPB (1942) 521; Backer & Bakhuizen *f.*, FJ 1 (1964) 346; Kochummen, TFM 3 (1978) 247; J.A.R. Anderson, CLTS (1980) 280; Thompson, Telopea 3 (1989) 301; Bean, Austrobaileya 3 (1992) 643; Corner, WSTM 4th. edition 2 (1997) 593; O'Brien *et al.*, Austr. J. Bot. 48, 5 (2000) 621; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 800; Beaman & C. Anderson, PMK 5 (2004) 208; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 263. **Synonyms:** *Glaphyria* Jack, Trans. Linn. Soc. Lond. 14 (1823) 128; *Macklottia* Korth., Ned. Kruidk. Arch. 1 (1847) 196; *Leptospermiopsis* S.Moore, J. Linn. Soc. Bot. 45 (1920) 202.

Trees or shrubs *with twisted trunks*. **Bark** fibrous, smooth, papery or coarsely flaky. Living parts glabrous or pubescent with silvery, fine soft hairs. **Leaves** *spirally* arranged, densely borne along horizontal twigs; *blades laminar*, *generally small*, elliptic, lanceolate or ovate, leathery and usually with recurved margin, often aromatic; *veins obscure*; stipules minute. **Flowers** on condensed shoots, axillary to bracts or occasionally *solitary* in the leaf-axils; pedicels usually distinct; *perianth 5-merous*; hypanthium tapering to base; calyx spreading apically at anthesis, with distinct caducous or persistent lobes; petals large, pink or white; stamens in 5 clusters opposite petals but appearing free, shorter than petals, attached around the hypanthium rim, filaments slender, anthers versatile with a prominent gland near the connective and a thickening at the base of each locule (theca), opening by slits; ovary (2–)3–5(or more)-locular, placentation axile in the distal half of the axis, ovules few or many per locule, anatropous, style short, cylindrical, set in a pit, stigma entire or lobed. **Fruit** *a woody capsule* with flattish dehiscent top. **Seeds** ovoid with reticulate testa, occasionally ridged or winged or irregularly striate.

**Distribution.** About 85 species, from S Myanmar and Thailand to Malesia, Australia (most species) and New Zealand. Two species in Borneo.

**Ecology.** Subtropical shrublands and tropical rocky summits and high mountain tops, and coastal heathlands in Australia; usually on acidic substrates.

## Key to *Leptospermum* species

Leaves thinly leathery, (5–)10–18(–35) mm long, margin flat or recurved. Hypanthium minutely warty……**1. L. javanicum**

Leaves thickly leathery, 3–6 mm long, margin distinctly recurved from apex to base. Hypanthium not warty……..**2. L. recurvum**

## 1. **Leptospermum javanicum** Blume Fig. 4, Plate 4C.

(of Java)

Bijdr. Fl. Ned. Ind. 17 (1827) 1100, *op. cit.* (1850) 68; Duthie *op. cit.* 464; Stapf, FMK (1894) 149; Merrill *op. cit.* (1921) 436; Masamune *op. cit.* 521; Thomson *op. cit.* 391; Bean *op. cit.* 652; Coode *et al.* (ed.), CLBD (1996) 370; Parnell & Chantaranothai *op. cit.* 800; Beaman & C. Anderson *op. cit.* 209. **Type:** *Blume s.n.*, Java, in cacumine montis Gede (holotype L, barcode L 0009496 & L 0009497). **Homotypic synonyms:** *Macklottia javanica* (Blume) Korth., Ned. Kruidk. Arch. 1 (1847) 196, *L. flavescens* Sm. var. *javanica* (Blume) King *op. cit.* 70. **Heterotypic synonyms:** *Glaphyria nitida* Jack, Trans, Linn. Soc. London 14 (1823) 128, *non Leptospermum nitidum* Hook. *f.*; *Leptospermum alpestre* Blume *op. cit.* (1827) 1100; ?*L. floribundum* Jungh., Nat. Geneesk. Arch. Ned. Ind. 2 (1845) 37, *non* Salisb.; *L. flavescens auct. non* J.E.Smith (1797): Merrill *op. cit.* (1921) 436, Ridley *op. cit.* (1922) 713, Merrill *op. cit.* (1923) 184, Masamune *op. cit.* 521, Backer & Bakhuizen *f.*, *op. cit.* 346, Kochummen *op. cit.* 248, J.A.R. Anderson *op. cit.* 280, Corner *op. cit.* 593; *L. amboinense auct. non* Blume (1827): Fisher, Bull. Misc. Inform. Kew (1932) 179, Masamune *op. cit.* 521, Bean *op. cit.* 653, *Macklottia amboinensis* (Blume) Korth. *op. cit.* 196.

Recumbent shrub or gnarled tree to 8 m tall, to 20 cm diameter, with flat-branched crown of twisted branches. **Bark** fibrous, cracked, grey-brown often lichen-covered. Young parts silvery downy, hairs ascending and more or less appressed, caducous, persisting only as a fringe round calyx lobes. **Twigs** 1–2 mm diameter apically, sharply 4-ribbed by paired thick flanges below each leaf base, orange-brown, soon cracking and flaking thereby becoming round. **Leaves** *thinly leathery*, drying pale olive-brown above, pink-brown and densely brown gland-dotted beneath, subsessile; *blades* obovate to sometimes oblanceolate (lower altitudes), (*5–)10–18*(*–35*) × *2–6*(*–10*) *mm*, base narrowly wedge-shaped, *margin flat or recurved*, apex obtuse or acute; lateral veins evident only in young leaves, main ones *c.* 4 pairs, ascending; intercostal venation obscure; intramarginal veins *c.* 1 mm within margin, hardly looped; petioles very short. **Flowers** solitary, axillary, sessile, with large broad bracteoles; buds subglobose, *c.* 4 mm diameter; *hypanthium* cup-shaped, *minutely warty*; calyx lobes ovate, to 2 × 2 mm, caducous; petals white, strap-shaped, to 6 mm long; stamens *c.* 25, filaments *c.* 4 mm long; ovary 5-locular, each locule with 12–24 ovules in 4–6 rows. **Fruits** more or less spherical, *c.* 5 mm diameter, with cup-shaped, rimmed hypanthium holding the 5-valved capsule.

**Vernacular names.** Sabah and Sarawak—*cinamaki* (Kadazan), *gelam bukit* (Malay).

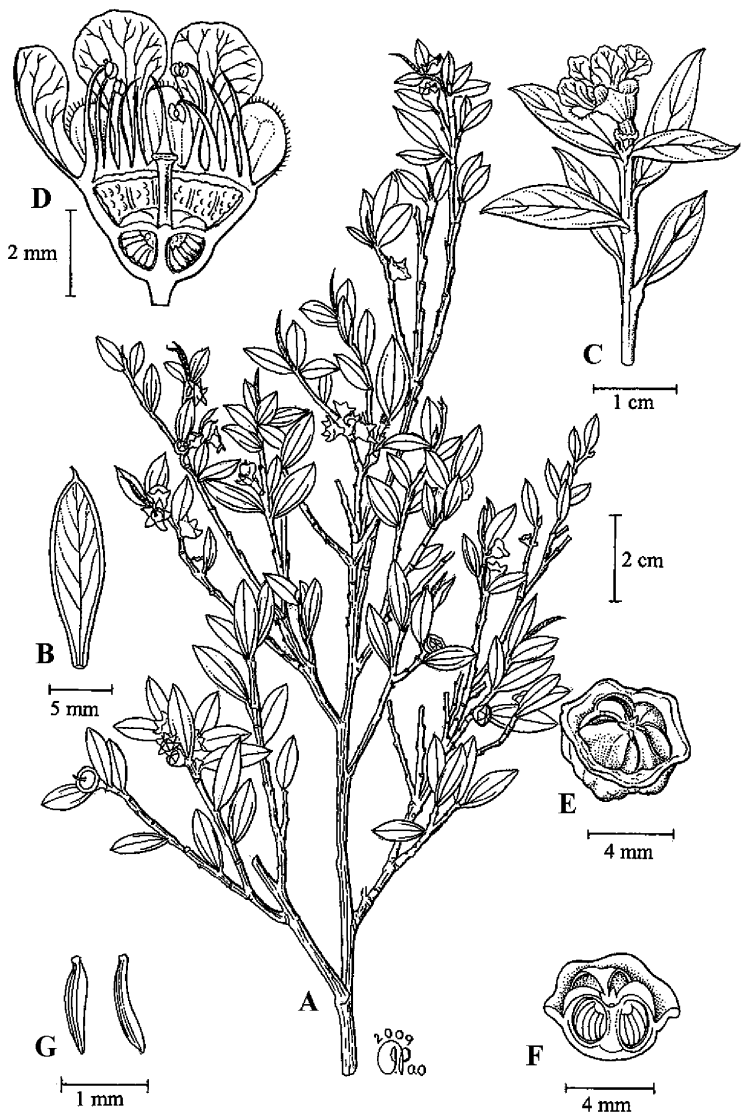


**Fig. 4.** *Leptospermum javanicum*. A, flowering and fruiting leafy twig; B, lower leaf surface; C, distal part of flowering leafy twig; D, longitudinal section of flower; E, fruit; F, longitudinal section of fruit; G, seeds. (A from *S 58548*, B–G from *S 35819*.)

**Distribution.** Peninsular Myanmar, S Thailand, Sumatra, Peninsular Malaysia, Java, Borneo, the Philippines and Sulawesi. In Sabah widespread and recorded from Keningau, Kota Belud, Kota Kinabalu, Kota Marudi, Ranau, Sandakan, Tambunan and Tuaran districts (e.g., *RSNB 1052*, *RSNB 4664*, *SAN 20038*, *SAN 31778*, *SAN 53993*, *SAN 74080* and *SAN 123343*), and in Sarawak from Kuching, Lawas, Limbang, Lundu, Marudi and Miri districts (e.g., *Argent & Jeremy 1020*, *Nooteboom & Chai 1983*, *S 13155*, *S 26480*, *S 37087*, *S 47931* and *S 50850*). Also known in Brunei (e.g., *Arifin 175*, *Wong WKM 820*, *BRUN 1058* and *Coode MC 7455*) and W, C and S Kalimantan (e.g., *Nooteboom 4610*).

**Ecology.** On the high mountains of Sabah and Sarawak in rocky places in upper montane forest, at altitudes between 1200–2400 m, up to 3000 m on Mt. Kinabalu and adjacent mountains including in scrub on ultramafic substrate. Also on exposed coastal hilltops near Kota Kinabalu and Sandakan, Sabah. Locally abundant. Ants of the genus *Crematogaster* form an apparently mutualistic association with this species (Weir & Kiew, Biol. J. Linn. Soc. 27 (1986) 113). The ants inhabit tunnels in branches and trunk, one colony to a tree. It seems that the ants gain carbohydrates and the tree protection against pathogens, herbivores, and epiphytes except for certain *Dischidia* species which absorb the decaying refuse left by the ants.

**Uses.** The wood is hard and suitable for tool handles and rafters in house building, while the leaves make an invigorating tea which can ameliorate cholic (Burkill, EPMP 2 (1935) 1334; PROSEA 5, 3 (1998) 327).

**Notes.** Bean (*op. cit.*) distinguishes *L. flavescens* Sm. as an exclusively Australian species with longer and more slender leaves. He also considers *L. amboinense* Blume, found in Borneo at altitudes between 50–2000 m as a distinct species on the basis of its larger narrower leaf blade, usually glabrous hypanthium, earlier caducous bracts and smaller fruits. Collections from lower altitudes do generally bear larger leaves but their size is highly variable, suggesting ontogenetic differences. I fail to see a discontinuity among the Bornean collections and doubt that, in Borneo, two species are involved on ecological and biogeographic grounds (see also discussion by Parnell & Chantaranothai *op. cit.* 800).

## 2. **Leptospermum recurvum** Hook. *f.* Fig. 5, Plate 4D & E.

(Latin, *recurvus* = bent back; referring to the leaf margins)

Icon. Pl. (1852) *t.* 893; Stapf *op. cit.* 149; Merrill *op. cit.* (1921) 436; Masamune *op. cit.* 521; Thompson *op. cit.* 391; Bean *op. cit.* 652; Beaman & C. Anderson *op. cit.* 209. **Type:** *Low*(*e*) *s.n.*, Borneo, Sabah, Mt. Kinabalu (holotype K).

Prostrate shrub or small tree. **Bark** pale, flaky. **Twigs** (young) silky pubescent or glabrous, distinctly flanged, especially near the node and extending around the sides of leaf base. **Leaves** *thickly leathery*, glossy and glabrous above, silky pubescent or occasionally glabrous beneath; *blades* broadly elliptic to orbicular-obovate, *3–6 × 2–3 mm*, base tapering into a very short petiole, *margin strongly recurved from apex to base*, apex broadly acute; venation obscure. **Flowers** solitary, in the axils of upper leaves; bracts and bracteoles rather large, hairy on the margins and at the apex; *hypanthium not warty*, *glabrous* or *silky pubescent*, often tinged dark and sometimes conspicuously glandular, *c.* 2–3 mm diameter, tapering into a very short or a *c.* 2 mm pseudostalk; calyx lobes almost hemispherical, *c.* 1.5–2 mm across, caducous, variably pubescent, usually paler and thinner toward margins; petals white, *c.* 5 mm long; stamens in bundles of 5(–7), *c.* 2.5 mm long; ovary 5-locular,

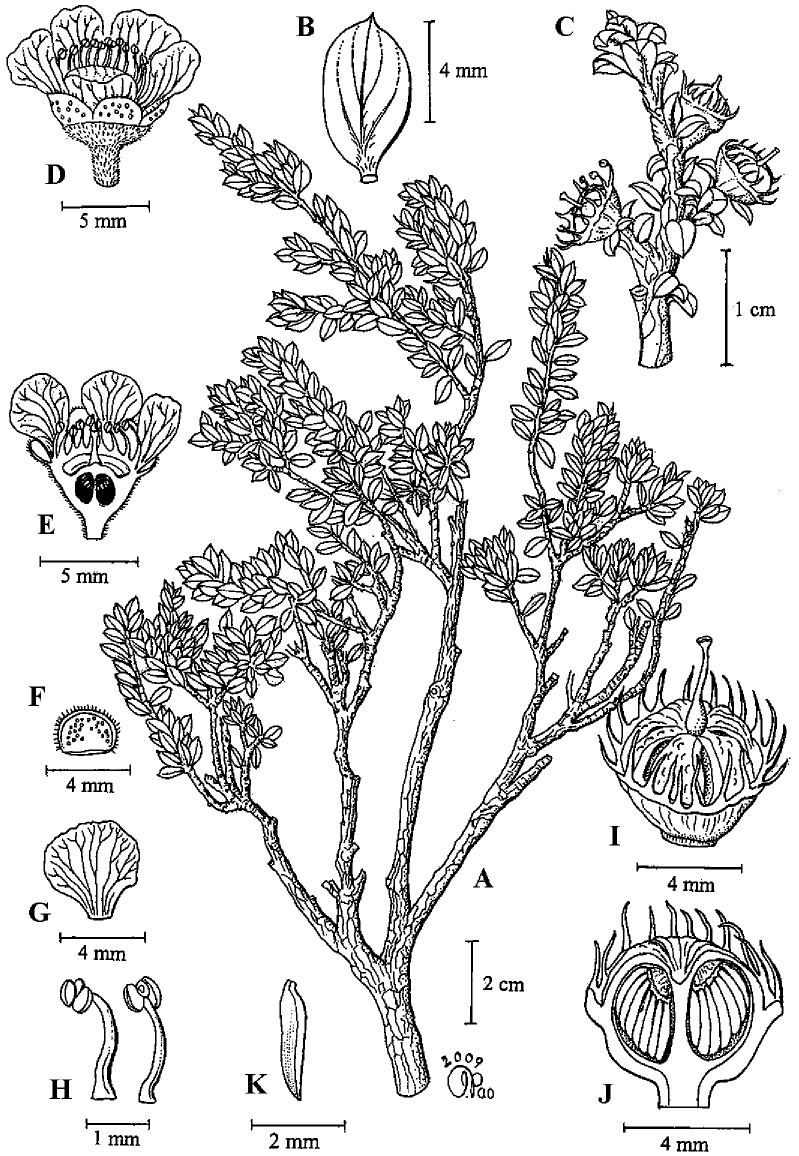


**Fig. 5.** *Leptospermum recurvum*. A, leafy twig; B, leaf blade; C, fruiting (young) leafy twig; D, open flower; E, longitudinal section of open flower; F, sepal; G, petal; H, stamens; I, fruit; J, longitudinal section of fruit; K, seed. (A from *SPN 5155*, B–C from *S 27085*, D–H from *KEP 80372*, I–K from *S 27085*.)

each locule with *c.* 20 ovules in *c.* 4 rows, style with a rather stout base, stigma minute. **Fruits** 6–7 mm diameter, widest just below the erect hypanthium rim, tapering towards a *c.* 1 mm long pseudostalk. **Seeds** irregularly linear-cuneiform, striate, 2–2.5 mm long.

**Disribution.** Borneo and Sulawesi. In Borneo, confined to Sabah and recorded from Kota Belud, Ranau and Tambunan districts (e.g., *Jacobs 5715*, *RSNB 5877*, *S 10608*, *SAN 20398*, *S 27085*, *SAN 29160*, *SAN 56340*, *KEP 80372*, *SAN 117231* and *SAN 134872*).

**Ecology.** From *c.* 2600 m to the summit on Mt. Kinabalu, occasionally lower on ultramafic substrate. Abundant at high altitudes.

**Notes.** Though Thompson (*op. cit.*) questions the distinctness of this taxon as a species from *Leptospermum javanicum*, naturalists familiar with it are convinced and I accept their verdict. Lee. & Lowry (Bot. J. Linn. Soc. 80 (1980) 223), compared the ontogeny and morphology of the two species in the field on Mt. Kinabalu. Though convinced of their separate identity, they found isozymal evidence that *L. recurvum* juveniles have limited genetic variability and suggested a sympatric origin. The putative existence of this same species in Sulawesi makes this unlikely. Nevertheless a molecular examinations of both species on Mt. Kinabalu and *L. recurvum* populations in Sulawesi could be rewarding.

# 5. **MELALEUCA** L.

(Greek, *melos* = black, *leucos* = white; some Australian species have black trunks and white branches)

*kayu putih* (Malay), *gelam* (Iban, Malay)

Mant. 1 (1767) 14; Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1099; A. de Candolle, Prodr. 3 (1828) 211; Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 66; Miquel, Fl. Ind. Bat. 1, 1 (1855) 401; Bentham *in* Bentham & Hooker *f.*, Gen. Pl. 1, 2 (1865) 693, 705; Niedenzu *in* Engler & Prantl, Nat. Pflanzenfam. 3, 7 (1898) 95; King, J. As. Soc. Beng. 70, 2 (1901) 70; Ridley, FMP 1 (1922) 713; Backer & Bakhuizen *f.*, FJ 1 (1964) 347; Blake, Contr. Queensland Herb. 1 (1968) 1; Kochummen, TFM 3 (1978) 248; J.A.R. Anderson, CLTS (1980) 280; Byrnes, Austrobaileya 1, 1 (1984) 65, *ibid*. 2, 2 (1985) 131; Barlow, Brunonia 9 (1986) 163; Craven & Barlow, Novon 7 (1997) 113; Corner, WSTM 4th. edition 2 (1997) 594; Argent *et al.* (eds.), MNDT-CK 2 (1997) 464; Craven & Lepschi, Austr. Syst. Bot. 12 (1999) 819; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 801; Chen & Craven, Fl. China 13 (2007) 328; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 236.

Trees or sometimes shrubs. **Bark** smooth to *exfoliating* or *shaggily coarsely flaky*. **Leaves** *spirally arranged* (in Borneo), decussate or ternate; *blades laminar*, *narrow and strap-shaped or small*; *venation* pinnate or *parallel* (in Borneo); petiole indistinct. **Flowers** *mostly in spike-like inflorescences* (in Borneo), solitary or in clusters of threes (in Borneo), in axils of mostly caducous bracts or floral leaves, generally polygamous; male flowers spherical, bisexual flowers oblong-cylindrical; *perianth 5-merous*; hypanthium bell- or urn-shaped; sepals distinct (in Borneo) or vestigial; petals small, elliptic, spreading; stamens few or many (in Borneo), inserted in a ring at base into 5 bundles opposite the petals and more or less connate (in Borneo), or free, filaments filiform, anthers mostly dorsifixed, versatile with 2 locules opening by lateral slits; ovary half-inferior, variously fused with hypanthium to *c.* ¾ its height (in Borneo), with villous convex top, 3-locular, each locule with few to many ovules, attached variously to placenta, style sunken in pit, filiform, with small or occasionally capitate stigma. **Fruit** *a loculicidally dehiscent capsule*, concealed within a

woody hypanthium; calyx lobes persistent. **Seeds** many, tiny, obovoid, with thin hard testa; embryo straight, cotyledons small, planoconvex to obvolute, not foliaceous.

**Distribution.** About 250 species, mostly in Australia; one (*M. leucadendra*) in New Guinea and surrounding area; one (*M. cajuputi*) in S China and SE Asia (including Borneo).

**Ecology.** Mostly in primary and succondary savannas.

## **Melaleuca cajuputi** Powell

(Malay, *kayu putih* = white tree; referring to the bark appearance; also the name of the medicinal oil extracted from the leaves)

Pharm. Roy. Coll. Phys. London, Transl. (1809) 22; Miquel *op. cit.* 402; Blake *op. cit.* 22; Kochummen *op. cit.* 248; Turner, Gard. Bull. Sing. 47, 2 (1996) 370; Craven & Barlow *op. cit.* 113; Argent *et al*. (eds.) *op. cit.* 464 ("*cajupti*"); Craven & Lepschi *op. cit.* 865; Parnell & Chantaranothai *op. cit.* 801; Chen & Craven *op. cit.* 329. **Type:** *Rumphius Herb. Amboin. 2* (*1741*) *76*, *t. 17*, *fig. 1*, *2* (figures and description). **Heterotypic synonyms:** *Myrtus saligna* Burm. *f.*, Fl. Ind. (1768) 116; *Melaleuca minor* Sm. *in* Rees, Cyclop. (1812) 23, no. 2; *Melaleuca viridifolia* Sm. var. *angustifolia* Blume *op. cit.* (1827) 1099; *Melaleuca lancifolia* Turcz., Bull. Soc. Imp. Mosc. 20 (1847) 164; *Melaleuca cumingiana* Turcz. *op. cit.* 164; *Melaleuca saligna* (Burm. *f.*) Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 66; *Melaleuca leucadendra* (L.) L. var. *minor* (Sm.) Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 465; *Melaleuca leucacendron auct. non* (L.) L. (1767): King *op. cit.* 70, Merrill, EB (1921) 436, Ridley *op. cit.* (1922) 713, Masamune, EPB (1942) 522, Backer & Bakhuizen *f. op. cit.* 347, J.A.R. Anderson *op. cit.* 280, Corner *op. cit.* 594.

**Distribution.** Myanmar, S China, Indo-China, Thailand, Sumatra, Peninsular Malaysia, Java, Borneo, Maluku, New Guinea and Australia.

**Notes.** Three subspecies, subsp. *cajuputi*, subsp. *cumingana* and subsp. *platyphylla* Barlow are recognised; only subsp. *cumingiana* is known in Borneo.

subsp. **cumingiana** (Turcz.) Barlow Fig. 6, Plate 4F.

(H. Cuming, 1791–1865, British naturalist and plant collector, principally in the Philippines)

Brunonia 9 (1987) 187. **Basionym:** *Melaleuca cumingiana* Turcz. *op. cit.* 164. **Type:** *Cuming 2437*, 'Sumatra' (mislabeled 'Singapore' at K), 1841 (isotype K). **Heterotypic synonyms:** *Melaleuca leucadendron auct. non* L. (1767): King *op. cit*. 90, Ridley *op. cit.* (1922) 713, Masamune *op. cit.* 522; *M. lancifolia* Turcz. *op. cit.* 164, J.A.R. Anderson *op. cit.* 280.

Tree to 20 m tall, to 50 cm diameter, with twisted trunk, ribbed and shortly buttressed at base; crown oblong, dull grey-green. **Bark** at first smooth, pale blue-green greyish, cracking and eventually buff-brown shaggily flaky; inner bark yellow-brown, fibrous. **Sapwood** dark yellow-brown, hard; heartwood dark brown. Parts at first grey-brown pubescent, indumentum caducous except on exposed parts of flower bud and fruit. **Twigs** *c*. 2 mm diameter apically, round in cross-section, rust-brown. **Leaves** thin, surfaces concolourous, drying more or less milky dark olive-brown, without visible gland dots or pits; blades lanceolate to sickle-shaped, 6–18 × 0.8–2.5 cm, base tapering gradually into short petiole, apex acute; lateral veins unequal, the main ones 4–5 pairs, parallel to margin, slender but raised on both surfaces; intercostal veins ascending, branched, hardly raised. **Inflorescences** terminal or subterminal-axillary, to 14 cm long; rachis *c.* 2 mm diameter at base; bracts and

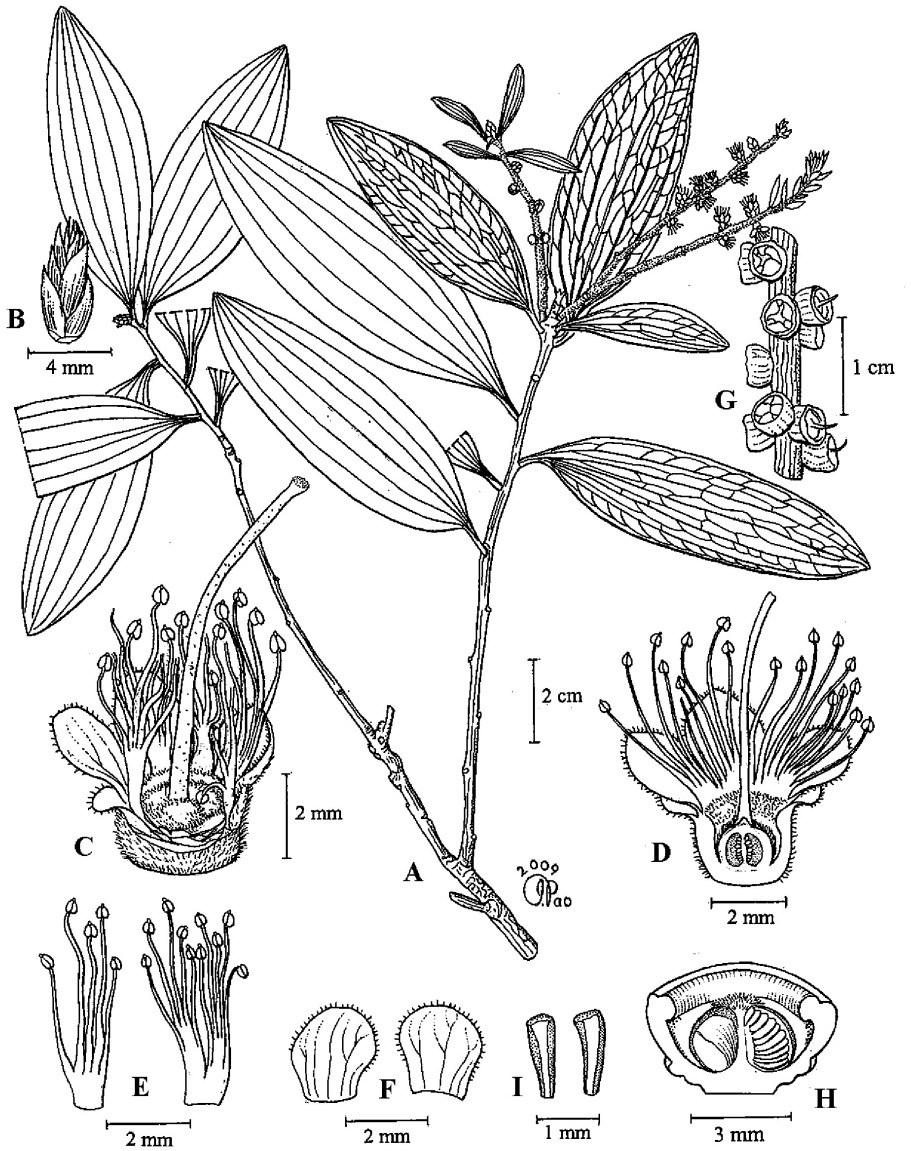


**Fig. 6.** *Melaleuca cajuputi* subsp. *cumingiana*. A, flowering leafy twig; B, apical bud; C, open flower with 2 sepals and 2 petals removed; D, longitudinal section of open flower; E, adaxial and abaxial view of stamens; F, petals; G, infructescence; H, longitudinal section of fruit; I, seeds. (A from *Frodin 2138*, B from *S 56311*, C–F from *Frodin 2138*, G–I from *S 56312*.)

bracteoles ovate-deltoid, to 7 × 4 mm, acute, cupped, caducous. **Flowers** in threes along spike; buds to 5 mm long, to 3 mm diameter, subsessile; hypanthium obconical; calyx lobes 5, ovate-deltoid, acute, to 1 × 1 mm; stamens many, filaments white, slender, exserted to *c.* 8 mm, anthers yellow; style exserted to 1 cm long, slender. **Fruit** a 3-valved capsule, subspherical, to 5 mm diameter; hypanthium hard, enclosing within an *c.* 3 mm diameter apical pore containing many tiny seeds.

**Vernacular name.** Sabah and Sarawak—*gelam* (Malay).

**Distribution.** Seasonal regions from S Asia and S China to the Philippines and Maluku; doubtfully native in aseasonal areas such as Borneo. In Sabah known from Sandakan district (e.g., *SAN 71270* and *SAN 71271*) and in Sarawak from Kuching and Samarahan districts (e.g., *Frodin 2138* and *S 56312*).

**Ecology.** Gregarious on infertile soils with impeded drainage, including acid sulphate soils behind the mangrove, where there is frequent fire and a perennial grass field layer.

**Uses.** Planted for firewood, also for posts and piling. The bark can be used for caulking and is inflammable, suitable for torches. Best known for the aromatic oil distilled from leaves, which is medicinal and used for skin complaints and also as a vermifuge.

# 6. **OSBORNIA** F.Muell.

(Joannes Walter Osborne, 1828–1902, an Australian physician and chemist)

Fragm. Phyt. Austral. 3 (1862) 30; Bentham *in* Bentham & Hooker *f*, Gen. Pl. 2, 2 (1862) 694, 711; Bentham, Fl. Austral. 3, 1 (1866) 271; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 235.

Shrub or small tree. Parts glabrous but for the flowers. **Leaves** *opposite*; *blades laminar*, *small*, *apex notched*; *pinnately veined*. **Flowers** in terminal or axillary triads, small, sessile, puberulent; *hypanthium* turbinate, hardly raised above ovary, *subequally 8-lobed*, lobes persistent; petals 0; stamens many, 2–3-seriate, free, hardly exserted, filaments filiform, anthers small, versatile, dehiscing by longitudinal slits; ovary inferior, imperfectly 1–2-locular, ovules numerous, placentation axile, style subulate stout, stigma small. **Fruits** included in and adnate to persistently lobed hypanthium, *hard*, *indehiscent*. **Seeds** 12, obovoid; testa thin; embryo straight, cotyledons thick, flat or subhemispherical, with long radicle.

**Distribution.** One species; from Borneo and the Philippines to N Australia and Polynesia.

## **Osbornia octodonta** F.Muell. Fig. 7.

(Latin, *octo* = eight, *donta* = toothed; referring to the number of calyx lobes)

Fragm. Phyt. Austr. 3 (1862) 30; Bentham *op. cit.* (1866) 271; Hooker, Icon. Pl. 3rd. Ser., 1 (1867–1871) 31, pl. 1041; Merrill, EB (1921) 435, Enum. Philip. Pl. 3 (1923) 182; Masamune, EPB (1942) 522; J.A.R. Anderson, CLTS (1980) 281. **Type:** *D. Henne s.n.*, N Australia, Trinity Bay (holotype MEL, *n.v.*).

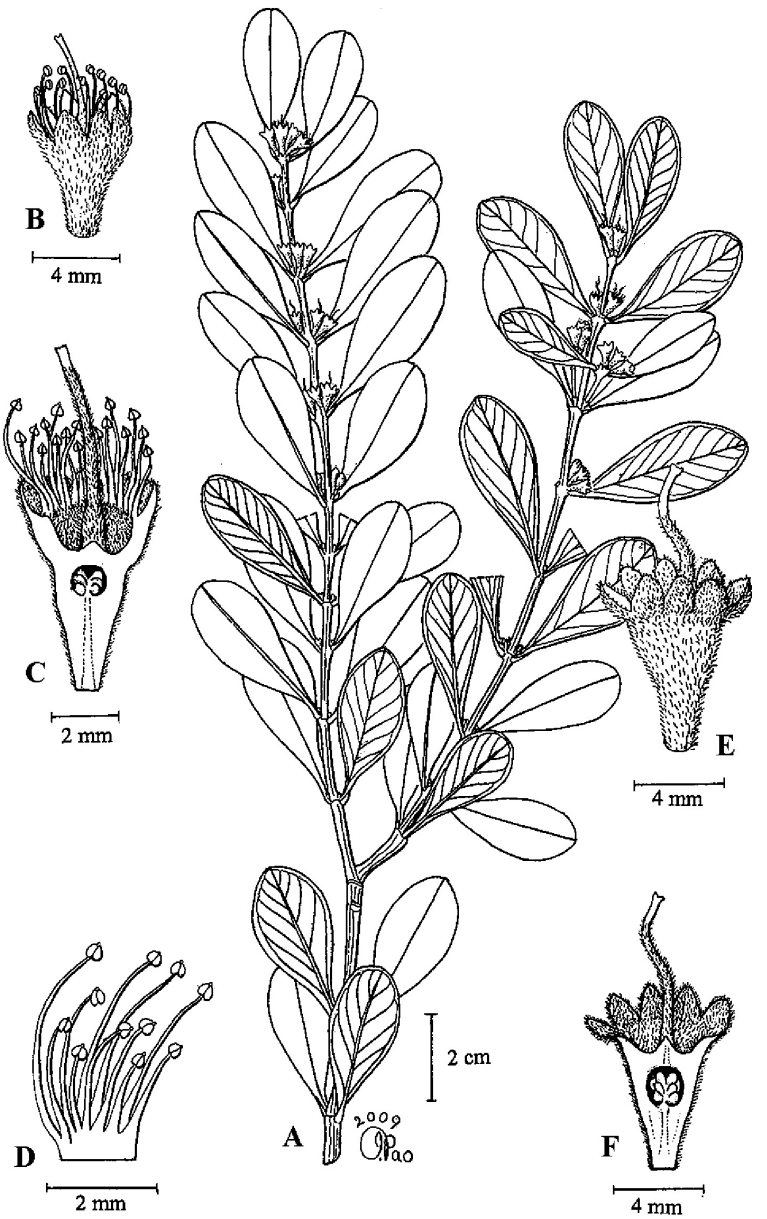


**Fig. 7.** *Osbornia octodonta*. A, fruiting (young) leafy twig; B, open flower; C, longitudinal section of open flower; D, adaxial view of stamen bundle; E, young fruit; F, longitudinal section of young fruit. (A from *S 53795*, B–D from *S 38933*, E–F from *S 53795*.)

Small tree, to 6 m tall, to 10 cm diameter. **Bark** yellow-brown, fissured and flaky, fibrous. Exposed parts of flower and fruit silvery-grey pubescent, otherwise parts glabrous. **Twigs** *c.* 2 mm diameter apically, cream-brown, round in cross-section, smooth, much-branched. **Leaves** thin, drying dull rust-brown, gland dots and pits obscure; blades obovate, 3–5 × 1.2–2 cm, base tapering into short obscure petiole and swelling into a pocket covering the axillary bud, apex rounded or shallowly notched; lateral veins hardly visible, *c.* 4 pairs, ascending; intercostal venation obscure; intramarginal veins close to margin. **Flowers** subsessile with minute bracteoles; buds obconical, *c.* 8 mm long, *c.* 4 mm diameter, with 8, *c.* 1 × 1 mm deltoid acute calyx lobes; stamens many, hardly exserted; style exserted to *c.* 6 mm long. **Fruits** obconical, to 9 mm long, to 5 mm diameter, hard, indehiscent, enclosed and adnate to hypanthium with persistent calyx lobes.

**Vernacular names.** Sabah—*gelam laut* (Malay, Bajau). Sarawak—*ubah laut* (Iban, Malay).

**Distribution.** As the genus. In Borneo, recorded in Sabah from Beaufort, Kuala Penyu, Lahad Datu, Sandakan, Semporna, Tawau and Tuaran districts (e.g., *Sugau JBS 364*, *SAN 26147*, *FD FMS 35358*, *FD FMS 44285*, *SAN 49159* and *SAN 62377*) and in Sarawak from Kuching and Lundu districts (e.g., *Haviland 3271*, *S 35132*, *S 38244*, *S 38933*, *S 42030* and *S 53795*). Also known in E Kalimantan (e.g., *Meijer 2010* and *bb 19785*).

**Ecology.** On sandy coasts, in sandy mangroves and on brackish river banks.

**Uses.** The bark was used for caulking boats; the wood which is strong and durable but the stems crooked, for house and fence posts.

# 7. **RHODAMNIA** Jack

(Greek, *rhodo* = red, *amnion* = the foetal membrane in mammals; referring to the viscous fluid round the ovules)

Mal. Misc. 2 (1822) 48; Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 77; Miquel, Fl. Ind. Bat. 1, 1 (1855) 478; Bentham *in* Bentham & Hooker *f.*, Gen. Pl., 1, 2 (1865) 715; Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 468; King, J. As. Soc. Beng. 70, 2 (1901) 74; Ridley, FMP 1 (1922) 716; Backer & Bakhuizen *f.*, FJ 1 (1964) 334; Kochummen, TFM 3 (1978) 250; Scott, Kew Bull. 33, 3 (1979) 429; J.A.R. Anderson, CLTS (1980) 281; Coode *et al.* (eds.), CLBD (1996) 234; Corner, WSTM 4th. edition 2 (1997) 596; Argent *et al.* (eds.), MNDT-CK 2 (1997) 466; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 805; Beaman & C. Anderson, PMK 5 (2004) 210; Chen & Craven, Fl. China 13 (2007) 330; Snow, Syst. Bot. Monogr. 82 (2007) 16; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 248. **Synonyms:** *Monoxora* Wight, Ill. Ind. Bot. 2 (1831) 12, *t.* 97, fig. 5; *Opanea* Raf., Sylva Tell. (1838) 106.

Small or canopy trees, often buttressed. **Bark** smooth. *Parts especially the leaves beneath more or less pubescent*. **Twigs** round in cross-section. **Leaves** *opposite*, petiolate; *blades laminar*, *3-veined at base*; *intramarginal veins equally prominent as the midrib*, *unlobed*. **Inflorescences** (in Borneo) axillary or ramiflorous *dichasial clusters of 1-many flowers*, rarely racemose; bracts and bracteoles small, deciduous. **Flowers** bisexual, *usually 4-merous*; hypanthium bell-shaped to spherical; calyx lobes 4–5, usually persistent, hardly exceeding the ovary; *petals white*, large, elliptic; stamens many, filaments free, anthers dorsifixed, versatile, dehiscing along lateral slits; *ovary more or less inferior*, *1-locular*, locule with 2(–3) parietal placentas each bearing many ovules in 4–6 series, style slender,

stigma capitate. **Fruit** an ellipsoid or spherical *berry*, usually crowned by persistent calyx lobes. **Seeds** *4–10 per fruit*, kidney-shaped to spherical, with hard shiny testa; embryo horseshoe-shaped with long radicle and short cotyledons.

**Distibution.** About 24 species, from Indo-Burma to eastern Australia, the Solomon Islands and New Caledonia. Three species in Borneo.

**Ecology.** In lowland to upper montane forest on infertile yellow or sandy soils, at altitudes to 2000 m.

## Key to *Rhodamnia* species

1. Exposed living parts including leaf undersurface golden-brown velvety. Leaf apex rounded or shortly broadly acuminate, base generally obtuse……...**2. R. mulleri**
   Exposed living parts including leaf undersurface silvery or pale rust-brown puberulent. Leaf apex slender acuminate or subcaudate, base generally wedge-shaped…….2

2. Leaf blade 7–20 × 2–6 cm, thin and wrinkled on drying, apex acuminate. Tree of secondary forest on yellow soils……**1. R. cinerea**
   Leaf blade 2.5–7 × 0.6–2 cm, somewhat leathery and not wrinkled on drying, apex subcaudate. Gnarled tree or shrub of mountain summits…….**3. R. uniflora**

## 1. **Rhodamnia cinerea** Jack — Fig. 8.

(Latin, *cinereus* = ash-grey; referring to the colour of the leaf undersurface)

Mal. Misc. 2 (1822) 48; Blume *op. cit.* (1850) 78; Miquel *op. cit.* (1855) 478; Merrill, EB (1921) 423; Ridley *op. cit.* (1922) 716; Masamune, EPB (1942) 522; Backer & Bakhuizen *f. op. cit.* 334; Kochummen, TFM 3 (1978) 250; Scott *op. cit.* 435; J.A.R. Anderson *op. cit.* 281; Kessler & Sidiyasa, TBSA-EK (1994) 186; Turner, Gard. Bull. Sing. 47, 2 (1996) 371; Coode *et al*. (eds.) *op. cit.* 234; Corner *op. cit.* 596; Argent *et al*. (eds.) *op. cit.* 468; Parnell & Chantaranothai *op. cit.* 805; Beaman & C. Anderson *op. cit.* 210. **Type:** *Jack s.n.*, Sumatra, *loc. incert.* (isotype L). **Heterotypic synonyms:** *Myrtus spectabilis* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1083; *Myrtus smilacifolia* Wall., Cat. (1831) 3629, *nom. nud.*; *Myrtus globosa* Korth., Ned. Kruidk. Arch. 1 (1847) 197, Merrill *op. cit.* (1921) 424, Masamune *op. cit*. 522; *Monoxora spectabilis* (Blume) Wight, Ic. Pl. Ind. Or. 2 (1843) 9; *Rhodamnia cinerea* var. *concolor* Blume, var. *laxiflora* Blume, var. *macrophylla* Blume *op. cit.* (1850) 78; *R. globosa* Blume *op. cit.*(1850) 79; *R. spectabilis* Blume *op. cit.* (1850) 79, *incl.* var. *cuspidata*; *R. subtriflora* Blume *op. cit.* (1850) 79, *incl.* var. *reticulata*; *R. nagelii* Miq. *op. cit.* (1855) 478; *R. subtriflora* var. *oblongata* Miq., Fl. Ind. Bat. Add. (1858) 1087; *R. concolor* Miq., Fl. Ind. Bat., Suppl. (1861) 315; *R. cinerea* var. *pilosior* Miq. *op. cit.* (1861) 315; *R. trinervia* (Sm.) Blume, var. *spectabilis* (Blume) Kurz, var. *concolor* (Blume) Kurz, J. As. Soc. Beng. 46 (1877) 62; *R. cinerea* var. *caudata* Ridl. *op. cit.* (1922) 716.

Tree to 20 m tall, to 20 cm diameter, hardly buttressed; crown diffuse, distinctly pale from beneath, with horizontal to slightly pendent twigs bearing leaves in a plane. *Exposed living parts*, including *leaf undersurface*, *persistently and densely silvery or pale rust-brown puberulent*. **Bark** smooth, mauve-brown, eventually scantily cracked. **Twigs** 1–2 mm diameter apically, slender, sometimes quadrangular beneath nodes, otherwise round in cross-section. **Leaves** *thin*, *drying wrinkled*; *blades* elliptic to sometimes lanceolate, *7–20 × 2–6 cm*, *base wedge-shaped* and shortly tapering, *apex sharply slender-acuminate*; midrib and 2 main lateral veins equal, slender, furrowed above, distinctly raised beneath; intercostal

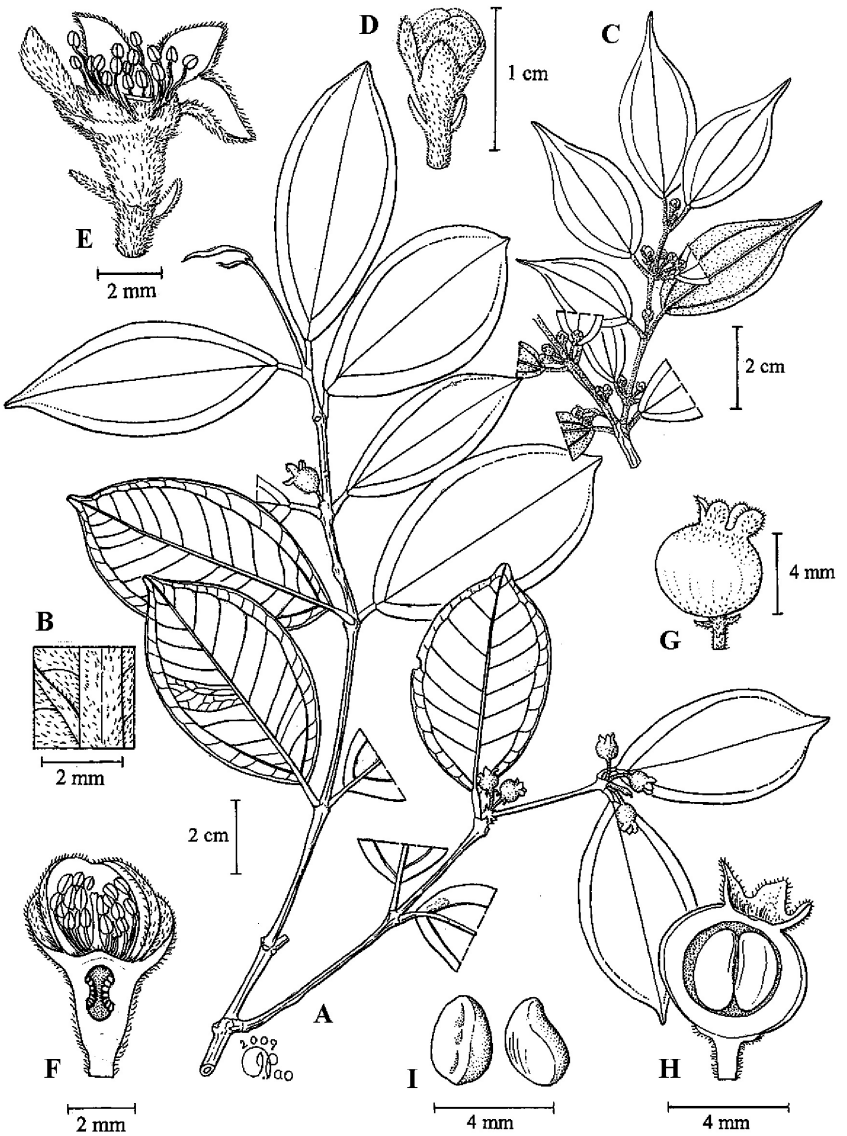


**Fig. 8.** *Rhodamnia cinerea*. A, fruiting leafy twig; B, indumentums on lower leaf surface; C, flowering leafy twig; D, flower bud; E, open flower; F, longitudinal section of mature flower bud; G, fruit; H, longitudinal section of fruit; I, different view of seeds. (A–B from *S 46092*, C–F from *S 47308*, G–I from *S 46092*.)

venation distinct, lax; intramarginal vein *c.* 0.5 mm within margin; petioles slender, *c.* 7 mm long. **Flowers** in dense axillary or sometimes terminal many-flowered dichasial clusters, reduced to 1–2 flowers at anthesis; buds subsessile; peduncle slender, to 6 mm long; hypanthium cup-shaped, *c.* 2 mm long, *c.* 2 mm diameter, with 5, *c.* 2 × 2 mm hemispherical calyx lobes; petals sparsely silky outside, glabrous inside; stamens *c.* 20, barely exserted, with slender sinuous filaments. **Fruits** juicy, ripening purplish, spherical, to 8 mm diameter, crowned with the persisting leafy calyx lobes. **Seeds** 4–10(–25), angular.

**Vernacular name.** Sarawak—*lidah katak bukit* (Malay).

**Distribution.** Myanmar, Peninsular Thailand, Sumatra, Peninsular Malaysia, Java, Borneo and the Philippines (Palawan only). In Borneo, common throughout Sabah (e.g., *SAN 26981*, *SAN 47824*, *SAN 74380*, *SAN 87158*, *SAN 116364* and *SAN 141020*) and in Sarawak recorded from Kuching, Lawas, Lundu and Miri districts (e.g., *Hose 518*, *S 31138*, *S 34529*, *S 38688* and *S 40337*). Also known in Brunei (e.g., *Forman 801*, *BRUN 926* and *BRUN 17106*) and Kalimantan (e.g., *Afriastini 1216*, *Arifin Berau 1535*, *Kessler PK 2203*, *van Balgooy 6064*, *Veldkamp 8258* and *Kostermans 13574*).

**Ecology.** Frequent in secondary forest on degraded land, usually on infertile pale yellow or sandy soils; also on landslips and, occasionally, large treefall gaps in primary forests; at altitudes to 1000 m, sometimes to 2000 m in the Mt. Kinabalu foothills.

**Uses.** According to Burkill (EPMP 2nd. printing, 2 (1966) 1935), the wood is used for small objects; the leaves and sometimes roots are used in a decoction after childbirth; the bark yields a black dye, and for tanning nets; and the fruit is edible.

**Notes.** Varying much geographically and ecologically, the two species that follow are doubtfully distinct from it. Formerly united with *Rhodamnia dumetorum* (DC) Merr. & L.M.Perry (J. Arn. Arb. 19 (1938) 195) under its synonym *R. trinervium* (Lour.) Blume, a species of the seasonal tropics from Indo-Burma to China and Australia, differs from *R. cinerea* by its racemose inflorescence and densely silky petals.

## 2. **Rhodamnia mulleri** (Korth.) Blume

(Salomon Müller, 1804–1864, German taxidermist and plant collector in southern Borneo)

Ann. Mus. Bot. Lugd.-Bat. 1 (1850) 79; Miquel *op. cit.* (1855) 479; Scott *op. cit.* 441. **Basionym:** *Myrtus mulleri* Korth. *op. cit.* 197. **Type:** *Muller s.n.*, Borneo, S Kalimantan, Doesoen, Karrau R. (holotype L).

Small tree or shrub, to 6 m tall. *Living parts persistently golden-brown velvety*, *becoming sparse on blade beneath*. **Twigs** *c.* 2 mm diameter apically, round in cross-section. **Leaves** thickly leathery, golden-brown beneath with dark purple-brown venation, drying dark purplish brown above; blades broadly elliptic to ovate or more often obovate, 3.5–10 × 1.5–7 cm, *base obtuse*, wedge- to shallowly heart-shaped, *apex rounded or broadly acuminate*, acumen to 8 mm long; midrib and main lateral veins usually slightly furrowed above, sometimes obtusely raised and prominent beneath, intermediate veins distinct, ascending, most of them reaching the intramarginal veins; intercostal venation obscure above, slightly elevated beneath; petioles *c.* 5 mm long. **Flowers** in axillary clusters of 1–3, subsessile; peduncle to 7 mm long; bracteoles acicular, to 3 mm long; hypanthium obovoid becoming bell-shaped, *c.* 4 mm long, *c.* 3 mm diameter; calyx lobes deltoid, erect, to 2 × 2 mm. **Fruits**

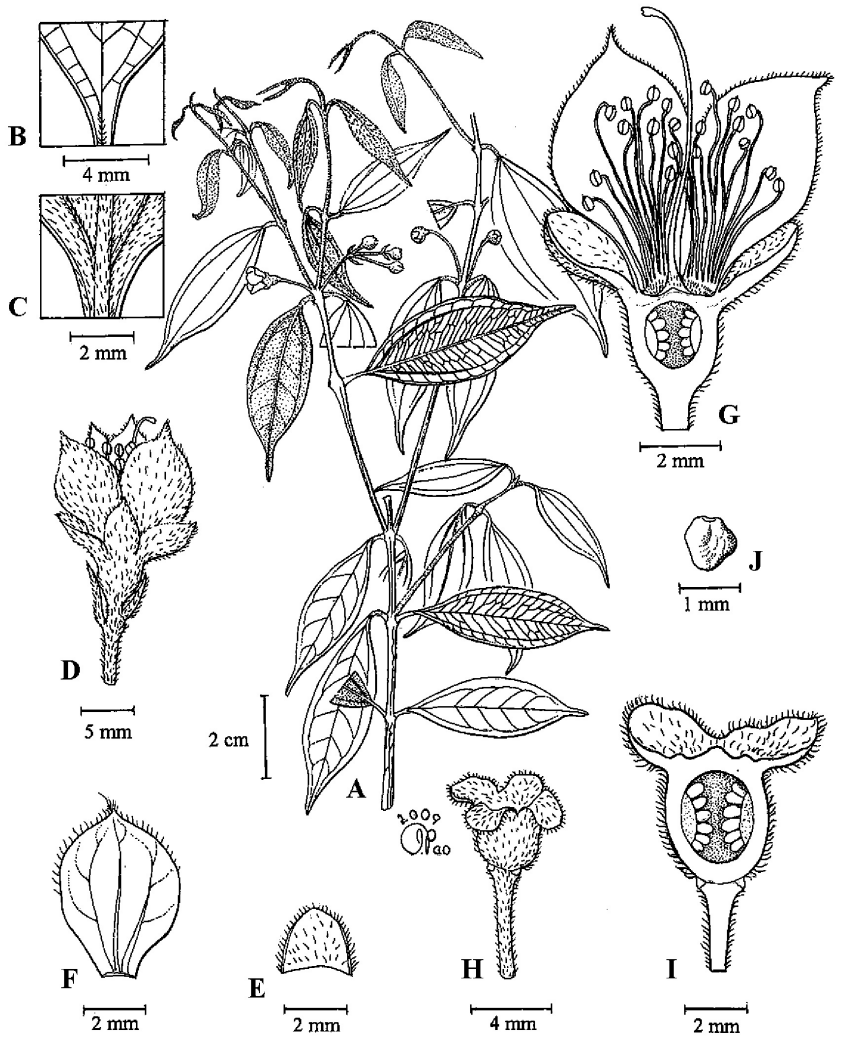


**Fig. 9.** *Rhodamnia uniflora*. A, flowering leafy twig; B, upper surface of leaf base; C, indumentum of lower surface of leaf base; D, open flower; E, sepal; F, petal; G, longitudinal section of open flower; H, young fruit; I, longitudinal section of young fruit; J, seed. (A–G from *Carrick 540*, H–J from *Brooke 8572*.)

spherical, to 8 mm diameter, pinkish, ripening purple, with persistent crown of erect calyx lobes. **Seeds** 5–7, angular.

**Vernacular name.** Sarawak—*lidah katak beludu* (Malay).

**Distribution.** Endemic to Borneo. Widespread but very local; unknown from Sabah. In Sarawak recorded from Kuching, Lawas, Lundu and Miri districts (e.g., *Beccari 1979*, *Haviland 2205*, *Purseglove 4883*, *S 12365*, *S 16209*, *S 17883* and *S 43109*). Also known in W Kalimantan (e.g., *van Balgooy 5607* and *Alston 13086*).

**Ecology.** Locally abundant, in *kerangas* on rocky plateaux, and on rocky summits in the lower facies of upper montane forest at altitudes to 1200 m; not far from the coast.

## 3. **Rhodamnia uniflora** (Ridl.) I.H.Burkill Fig. 9.

(Latin, *unus* = one, *flos* = flower; referring to the solitary flowers)

Gard. Bull. Str. Settl. 3 (1923) 42; Scott *op. cit.* 440; Beaman & C. Anderson, *op. cit.* 211. **Basionym:** *Rhodamnia trinervia* Blume var. *uniflora* Ridl., J. Fed. Mal. St. Mus. 6 (1915) 146. **Type:** *Wray & Robinson 5500*, Peninsular Malaysia, *loc. incert.* (isotype BM). **Homotypic synonym:** *Rhodamnia cinerea* Jack var. *uniflora* (Ridl.) Ridl., Fl. Mal. Pen. 1 (1922) 71.

Small much-branched, dense-crowned tree or shrub to 10 m tall. **Bark** smooth. *Exposed living parts more or less pale rust-brown puberulent*, glabrescent, except for the midrib, fruits and hypanthium. **Twigs** *c.* 1 mm diameter apically, slender, much-branched, at first somewhat quadrangular. **Leaves** *thinly leathery*, *distinctly silvery or pale rust-brown puberulent beneath* even in juveniles, *drying not wrinkled*, dark purplish brown above, without distinct gland dots or pits; *blades* elliptic-lanceolate, *2.5–7 × 0.6–2 cm*, *base wedge-shaped*, shortly tapering, *apex subcaudate*, acumen to 15 mm long; intermediate veins distinct beneath, unequal, *c.* 5 pairs, reaching intermarginal veins; intercostal venation dense, more or less equally distinct on both surfaces. **Flowers** in axillary clusters, small; peduncle slender, to 10 mm long (generally shorter); bracteoles acicular to 1 mm long; hypanthium obconical, to 6 mm long, to 2 mm diameter; calyx lobes deltoid, thick, to 1 × 1 mm. **Fruits** spherical, to 8 mm diameter, ripening purple. **Seeds** 3–6.

**Vernacular name.** Sarawak—*lidah katak runcing* (Malay).

**Distribution.** Peninsular Malaysia and Borneo. In Borneo, recorded in Sabah from Beaufort, Kinabatangan, Ranau, Sandakan and Sipitang districts (e.g., *Clemens 33065*, *Clemens 35084*, *SAN 86363*, *SAN 124610* and *SAN 131726*) and in Sarawak from Kuching, Lundu and Sri Aman districts (e.g., *Beccari 2406*, *Purseglove 4775*, *S 13561*, *S 13613* and *S 88570*).

**Ecology.** Local, on rocky summits at 1000–2000 m altitude, in the lower facies of upper montane forest.

# 8. **RHODOMYRTUS** (DC.) Rchb.

(Greek, *rhodos* = red, Latin, *myrtus* = the myrtle tree)

Deut. Bot. Herb.-Buch (1841) 117; Hasskarl, Flora 25 (1842) 35; Blume, Bot. Mus. Lugd.-Bat. 1 (1850) 76; Miquel, Fl. Ind. Bat. 1, 1 (1855) 477; Bentham *in* Bentham & Hooker *f.*, Gen. Pl. 2, 2 (1862) 695, 713; Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 469; King, J. As. Soc. Beng. 70, 2 (1901) 75; Ridley, FMP 1 (1922) 717; Merrill, Enum. Philip. Pl. 3 (1923) 156; Backer & Bakhuizen *f.*, FJ 1 (1964) 335; Kochummen TFM 3 (1978) 251; Scott, Kew Bull. 33, 2 (1978) 311; Corner, WSTM 4th. edition 2 (1997) 596; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 809; Beaman & C. Anderson, PMK 5 (2004) 211; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 247. **Basionym:** *Myrtus* L. sect. *Rhodomyrtus* DC., Prodr. 3 (1828) 240.

Shrubs or trees. *Young parts woolly pubescent*. **Leaves** *opposite*; *blades laminar*, *dull beneath*, *apex blunt*, *typically 3-veined at base*, sometimes pinnately veined; *intramarginal veins as prominent as the midrib*, *unlobed*. **Flowers** axillary or terminal, *solitary or in pedunculate cymes*; bracteoles small; *perianth 4–5-merous*; hypanthium ellipsoid or globose, hardly extended above the ovary; calyx lobes broad, herbaceous, equal or unequal; usually persistent in fruit; *petals pink*, large, elliptic-oblong; *stamens many*, free in a ring or partly clustered opposite petals, filaments slender, anther locules paired, versatile or attached near base, opening by lateral slits; *ovary inferior*, (*1–*)*2*(*–4*)*-locular*, each locule with many ovules usually on 3–4 axile placentas, rarely 1 parietal, style short, cylindrical, with capitate stigma. **Fruit** *a dry or fleshy berry*, usually crowned by persistent calyx lobes. **Seeds** kidney-shaped, *few or many*, each seed separated by thin false septa, in 5–20 rows; testa hard; embryo horseshoe- or ring-shaped with a long radicle and very short cotyledons.

**Distribution.** About 11 species, from S China and SE Asia eastward to the Solomon Islands and eastern Australia; one in Borneo.

## **Rhodomyrtus tomentosa** (Soland. *ex* Aiton) Hassk. Fig. 10, Plate 5A.

(Latin, *tomentosum* = thickly and evenly covered with short more or less appressed curled or curved matted hairs; referring to the indumentum of the exposed living parts)

Flora 25 (1842) 35; Wight, Spicil. Neilgherr. 1 (1851) 60, *t*. 71; Blume *op. cit.* (1850) 77; Miquel *op. cit.* (1855) 477; Duthie *in* Hooker *f. op. cit.* 469; King *op. cit.* 75; Merrill, EB (1921) 425; Ridley *op. cit.* (1922) 717; Merrill *op. cit.* (1923) 156; Masamune, EPB (1942) 522; Backer & Bakhuizen *f. op. cit.* 335; Kochummen *op. cit.* 251; Scott *op. cit.* 313; J.A.R. Anderson, CLTS (1980) 281; Turner, Gard. Bull. Sing. 47, 2 (1996) 371; Coode *et al*. (eds.), CLBD (1996) 234; Corner, WSTM 4th. edition 2 (1997) 597; Parnell & Chantaranothai *op. cit.* 809; Beaman & C. Anderson *op. cit.* 211. **Basionym:** *Myrtus tomentosa* Soland. *ex* Aiton, Hort. Kew 2 (1789) 159, Blume, Bijdr. Fl. 17 (1827) 1081, Reichbach *op. cit.* 117. **Type:** Unknown (Based on a plant growing in the Royal Botanic Gardens, Kew, introduced *c.* 1776 by a Mrs Norman, from China).

Low shrub. Exposed living parts golden-buff velvety pubescent, indumentum sparse and glabrescent on leaf above, otherwise persistent and dense. **Twigs** 1–2 mm diameter apically, round in cross-section, smooth becoming minutely cracked and shallowly flaky, pale grey-brown. **Leaves** thin but fleshy when fresh, gland dots and pits obscure, drying ochreous-buff beneath, dark purplish brown above; blades lanceolate to elliptic, 2.5–9 × 1.5–4 cm, base broadly wedge-shaped, margin narrowly recurved, apex notched to 6 mm broadly and bluntly acuminate; main lateral veins *c.* 6 pairs, with more or less obscure intermediate veins, slender, raised beneath; intramarginal veins 5–6 mm within margin, somewhat looped; intercostal venation slightly raised and visible beneath, obscure above, net-like, ladder-like between intramarginal veins and margin; petioles to 5 mm long. **Flowers** in axillary clusters of 3; peduncles slender, to 1.5 cm long; bracteoles persistent, ovate acute, *c.* 2 × 2 mm; buds including stout pseudostalk, to 15 mm long, to 10 mm diameter; hypanthium shallowly bell-shaped, *c.* 3 mm long, *c.* 2 mm diameter; calyx lobes 5, thin,

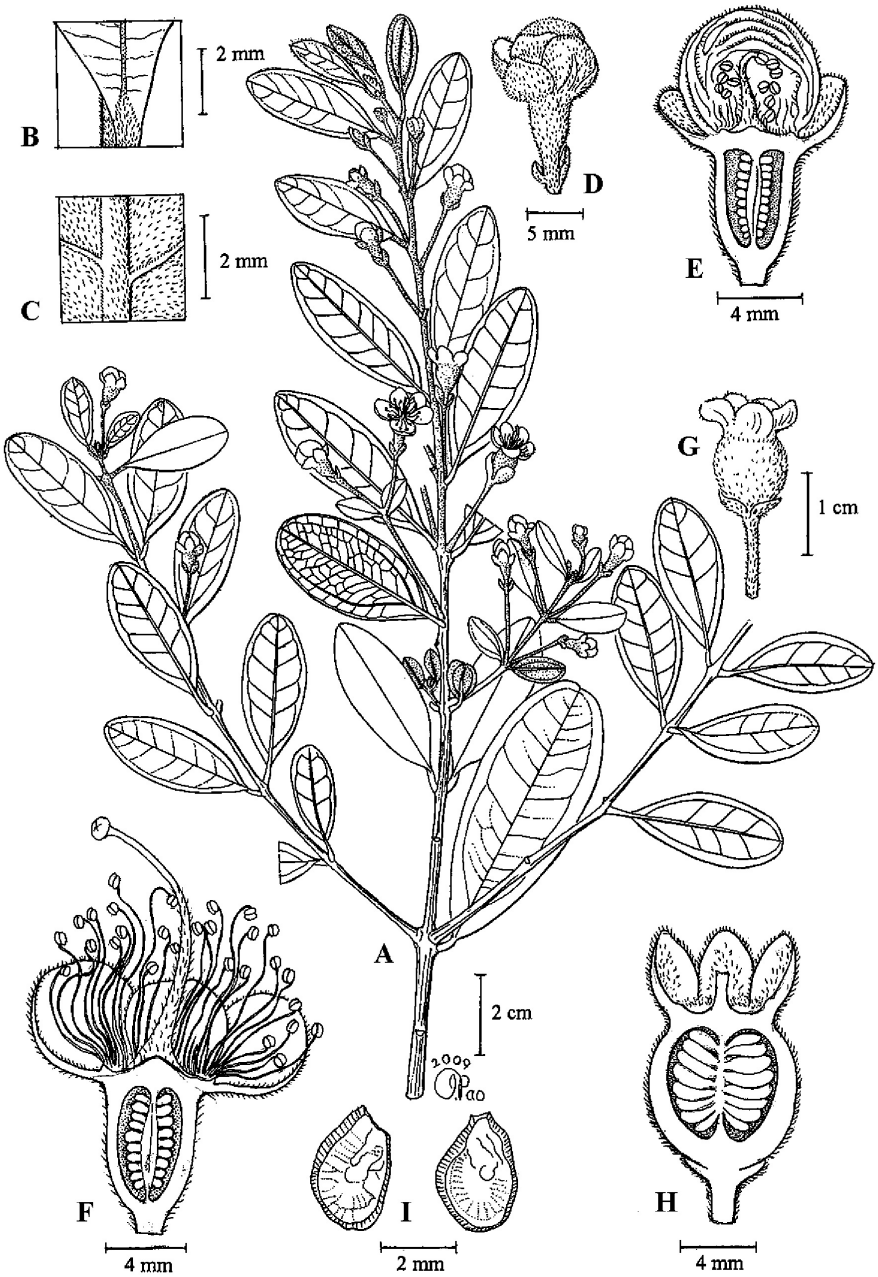


**Fig. 10.** *Rhodomyrtus tomentosa*. A, flowering leafy twig; B, upper surface of leaf base; C, indumentum of lower surface of leaf base; D, mature flower bud; E, longitudinal section of mature flower bud; F, longitudinal section of open flower; G, young fruit; H, longitudinal section of young fruit; I, seeds. (A–C from *S 56303*, D–F from *S 57315*, G–I from *S 24538*.)

ovate *c.* 4 × 4 mm; petals large, pink, white, pubescent outside; stamens many, filaments pink, slender, exserting to *c.* 10 mm long, anthers small, yellow; ovary 3–4-locular, style slender but rigid, exserting to *c.* 12 mm long. **Fruits** ellipsoid, *c.* 15 mm long, *c.* 8 mm diameter, with persistent crown of spreading calyx lobes. **Seeds** many.

**Vernacular names.** Sarawak—*kemunting* (Malay), *lidah katak laut* (Malay).

**Distribution.** S and SE Asia to Australia and New Caledonia. In Borneo, widespread and recorded in Sabah from Beaufort, Kuala Penyu, Kudat, Lahad Datu, Papar, Penampang, Ranau, Sandakan, Sipitang and Tuaran districts (e.g., *Clemens 27628*, *SAN 32226*, *SAN 33849*, *SAN 66264*, *SAN 84374*, *SAN 116159* and *SAN 130165*) and in Sarawak from Bintulu, Kuching, Lundu and Miri districts (e.g., *S 8322*, *S 24538*, *S 45231*, *S 51583* and *S 57315*). Also known in Brunei (e.g., *van Niel 4129*, *BRUN 5214*, *Jacobs 5670* and *BRUN 7750*) and Kalimantan (e.g., *Sidiyasa 1068*, *Kessler 1639* and *Arbainsyah AA 1858*).

**Ecology.** Common in derelict and degraded land on white and yellow sands where the organic matter has been lost, and on sandy seashores, at altitudes to 1000 m.

**Uses.** Burkill (EPMP 2nd. printing, 2 (1966) 1903) states that the fruit can be used for jams and tarts, and against diarrhea, while the roots can be used for stomach ache and diarrhea, and as a poultice at child-birth. The wood can be carved into small objects.

# 9. **SEORSUS** Rye & Trudgen

(Latin, *seorsus* = apart; referring to the great geographical separation of the different species)

Nuytsia 18 (2008) 248.

Shrubs or treelets, *often prostrate*. Parts glabrous. **Bark** fibrous, becoming scaly. **Twigs** *rigid*, with prominent flanges along whose edges cracks develop. **Leaves** *opposite and decussate*, petiolate, the petioles borne on twig swellings, *gland dots and pits more or less obscure*; without stipules; *blades linear*, variously textured and *curved* or *flat at margins*, margins entire; venation obscure. **Flowers** axillary on short peduncles, subsessile, with minute bracteoles; *perianth 5*(*–6*)*-merous*; hypanthium cup-shaped with distinct often fringed calyx lobes; petals round, early caducous; *stamens* 15–78, *in fascicles of threes opposite the petals*, shorter than sepals (except for Bornean species), unequal with the shortest inside, filaments slender, united into a slender claw, anthers adnate, dorsifixed, 2-locular, latrorse, meeting apically at a triangular connective with large inward gland, separate at base; ovary inferior, (2–)3-locular, each locule with (2–)6–16 ovules in 2 rows or scattered around placenta, placentation axile, style short with capitate stigma. **Fruit** a hemispherical or bowl-shaped *woody capsule*, dehiscing loculicidally; calyx lobes persistent. **Seeds** many, discoid or cuboid, angular; *embryo with minute cotyledons* and *long radicle*.

**Distribution.** Four species; two in Borneo and two in Australia. Of the two Bornean species, *Seorsus taxifolius* is found in upper montane forest and rocky summits of G. Murud and the Dulit Ranges at 1300–2400 m altitude in Sarawak, and *S. aequatorius* Rye & Trudgen is known from G. Kelam and G. Palung in W Kalimantan, at 600–1000 m altitude.

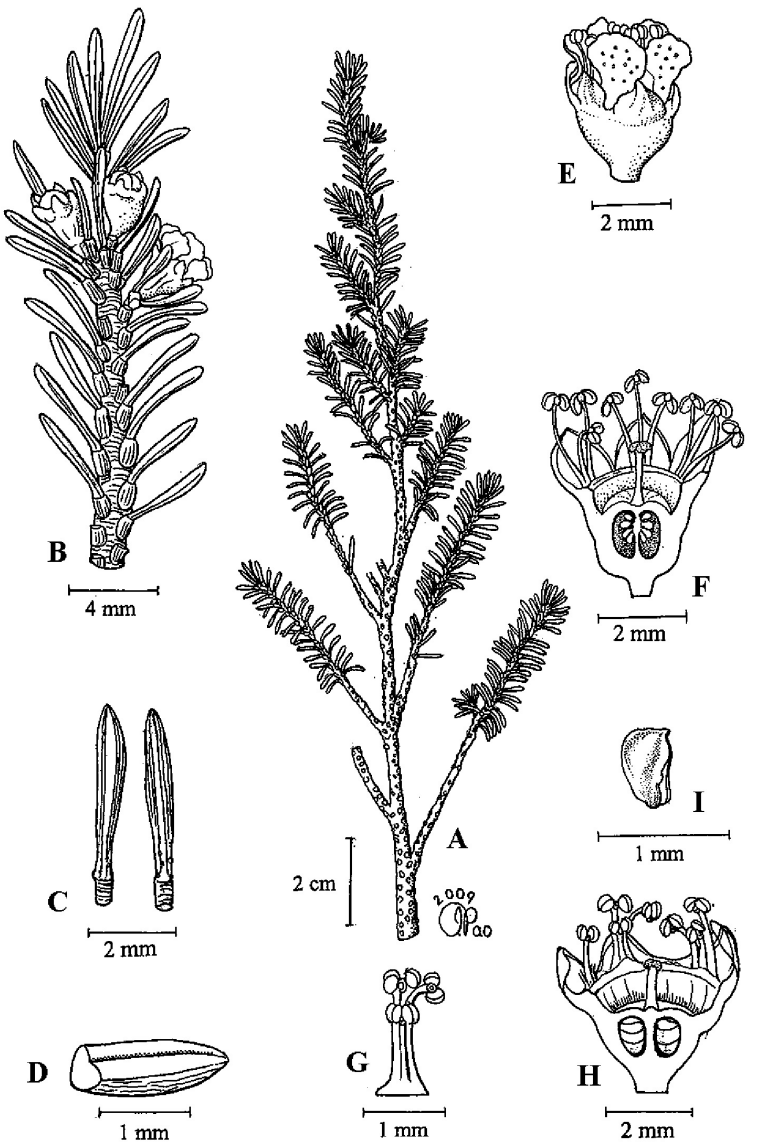


**Fig. 11.** *Seorsus taxifolius*. A, leafy twig; B, distal part of flowering leafy twig; C, adaxial and abaxial view of leaf blade; D, section of leaf blade; E, open flower; F, longitudinal section of open flower; G, stamens; H, longitudinal section of young fruit; I, seed. (A–F from *Nooteboom & Chai 02016*, G–I from *S 80014*.)

**Seorsus taxifolius** (Merr.) Rye & Trudgen Fig. 11.
(Latin, *taxus* = the Yew tree, *folium* = leaf; referring to the needle-like yet soft leaf, resembling that of Yew tree)

Nuytsia 18 (2008) 255. **Basionym:** *Baeckea taxifolia* Merr. Sar. Mus. J. 3 (1928) 534, Masamune, EPB (1942) 520; J.A.R. Anderson, CLTS (1980) 272. **Homotypic synonym:** *Babingtonia taxifolia* (Merr.) A.R.Bean, Austrobaileya 4 (1997) 632. **Lectotype** (Bean, 1997)**:** *Mjőberg 111*, Oct. 1922, G. Murud, NE Sarawak, at 2400 m (UC, *n.v.*; isolectotypes BM, K).

Prostrate shrub or treelet to 2 m tall. Parts more or less glabrous. **Twigs** *c.* 1 mm diameter apically, round in cross-section, greyish, with flanges beneath leaves until twig becomes coarsely persistently flaky. **Leaves** opposite; blades 4–8 × 1 mm, base tapering, apex blunt, triangular in cross-section, somewhat recurved, slightly shiny, drying dark olive-brown, with minute pits and gland-dots; petioles *c.* 2 mm long, attached at apex to *c.* 1 × 0.8 mm fingernail-like hyaline smooth stem flanges. **Flowers** axillary, solitary or in clusters of 2, on *c*. 1 mm peduncles; calyx lobes 5, erect, deltoid, *c*. 1.5 × 1 mm; petals white; stamens reddish, 15 in threes opposite petals, anthers adnate; floral disc flat; ovary 3-locular, each locule with *c*. 6 ovules, style short, cylindrical, sunken in pit. **Fruits** subhemispherical-truncate, to 1.8 mm long, to 3.5 mm diameter, valves triangular. **Seeds** cuboid, imbedded with very many chaff-like aborted seeds.

**Distribution and ecology.** Endemic to upper montane forest on exposed rocky summit ridges on G. Murud NE Sarawak (e.g., *Mjőberg 84*, *111*, *Nooteboom & Chai 02016*, *S 26456* and *Julaihi S 80014*), and the Dulit range, Tinjar-Belaga divide, at 1300–2400 m altitude (*Richards 2121*).

# 10. **SYZYGIUM** Gaertn.

(Greek, *syzygos* = a partner; referring to the paired leaves)

Fruct. Sem. Pl. 1 (1788) 166, *t.* 33; A. de Candolle, Prodr. 3 (1828) 259; Miquel, Fl. Ind. Bat. 1, 1 (1855) 446; Niedenzu *in* Engler & Prantl, Nat. Pflanzenfam. 3, 7 (1898) 85; Merrill & Perry, Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 140; Masamune, EPB (1942) 522; Merrill, Philip. J. Sc. 79 (1950) 351; Backer & Bakhuizen *f.*, FJ 1 (1964) 337; Ashton *in* Dassanayake & Fosberg (eds.), Rev. Handb. Fl. Ceylon 2 (1981) 420; Kostermans, Quart. Journ. Taiwan Mus. 34 (1982) 122; Turner, Gard. Bull. Sing. 47, 2 (1996) 371; Coode *et al.* (eds.), CLBD (1996) 234; Argent *et al.* (eds.), MNDT-CK 2 (1997) 466; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 811; Beaman & C. Anderson, PMK 5 (2004) 221; Craven & Biffin, Blumea 55 (2010) 94; Biffin *et al*., J. Bot. 106 (2010) 79; Wilson *in* K. Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10 (2011) 245. **Synonyms:** *Caryophyllus* L., Gen. Pl. 5th. edition (1754) 232, no. 594; *Jambos* Adans., Fam. Pl. 2 (1763) 88; *Calyptranthus* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1089; *Acmena* DC., Prodr. 3 (1828) 262, Masamune *op. cit.* 520, Merrill & Perry, J. Arn. Arb. 19 (1938) 1, Backer & Bakhuizen *f. op. cit.* 336, Coode *et al.* (eds.) *op. cit.* 233, Argent *et al.* (eds.) *op. cit.* 463, Parnell & Chantaranothai *op. cit.* 784, Beaman & C. Anderson *op. cit.* 206; *Jambosa* Comm. *ex* DC. *op. cit.* (1828) 286; *Cerocarpus* Colebr. *ex* Hassk., Flora 25, Beibl. 2 (1842) 36; *Clavimyrtus* Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 113, *t.* 49; *Cleistocalyx* Blume *op. cit.* (1850) 84, Masamune *op. cit.* 520, Merrill & Perry, J. Arn. Arb. 18 (1937) 322, Backer & Bakhuizen *f.*, *op. cit.* 336, Kostermans *op. cit.* (1982) 120, Coode *et al.* (eds.) *op. cit.* 233, Argent *et al.* (eds.) *op. cit.* 464, Parnell & Chantaranothai *op. cit.* 784, Beaman & C. Anderson *op. cit.* 207; *Microjambosa* Blume *op. cit.* (1850) 117; *Strongylocalyx* Blume *op. cit.* (1850) 89, *t.* 54; *Gelpkea* Blume *op. cit.* (1850) 88; *Macropsidium* Blume *op. cit.* (1850) 85; *Macromyrtus* Miq. *op. cit.* (1855) 439; *Eugenia auct. non* L.: Miquel *op. cit.* (1855) 442, Bentham *in* Bentham & Hooker *f.*, Gen. Pl. 2, 2, (1862) 695, 718, Duthie *in* Hooker *f.*, Fl. Br. Ind. 2 (1879) 470, King, J. As. Soc. Beng. 70, 2 (1901) 77, Merrill,

EB (1921) 425, Ridley, FMP 1 (1922) 718, Merrill, Enum. Philip. Pl. 3 (1923) 156, M.R. Henderson, Gard. Bull. Sing. 12 (1949) 1, Browne, FTSB (1955) 274, Smythies, CST (1965) 105, Burgess, TBS (1966) 411, Kochummen, TFM 3 (1978) 172, J.A.R. Anderson, CLTS (1980) 273, Kessler & Sidiyasa, TBSA-EK, (1994) 185, Chantaranothai & Parnell, Thai For. Bull. (Botany) 21 (1994) 1, Corner, WSTM 4th. edition 2 (1997) 574; *Aphanomyrtus* Miq. *op. cit.* (1855) 480, Merrill, Blumea Suppl. 1 (1937) 107, Airy Shaw, Kew Bull. 4 (1949) 124, Backer & Bakhuizen *f. op. cit.* 336; *Pseudoeugenia* Scort., J. Bot. 23 (1885) 153, King *op. cit.* 133, Ridley *op. cit.* (1922) 755, Kochummen *op. cit.* 249; *Tetraeugenia* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 230.

Trees or occasionally shrubs, mostly reaching the main canopy; mature crown generally hemispherical, dense and dark, diffuse and irregular in subcanopy trees and juveniles; bole usually relatively short and often misshapen; buttresses thin or stout; stilt roots frequently present. **Bark** smooth and usually with a green scrape, mostly becoming flaky, variously whitish, coppery-, grey- leaden- or purplish-brown; inner bark more or less fibrous, astringent and blackening steel blades. Parts generally glabrous, sometimes evenly finely or coarsely hairy. **Twigs** *round or elliptic*, *or variously 4-angled*, *-ribbed or -winged*, *rarely 2-ribbed in cross-section*; *branching syllepticallly* thereby forming 3 subequal branchlets, often densely branched. **Leaves** *opposite*, *decussate*, *rarely subopposite* or partially in 3s, more or less leathery, *drying not wrinkled*, more or less aromatic (smelling of cloves), with more or less visible, diffuse or dense, colourless, more or less raised brown or black gland-dots below and pits above; *blades laminar*, margin entire, base and apex various; midrib narrowly furrowed and often with bordering rim above, raised and rounded sometimes sharply so beneath; *veins pinnate*, with 2 prominent more or less looped intramarginal veins; *lateral veins more than 7 pairs*, unequal to subequal but never truly equal (*cf. Calophyllum* L., Clusiaceae), the most prominent or all reaching the intramarginal vein, variously raised or furrowed above; intramarginal veins 1–3, the inner most distinct, distinctly looped and associated with unequal lateral veins the main veins of which anastomose at the loop bases, or close to the margin and hardly looped and associated with subequal lateral veins; intercostal venation variously distinct or obscure, raised or not raised, lax or dense, net-like; petioles short or long, channelled above, without knee. **Inflorescences** *paniculate*, 3x-branched with flowers often clustered on branchlets, *sometimes reduced to a raceme*, *cyme or congested flower cluster*, terminal or generally subterminal-axillary, sometimes ramiflorous or cauliflorous; with generally fugacious, occasionally subpersistent paired bracts and bracteoles, sometimes in 4s apparently by reduction of internodes. **Flower** *4*(*–5*)*-merous*, sessile or stalked; hypanthium extending above the ovary; calyx lobes free or united in a cap ('calyptra'); buds variously shaped, with more or less distinct hypanthium and variously stout or slender more or less tapering pseudostalk; calyx lobes vestigial to prominent, generally falling at or shortly after anthesis (Figure 13); petals small or prominent, sometimes tightly folded over the stamens, borne on a disc at the edge of the hypanthium, in bud forming a more or less exposed dome-like gland-dotted cap, sometimes calyptrate; *stamens mostly many*, sometimes reduced to 5, forming a brush-like mass at anthesis, anthers oblong, locules (thecae) parallel and opening longitudinally or anthers broader than long with the locules diverging from the base and end-porous (*S. acuminatissimum*), filaments slender; *ovary semi-inferior or inferior*, *2–3*(*–4*)*-locular*, ovules few–many in each locule, placentation axile, style slender, stigma obscure. **Fruit** *a hard*, *crisp* (like a ripe apple) *or fleshy berry*, variously shaped and ripening green, white, pink, red or blackish, smooth or variously ribbed, with a distinct apical pit surrounded by the persisting calyx lobes or their bases as a tubular or flanged crown, or as a rim. **Seeds** *1–2*, *less often several per locule*; embryo divided into distinct cotyledons or undivided (*S. acuminatissimum*), cotyledons with or without (*S. acuminatissimum*) intrusive tissue; testa loosely or closely adhering to pericarp.

**Vernacular names.** Sabah—*obah* (Dusun). Sarawak—*ubah* (Iban, Malay), *bah* (Bidayuh), *kelat* or *ubar* (Kelabit), *ubur* (Tutong), *ubal* (Murut), *teribai* (Bidayuh), *letana* (Berawan), *uvah* (Kayan).

**Distribution.** Over 1200 species throughout the Old World tropics to the margins of the subtropics. In Borneo, over 200 species of which 178 species occur in Sabah and Sarawak. Of these, four are only known in cultivation, while 114 or 64% of the rest are endemic to Borneo. The far bigger, and in the lowlands more diverse, landscape of Borneo versus Peninsular Malaysia thus appears to support only a similar number of species. This is likely partly because more are yet to be discovered; partly also, the ancient Peninsular mountains support many point or local endemics, whereas these occur in the Upper Miocene or younger northern Bornean mountains only where there are exceptional montane habitats, such as the Kinabalu ultramafics or Mulu limestone.

**Ecology.** *Syzygium* is the largest genus of trees in Borneo, with more tree species than *Ficus* L. (Moraceae) and *Shorea* Roxb. *ex* Gaertn. (Dipterocarpaceae). As in those genera, most species are habitat-specific. Within each habitat several species generally occur together. Comparative ecophysiological studies in Sri Lanka demonstrated there that each achieves a specific place in the forest structure at maturity, and each has its distinctive adaptations and response to light in its community (Gamage *et al.*, Bot. J. Linn. Soc. 141 (2003) 365–377; Singhakumara *et al.*, For. Ecol. Manag. 174 (2003) 511–520). Most species attain full crown exposure in the forest canopy at maturity; small or shrubby species mostly occur on exposed rocky peaks, river banks or low scrubby forest, though a few, e.g. *S. biniflorum*, *S. velutinum* are of the understorey. Most are successional though few are true pioneers. Many, perhaps most, coppice by growing suckers following trunk snapping even at maturity, unusual among Bornean rain forest trees.

Pollination is by a range of insects. Large-flowered species, e.g. *S. pycnanthum*, may be visited by Lepidoptera as well as Hymenoptera, and sunbirds and flower peckers. The fruit, a berry, is bird and squirrel dispersed, though that of large-fruited species may also be dispersed by primates. It is remarkable that *Syzygium*, with a means of seed dispersal as efficient as any in the windless climate and closed canopy of Bornean forests, has a level of species endemism in Borneo almost identical to that of *Shorea*, whose fruit are mostly dispersed simply by gyration, among the least efficient means. This implies that intense habitat-specialisation, which has led to ecological fragmentation of habitats inducing limitations to seed dispersal, is the overriding cause of local speciation in these genera.

The combination of seed dispersal by birds and pioneer characters enabling survival in shifting agricultural fields and secondary forest, indicates that *Syzygium* species will become increasingly abundant, even dominant, in the degraded forests that are Borneo's modern legacy, replacing the fire- and soil-disturbance averse dipterocarps.

*Syzygium* species are often considered particularly abundant on acid organic soils in *kerangas*, peatswamp and upper montane forest (Whitmore, Tropical Rain Forests of the Far East 2nd. edition, Oxford University Press 1984), but the number of species, and often individuals is often as great in mixed dipterocarp forest; nevertheless there are relatively more species of *Syzygium* than *Shorea* in montane forests and some reach higher altitudes than any dipterocarps (Figure 12); and there are 16 species on river banks where several can be gregarious, both on the banks and as rheophytes below the flood line. In Borneo, the prevalence of organic soils at all altitudes with many species of *Syzygium* on them, and the

presence of the highest mountain in the region, e.g. Mt. Kinabalu, may explain why so many lowland species extend to higher altitudes than in other parts of the Sunda Shelf. If the 16 riparian species are excluded, 62, or 45% of the 138 species occurring in the lowlands extend above 900 m, which is the usual upper limit of the lowland rainforest flora. In addition, there are 13 species known only from lower montane and 15 from upper montane forest. In comparison, and if the 11 species of riparian or lowland peatswamp *Shorea* are similarly excluded, only 28 or 24% of the remaining 117 *Shorea* species in Borneo extend above 900 m, while there are only 5 obligate montane *Shorea* species, all confined to lower montane forest. Overwhelmingly, the many *Syzygium* species occurring in montane forests in Borneo are there either on the skeletal or truncated soils which support the upper dipterocarp forest, or on organic soils in lower montane *kerangas* or the lower facies of upper montane forests. Those species occurring on the Kinabalu massif extend to higher altitudes there than elsewhere, sometimes by more than 500 m. Those that extend even into upper montane forest (*Syzygium caudatilimbum*, *S. fastigiatum*, *S. urceolatum* subsp. *kuchingense* to 2200 m, *S. castaneum*, *S. pachysepalum* to 2300 m, *S. subcrenatum*, *S. rostratum*, *S. steenisii* to 2400 m) are, with the exception of *S. rostratum* which is common in lower montane forest only, species confined to or common on acid organic soils in the lowlands.

**Uses.** The timber is moderately hard and light to moderately heavy, (450–)520–925(–1100) kg/m³, and logs sink in water (PROSEA 5, 2 (1995) 441). It can be used for interior construction though neither its short fibres, strength properties nor its figure are promising. It is therefore of low value, and mostly used as a filler for laminated boards. The genus is best known for the clove, which is the dried flower bud of *Syzygium aromaticum*, the *cengkeh*. Several species produce comestible fruits, the *jambu* (e.g., *S. aqueum*, *S. malaccense* and *S. samarangense*), and are cultivated; the flesh is crisp, resembling a watery apple with a mild flavour of cloves. The dry leaves of *S. polyanthum*, the *daun salam*, are used for flavouring vegetable dishes and curry in Java, much as bay is used in Europe. Fresh young shoots and leaves of *S. malaccense* and *S. longiflorum* are used in West Java and elsewhere as *lalab*, eaten raw or mixed in rice or *sambals*. The bark (*samak*) of those species in which it is thick, reddish and fibrous was once an important source for tanning, especially fishing nets. The astringent juices of inner bark and roots were formerly widely used to staunch bleeding, especially in childbirth. The bark also yield a brick red dye or, if the material is also treddled in mud or with iron shavings, a black dye.

**Notes.** We are fortunate in having the extensive researches of Merrill & Perry (*op. cit.* 1939) on this genus, synthesised for Borneo in their semi-monographic treatment. This work has stood the test of time remarkably considering the sparse and often poor material then available, including the difficulty of interpreting the many early types based on sterile fragments, particularly from the early collections of Korthals. As is usual, the abundant material now available from northern parts of Borneo has led to the disappearance of differences between some entities, particularly around *S. scortechinii*, *S. formosum* and their allies, while a surprisingly limited number of new species have become apparent.

Merrill and Perry (*op. cit.* 1939) were the first in recent time to conclude that *Syzygium* represents a separate genus from the overwhelmingly neotropical *Eugenia*, principally on the basis of divided cotyledons, which are undivided in *Eugenia.* M.R. Henderson (*op. cit.* 1949) examined embryos of many Peninsular Malaysian species and remained unconvinced, and Kochummen (*op. cit.* 1978) followed his view. However Schmid (Amer. J. Bot. 59 (1972) 423–436) convincingly showed that the two genera consistently differ in several aspects of floral anatomy, notably that in *Syzygium* the ovules have an axile vascular supply,

whereas in *Eugenia s.s.* it is transeptal. He pointed out other general but less constant differences, in the presence or absence of hairs, the nature of the bracteoles, and the presence of a hypanthium. Haron & Moore (Bot. J. Linn. Soc. 120 (1996) 265–277) found, in an examination of a limited number of species in both genera, that whereas anticlinal wall patterns of the abaxial and adaxial leaf sufaces of *Eugenia* species are generally 'more or less the same', they are distinctly different in *Syzygium*. The generic distinction is now supported by molecular evidence (Wilson *et al.*, Pl. Syst. Evol. 251 (2005) 3–19); Biffin *et al.*, Taxon 55 (2006) 79–94). Merrill & Perry (*op. cit.* 1937, *op. cit.* 1938) also regarded *Acmena* on grounds of the embryo and anthers, and *Cleistocalyx* on the basis of the calyptrate calyx, to be separate genera, but molecular and other evidence has failed to support that conclusion (Harrington & Gadek, Austral. Syst. Bot. 17 (2004) 63–72; Wilson *et al. op. cit.* 2005; Craven *et al.*, Blumea 51 (2006) 131–142). Only one of the Bornean species was formerly included in *Acmena* (*S. acuminatissimum*), but several of the species with calyptrate calyces fail to group in our hypothetical systematic key based on morphology. Recently, Craven and Biffin (*op. cit.* 2010) have proposed a new infrageneric classification based on molecular evidence. It must be regarded as preliminary, as relatively few W Malesian and continental SE Asian species have been examined. The proposed infrageneric taxa are often solely differentiated on anatomical characters, making them difficult to use in the herbarium. Only two concern us here, namely subgen. and sect. *Acmena* (DC) Craven & Biffin which is mainly Australasian but includes our *S. acuminatissimum*, and subgen. *Perikion* Craven & Biffin which we have recognized as our Claviflorum Group. Both are indicated in our systematic key.

*Syzygium* species are generally considered a challenge to identify in the field, but with a little effort nearly all species can be established because they have a range of characters which, when understood, are reliable. This is surprising because apomixis, through adventive embryony, has been reported (Kaur *et al.*, Nature, London 271 (1978) 440–442). Apomixis is associated with fragmentation of species, defying easy identification, when coupled with frequent interspecific hybridization. Though the commoner species exhibit much variation, the generally constant distinctions between *Syzygium* species implies that their hybrids seldom survive in nature. As with most canopy trees, juveniles can differ in important characters, particularly of the leaf blade which is generally larger than indicated in these descriptions. Our leaf descriptions are based on dry leaves, and colour and vein prominence will be quite different in living material.

Bark and buttress characters, particularly colour, can be useful, though in most species eventually become flaky, and most large species become buttressed; nevertheless, these characters deserve more field study. Nearly all *Syzygium* are glabrous; the presence of hairs on the twig or elsewhere at once reduces the options to less than 10 species. Most have elliptic (in cross-section) twigs, but in a minority they are variously angled, ribbed or winged. The petioles vary in length and thickness; some, when the tree is mature, are distinctly buff or cream and corky. The blades generally taper into the petioles, but in some the leaf base terminates abruptly; the base is variously wedge-shaped or rounded to heart-shaped. Many qualitative characters of leaf venation also remain constant during ontogeny: the sharpness and prominence of the midrib; the equality of the lateral veins (termed unequal here when some do not reach the intramarginal vein, or when some are distinctly more prominent than the others), whether the intermediate lateral veins are numerous or few, reach the intramarginal main vein or not, or branch; the intramarginal veins, which can be 1–3 pairs though the innermost is always the most prominent, can hug the leaf margin or be well within it and then generally looped with the main veins joining at the loop bases (providing the means to identify and count main lateral veins). Though these leaf and twig

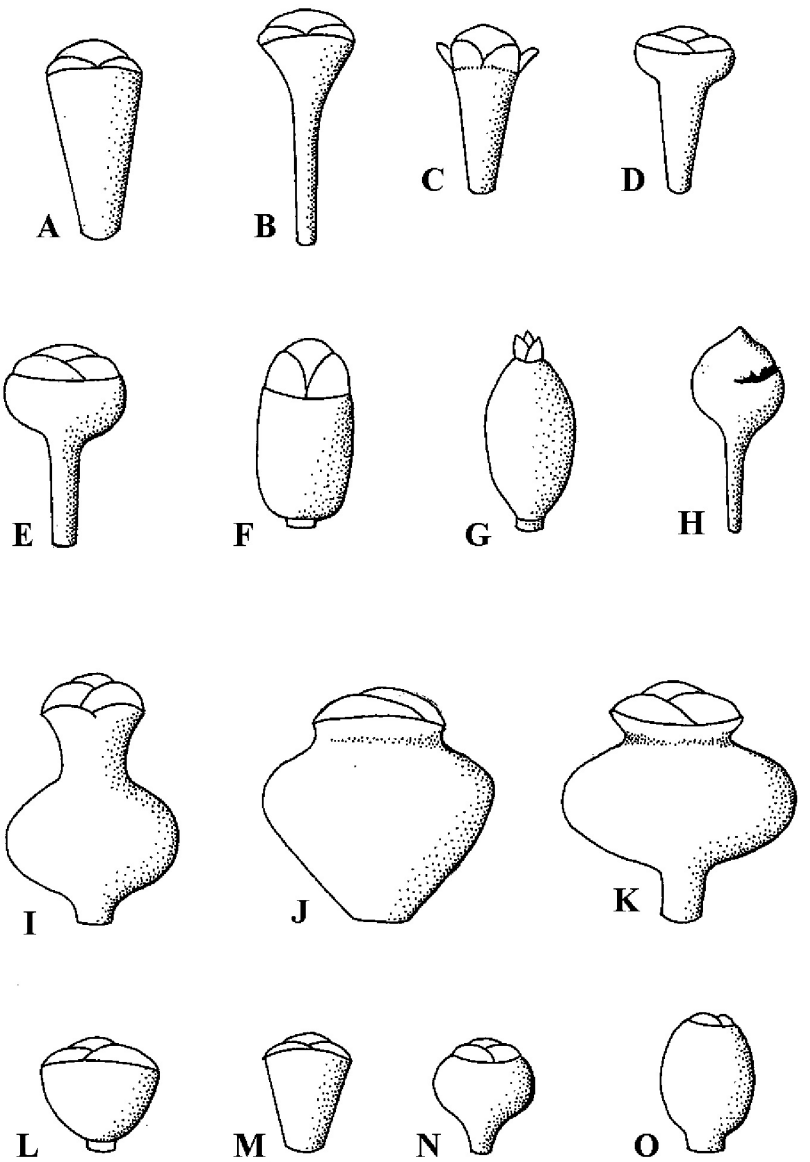


**Fig. 13.** Terminology for flower bud (hypanthium and pseudostalk) shape in *Syzygium*: A, torch-shaped; B, trumpet-shaped; C, clove-shaped; D, club-shaped; E, goblet-shaped; F, cylindrical; G, spindle-shaped; H, snuffer-shaped; I, funnel-shaped; J, urn-shaped; K, jambu-shaped; L, obovoid; M, obconical; N, pear-shaped; O, ellipsoid-oblong.

characters usually remain constant from seedling to maturity, texture, size, apex shape, number of veins and whether they become furrowed in the dry leaf, colour on drying, and surface dullness can vary substantially as, for instance, in *S. oligomyrum*. So also can the visibility and sometimes density of glandular pits and dots. Bearing that in mind, these still provide valuable characters in the mature tree.

The position of the inflorescence, number arising from one site, length and shape of the rachis, and presence and shape of bracts and bracteoles are useful. The flower, in bud and at anthesis, is characteristic in shape, but the shape changes from bud into the young fruit and the species-specific characters must be evaluated in this light. The calyx lobes vary in number among related species; typically 4, some have 5, but some variation within species including within individuals occurs. Calyx lobes vary between species in size and shape, but often fall near anthesis leaving a rim which can be confused with the ring of vestigial lobes characteristic of some other species. The shape of the hypanthium, on a more or less distinct stalk-like base, the 'pseudostalk', is characteristic in shape but also changes during development (Figure 13). The fruit shape becomes characteristic at maturity but need not be obvious when young; but a milky suffusion, wartiness, ribs or roughness when present are valuable characters and develop early.

Though several groups of related species can be recognised in Borneo, at this point no distinct systematic infrageneric classification based on morphological characters seems possible within the genus. Many species in Sabah and Sarawak are nevertheless associated within large groups sharing a number of characters in common. These two factors form the basis for the hypothetical systematic key presented. The character of the leaf lateral venation, whether subequal or the main veins of two or more distinct ranks, appears to be consistent within all groups, but characters of flower and fruit appear diagnostic for some groups more than others. Many of the Bornean endemics are specialists of island habitats including yellow sandy soils in dipterocarp forest, *kerangas*, limestone and ultramafic substrates and are clearly sister to widespread species. Several groups of species which share developmentally independent characters in common are recognisable, and these have been recognised in the systematic key. Also, sister-pairs or short series of closely similar but ecologically distinct species are common in Borneo, particularly between lowland and montane, riparian and upland, and dipterocarp forest or *kerangas* and limestone karst or ultramafic habitats (Table 1). In some cases, particularly the riparian species which are generally rheophytic, it remains unclear whether separate species status will eventually prove justifiable. The abundance of *Syzygium* in montane habitats notwithstanding, only 28, or 15% are exclusively montane compared with 21% in Kochummen's account (*op. cit.* 1978) for Peninsular Malaysia. Apart from Kinabalu, point species endemism is also comparatively lower among montane species in Borneo than in Peninsular Malaysia. In summary, in comparison with Peninsular Malaysian *Syzygium*, the Bornean *Syzygium* flora bears evidence of relatively recent diversification, and also reflects the youth of the mountains themselves, which are mainly upper Miocene to early quaternary (1–5 mya) in contrast to the ancient granitic Peninsular Main Ranges which rose in the late Jurassic *c*. 150 mya and has remained relatively stable ever since. Interestingly, sister pairs occupying different lowland habitats, such as between mixed dipterocarp forest and *kerangas* or on contrasting soils within dipterocarp forest, are not so clear except in some larger species clusters, notably the *S. fastigiatum*, *S. odoardoi*, *S. incarnatum*, *S. cuneiforme* group, and *S. urceolatum* and its subspecies as circumscribed in this account.

**Table 1.** Ecologically allopatric species pairs of *Syzygium* in Sabah and Sarawak

| | | |
|---|---|---|
| a. | Lowland | Montane |
| | *S. kudatense*, *S. multibracteolatum* | *S. pterophorum* |
| | *S. napiforme* | *S. adenophyllum* |
| | *S. castaneum*, *S. paludosum* | *S. castaneum* subsp. *altecastaneum* |
| | *S. beccarii* | *S. ampullarium* |
| | *S. bankense* | *S. bankense*, *S. nummularium* |
| | *S. fusticuliferum* | *S. chaii* |
| | *S. velutinum* | *S. dasyphyllum* |
| | *S. glanduligerum* | *S. erythranthum* |
| | *S. punctilimbum* | *S. hypsipetes* |
| | *S. subcrenatum* | *S. steenisii* |
| | *S. napiforme* | *S. flagrimonte* |
| b. | At two altitudes on Kinabalu and the north-eastern Borneo mountains | |
| | *S. myrtillus* and *S. myrtilloides* | |
| | *S. kinabaluense* subspecies | |
| | *S. houttuynii* and *S. houttuyniifolium* | |
| c. | Rheophytic | Riparian or upland |
| | *S. medium* | *S. jambos* |
| | *S. odoardoi* | *S. fastigiatum* |
| | *S. pycnanthum* var. *angustifolium* | *S. pycnanthum* |
| d. | Lowland zonal | Ultramafic/limestone |
| | *S. claviflorum* | *S. cornuflorum*, *S. claviflorum* subsp. *tavaiense* |
| | *S. penibukanense* | *S. silamense*, *S. ultramaficum*, *S. subisense* |
| | *S. castaneum* | *S. georgeae* |
| | *S. racemosum* subsp. *racemosum* | *S. racemosum* subsp. *calcimontanum* |
| e. | Clay soils | Sandy soils |
| | *S. hirtum* | *S. villiferum* |
| | *S. rosulentum* | *S. praestantilimbum* |
| | *S. urceolatum* subsp. *palembanicum* | *S. urceolatum* subsp. *kuchingense*, subsp. *urceolatum* |
| | *S. nigricans* subsp. *nigricans* | *S. nigricans* subsp. *phaeophyllum* |

Leaves. The wealth of characters require unambiguous terminology. Leaf characters are invaluable, but leaf size is very variable in many species, often becoming atypically small beneath inflorescences. In a number of species descriptions, the average leaf blade size is quoted, then size range in parentheses.

Venation. There are three distinct categories of veins in addition to the midrib: the lateral veins, the intramarginal vein, and the intercostal veins (= tertiary and quaternary fine veins located between and interconnecting adjacent lateral veins). The lateral veins are always somewhat unequal, consisting of two recognisable subcategories: the *main lateral veins*, distinguished because the intramarginal vein is only indented where they meet it, and *intermediate lateral veins*, which vary between species in their number between each main lateral vein, and in their length many not reaching the intramarginal vein. I distinguish between species in which the veins are termed *unequal*, when the intermediate lateral veins

are clearly shorter and/or less prominent beneath than the main lateral veins; and *subequal*, where they are equal in length reaching the margin and/or almost equally raised with the main lateral veins at least towards their bases. In species where veins are termed subequal, they are almost always numerous, thereby giving the appearance of true equality. Four species, *S. creaghii*, *S. imperiale*, *S. leucocladum* and *S. selukaifolium* are exceptions, their main lateral veins being slender but prominent beneath, their intermediate lateral veins very few, irregularly placed between the main lateral veins, but reaching the intramarginal veins. Clearly though, there is no example of complete equality of veins, and the two categories are not therefore clearly separable: those species in which categorisation is problematic are entered under both in the field key. The intramarginal veins may be single, or consist of one prominent vein with a further 1–3 less distinct veins between it and the leaf margin. The distance of the margin from the main intramarginal vein is given; the total number of visible intramarginal veins is also indicated.

Flower. The inferior ovary is set in a hemispherical hypanthium with the stamens and perianth in a ring around an apical platform. In bud, they together comprise a spherical knob held on a base which generally tapers to the short peduncle; this base is here termed a *pseudostalk*. The flower bud as a whole may be cylindrical or obconical if the pseudostalk is short or obscure, but like a torch, club, a clove if the pseudostalk is prominent (see Figure 13 for terminology adopted here). When open, this latter form appears like trumpet, especially a bugle if slender. The calyx is fused at the base; the apex, except in the calyptrate forms clasps the domed overlapping petals at or above the centre of the knob, and is fringed with 4(–5) *calyx lobes* which, in many species, are reduced to teeth or obscure so that the hypanthium terminates in a rim.

## Systematic key to *Syzygium* species

This key aims to hypothesise phylogenetic relationships, and is not primarily intended for identification which would often require both flowers and fruits, rarely simultaneously available. Species names in parentheses are particularly tentative, being placed in the absence of fruit or flower.

1. Anther locules divergent. Seed with intrusive tissue interlocking the cotyledons…….. ……..……..**1. S. acuminatissimum** (subgen. & sect. *Acmena* (DC) Craven & Biffin)
   Anther locules parallel. Seed without intrusive tissue interlocking the cotyledons……..2

2. Flower bud typically spindle-shaped; ovary in a medial swelling of the pseudostalk…..3
   Flower bud of other shapes; ovary at the distal end of the flower bud……4

3. Flowers in up to 10 cm long panicles; buds to 15 mm long, to 4 mm diameter. Leaves prominently gland-dotted beneath…….**51. S. filiforme**
   Flowers in dense clusters; buds to 35 mm long, to 5 mm diameter. Leaves sparsely finely or not gland-dotted beneath……...**90. S. macromyrtus** (in part)

4. Calyx lobes prominent, rounded, broadly hyaline towards the often wavy margin, loosely spreading or becoming reflexed and persisting into the ripe fruit. Leaf main lateral veins unequal……..5
   Calyx lobes hyaline but not becoming prominently reflexed and falling following anthesis, or thick to margin, or vestigial. Leaf main lateral veins unequal or subequal…. ……...……46 (to p. 135)

5. Mature flower bud jambu- or urn-shaped, often large; hypanthium longer than pseudostalk; calyx lobes becoming reflexed. Leaf base mostly cordate; main lateral veins unequal, furrowed above: **S. jambos Group**……..6
Mature flower bud of other shapes, occasionally urn-shaped; hypanthium hardly swollen, tapering into pseudostalk; calyx lobes loosely clasping or spreading, not reflexed. Leaf base and main lateral veins above variable: **S. pycnanthum Group**…….
……..…….24 (to p. 133)

6. Flower bud at least 2x as long as wide……..7
Flower bud less than 2x as long as wide……10

7. Flower bud more than 4 cm long. Leaf blade less than 2x as long as wide……
……..……..**166. S. velutinum**
Flower bud less than 3 cm long. Leaf blade more than 2x as long as wide……..8

8. Flowers borne on trunk swellings; buds larger than 25 mm long, 12 mm diameter. Twigs round in cross-section……**119. S. penibukanense**
Flowers in terminal or axillary clusters; buds smaller than 20 mm long, 10 mm diameter. Twigs round, quadrangular or winged in cross-section……9

9. Leaf main lateral veins *c.* 11 pairs. Twig round in cross-section……
……..……..(**89. S. lunduense**: fruit unkown)
Leaf main lateral veins 12–15 pairs. Twig more or less sharply quadrangular in cross-section……**80. S. kiauense**

10. Flower bud more than 30 mm long……**161. S. ultramaficum**
Flower bud less than 20 mm long……...11

11. Flower bud less than 6 mm long……**152. S. subisense**
Flower bud more than 9 mm long……...12

12. Flowers ramiflorous to cauliflorous. Leaf main lateral veins *c.* 20 pairs...**23. S. bujangii**
Flowers terminal or axillary. Leaf main lateral veins fewer than 18 pairs…….13

13. Flowers in clusters……..14
Flowers in distinct inflorescences……...19

14. Twigs winged……..15
Twigs elliptic-round in cross-section or shouldered only……...16

15. Twig slender. Leaf blade mostly less than14 cm long……...**115. S. panzeri**
Twig stout. Leaf blade more than 16 cm long…….**82. S. kudatense**

16. Twig round throughout in cross-section, cream-white. Leaf main lateral veins mostly less than 9 pairs……(**48. S. eugeniforme**: fruit unknown)
Twig with distinct ribs or shoulders, cream or brown. Leaf main lateral veins generally more than 11 pairs……...17

17. Petiole *c.* 12 mm long. Leaf venation oscure, veins not furrowed above……...
……..……..**135. S. ramiflorum**
Petiole less than 9 mm long. Leaf venation distinct, veins furrowed above……...18

18. Twig cream. Leaf blade *c.* 26 × 8 cm; petiole corky cream……**53. S. formosum**
Twig golden brown. Leaf blade *c*. 18 × 6 cm; petiole drying blackish……..
……..……..**144. S. scortechinii**

19. Leaf base heart-shaped……..**8. S. aqueum**
Leaf base wedge-shaped……20

20. Leaf blade broadest in the upper half……..21
Leaf blade broadest in the middle or basal half……..…22

21. Twig at first shouldered at internodes. Leaf blade at least 27 × 9 cm; petiole more than 6 mm diameter……..**92. S. malaccense**
Twig not shouldered at internodes. Leaf blade *c*. 17 × 6 cm; petiole to 3 mm diameter…
……**143. S. samarangense**

22. Leaf blade hardly longer than wide……**43. S. dasyphyllum**
Leaf blade *c.* 3x as long as wide or rounded……...23

23. Fruit pumpkin-shaped. Leaf blade usually larger than 15 × 3.5 cm; petiole *c*. 7 mm long……..……**77. S. jambos**
Fruit urn-shaped. Leaf blade smaller than 12 × 2 cm; petiole *c.* 4 mm long……..
……..……**93. S. medium**

24. Young parts hairy……25
Young parts glabrous……..28

25. Parts at first bright coppery-brown downy (soft hairy). Leaf main lateral veins *c.* 10 pairs……**55. S. fulvotomentosum**
Parts purplish- to dark rust-brown downy or variously hairy. Leaf main lateral veins at least 15 pairs……26

26. Parts shaggily hairy. Leaf undersurface sparsely so……**66. S. hirtum**
Parts downy or scabrous……27

27. Parts scabrous, tomentum minute. Leaf blade broadly elliptic-obovate, main lateral veins *c.* 17 pairs……**141. S. rosulentum** (in part)
Tomentum downy, leaf undersurface densely so. Leaf blade oblong to lanceolate, main lateral veins *c.* 26 pairs……...**168. S. villiferum**

28. Mature flower bud *c*. 20 mm long, *c.* 10 mm diameter. Leaf blade *c*. 40 cm long, base heart-shaped……**39. S. creaghii**
Flower bud less than 18 mm long, 8 mm diameter. Leaf blade less than 35 cm long, base mostly wedge-shaped……..29

29. Flowers in dense clusters or inflorescence vestigial……...30
Flowers on distinct inflorescences……..32

30. Flower bud with distinct pseudostalk. Leaf main lateral veins at least 10 pairs…….
……**153. S. subsessilifolium**
Flower bud without distinct pseudostalk. Leaf main lateral veins *c.* 8 pairs……..31

31. Main lateral veins evenly spaced, each with at least one intermediate vein……..
……..…….**30. S. cephalophorum**
Main lateral veins unevenly spaced, with only occasional intermediate veins……..
……...…….**37. S. conglobatum**

32. Mature flower bud less than 8 mm long…….33
Mature flower bud at least 10 mm long…….…….40

33. Bracteoles in double pairs, triangular, not falling at first. Leaf main lateral veins furrowed above……...34
Bracteoles in single pairs, falling very early. Leaf main lateral veins raised or furrowed above……...36

34. Twig quadrangular in cross-section. Leaf blade more than 2x as long as broad……...…….……..**107. S. oblanceolatum**
Twig round in cross-section. Leaf blade less than 2x as long as broad……..35

35. Leaf blade *c*. 14 × 7 cm. Inflorescences to 8 cm long……...**141. S. rosulentum** (in part)
Leaf blade *c*. 25 × 14 cm. Inflorescences to 4 cm long……**126. S. praestantilimbum**

36. Leaf base wedge-shaped…….37
Leaf base heart-shaped or rounded…….39

37. Inflorescences ramiflorous……...**85. S. leptostemon**
Inflorescences terminal or subterminal-axillary…….38

38. Leaf main lateral veins somewhat unequal only, *c*. 15 pairs; intercostal veins more visible above than below……..**131. S. pycnanthum**
Leaf main lateral veins prominently unequal, *c*. 8 pairs with one short intermediate lateral vein between each; intercostal veins more prominent below than above……
……...……**13. S. bakoense**

39. Leaf main lateral veins 7–8 pairs, furrowed above; intercostal veins obscure throughout…….**21. S. brachypodum**
Leaf main lateral veins *c*. 12 pairs, raised above; intercostal veins distinct beneath……..
……...…….**117. S. paucipunctatum**

40. Leaf blade papery; main lateral veins at least 12 pairs……...41
Leaf blade leathery; main lateral veins *c*. 11 pairs or less…….42

41. Leaf blade prominently densely black-dotted throughout; main lateral veins *c*. 12 pairs……...**118. S. pendens**
Leaf blade obscurely or not black-dotted; main lateral veins *c*. 16 pairs……
……..…….**150. S. stipitatum**

42. Twig at first cream- to golden-yellow, more or less bluntly angled in cross-section…….43
Twig brown, round in cross-section…….44

43. Stamens pale cream-yellow. Leaf intercostal veins forming a distinctly raised open lattice on both surfaces……..**57. S. garcinifolium**

Stamens bright red. Leaf intercostal veins obscure……..**47. S. erythranthum**

44. Leaf blade at least 2½x as long as broad. Flower bud without visible gland dots……..……**84. S. lambirense** (in part)
Leaf blade less than 2½x as long as broad. Flower bud distinctly glandular……..45

45. Hypanthium warty. Leaf blade obscurely gland-dotted beneath……**44. S. durifolium**
Hypanthium gland-dotted not warty. Leaf blade with large pale gland-like swellings beneath…….**61. S. glanduligerum**

46. Flower buds ellipsoid, oblong, or cylindrical but for small swelling below calyx lobes; bud often with milky bloom; calyx lobes usually erect, triangular; bracteoles often not falling at first, lanceolate. Twigs mostly quadrangular or narrowly winged: **S. zeylanicum Group**……47
Flower buds broadest and swollen towards apex, with or without distinct pseudostalk; calyx lobes and bracteoles not as above. Twigs mostly round or elliptic in cross-section, occasionally quadrangular or ribbed……...57

47. Twigs round in cross-section. Bracteoles early caducous. Flower bud (hypanthium) smooth, not milky……...48
Twigs quadrangular, ribbed or winged. Bracteoles persisting to anthesis. Flower bud (hypanthium) smooth or warty, usually milky……49

48. Inflorescence to 3 cm long. Flower bud obovoid-cylindrical. Leaf main lateral veins hardly raised……..**6. S. antisepticum**
Inflorescence to 10 cm long. Flower bud ellipsoid. Leaf main lateral veins distinctly raised beneath……..**159. S. treubii**

49. Flower buds smooth, not milky……...50
Flower buds warty, milky……...51

50. Leaf blade broadly elliptic-obovate; main lateral veins subequal, *c.* 20 pairs, equally and distinctly raised on both surfaces…….**70. S. hypsipetes**
Leaf blade lanceolate; main lateral veins unequal, *c.* 6 pairs, obscure above, evident but hardly raised beneath……**160. S. tubiflorum**

51. Leaf base heart-shaped……52
Leaf base rounded or wedge-shaped……...54

52. Leaf main lateral veins *c.* 4 pairs…….**7. S. apiarii**
Leaf main lateral veins more than 10 pairs…….53

53. Leaf margin recurved; main lateral veins distinctly raised beneath, shallowly furrowed above with the blade corrugated in between……**128. S. pterophorum**
Leaf margin hardly recurved; main lateral veins more or less obscure, blade flat…….
……..**97. S. multibracteolatum**

54. Leaf blade *c.* 7 × 3 cm; main lateral veins *c.* 6 pairs……...**170. S. zeylanicum**
Blade less than 4 × 2 cm; main lateral veins more than 8 pairs……..55

55. Intermediate lateral veins dense, distinctly raised, the larger ones almost equal with main lateral veins……**81. S. kinabaluense**
Intermediate lateral veins obscure or few……...56

56. Young twigs fibrous flaky. Leaves in alternately overlapping pairs……..
……..……..**106. S. nummularium**
Young twigs not fibrous flaky. Leaves not in alternately overlapping pairs……..
……..**14. S. bankense**

57. Fruit ellipsoid-obovoid or pear-shaped often ripening bright scarlet-red, mostly drying pale straw-coloured. Leaf blade usually sparsely faintly black-dotted beneath…….58
Fruit spherical, ovoid, obovoid or urn-shaped with various calyx rims, ripening green-brown, white or black, or if ellipsoid always drying dark. Leaf blade variously dotted or pimpled beneath, or dots and pimples obscure or wanting……..……76 (to p. 137)

58. Leaf blade densely finely dotted beneath, narrowly elliptic-lanceolate or narrowly ovate. Flower calyx lobes to 3 × 3 mm, distinct…….59
Leaf blade sparsely more or less faintly dotted beneath, obovate or if elliptic or lanceolate. Flower calyx lobes reduced to a shallow rim or small and distinct……..60

59. Leaf blade narrowly elliptic-lanceolate, main lateral veins *c.* 14 pairs, prominently furrowed above……**130. S. pustulatum**
Leaf blade narrowly ovate, main lateral veins *c.* 9 pairs, raised above……..
……..…….**59. S. glabratum**

60. Stamens at most 26…….61
Stamens at least 30……..62

61. Inflorescence a rigid panicle. Stamens *c.* 25. Leaf blade *c.* 14 × 6 cm, drying satiny olive-brown; main lateral veins unequal……**19. S. biniflorum**
Flowers in subsessile clusters. Stamens 8. Leaf blade *c.* 8 × 3 cm, drying dull pale rust-brown beneath, yellow-brown above; main lateral veins subequal……
……..…….**147. S. skiophilum**

62. Leaves obovate or lorate-lanceolate. Flower buds obconical or narrowly pear-shaped with pseudostalk at most 1 mm long. Inflorescence and flower bud drying pale; bracteoles generally persisting to anthesis, ovate, cupped: **S. fastigiatum Group**……63
Leaves elliptic, ovate or lanceolate. Flower buds clove-, or club-, or horn-, or trumpet-, or torch-shaped with pseudostalk longer than 1 mm. Inflorescence and flower bud drying dark; bracteoles early caduceus……...67

63. Flower bud larger than 15 mm long, 7 mm diameter. Twigs at first *c.* 6 mm diameter, stout……..**41. S. cuneiforme**
Flower bud smaller than 9 × 6 mm. Twigs at first to 4 mm diameter, slender……...64

64. Leaf blade lorate-lanceolate, more than 6x as long as broad……..65
Leaf blade obovate, less than 4x as long as broad……..66

65. Main lateral veins subequal, *c.* 35 pairs……..**109. S. odoardoi**
Main lateral veins unequal, *c.* 18 pairs……**102. S. neriifolium**

66. Flower bud with short but distinct pseudostalk; calyx lobes unequal, hemispherical, almost enveloping corolla. Leaf blade leathery; venation indistinct beneath, drying same colour as blade……**74. S. incarnatum**
Flower bud with obscure pseudostalk; calyx lobes subequal, short, triangular. Leaf blade thin, wrinkling on drying; venation distinct beneath, drying darker than blade……..……..**50. S. fastigiatum**

67. Flower buds to 35 mm long, trumpet-shaped……..……**90. S. macromyrtus** (in part)
Flower buds at most 30 mm long, not trumpet-shaped……...68

68. Flower buds usually clove-shaped, in panicles not clustered. Main lateral veins dense, subequal with intermediate lateral veins: **S. attenuatum Group**……..……69
Flower buds usually torch-shaped, densely clustered on short inflorescences. Main lateral veins somewhat more prominent than intermediate lateral veins: **S. claviflorum Group** (= subgen. *Perikion* Craven & Biffin)……74

69. Mature flower bud to 8 mm long, to 2 mm diameter……**11. S. attenuatum**
Mature flower bud larger than 10 mm long and 4 mm diameter……70

70. Leaf blade to 3 × 2.2 cm, apex obtuse to subacuminate; petiole *c*. 4 mm long. Flower calyx lobes small but distinct, distant round the calyx rim……...**52. S. flagrimonte**
Leaf blade at least 5 × 3 cm, apex acuminate to subcaudate; petiole at least 6 mm long. Flower calyx lobes prominent and adjacent, or vestigial……71

71. Calyx lobes to 2 × 2 mm, distinct. Leaf drying chocolate-brown.....
……..**56. S. fusticuliferum**
Calyx lobes at most 1 mm long, vestigial. Leaf drying pale yellowish brown to golden in mature trees……72

72. Inflorescences to 2 cm long, terminal or subterminal-axillary, densely branched. Leaf blade thickly leathery, glistening above, densely pimple-dotted beneath……...
……**2. S. adenophyllum**
Inflorescences to 6 cm long, lax, terminal or axillary, not densely branched. Leaf blade leathery or not so, finely or not pimple-dotted beneath……..73

73. Flower bud warty. Leaf blade elliptic-lanceolate, *c*. 8 × 3 cm, thinly leathery, apex subcaudate, drying grey-green……..**101. S. napiforme**
Flower bud not warty. Leaf blade elliptic-oblong, *c*. 11 × 5 cm, thickly leathery, apex broadly acuminate, drying golden-brown beneath (warm chocolate-brown in juveniles)……**110. S. oligomyrum**

74. Inflorescenses axillary, to 1 cm long. Leaf blade *c*. 8.5 × 3.5 cm…….**34. S. claviflorum**
Inflorescences terminal or subterminal-axillary, to 1.5 cm long. Leaf blade at most 8 × 3 cm……75

75. Twig round in cross-section. Leaf blade *c*. 6.5 × 2.5 cm……...**169. S. viridifolium**
Twig quadrangular in cross-section. Leaf blade to 2.2 × 1.2 cm……
……...……..(**38. S. cornuflorum**: fruit unknown)

76. Flower bud more than 2x as long as broad……77
Flower bud at most 2x as long as broad……..106 (to p. 140)

77. Petiole 3–7 mm long; blade ovate to oblong-lanceolate; main lateral veins unequal. Twig round in cross-section……78
Petiole longer than 4 mm or, if short, twig quadrangular or winged in cross-section……..…79

78. Flower bud to 15 mm long, to 7 mm diameter, without distinct pseudostalk…….
……..……..**17. S. beccarii**
Flower bud *c*. 3 mm long, *c.* 1.5 mm diameter, with prominent slender pseudostalk……
……..……**60. S. gladiatum**

79. Stamens 4…….**29. S. caudatum**
Stamens more than 20……..……80

80. Calyx lobe margins broadly hyaline, falling after anthesis……81
Calyx lobes vestigial, or distinct with the margins not or only narrowly hyaline, or calyx snuffer-shaped……..……84

81. Main lateral veins prominent beneath, unequal……..……**72. S. iliasii**
Main lateral veins slender, distinctly or hardly raised beneath, subequal: **S. chloranthum Group**……..82

82. Flower bud *c*. 3x as long as broad. Leaf blade beneath densely minutely pimpled……
……..……**94. S. monticolum**
Flower bud *c.* 2x as long as broad. Leaf blade minutely sparsely dotted beneath……..83

83. Inflorescences mostly terminal. Leaf main lateral veins ascending, distinctly raised beneath……..……**26. S. caryophylliflorum**
Inflorescences mostly axillary. Leaf main lateral veins spreading, hardly raised beneath……**32. S. chloranthum**

84. Leaf main lateral veins slender, hardly raised, subequal……85
Leaf main lateral veins prominent beneath……..……93 (to p. 139)

85. Calyx lobes vestigial……...86
Calyx lobes apparent, at least 1 mm long, thick to margin or broadly hyaline towards margin……89

86. Fruit juicy, ripening black. Leaf blade elliptic-lanceolate. Twig pink-brown……
……..……**98. S. myrtifolium**
Fruit ripening hard, dark green or red. Leaf blade ovate-elliptic. Twig grey-brown……..87

87. Twig at first quadrangular in cross-section. Leaf blade slightly milky beneath, hardly or not dotted beneath……...**127. S. prasiniflorum**
Twig round throughout in cross-section. Leaf blade not milky but dotted beneath.....…88

88. Flower calyx lobes 4; pseudostalk indistinct. Twig pale yellow-brown. Leaf blade dull throughout, margin narrowly recurved, apex mostly blunt or notched……...
……..……**151. S. subcrenatum** (in part)

Flower calyx lobes 5; pseudostalk distinct. Twig dark brown. Leaf blade glistening above, margin not recurved, apex subcaudate……**104. S. nigricans**

89. Flower bud larger than 12 mm long, 6 mm diameter, with stout or obscure pseudostalk. Fruit generally ellipsoid or obovoid……90
Flower bud smaller than 9 mm long, 3 mm diameter, with slender pseudostalk. Fruit spherical: **S. longiflorum Group**……...91

90. Calyx lobes prominent, clawed. Leaf blade obovate-oblong. Young parts strongly aromatic……**10. S. aromaticum**
Calyx lobes rounded. Leaf blade elliptic. Young parts faintly aromatic only……
……..……**84. S. lambirense** (in part)

91. Calyx lobes persisting into ripe fruit. Twig quadrangular in cross-section. Leaf blade *c*. 10 × 5 cm……..**132. S. pyrifolium**
Calyx lobes falling as fruit ripens. Twig round in cross-section. Leaf blade *c*. 6 × 3 cm...
…..……92

92. Calyx lobes at first persisting in young fruit, mounted on a thick collar. Leaf blade with prominently caudate apex; intercostal veins in a distinct usually raised net……..
……..……**140. S. rostratum**
Calyx lobes falling after anthesis. Leaf blade with shortly caudate apex; intercostal veins lax, subparallel with main lateral veins, hardly raised……**88. S. longiflorum**

93. Leaf with few, intermediate veins subequal to main lateral veins……..94
Leaf with many intermediate veins unequal to main lateral veins……..95

94. Flower bud with distinct pseudostalk. Leaf blade drying golden-brown beneath with purple midrib……**73. S. imperiale**
Flower bud with obscure pseudostalk. Leaf blade drying olive-brown beneath, midrib not as above……**145. S. selukaifolium**

95. Twigs 4-ribbed to narrowly 4-winged in cross-section. Leaf blade mostly densely pimpled beneath……..96
Twigs round in cross-section. Leaf blade not or sparsely pimpled beneath…….101

96. Calyx lobes free. Leaf base rounded, auriculate to heart-shaped……97
Calyx lobes united in bud into a pointed snuffer. Leaf base wedge-shaped……...98

97. Inflorescence to 25 cm long. Leaf blade lanceolate *c*. 35 × 7 cm……**136. S. rejangense**
Inflorescence to 7 cm long. Leaf blade ovate-lanceolate, to 9 × 5.5 cm…….
……..……**156. S. taytayense**

98. Leaf blade to 9 × 3.5 cm, thin, not pimpled beneath……...**9. S. arcanum**
Leaf blade at least 15 × 5 cm, densely pimpled beneath: **S. barringtonioides Group**.....
……...……..99

99. Inflorescence racemose, to 1 cm long……..……**121. S. perspicuinervium**
Inflorescence paniculate, to 18 cm long……100

100. Inflorescence spreading, doubly branched along rachis. Flower bud to 15 mm long, to 5 mm diameter……**16. S. barringtonioides**
Inflorescence erect, rigid, bearing hardly branched short subterminal branchlets. Flower bud to 7 mm long, to 3 mm diameter……**35. S. cleistocalyx**

101. Flower calyx lobes united into a pointed snuffer. Leaf blade elliptic-obovate, base rounded to heart-shaped……..**116. S. paradoxum**
Flower calyx lobes free, distinct. Leaf blade elliptic, ovate or oblanceolate, base wedge-shaped……102

102. Mature flower bud larger than 15 mm long, 6 mm diameter. Leaf blade drying matt orange-brown beneath……**5. S. anthicum**
Mature flower bud smaller than 9 mm long, 4 mm diameter. Leaf blade drying dull or glistening brown, not matt beneath……...103

103. Flower bud *c*. 6 mm long, *c.* 2 mm diameter; calyx lobes vestigial with thick margin. Leaf blade black-dotted beneath……...**91. S. maingayi**
Flower bud larger than 6 mm long, 3 mm diameter, with distinct calyx lobes. Leaf blade not or obscurely dotted beneath……104

104. Twig red-brown becoming narrowly flaky. Leaf blade drying dull throughout…….
……**114. S. paludosum**
Twig distinct whitish, remaining smooth. Leaf blade drying glistening throughout…105

105. Inflorescence terminal or subterminal-axillary. Leaf main lateral veins more than 20 pairs……...**157. S. tenuicaudatum**
Inflorescence mostly axillary. Leaf main lateral veins less than 15 pairs……...
……**125. S. pontianakense**

106. Leaf main lateral veins subequal……...107
Leaf main lateral veins unequal……..131 (to p. 142)

107. Flower calyx lobes united in bud in a pointed snuffer……...**24. S. calyptrocalyx**
Flower calyx lobes free, with thick or hyaline margins or vestigial……108

108. Twig quadrangular, ribbed or narrowly winged in cross-section……109
Twig round in cross-section when young, becoming quadrangular only when older……
……116 (to p. 141)

109. Twig with 2 opposite ribs. Flower bud pear-shaped with stout tapering pseudostalk……
……..**18. S. bicostatum**
Twig 4-angled or 4-winged. Flower bud not as above……110

110. Flower bud with distinct slender pseudostalk. Leaf blade mostly broadest in the basal half……111
Flower bud with short, indistinct pseudostalk. Leaf blade broadest in the upper half……
……...113

111. Twig cream-coloured. Leaf blade papery, drying greenish brown, prominently dotted beneath; intercostal veins lax, obscure above……**86. S. leucocladum**

Twig dark coloured. Leaf blade thinly leathery, drying purplish chocolate, *or golden-brown*, obscurely pimpled or finely dotted beneath; intercostal veins dense, raised throughout……112

112. Leaf base wedge-shaped; main lateral veins raised more above than below……..
……..……..**27. S. castaneum**
Leaf base cordate; main lateral veins furrowed above……..**58. S. georgeae**

113. Leaf drying papery, prominently black pimpled or dotted beneath……
……**105. S. nigropunctatum**
Leaf more or less leathery, not prominently dotted or pimpled beneath……..114

114. Leaf blade smaller than 3.5 × 1.2 cm; intercostal veins forming a distinct net beneath….
……..……..**79. S. khoonmengianum**
Leaf blade larger than 4 × 1.5 cm; intercostal veins not distinctly net-like……..115

115. Flowers in dense axillary clusters. Leaf blade thinly leathery; venation obscure throughout……..**76. S. jaherii**
Flowers in short congested terminal inflorescences. Leaf blade thickly leathery; venation distinct beneath……**129. S. punctilimbum**

116. Calyx lobes to 0.5 mm long, vestigial……...117
Calyx lobes more than 1 mm long, distinct……..123

117. Twig at first 4-ribbed in cross-section……**164. S. valdevenosum**
Twig round in cross-section……..118

118. Leaf margin minutely bluntly toothed towards apex…..…**151. S. subcrenatum** (in part)
Leaf margin entire……119

119. Twigs grey or brown……120
Twigs cream-white……121

120. Inflorescence to 13 cm long, terminal or axillary. Stamens many. Leaf blade elliptic-obovate, main lateral veins *c*. 20 pairs……..**149. S. steenisii**
Inflorescence less than 4 cm long, axillary. Stamens 10. Leaf blade elliptic-ovate or oblong; main lateral veins *c*. 27 pairs……**122. S. petrophilum**

121. Inflorescence to 3 cm long. Leaf blade minutely puckered beneath; venation obscure….
……...……**78. S. kalahiense**
Inflorescence more than 4 cm long. Leaf blade not puckered beneath; venation slender but distinct……122

122. Inflorescence to 9 cm long, terminal or subterminal-axillary. Leaf blade elliptic-lanceolate to ovate, *c*. 7 × 4 cm, densely distinctly dotted beneath, pitted above; intercostal veins generally forming a dense lattice drying pale, distinct on both surfaces……...**87. S. leucoxylon**
Inflorescence to 4 cm long, mostly axillary. Leaf blade narrowly elliptic-oblong, *c*. 18 × 5.5 cm, indistinctly dotted beneath and pitted above; intercostal veins obscure above, not forming a dense pale lattice……...**167. S. villamilii**

123. Calyx lobes 5. Twig smooth or scurfy……..124
Calyx lobes 4. Twig flaky……125

124. Twig smooth……..**75. S. inophyllum**
Twig prominently purplish brown scurfy……**42. S. curtisii**

125. Leaf blade elliptic to obovate……126
Blade ovate, lanceolate or elliptic……128

126. Leaf blade thickly leathery, drying glistening chocolate-brown…..……
……..……..……..**62. S. gracilipaniculum**
Leaf blade thinly leathery, drying rust- to pink-brown……127

127. Leaf blade dull throughout, apex caudate; intercostal veins obscure…….
……..**99. S. myrtilloides**
Leaf blade glistening, apex acute to subacuminate; intercostal veins evident……
……..……**100. S. myrtillus**

128. Main lateral veins minutely furrowed above……..……**65. S. havilandii**
Main lateral veins not or only rarely narrowly furrowed above……...129

129. Flower bud clove-shaped; calyx lobes with median rib. Twig more than 2 mm diameter, stout. Leaf blade densely dotted beneath……**112. S. pachysepalum**
Flower bud obconical or club-shaped; calyx lobes not ribbed. Twig less than 2 mm diameter, slender. Leaf blade sparsely or not dotted beneath……...130

130. Leaf blade drying leaden-grey, with shagreened undersurface……...**142. S. rugosum**
Leaf blade drying rust- to pink-brown, dull and not shagreened throughout…….
……**154. S. syzygioides**

131. Flower calyx lobes hyaline, falling after anthesis……..**120. S. peregrinum**
Flower calyx lobes not or hyaline only at margin……132

132. Inflorescence exclusively ramiflorous……..……133
Inflorescence terminal, or axillary or ramiflorous……134

133. Flower calyx snuffer-like, breaking off at anthesis……...**103. S. nervosum**
Flower calyx with distinct lobes, not breaking off at anthesis…..…**124. S. polyanthum**

134. Calyx lobes shorter than 1 mm, vestigial……...135
Calyx lobes at least 1 mm long, distinct……...142

135. Leaf main lateral veins distinctly raised beneath, slender but prominent…….136
Leaf main lateral veins hardly raised beneath, faint……139

136. Bracteoles subpersistent. Leaf blade dull; main lateral veins to 8 pairs……...137
Bracteoles falling early. Leaf blade glistening throughout; main lateral veins at least 9 pairs……...138

137. Inflorescence 2x-branched. Leaf blade dark pimpled beneath; main lateral veins *c*. 7 pairs……..……**83. S. kunstleri**

Inflorescence 3x-branched. Leaf blade obscurely or faintly dotted beneath; main lateral veins 5–6 pairs…….**20. S. borneense**

138. Leaf main lateral veins more than 12 pairs; intramarginal vein 3–5 mm within margin……**45. S. elliptilimbum**
Leaf main lateral veins *c.* 10 pairs; intramarginal vein 4–12 mm within margin……...
……..……**137. S. remotifolium**

139. Leaf blade to 8 × 4 cm……..140
Leaf blade usually greater than 10 × 5 cm……141

140. Flower bud obconical. Leaf blade lanceolate, not dotted beneath; main lateral veins narrowly furrowed above; intramarginal vein distinctly looped…….
……..**139. S. roseomarginatum**
Flower bud torch-shaped. Leaf blade ovate to elliptic, faintly dotted beneath; main lateral veins obscure above; intramarginal vein close to margin, obscure……..
…….(**49. S. faciflorum**: mature fruit unknown)

141. Calyx lobes 5. Fruit with 2 mm high funnel-like calyx-rim. Leaf blade thickly leathery; intercostal veins obscure……...**108. S. oblatum**
Calyx lobes 4. Fruit calyx rim hardly raised. Leaf blade thinly leathery; intercostal veins visible throughout……..**134. S. racemosum**

142. Twig quadrangular, bluntly 4-ribbed to narrowly winged in cross-section……...143
Twig 2-grooved, elliptic or round in cross-section……...148

143. Leaf blade prominently darkly pimpled beneath……..**95. S. moultonii**
Leaf blade sparsely obscurely dotted, not pimpled beneath…….144

144. Twig sharply 4-angled or narrowly winged……..145
Twig bluntly 4-ribbed……...146

145. Twig at first dark and narrowly 4-winged, soon becoming cream and round. Leaf blade drying red-brown, obscurely dotted; main lateral veins *c.* 12 pairs, darker beneath……..
……...……**15. S. baramense**
Twig remaining dark. Leaf blade drying dull mauve-brown, sparsely black dotted beneath; main lateral veins *c.* 8 pairs, not darker beneath…...…**133. S. quadricostatum**

146. Mature flower bud larger than 15 mm long, 8 mm diameter, with clawed calyx lobes. Leaf base rounded to heart-shaped……...**3. S. ampullarium**
Flower bud to 10 mm long, 6 mm diameter. Leaf base wedge-shaped……147

147. Mature flower bud larger than 8 mm long, 4 mm diameter. Leaf blade thinly leathery, dull; main lateral veins prominent beneath……**22. S. brachyrachis**
Mature flower bud to 3 mm long, 2 mm diameter. Leaf blade thickly leathery, glistening above; main lateral veins obscure……**123. S. phryganodes**

148. Flowers in dense axillary clusters to 2 cm long……149
Flowers in distinct terminal, axillary or ramiflorous inflorescences to 10 cm long….151

149. Calyx lobes 5. Twigs white. Leaf main lateral veins prominent beneath……..
……**67. S. hoseanum**
Calyx lobes 4. Twigs brown. Leaf main lateral veins slender or obscure beneath…….....150

150. Leaf blade thickly leathery; venation obscure……**28. S. caudatilimbum**
Leaf blade papery; venation slender but distinct beneath……..**25. S. capitatum**

151. Inflorescence ramiflorous……...**40. S. crypteronioides**
Inflorescence terminal or axillary……152

152. Twig cream-white or golden……153
Twig variously brown……...156

153. Leaf drying dull dark red-brown……...154
Leaf drying glistening grey-brown or purplish brown……..155

154. Inflorescence racemose. Leaf blade elliptic-obovate…….……**111. S. pachyphyllum**
Inflorescence paniculate. Leaf blade ovate-lanceolate……..**33. S. christmannii**

155. Flower bud to 5 mm long, to 2.5 mm diameter. Twig *c*. 2 mm diameter. Leaf main lateral veins *c*. 12 pairs……...**71. S. idrisii**
Flower bud to 20 mm long, to 10 mm diameter. Twig *c*. 3 mm diameter, stout. Leaf main lateral veins *c*. 6 pairs……**68. S. houttuynii**

156. Flowers dense on inflorescence branchlets. Twig at least 3 mm diameter at first, stout: **S. urceolatum Group**……...159
Flowers lax on inflorescence. Twig less than 3 mm diameter at first, slender…….157

157. Inflorescence racemose. Leaf thickly leathery; venation obscure……..
……...(**148. S. soepadmoi**: fruit unknown)
Inflorescence paniculate. Leaf blade thinly leathery; venation distinct or obscure……..158

158. Leaf blade at least 4x as long as broad, wrinkled on drying, venation obscure……..
……..**158. S. tenuilimbum**
Leaf blade at most 3x as long as broad, not wrinkled on drying, venation evident……
……**96. S. muelleri**

159. Inflorescence a raceme or spike……160
Inflorescence a spreading panicle……163

160. Leaf blade drying distinctly matt greenish to pink-brown beneath…...…**46. S. elopurae**
Leaf blade drying dull but not matt beneath……161

161. Calyx lobes 4. Leaf main lateral veins somewhat raised above; basal lateral veins longer than others……**113. S. palawanense**
Calyx lobes 5. Leaf main lateral veins generally furrowed above; basal lateral veins shorter than those adjacent……162

162. Leaf blade drying greyish mauve-brown; intercostal veins just visible beneath……
……**64. S. griffithii**
Leaf blade drying pale yellowish brown; intercostal veins invisible……..
……..**163. S. valdecoriaceum**

163. Mature flower bud *c*. 10 mm long, *c*. 2x as long as broad, tapering without distinct pseudostalk……**155. S. tawahense**
Mature flower bud less than 10 mm long, less than 2x as long as broad or, if 10 mm long, with distinct pseudostalk……..164

164. Leaf blade distinctly pitted above, dotted beneath, drying dull throughout……...
……**69. S. houttuyniifolium**
Leaf blade usually obscurely pitted above, not dotted beneath, drying glistening or satiny above……...165

165. Fruit smooth……..**63. S. grande**
Fruit ribbed……166

166. Fruit ribs shallow. Leaf blade elliptic-lanceolate, to 9 cm long; main lateral veins ascending……**36. S. confertum**
Fruit ribs prominent. Leaf blade elliptic-oblong, at least 12 cm long; main lateral veins spreading…….……**162. S. urceolatum**

***Incertae sedis*** (no flowers or fruit)**: 4. S. anthicoides**, **12. S. badescens**, **31. S. chaii**, **54. S. fossiramulosum**, **138. S. rheophyticum**, **146. S. silamense**, **165. S. valentissimum**, **Syzygium sp. A–H (171–178)**.

## Field key to *Syzygium* species

(Use hand lens for leaf pits, gland dots and intercostal vein characters; consult venation terminology in genus introduction before use)

1. Twigs at first 4-angled, 4-ribbed or winged along internode……2
Twigs round or elliptic in cross-section, smooth or ribbed but if angled only near apex……...……56 (to p. 150)

2. Venation not or hardly raised, more or less obscure; main lateral veins unequal, intermediate lateral veins few……...3
Venation distinct or, if obscure, then intermediate lateral veins many……4

3. Twig bluntly quadrangular in cross-section. Leaf blade 6–14 × 1.5–4 cm……
……**5. S. anthicum**
Twig narrowly but distinctly 4-winged. Leaf blade 1.5–4 × 0.3–1.5 cm……...
……..**160. S. tubiflorum**

4. Main and intermediate lateral veins slender, dense and more or less equally raised beneath, or venation obscure……5
Main lateral veins distinctly raised beneath, more prominently so than intermediate lateral veins, or intermediate lateral veins few or obscure……24 (to p. 147)

5. Leaf blade at most 3 cm long, apex indented, obtuse, acute or bluntly acuminate……...6
   Leaf blade mainly at least 4.5 cm long, apex subcaudate……7

6. Leaf densely black pimple-dotted beneath; venation obscure……
   ……**105. S. nigropunctatum**
   Leaf obscurely or not dotted beneath; venation distinct……**81. S. kinabaluense**

7. Leaf blade more than 6x longer than broad, strap-shaped. Rheophytic shrub……
   ……**138. S. rheophyticum**
   Leaf blade less than 4x longer than broad. Not rheophytic……..8

8. Leaf blade broadest in the distal half……9
   Leaf blade broadest at or below the middle……12

9. Leaf blade sharply acuminate at apex, shiny at least beneath. Twig endings cinereous, finely flaky. Trees of forest on sandy soils in lowlands and lower montane *kerangas*……..**27. S. castaneum**
   Leaf blade obtuse to bluntly or shortly acuminate at apex, dull throughout. Twigs glabrous, not flaky. Trees of forest on mountains and rocky ridges……...10

10. Leaf blade thickly leathery; petiole *c.* 1 mm long……...……11
    Leaf blade thinly leathery or papery; petiole more than 3 mm long, slender……13

11. Leaf blade *c*. 8.5 × 4.5 cm, thickly leathery; main lateral veins obscure above…….
    ……**129. S. punctilimbum**
    Leaf blade *c*. 3.5 × 1.2 cm, thinly leathery; main lateral veins distinctly raised above…..
    ……..…….**79. S. khoonmengianum**

12. Main lateral veins obscure. Flowers in dense axillary fascicles……**76. S. jaherii**
    Main lateral veins visible beneath, obscure or minutely furrowed above. Flowers in slender 3x-branched terminal or axillary inflorescences to 3.5 cm long……
    ……**133. S. quadricostatum**

13. Leaf blade elliptic to oblong, broadest at the middle……..14
    Leaf blade round or mostly broadest in the basal half……19

14. Leaf blade 2x longer than wide, drying red-, yellow- or grey-brown……15
    Leaf blade about 3x longer than wide, drying dull yellow- or golden-brown……16

15. Main lateral veins *c*. 8 pairs, each with one intermediate lateral vein……
    ……...……**13. S. bakoense**
    Main lateral vein *c.* 14 pairs, each with several intermediate lateral veins…….
    ……**34. S. claviflorum** (in part)

16. Leaf blade base shallowly heart-shaped……..17
    Leaf base wedge-shaped……18

17. Leaf blade satiny; main lateral veins *c.* 11 pairs; venation slender, drying blackish beneath with the intermediate lateral veins branching among the intercostal veins forming a net……..……**58. S. georgeae**

Leaf blade dull; main lateral veins *c.* 16 pairs; venation drying same colour as blade beneath, not forming a net……..……**146. S. silamense**

18. Leaf blade drying red-brown, slightly glistening, margin narrowly recurved…… ……**127. S. prasiniflorum**
Leaf blade drying grey- to yellowish-brown, dull, margin flat…..…**38. S. cornuflorum**

19. Leaf blade 3x as long as broad; main lateral veins not raised beneath…….. ……..**98. S. myrtifolium**
Leaf blade at most 2.5x as long as broad; main lateral veins somewhat raised beneath… ……20

20. Petiole *c.* 5 mm long; main lateral veins *c.* 6 pairs……..**170. S. zeylanicum**
Petiole more than 7 mm long; main lateral veins more than 8 pairs……...21

21. Twig at least 4 mm diameter apically, stout. Leaf blade thickly leathery, petiole *c.* 3 mm diameter, stout……**165. S. valentissimum**
Twig to 2 mm diameter apically. Leaf blade at most thinly leathery; petiole less than 2 mm diameter, slender……..22

22. Leaf blade drying brown above; petiole *c.* 10 mm long……..……**132. S. pyrifolium**
Leaf blade drying grey-brown; petiole to 7 mm long…….23

23. Leaf blade drying dull above; petiole *c.* 3 mm long……**9. S. arcanum**
Leaf blade drying glistening above; petiole *c.* 7 mm long……..**4. S. anthicoides**

24. Leaf blade broadly ovate to round; main lateral veins *c.* 4 pairs, distinctly raised beneath…….**7. S. apiarii**
Leaf blade narrowly ovate, ovate-lanceolate to broadly elliptic-oblong; main lateral veins more than 6 pairs, hardly raised beneath……...25

25. Leaf blade less than 2 × 1 cm. Small *kerangas* and mountain trees……...26
Leaf blade at least 3 × 1.5 cm. Not as above……..28

26. Leaf base tapering towards petiole; main lateral veins at least 16 pairs……. ……...……..**70. S. hypsipetes**
Leaf base abruptly ending at the petiole; main lateral veins less than 14 pairs……..27

27. Leaves in alternately overlapping pairs. Twig spindly……..**106. S. nummularium**
Leaves not in alternately overlapping pairs. Twig rigid……...**14. S. bankense**

28. Leaf base heart-shaped or auriculate or sharply obtuse……..……29
Leaf base wedge-shaped or rounded but tapering into petiole……..44 (to p. 149)

29. Leaf blade mostly less than 14 cm long……..30
Leaf blade mostly at least 15 cm long…….37

30. Twig becoming whitish. Leaf blade more than 3x longer than wide…….**115. S. panzeri**
Twig brown. Leaf blade less than 3x longer than wide……..31

31. Leaf blade *c.* 3x as long as broad. Trees of lower montane forest……..
……..……**128. S. pterophorum**
Leaf blade at most 2.5x as long as broad. Trees not as above……32

32. Main lateral veins not furrowed above……...33
Main lateral veins furrowed along their crests above…….35

33. Twig bluntly quadrangular in cross-section. Leaf blade to 5 cm long, elliptic-oblong…..
……..**3. S. ampullarium**
Twig prominently winged. Leaf blade to 8 cm long, ovate-lanceolate……...34

34. Main lateral veins more or less obscure, hardly raised beneath. Leaf blade not blistered between lateral veins……...**97. S. multibaracteolatum**
Main lateral veins distinctly raised beneath. Leaf blade somewhat blistered between lateral veins……...**178. Syzygium sp. H**

35. Leaf blade pits obscure, gland dots indistinct. Lowland mixed dipterocarp forest tree……..**117**. **S. paucipunctatum**
Leaf blade pits and gland dots or pimples distinct. Cultivated or lowland forest tree……
……..……36

36. Leaf blade papery, wrinkled on drying, warm chocolate-brown throughout, pimpled but not dotted beneath. Lowland forest tree……**156. S. taytayense**
Leaf blade leathery, drying not wrinkled, greenish brown above, chestnut-brown beneath, dotted beneath. Cultivated tree…….**8. S. aqueum** (in part)

37. Leaf base distinctly heart-shaped to auriculate……...……38
Leaf base rounded…….43 (to p. 149)

38. Parts including leaf undersurface densely rust-brown velvety hairy…**168. S. villiferum**
Parts glabrous or twigs only downy……39

39. Twig distinctly winged. Leaf blade drying rich red-brown or yellowish brown……40
Twig angled or ribbed but not winged. Leaf blade drying grey-green to greenish brown……..……41

40. Leaf blade drying yellow-brown beneath, dull pink-brown above…….**82. S. kudatense**
Leaf blade drying rich rust-brown throughout, shiny above……**136. S. rejangense**

41. Twig endings less than 2 mm diameter, slender. Leaf pits and gland dots dense; intercostal veins distinct above. Inflorescence short, compact……..
……..……**144. S. scortechinii** (in part)
Twig endings more than 3 mm diameter, stout. Leaf pits and gland dots dense or sparse; intercostal veins evident on both surfaces or distinct beneath. Inflorescence paniculate, to 15 cm long……...42

42. Inflorescence compact, to 2 cm long. Leaf pits and gland dots dense; intercostal veins distinct above……..**8. S. aqueum** (in part)
Inflorescence many-flowered, open, to 15 cm long. Leaf pits and gland dots sparse; intercostal veins obscure above……**80. S. kiauense**

43. Leaf subsessile; main lateral veins 7–8 pairs, not furrowed above……
……**77. S. jambos** (in part)
Leaf with distinct petiole; main lateral veins 10–12 pairs, shallowly furrowed above…..
……**144. S. scortechinii** (in part)

44. Leaf blade at least 3x as long as broad…….**22. S. brachyrachis** (in part)
Leaf blade less than 3x as long as broad…….45

45. Leaf blade mostly less than 9 × 3 cm……..46
Leaf blade mostly at least 10 × 4 cm……..47

46. Young twig distinctly 4-winged in cross-section, drying dark brown, peeling. Leaf blade narrowly elliptic, obscurely gland-dotted beneath, drying dull dark red-brown with blackish veins…….**15. S. baramense**
Young twig deeply grooved, initially slightly angled below the nodes, drying pale grey-brown, not peeling. Leaf blade elliptic-ovate, minutely densely pitted above, dotted beneath, drying dull greenish……...**29. S. caudatum**

47. Twig coppery brown downy. Axillary buds distinct, pointed….**55. S. fulvotomentosum**
Twigs glabrous. Axillary buds obscure……...48

48. Twigs conspicuously cream-coloured. Leaf blade distinctly brown dotted beneath, base wedge-shaped but ending more or less abruptly at the petiole……...
……...**86. S. leucocladum** (in part)
Twigs brown or greyish. Leaf blade more or less pimpled, not or indistinctly dark dotted beneath, base wedge-shaped and distinctly tapering into the petiole……..49

49. Leaf blade lanceolate, drying dull dark olive-brown beneath…….**145. S. selukaifolium**
Leaf blade elliptic-obovate, drying red- or chocolate-brown beneath……50

50. Twig endings at most 2 mm diameter. Leaf blade elliptic-obovate, mostly broader in the upper half. Calyx lobes distinct……...51
Twig endings at least 3 mm diameter. Leaf blade oblong or oblong-obovate, broader in the middle. Calyx lobes calyptrate……..52

51. Leaf blade drying glistening above; intercostal veins distinctly open-reticulate. Inflorescence terminal or subterminal-axillary……**57. S. garcinifolium** (in part)
Leaf blade drying dull throughout; intercostal veins not as above. Inflorescence on twigs behind the leaves……..**85. S. leptostemon** (in part)

52. Leaf blade less than 3x longer than broad; midrib sharply ridged beneath……
……...……**35. S. cleistocalyx**
Leaf blade more than 3x longer than broad; midrib rounded beneath……53

53. Leaf blade elliptic-oblong or lanceolate; main lateral veins not furrowed above……...54
Leaf blade elliptic-obovate to oblanceolate; main lateral veins raised above but set between blisters of the blade or furrowed along their crests……...55

54. Petiole *c.* 9 mm long; main lateral veins *c.* 11 pairs. Tree of mixed dipterocarp forest….
……...**164. S. valdevenosum**

Petiole *c.* 12 mm long; main lateral veins *c*. 14 pairs. Tree of banks of whitewater rivers……**16. S. barringtonioides**

55. Leaf blade oblanceolate; main lateral veins drying darker than blade beneath, furrowed along crests above……..**107. S. oblanceolatum**
Leaf blade elliptic-obovate; main lateral veins not darker than blade beneath, set between blisters of the blade above……..**121. S. perspicuinervium**

56. Main lateral veins subequal; intermediate lateral veins equally raised with main lateral veins and all reaching the intramarginal vein, and/or main lateral veins very slender, hardly raised; intramarginal vein usually hardly looped, close to margin; or venation obscure……57
Main lateral veins obviously unequal, more prominent or longer than intermediate lateral veins; intramarginal vein usually well within margin, looped…….115 (to p. 154)

57. Young parts scurfy hairy……**27. S. castaneum** subsp. **altecastaneum**
Young parts glabrous……..58

58. Leaf margin distinctly toothed towards apex…….……**151. S. subcrenatum** (in part)
Leaf margin not toothed……..59

59. Leaf blade drying warm chocolate-, red or purplish-brown beneath……..60
Leaf blade drying greyish, greenish to rust-, yellowish- or orange-brown beneath……...
……...77 (to p. 151)

60. Twig with 2 distinct ribs, running down beneath each petiole. Tree of lower montane *kerangas*……**18. S. bicostatum**
Twig not 2-ribbed. Tree of various forest types……..61

61. Leaf venation narrowly furrowed at least above……62
Leaf venation not furrowed above……..65

62. Intercostal veins minutely furrowed above……**65. S. havilandii** (in part)
Intercostal veins not furrowed above……..63

63. Main lateral veins *c.* 15 pairs; intercostal veins visible beneath. Tree of lower montane forest……...**31. S. chaii** (in part)
Main lateral veins more than 18 pairs; intercostal veins obscure. Tree of other forest habitat……..64

64. Leaf blade oblong-ovate; petiole slender; main lateral veins *c.* 20 pairs……
……..**108. S. oblatum**
Leaf blade elliptic-oblong; petiole stout; main lateral veins *c.* 25 pairs……
……...**110. S. oligomyrum** (in part; juvenile)

65. Dry leaf blade glistening throughout……..66
Dry leaf blade dull or slightly satiny only, or shiny above only……67

66. Leaf blade minutely puckered (‘shagreened’) beneath; intercostal veins obscure…….
……**142. S. rugosum**
Leaf blade not shagreened beneath; intercostal veins distinct……68

67. Leaf blade elliptic-ovate, margin not recurved, apex slender-acuminate; pits above and gland dots beneath distinctly visible……...**104. S. nigricans** subsp. **nigricans**
Leaf blade elliptic-obovate, margin narrowly recurved, apex notched to subacute; pits and dots obscure……..**62. S. gracilipaniculum**

68. Leaf blade at least 3x as long as broad……..……**154. S. syzygioides** (in part)
Leaf blade less than 3x as long as broad……69

69. Intercostal veins sharply densely reticulate……**104. S. nigricans** subsp. **phaeophyllum**
Intercostal veins obscure, or visible but not prominently raised……70

70. Leaf pits and gland dots obscure……71
Leaf pits and gland dots or pimples visible……73

71. Leaf blade elliptic-obovate; intercostal veins evident……**149. S. steenisii** (in part)
Leaf blade elliptic or oblong; intercostal veins obscure……72

72. Intramarginal veins close to margin, hardly looped……**110. S. oligomyrum** (in part)
Intramarginal veins 2–3 mm within margin, looped……**148. S. soepadmoi**

73. Leaf pits and gland dots sparse……...**49. S. faciflorum**
Leaf pits and gland dots dense……74

74. Leaf blade oblong, drying shiny above……...**25. S. capitatum**
Leaf blade elliptic to broadly lanceolate, drying dull above……...75

75. Leaf main lateral veins narrowly furrowed above and often on both surfaces. Bark pale, smooth……**65. S. havilandii** (in part)
Leaf main lateral veins equally raised on both surfaces. Bark brown, becoming flaky….
……..……76

76. Leaf venation distinct; intercostal veins net-like……**151. S. subcrenatum** (in part)
Leaf venation including intercostal veins somewhat obscure…….
……**11. S. attenuatum** (in part)

77. Twigs pale grey- to conspicuous cream-white……78
Twigs black, brown or grey-brown……80

78. Leaf blade at least 3x as long as broad, elliptic-oblong to oblong-lanceolate……
……...……**167. S. villamilii** (in part)
Leaf blade at most 2.5x as long as broad, elliptic or ovate……79

79. Leaf blade drying dull pale grey-green throughout, with dense minute pits above, gland dots beneath……**87. S. leucoxylon**
Leaf blade drying rust-brown beneath, glistening yellowish green above, minutely pimpled on both surfaces and gland-dotted beneath……**2. S. adenophyllum** (in part)

80. Leaf blade obovate-elliptic to oblanceolate, apex obtuse or shortly bluntly acuminate….
……...……..81
Leaf blade oblong, elliptic, ovate or lanceolate, apex various……86

81. Petiole at most 7 mm long. Mostly trees of montane forest……...82
Petiole at least 9 mm long. Mostly trees of lowland forest……83

82. Leaf blade dull throughout, apex caudate; intercostal veins obscure…….
……..**99. S. myrtilloides**
Leaf blade somewhat glistening, apex acute to subacuminate; intercostal veins visible…
……..……..……**100. S. myrtillus**

83. Leaf blade at least 6x as long as broad……**109. S. odoardoi**
Leaf blade at most 4x as long as broad……...84

84. Leaf blade thin, more or less wrinkled on drying; main lateral veins distinct beneath, typically drying darker than the blade. Twig endings *c*. 3 mm diameter……
……..**50. S. fastigiatum**
Leaf blade leathery, drying not wrinkled; main lateral veins indistinct beneath, drying same colour as blade……...85

85. Leaf blade *c*. 17 × 7 cm. Twig endings *c*. 6 mm diameter.....**41. S. cuneiforme**
Leaf blade *c.* 7 × 4 cm. Twig endings *c*. 2 mm diameter.....**74. S. incarnatum** (in part)

86. Leaf main lateral veins more distinct beneath than above……..87
Main lateral veins more or less equally raised or not raised on both surfaces……
…….....101 (to p. 153)

87. Leaf blade subcaudate at apex, margin distinctly undulate……**12. S. badescens**
Leaf blade not subcaudate at apex, margin not undulate……88

88. Leaf blades densely pitted above, black dotted beneath, mostly at least 9 × 4.5 cm……..
……89
Leaf blades not or sparsely pitted above or pitted on both surfaces, mostly less than 8.5 × 3 cm……94

89. Leaf blade to 3 × 2 cm. Tree of upper montane forest……..**52. S. flagrimonte**
Leaf blade mostly at least 9 × 4.5 cm. Tree of other forest habitats……...90

90. Leaf blade elliptic-oblong, at least 20 cm long; main lateral veins sharply prominent beneath; intermediate lateral veins few, mostly reaching margin……**73. S. imperiale**
Leaf blade elliptic, ovate or lanceolate, at most 18 cm long; main lateral veins slender, hardly raised; intermediate lateral veins not as above……91

91. Leaf margin recurved; petiole 2–3 mm diameter, stout……..**34. S. claviflorum** (in part)
Leaf margin hardly or not recurved; petiole less than 2 mm diameter, slender……..92

92. Leaf blade drying pale golden-brown and not gland-dotted beneath….**78. S. kalahiense**
Leaf blade drying dark greenish- or yellow-brown and gland-dotted beneath……...93

93. Twig smooth. Leaf intercostal veins visible, gland dots scattered beneath. Tree with reddish bark and tall stilt roots……..**32. S. chloranthum**
Twig at first distinctly scurfy. Leaf intercostal veins obscure, gland dots dense beneath. Buttressed tree with grey-brown bark……...**42. S. curtisii**

94. Leaf apex rounded or with short or tapering acumen; blades densely pitted and dull or drying satiny above……95
Leaf apex caudate; blades sparsely pitted above, drying dull throughout……..99

95. Leaf blade drying satiny above……...96
Leaf blade drying dull above……..98

96. Leaf margin flat; main lateral veins *c*. 25 pairs; intercostal veins obscure…….
……..**56. S. fusticuliferum**
Leaf margin recurved; main lateral veins *c*. 10 pairs; intercostal veins forming a distinct net beneath……..97

97. Leaf blade ovate-elliptic, drying chocolate-brown beneath; petiole *c*. 8 mm long…….
……**31. S. chaii** (in part)
Leaf blade narrowly elliptic, drying greenish brown; petiole 3–5 mm long……...
……**84. S. lambirense**

98. Petiole *c*. 3 mm long……...**169. S. viridifolium**
Petiole at least 5 mm long……**122. S. petrophilum**

99. Leaf blade beneath distinctly black gland-dotted; petiole *c*. 10 mm long……..
……...……**101. S. napiforme**
Leaf blade beneath sparsely or obscurely gland-dotted; petiole less than 8 mm long……
……..100

100. Leaf main lateral veins narrowly furrowed above……..**6. S. antisepticum** (in part)
Leaf main lateral veins not furrowed above……..**154. S. syzygioides** (in part)

101. Leaf intercostal veins not raised beneath, visible or obscure (mature trees)……102
Leaf intercostal veins slightly raised and visible on both surfaces……...113

102. Leaf main lateral veins furrowed along crests above……..
……**26. S. caryophylliflorum** (in part)
Leaf main lateral veins not furrowed above……..103

103. Leaf blade mostly more than 9 cm long……104
Leaf blade usually less than 8.5 cm long……..109

104. Leaf thin-papery, drying satiny olive-brown throughout……...**19. S. biniflorum**
Leaf blade thickly leathery, drying variously but not olive-brown throughout……105

105. Leaf blade wrinkled on drying, densely minutely pitted or pimpled above, densely minutely pimpled beneath……**94. S. monticolum**
Leaf blade not wrinkled on drying, more or less black gland-dotted beneath……..106

106. Twig endings at first powdery mauve-brown flaky. Leaf blade drying dull mauve-brown, obscurely gland-dotted beneath; midrib sharp beneath; main lateral veins ascending…….....107
Twig endings glabrous, smooth. Leaf blade drying yellowish-, ochreous- or rust-brown, distinctly gland-dotted or pimpled beneath; midrib rounded beneath; main lateral veins spreading……...108

107. Leaf blade drying dull mauve-brown throughout, obscurely gland-dotted beneath; midrib sharp beneath……**28. S. caudatilimbum** (in part)
Leaf blade drying rust-brown and distinctly black gland-dotted beneath; midrib rounded beneath……**112. S. pachysepalum**

108. Main lateral veins obscure, level or somewhat elevated above……..
……..……**110. S. oligomyrum** (in part; mature leaves)
Main lateral veins finely furrowed above……**75. S. inophyllum**

109. Leaf blade drying dull above……110
Leaf blade drying glistening above……...112

110. Leaf apex caudate, acumen more than 1/3 the length of blade…….**140. S. rostratum**
Leaf apex not caudate, acumen less than 1/4 the length of blade……111

111. Leaf blade elliptic with wavy margin; petiole at most 6 mm long…..**147. S. skiophilum**
Leaf blade elliptic to ovate-lanceolate, margin not wavy; petiole *c*. 10 mm long……..
……..……**11. S. attenuatum** (in part)

112. Twig endings whitish. Leaf apex acuminate; blades densely pimply dotted beneath……
……..**2. S. adenophyllum** (in part)
Twig endings grey-brown. Leaf apex blunt; blades sparsely gland-dotted beneath……...
……**74. S. incarnatum** (in part)

113. Leaf blade densely black gland-dotted beneath. Tree of montane forest……
……**51. S. filiforme**
Leaf blade sparsely or obscurely black gland-dotted beneath. Tree of lowland and hill forest……..114

114. Leaf blade sparsely black gland-dotted beneath. Young twig slightly flaky. Inflorescence longer than its subtending leaf……..**26. S. caryophylliflorum** (in part)
Leaf blade sparsely pimpled on both surfaces, sometimes minutely gland-dotted beneath. Young twig smooth. Inflorescence usually shorter than its subtending leaf……
……..……**88. S. longiflorum**

115. Leaf beneath and twig distinctly hairy……...116
Leaf beneath and twig glabrous, cinereous, scabrous or smooth……..118

116. Twig slender; indumentum sparse but coarse……...**66. S. hirtum**
Twig stout, indumentum short, velvety……117

117. Leaf blade *c*. 2x as long as broad, ovate……..**166. S. velutinum** (in part)
Leaf blade *c*. 3x as long as broad, oblong-lanceolate……**168. S. villiferum**

118. Leaf blade at most 8 cm long……119
Leaf blade at least 8.5 cm long……122

119. Leaf blade at least 4x as long as broad, partly in threes on twig. Shrub or small tree of shingle beaches below flood level of whitewater rivers……**93. S. medium**
Leaf blade at most 2x as long as broad, all opposite. Tree of other forest habitats…..120

120. Leaf blade somewhat bullate; main lateral veins distinctly raised on both surfaces, shallowly furrowed within folds of the blade above. Tree of montane forest……
……**68. S. houttuynii**
Leaf blade not bullate, main lateral veins slender, hardly raised on both surfaces, furrowed along crests above. Tree of peatswamp, lowland and montane *kerangas* forest……..……121

121. Leaf blade to 5 × 4 cm, obovate to oblanceolate. Tree of lower montane *kerangas*……..
……**123. S. phryganodes**
Leaf blade at least 8 × 3.5 cm, ovate to elliptic. Tree of peat swamp and lowland *kerangas*……...……**24. S. calyptrocalyx** (in part)

122. Base of leaf blade heart-shaped, auriculate or abruptly rounded……..123
Base of leaf blade wedge-shaped, abruptly terminating or tapering into petiole……
……142 (to p. 156)

123. Twig at first *c.* 1 mm diameter apically, slender……...124
Twig at least 3 mm diameter apically, stout……128

124. Leaf blade *c.* 4.7 × 3 cm, base abruptly rounded, subequal; petiole distinctly slender…...
……...…….……**6. S. antisepticum** (in part)
Leaf blade more than 8 × 5 cm, base wedge-shaped, rounded, heart-shaped or auriculate; petiole very short, stout (leaf subsessile)……125

125. Leaf base wedge-shaped, subequal……..**69. S. houttuyniifolium**
Leaf base rounded, heart-shaped or auriculate, equal……...126

126. Leaf subsessile……**153. S. subsessilifolium**
Leaf with at least 3 mm long petiole……127

127. Leaf blade densely gland-dotted beneath; main lateral veins raised above……
……**48. S. eugeniforme**
Leaf blade without distinct gland-dots beneath; main lateral veins furrowed above……..
……**72. S. iliasii**

128. Twig becoming cream-white……129
Twig becoming grey or brown……..130

129. Twig internodes not shouldered. Leaf blade *c.* 26 × 8 cm, drying brown; petiole pale, corky, wrinkled when dry. Mature flower bud *c.* 15 mm long, tapering towards base…..
……..……**53. S. formosum**
Twig internodes at first with 4 distinct apical shoulders. Leaf blade *c.* 19 × 6.5 cm, drying greenish; petiole not corky nor wrinkled when dry. Mature flower bud *c.* 12 mm long, abruptly narrowing above base……**144. S. scortechinii** (in part)

130. Leaf main lateral veins mostly at most 13 pairs; blade distinctly glanden-dotted beneath……..131
Leaf main lateral veins at least 15 pairs; blade not as above……137

131. Leaf main lateral veins furrowed above……132
Leaf main lateral veins not furrowed above……..135

132. Twig internodes at first with distinct apical shoulders. Leaf intercostal veins distinct beneath……..**144. S. scortechinii** (in part)
Twig internodes without shoulders. Leaf intercostal veins obscure……133

133. Leaf generally at least 20 cm long, often broadest in the distal half. Tree of lowland forest……**89. S. lunduense**
Leaf generally less than 18 cm long, broadest at or below the middle. Tree of montane forest……..134

134. Leaf blade thinly leathery, base heart-shaped to rounded……**21. S. brachypodum**
Leaf blade thickly leathery, base broadly wedge-shaped to rounded…….
……**43. S. dasyphyllum**

135. Leaf blade thickly leathery, margin recurved, base unequal; intramarginal vein close to margin, hardly looped……**17. S. beccarii** & **60. S. gladiatum**
Leaf blade thinly leathery, margin flat, base subequal; intramarginal vein well within margin, looped……..136

136. Leaf blade drying dull above; main lateral veins drying same colour as blade; intermediate lateral veins not distinctly bifurcating……**8. S. aqueum** (in part)
Leaf blade drying glistening above; main lateral veins beneath drying darker than blade; intermediate lateral veins distinctly bifurcating distally…….**116. S. paradoxum**

137. Leaf blade beneath drying dull ochreous-brown and suede-like or rich golden rufous velvety……...……138
Leaf blade beneath drying not as above……139

138. Leaf blade narrowly elliptic, *c*. 40 × 11 cm, with suede-like undersurface; main lateral veins only slightly unequal though prominent, *c*. 30 pairs…….**39. S. creaghii**
Leaf blade broadly lanceolate, *c*. 25 × 11 cm, with smooth dull undersurface; main lateral veins strongly unequal, *c.* 20 pairs……...**166. S. velutinum** (in part)

139. Leaf blade satiny, drying yellow-brown beneath, grey-green above……140
Leaf blade drying rust- or chocolate-brown throughout……...141

140. Leaf blade at least 6.5 cm broad; main lateral veins *c*. 22 pairs; intercostal veins visible beneath, obscure above; petiole drying black……**152. S. subisense**
Leaf blade at most 4 cm broad; main lateral veins *c*. 17 pairs; intercostal veins obscure beneath, visible above; petiole corky, whitish……**161. S. ultramaficum**

141. Leaf blade satiny; petiole stout, *c.* 3 mm long; main lateral veins *c*. 20 pairs……
……**23. S. bujangii**
Leaf blade dull, subsessile; main lateral veins *c*. 30 pairs…….**119. S. penibukanense**

142. Twigs cream-white or bright yellow……143
Twigs grey or brown……...158 (to p. 158)

143. Twig bright golden yellow, obscurely angled in cross-section. Leaf blade thickly leathery, strictly elliptic, with hardly acuminate blunt apex; intercostal veins obscure. Tree of upper montane forest……**47. S. erythranthum**

Twig not as above, if golden yellow, then the leaf blade ovate- or obovate-elliptic, and the intercostal veins evident. Tree of lowland and lower montane forests……...144

144. Leaf blade drying glistening above; intercostal veins forming a distinctive raised net above……**57. S. garcinifolium** (in part)
Leaf blade drying glistening or dull above; intercostal veins not as above or, if net-like, blade dull……...145

145. Leaf blade obovate-elliptic……146
Leaf blade ovate-lanceolate to elliptic……..149

146. Leaf main lateral veins mostly 5–6 pairs; blade drying grey-brown, somewhat milky beneath……...**20. S. borneense** (in part)
Leaf main lateral veins at least 9 pairs; blade not milky beneath…….147

147. Leaf blade shortly subcaudate at apex, drying rich rust-brown and densely pimpled beneath…….**83. S. kunstleri** (in part)
Leaf blade tapering acuminate at apex, drying purplish brown, minutely black gland-dotted beneath……...148

148. Leaf apex shortly acuminate; main lateral veins slender but slightly raised beneath…….
……**111. S. pachyphyllum**
Leaf apex tapering acuminate, acumen to 1.5 cm long; main lateral veins prominently raised beneath……..**67. S. hoseanum**

149. Leaf blade upper surface drying shiny grey- to chocolate-brown; pits and gland-dots obscure……..150
Leaf blade upper surface drying dull yellow-, greenish- to rust- or pink-brown; distinctly gland-dotted or pimpled beneath……...152

150. Leaf blade tapering acuminate at apex; main lateral veins not furrowed above…….
……**71. S. idrisii**
Leaf blade caudate at apex; main lateral veins furrowed above……...151

151. Leaf blade *c.* 20 × 3.5 cm; main lateral veins *c*. 25 pairs……..**157. S. tenuicaudatum**
Leaf blade *c*. 13 × 5 cm; main lateral veins at most 15 pairs…….**125. S. pontianakense**

152. Leaf intercostal veins visible on both surfaces……153
Leaf intercostal veins obscure on at least one surface……..154

153. Leaf blade leathery, drying rust-brown beneath. Tree of peatswamp and *kerangas* forest……..**33. S. christmannii** (in part)
Leaf blade thin, drying pale grey-green beneath. Tree of mixed dipterocarp and secondary forest……**134. S. racemosum** (in part)

154. Leaf blade lanceolate-elliptic, apex caudate; main lateral veins *c*. 7 pairs; intermediate lateral veins reaching at least half way to margin; intercostal veins obscure on both surfaces……**83. S. kunstleri** (in part)
Leaf blade elliptic or ovate, apex acuminate, acumen tapering; main lateral veins mostly at least 10 pairs, intermediate lateral veins short or absent; intercostal veins evident on one surface or obscure……...155

155. Petiole at least partially cream corky……156
Petiole not cream corky……157

156. Leaf blade drying pale chocolate-brown beneath; apex acuminate. Inflorescence axillary to ramiflorous……**120. S. peregrinum**
Leaf blade drying greenish brown beneath; apex subcaudate. Inflorescence terminal…... ……...**86. S. leucocladum** (in part)

157. Main lateral veins minutely furrowed above and sometimes beneath; intermediate lateral veins reaching at least half way to margin; intercostal veins obscure……. ……**24. S. calyptrocalyx** (in part)
Main lateral veins not minutely furrowed; intermediate lateral veins short or mostly absent; intercostal veins visible on at least one surface…….**85. S. leptostemon** (in part)

158. Leaves more than 3x as long as broad, lanceolate or elliptic……159
Leaves less than 3x as long as broad, or if longer then obovate…….174 (to p. 159)

159. Twig ending at least 3 mm diameter, stout. Leaf blade drying grey-brown beneath; main lateral veins and their intermediates stout beneath……..160
Twig ending at most 3 mm diameter, slender. Leaf blade drying dull pale grey-green, tawny-, chocolate-, orange- or rust-brown; main lateral veins and their intermediates slender, hardly or distinctly raised beneath……...164

160. Twig prominently channelled below nodes. Petiole corky, cream……. ……...……**54. S. fossiramulosum**
Twig not prominently channelled below nodes. Petiole drying black not corky……..161

161. Leaf main lateral veins *c.* 7 pairs; acumen tapering, sharp……**77. S. jambos** (in part)
Leaf main lateral veins at least 10 pairs; acumen short, blunt……..162

162. Leaf blade elliptic-obovate; main lateral veins not furrowed above……... ……**131. S. pycnanthum** var. **angustifolium** (in part)
Leaf blade elliptic; main lateral veins furrowed above…….163

163. Leaf blade lanceolate, drying satiny rust-brown beneath, greenish brown above; petiole *c.* 25 mm long……**40. S. crypteronioides**
Leaf blade elliptic to oblong-lanceolate, drying mauve-brown; petiole *c.* 7 mm long…... ……**64. S. griffithii** (in part)

164. Leaf main lateral veins furrowed above……165
Leaf main lateral veins not furrowed above……169

165. Leaf margin prominently wavy; main lateral veins *c.* 40 pairs, irregularly spaced, hardly raised beneath……**90. S. macromyrtus**
Leaf margin otherwise; main lateral veins at most 25 pairs, not as above……...166

166. Leaf blade drying pale grey or yellowish-green throughout, distinctly sparsely or densely gland-dotted beneath……167
Leaf blade drying chocolate- or mauve-brown above, obscurely gland-dotted beneath……..168

167. Main lateral veins *c*. 14 pairs, drying the same colour with that of the blade; leaf blade densely minutely brown gland-dotted beneath……**130. S. pustulatum**
Main lateral veins *c*. 20 pairs, drying darker than the blade; leaf blade sparsely gland-dotted beneath……..**102. S. neriifolium**

168. Leaf blade drying not wrinkled; intramarginal vein hardly looped; intercostal veins dense……..**134. S. racemosum** (in part)
Leaf blade drying wrinkled; intramarginal vein distinctly looped; intercostal veins lax……..170

169. Leaf blade *c*. 14 × 4.5 cm; petiole *c*. 12 mm long; main lateral veins *c*. 10 pairs……...
……..**174. Syzygium sp. D**
Leaf blade *c*. 6 × 2 cm; petiole *c*. 7 mm long; main lateral veins *c*. 14 pairs……..
……..**139. S. roseomarginatum**

170. Leaf main lateral veins at least 18 pairs……171
Leaf main lateral veins at most 15 pairs……...172

171. Leaf blade oblong-lanceolate; main lateral veins *c*. 20 pairs……..
……...……**167. S. villamilii** (in part)
Leaf blade oblanceolate; main lateral veins *c*. 30 pairs……**95. S. moultonii**

172. Leaf main lateral veins *c*. 8 pairs, slender but distinctly raised; leaf upper surface densely minutely pitted; lower surface densely black gland-dotted, pale rust-brown……
……..**22. S. brachyrachis** (in part)
Leaf main lateral veins at least 12 pairs, hardly raised or obscure; leaf upper surface with or without pits; lower surface sparsely gland-dotted, pale shagreened……173

173. Leaf blade *c*. 30 × 6 cm, pale shagreened and sparsely gland-dotted beneath; main lateral veins obscure above, hardly raised beneath……**135. S. ramiflorum**
Leaf blade to 19 × 4.5 cm, dull mauve-brown on both surfaces, distinctly, gland-dotted beneath; main lateral veins slightly and equally raised throughout……
……...……**158. S. tenuilimbum**

174. Leaf blade broadest in the upper half……175
Leaf blade broadest at or below the middle……186 (to p. 160)

175. Leaf blade mostly at least 25 cm long……...176
Blade mostly less than 22 cm long……177

176. Leaf main lateral veins *c*. 10 pairs, very shallowly furrowed above; intermediate veins short. Stamens bright pink. Village tree……**92. S. malaccense**
Entire venation distinctly furrowed above; main lateral veins *c*. 17 pairs with subequal intermediate veins. Stamens white. Forest trees……...…**141. S. rosulentum** (in part)

177. Leaf main lateral veins distinctly or narrowly furrowed above……178
Leaf main lateral veins not or only slightly furrowed above……182

178. Leaf intercostal veins distinct above……179
Leaf intercostal veins obscure above…….....180

179. Young shoots highly aromatic. Leaf main lateral veins very slender, equally raised on both surfaces; intramarginal veins close to margin, hardly looped. Inflorescence terminal or subterminal-axillary. Village tree……..**10. S. aromaticum**
Young shoots weakly aromatic. Leaf main lateral veins prominent, more so beneath than above; intramarginal vein *c*. 3 mm within margin, looped. Inflorescence borne behind the leaves……..**124. S. polyanthum** (in part)

180. Leaf blade drying dark rich purple-brown with blackish veins beneath; main lateral veins at least 15 pairs. Inner bark fibrous, meaty red……**141. S. rosulentum** (in part)
Leaf blade drying pink- or yellow-brown beneath; main lateral veins at most 15 pairs. Inner bark not as above…….181

181. Leaf blade less than 2x longer than broad, densely pitted above; main lateral veins drying blackish beneath; intercostal veins obscure throughout……..
……...**20. S. borneense** (in part)
Leaf blade more than 2.5x longer than broad, obscurely pitted above; main lateral veins not drying darker than blade; intercostal veins visible beneath……..
…….**131. S. pycnanthum** var. **angustifolium** (in part)

182. Leaf blade thickly leathery, margin recurved; pits and gland-dots obscure…….183
Leaf blade thinly leathery or papery, margin not recurved; pits and gland-dots otherwise……...184

183. Leaf blade *c*. 17 × 9.5 cm, densely obscurely pimpled beneath; main lateral veins *c*. 11 pairs. Tree of lowland forest…….**172. Syzygium sp. B**
Leaf blade to 10 × 4 cm, not pimpled beneath; main lateral veins to 10 pairs. Tree of montane forest…….**149. S. steenisii** (in part)

184. Leaf main lateral veins at least 12 pairs, more raised beneath than above; intercostal veins obscure above; blade not pitted above…….**91. S. maingayi**
Leaf main lateral veins *c*. 10 pairs, more raised above than beneath or equally raised throughout; intercostal veins visible on both surfaces; blade minutely pitted above...185

185. Twig more or less angular at apex. Leaf blade tapering into petiole, apex caudate-acuminate, shagreened above. Forest tree……..**85. S. leptostemon** (in part)
Twig not angular at apex. Leaf blade ending abruptly at the petiole, apex bluntly shortly acuminate, dull above. Village tree……..**143. S. samarangense** (in part)

186. Leaf blade drying yellow-, greyish-, pink-, greenish-, rust- or orange-brown beneath……..……187
Leaf blade drying distinctly, often leaden, chocolate- or mauve- or purplish-brown beneath……210 (to p. 162)

187. Main lateral veins furrowed along their crests above……...188
Main lateral veins not or hardly furrowed above……..197

188. Leaf main lateral veins more raised beneath than above; at most one surface of the blade black dotted……189
Leaf main lateral veins slender but more or less equally raised on both surfaces; both surfaces of blade black gland-dotted…….195

189. Leaf blade thin-papery, wrinkled on drying……..190
Leaf blade more or less leathery, not wrinkled on drying……191

190. Leaf main lateral veins *c*. 8 pairs, irregularly spaced, with occasional intermediate veins……**37. S. conglobatum**
Leaf main lateral veins *c*. 13 pairs, equally spaced, with several intermediate veins……**103. S. nervosum** (in part)

191. Petiole *c*. 8 mm long……192
Petiole mostly at least 9 mm long……193

192. Leaf blade bluntly acuminate at apex; intercostal veins indistinct beneath……
……...**159. S. treubii** (in part)
Leaf blade sharply acuminate at apex; intercostal veins distinct beneath……...
……**30. S. cephalophorum**

193. Leaf blade elliptic-obovate; intercostal veins visible above……...
……..**124. S. polyanthum** (in part)
Leaf blade elliptic-lanceolate or elliptic-ovate; intercostal veins obscure above…….194

194. Leaf blade minutely white-dotted beneath; main lateral veins ascending, raised with furrowed crest above……..**46. S. elopurae**
Leaf blade black dotted beneath; main lateral veins spreading, not raised above……..
……..**103. S. nervosum** (in part)

195. Main lateral veins *c*. 6 pairs……**29. S. caudatum**
Main lateral veins *c*. 12 pairs……196

196. Main lateral veins equally raised on both surfaces; intercostal veins distinctly so, lattice-like……**118. S. pendens**
Main lateral veins more raised beneath than above; intercostal veins visible but not as above……...**1. S. acuminatissimum** (in part)

197. Leaf venation obscure on both surfaces; midrib sharply angled beneath……...
……..**28. S. caudatilimbum** (in part)
Leaf venation distinct on at least one surface of the blade; midrib not sharply angled beneath……..…..…..……198

198. Petiole *c*. 5 mm long, stout. Cultivated tree……..**143. S. samarangense** (in part)
Petiole at least 7 mm long. Forest tree……...199

199. Leaf blade drying distinctly glistening above……...200
Leaf blade drying dull or satiny but not glistening above……202

200. Leaf blade with minute black dots beneath……...201
Leaf blade without black dots beneath……..203

201. Leaf blade drying glistening throughout, without large pale gland-like warty lumps beneath……..**171. Syzygium sp. A**
Leaf blade drying dull red-brown, with large pale gland-like warty lumps beneath……**61. S. glanduligerum**

202. Leaf blade elliptic-ovate, *c*. 11 × 5 cm; venation equally prominent on both surfaces……...**44. S. durifolium**
Leaf blade elliptic-obovate, *c*. 16 × 7.5 cm; venation more prominent beneath than above……**57. S. garcinifolium** (in part)

203. Leaf blade bluntly stoutly acuminate at apex; main lateral veins *c*. 6 pairs, the basal pair continuing up half the blade margin……...**96. S. muelleri**
Leaf blade caudate or sharply acuminate at apex; main lateral veins 7–30 pairs, the basal pair short……..204

204. Leaf apex caudate; main lateral veins *c*. 7 pairs……..**83. S. kunstleri** (in part)
Leaf apex sharply acuminate; main lateral veins at least 8 pairs……..205

205. Leaf intercostal veins obscure beneath; blade beneath distinctly brown gland-dotted. Large tree overhanging river banks, or a rheophyte……..**131. S. pycnanthum**
Leaf intercostal veins variably distinct beneath; gland dots if present black. Forest tree……206

206. Twig distinct cream to coppery yellow. Leaf main lateral veins prominent; intramarginal vein well within margin, looped……..**33. S. christmannii** (in part)
Twig pale brown. Leaf main lateral veins not prominent; intramarginal vein close to margin, hardly looped……...207

207. Leaf blade densely black dotted beneath, wrinkled on drying……
……..……**103. S. nervosum** (in part)
Leaf blade not black dotted beneath, not wrinkled on drying……...208

208. Leaf blade thickly leathery, main lateral veins *c*. 15 pairs; intercostal veins obscure……**163. S. valdecoriaceum**
Leaf blade thinly leathery; main lateral veins mostly less than 13 pairs; intercostal veins visible on at least one surface……...……209

209. Leaf main lateral veins *c*. 12 pairs; intramarginal vein very close to margin, hardly looped; blade minutely pitted on both surfaces……..**1. S. acuminatissimum** (in part)
Leaf main lateral veins *c*. 9 pairs; intramarginal vein distinctly looped; blade minutely pimpled on both surfaces……**59. S. glabratum**

210. Main lateral veins furrowed above on dry leaf……211
Main lateral veins not furrowed above……218

211. Twigs flaking in minute upcurled strips……..**114. S. paludosum**
Twigs flaking in plates or smooth……212

212. Leaf blade broadest at the middle……213
Leaf blade mostly broadest in the upper half……216

213. Main lateral veins at least 15 pairs……...**126. S. praestantilimbum**
Main lateral veins at most 14 pairs……...214

214. Blade 2 ½–3x as long as broad; lateral veins narrowly furrowed above……
……..……**64. S. griffithii** (in part)

Blade about twice as long as broad; lateral veins more or less raised above……215

215. Leaf base narrowly wedge-shaped, apex to 15 mm caudate; main lateral veins *c*. 9 pairs……**113. S. palawanense** (in part)
Leaf base broadly wedge-shaped, apex broadly bluntly to 5 mm acuminate to notched; main veins 8–14 pairs……..**162. S. urceolatum** subsp. **palembanicum** (in part)

216. Leaf blade *c*. 20 × 8 cm, sparsely gland-dotted beneath; main lateral veins *c*. 17 pairs; intercostal veins visible beneath. Inner bark fibrous meaty red, thick……
……...**141. S. rosulentum** (in part)
Leaf blade generally less than 10 × 5 cm, faintly or not gland-dotted beneath; main lateral veins to 15 pairs; intercostal veins indistinct beneath. Inner bark not as above……217

217. Leaf blade elliptic-obovate; main lateral veins 5–6 pairs; intercostal veins obscure or visible above only……..**20. S. borneense** (in part)
Leaf blade narrowly elliptic-lanceolate; main lateral veins *c*. 15 pairs; intercostal veins visible throughout……**173. Syzygium sp. C**

218. Leaf blade *c.* 3x longer than broad. Rheophytic tree……
……**131. S. pycnanthum** var. **angustifolium** (in part)
Leaf blade less than 3x longer than broad. Tree of uplands and river banks but not rheophytic……..219

219. Leaf blade ending abruptly at the petiole; intercostal veins dense forming a distinctly raised net beneath……..**134. S. racemosum** (in part)
Leaf blade tapering into the petiole; intercostal veins not as above……220

220. Leaf undersurface distinctly gland-dotted……221
Leaf undersurface without gland-dots……...222

221. Leaf apex slender acuminate; blade undersurface sparsely gland-dotted; main lateral veins *c*. 12 pairs……**159. S. treubii** (in part)
Leaf apex broadly acuminate; blade undersurface densely gland-dotted; main lateral veins *c*. 20 pairs……...**149. S. steenisii** (in part)

222. Leaf intercostal veins obscure above (obscure or distinct beneath)……..223
Leaf intercostal veins distinct on both surfaces……226

223. Twig compressed and grooved. Leaf blade caudate at apex……...
…….……**113. S. palawanense** (in part), **175. Syzygium sp. E**, **176. Syzygium sp. F**
Twig round in cross-section. Leaf blade acuminate at apex……224

224. Intramarginal veins 3 pairs, the main pair 4–12 mm within margin, prominently looped……...**137. S. remotifolium**
Intramarginal veins 1–2 pairs, at most 6 mm within margin, not prominently looped……225

225. Leaf blade elliptic to lanceolate, *c.* 9 cm long, not milky beneath; main lateral veins ascending……**36. S. confertum**

Leaf blade elliptic-oblong, *c.* 13 cm long, milky beneath; main lateral veins spreading……**162. S. urceolatum** subsp. **kuchingense**

226. Leaf main lateral veins *c.* 16 pairs……227
Leaf main lateral veins at most 15 pairs……...230

227. Leaf blade papery, drying dull, pale yellow-brown beneath. Tree of lowland river banks……..**150. S. stipitatum**
Leaf blade leathery, drying glistening above, chocolate-brown beneath. Tree of upland forest……..228

228. Leaf main lateral veins spreading, only slightly more raised beneath. Bark remaining smooth……..**45. S. elliptilimbum** (in part)
Leaf main lateral veins ascending, distinctly more prominent beneath. Bark not as above……229

229. Leaf midrib stout; main lateral veins prominent beneath……**63. S. grande**
Leaf midrib slender; main lateral veins slender, hardly raised beneath……..
……..….**177. Syzygium sp. G**

230. Leaf main lateral veins spreading, only slightly more raised beneath. Bark remaining smooth……..**45. S. elliptilimbum** (in part)
Leaf main lateral veins ascending, distinctly more prominent beneath. Bark remaining smooth or becoming flaky……231

231. Leaf main lateral veins hardly raised above. Bark remaining smooth……
……**162. S. urceolatum** subsp. **palembanicum** (in part)
Leaf main lateral veins distinctly sharply raised above. Bark becoming flaky……..
……...**155. S. tawahense**

## 1. **Syzygium acuminatissimum** (Blume) DC. Plate 5B.

(Latin, *acuminatissimus* = very pointed; referring to the leaf tip)

Prodr. 3 (1828) 261. **Basionym:** *Myrtus acuminatissima* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1088. **Type:** *Blume s.n.*, *loc. incert.*, Java (holotype L). **Homotypic synonyms:** *Jambosa acuminatissima* (Blume) Hassk., Cat. Hort. Bog. Alt. (1844) 262; *Eugenia acuminatissima* (Blume) Kurz, Rep. Pegu App. A (1875) lxiii, J. As. Soc. Beng. 46 (1877) 67, Ridley *op. cit.* (1922) 746, Burgess, TBS (1966) 411, J.A.R. Anderson *op. cit.* (1980) 273, Coode *et al.* (eds.) *op. cit.* 233; *Acmena acuminatissima* (Blume) Merr. & L.M.Perry, J. Arn. Arb. 19 (1938) 12, 205, Masamune *op. cit.* 520, Coode *et al*. (eds.) *op. cit.* 233, Argent *et al*. (eds.) *op. cit.* 463, Parnell & Chantaranothai *op. cit.* 780, Beaman & C. Anderson *op. cit.* 206. **Heterotypic synonyms:** *Syzygium subdecurrens* Miq. *op. cit.* (1855) 449, *E. subdecurrens* (Miq.) Merr. & Chun, Sunyatsenia 2 (1935) 289; *E. cumingiana* Vidal, Phan. Cuming. Philip. (1885) 173, M.R. Henderson *op. cit.* (1949) 260, *S. cumingianum* (Vidal) Gibbs, J. Linn. Soc. Bot. 42 (1914) 76, Masamune *op. cit.* 527; *E. saligna* Merr. *op. cit.* (1921) 433, PEB (1929) 216; *E. attenuatifolia* Merr., Philip. J. Sci. 18 (1921) 299; *E. eucaudata* Elm. *in* Merr., En. Philip. Pl. 3 (1923) 176.

Small canopy tree, to 20 m tall, to 50 cm diameter; buttresses small; stilt roots often present. **Bark** pale brown, smooth to patchily thinly flaky; inner bark pink-brown. *Parts glabrous*. **Twigs** *2–3 mm diameter apically*, *round* or *slightly quadrangular in cross-section*, *pale brown*, smooth. **Leaves** often subopposite, thinly leathery, *drying dull pale brown*,

*glistening above*, *not distinctly wrinkled*, sparsely minutely pitted above, *without dots or with minute scattered black dots beneath*; *blades elliptic to occasionally lanceolate*, (*3.5–*) *8–13 × 1.5–4 cm*, *base narrowly wedge-shaped tapering*, *apex acuminate*, acumen *c.* 2 cm long, slender; *midrib not sharply angled beneath*; *main lateral veins unequal*, *c. 12 pairs*, *hardly or not furrowed above*, distinctly raised beneath but slender, ascending, *basal pair short*; *intercostal venation visible throughout*; *intramarginal veins close to margin*, *hardly looped*; *petioles c. 8 mm long*, slender. **Inflorescences** *paniculate*, *terminal or subterminal-axillary*, to 6 cm long; rachis slender, 2–3x-branched. **Flowers** bunched on the rachis branchlets; *buds club-shaped*, *to 5 mm long*, *to 3 mm diameter*; pseudostalk *c.* 3 mm long, slender; calyx lobes 4, broadly hemispherical, cupped, deciduous; stamens many, exserted to *c.* 4 mm long, anthers subglobose or broader than long, *locules spreading from the base*, *end-porous*; style exserting to *c.* 4 mm long. **Fruits** *c.* 15 mm diameter, generally bilobed often misshapen, with minute raised calyx-rim, ripening pinkish to purple. **Seeds** *with intrusive tissue interlocking the cotyledons*.

**Vernacular name.** Sabah and Sarawak—*ubah samak* (Brunei, Dusun, Iban).

**Distribution.** India to South China and throughout Malesia. In Borneo common and widespread; known in Sabah from various districts (e.g., *SAN 19389*, *SAN 26342*, *SAN 43284*, *SAN 50525*, *SAN 62790*, *SAN 117026*, *SAN 124026* and *SAN 131773*) and in Sarawak from Belaga, Bintulu, Kapit, Kuching, Lawas, Limbang, Lundu, Marudi, Miri, Serian and Sri Aman districts (e.g., *Chew CWL 354*, *Haviland 2931*, *S 24147*, *S 51735*, *S 68293*, *S 79188* and *S 84521*). Also known from Brunei (e.g., *Haslani HA 51*, *BRUN 15076*, *BRUN 16438*, *BRUN 16879* and *BRUN 17454*) and Kalimantan (e.g., *Sidiyasa 584*, *Church 1320*, *Burley NGS 1894*, *Kostermans 5398* and *Kostermans 10217*).

**Ecology.** Locally common in primary and secondary mixed dipterocarp and *kerangas* forest on leached yellow sandy and clay soils and degraded sands, including on the Iju rhyolite and Hose mountains dacite; at altitudes to 1700 m.

## 2. **Syzygium adenophyllum** Merr. & L.M.Perry

(Greek, *adenos* = glandular, *phullon* = leaf; referring to the prominent gland dots on the leaf undersurface)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 184; Beaman & C. Anderson *op. cit.* 211. **Type:** *Clemens 50338*, Borneo, Sabah, Penibukan, Mt. Kinabalu (holotype A; isotypes K, L). **Homotypic synonym:** *Eugenia adenophylla* (Merr. & L.M.Perry) J.A.R.Anderson, CLTS (1980) 273.

Canopy tree to 30 m tall; buttresses to 3 m tall, plank-like. **Bark** red-brown, rough, becoming shallowly fissured and crumbly flaking. *Parts glabrous*. **Twigs** slender, *round in cross-section*, *whitish*, striated and becoming flaky. **Leaves** *thickly leathery*, *drying glistening yellowish green above*, *dull rich rust-brown beneath*, *minutely densely pimpled on both surfaces and minutely black dotted beneath*; *blades elliptic*, *5–13 × 4–6 cm*, base wedge-shaped, *margin entire*, *apex acuminate*, *acumen c. 15 mm long*, tapering, blunt; *venation hardly or not visible or raised*; *main lateral veins subequal*, *c.* 30 pairs, spreading; *intercostal veins not raised*, *visible or obscure*; *intramarginal vein close to margin*, *hardly looped*; *petioles c. 11 mm long*. **Inflorescences** *paniculate*, *to 2 cm long*, *terminal or subterminal-axillary*; rachis slender, *densely branched*, each branch 3-flowered. **Flowers:** *buds clove-shaped*, *to 15 mm long*, *to 5 mm diameter*, *drying dark brown*; pseudostalk at least 2x longer than hypanthium, shriveling, not warty; *calyx lobes 4*, *hemispherical*, *c. 1*

*mm*, forming an even rim round the conical acute protruding corolla; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *obovoid*, to 15 mm long, to 9 mm diameter, with 3 mm diameter apical rim and pore, and short stalk, *drying pale milky mauve or honey-brown*.

**Distribution.** Endemic to Borneo. Known in Sabah from Beluran, Lahad Datu, Ranau and Tawau districts (e.g., *SAN 46751*, *SAN 57535*, *SAN 60609* and *SAN 92991*) and in Sarawak from Kuching, Lundu and Miri districts (e.g., *S 36614*, *S 45883*, *S 46755* and *S 48967*). Also recorded from C and S Kalimantan (e.g., *Sidiyasa 1069*, *Laman 1316* and *de Vogel 1932*).

**Ecology.** In *kerangas* on skeletal soils on sandstone, and on rocky summits into the lower facies of upper montane forest on Mt. Kinabalu, at 1400–1700 m altitude.

## 3. **Syzygium ampullarium** (Stapf) Merr. & L.M.Perry

(Latin, *ampullarius* = flask-shaped; referring to the fruit)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 164; Masamune *op. cit.* 523; Coode *et al.* (eds.) *op. cit.* 234; Beaman & C. Anderson *op. cit.* (1980) 211. **Basionym:** *Eugenia ampullaria* Stapf, FMK (1894) 193, Plate 11C, fig. 13, Merrill J. Str. Br. Roy. As. Soc. 79 (1918) 21, *op. cit.* (1921) 425, Burgess *op. cit.* 412, J.A.R. Anderson *op. cit.* 273. **Type:** *Haviland 1096*, Borneo, Sabah, Mt. Kinabalu (holotype K; isotype SING).

Small unbuttressed canopy tree, to 15 m tall, to 20 cm diameter. **Bark** greyish, becoming thinly flaky. Parts glabrous. **Twigs** *c*. 2 mm diameter apically, much-branched, *bluntly 4-ribbed in cross-section*, somewhat flaky, *dark purplish brown*. **Leaves** thinly leathery, drying dull dark purplish-brown, *gland dots and pits obscure*; *blades broadly elliptic-oblong*, *c*. *4 × 2.5*(*2–5 × 1.5–3.5*) *cm*, *base cordate to obtuse*, apex obtuse; venation evident but slender and hardly raised more so beneath; *main lateral veins distinctly unequal*, *c. 12 pairs*, well-spaced, *not furrowed above*, spreading; intercostal veins evident; intramarginal vein well within margin, looped; petioles *c*. 3 mm long. **Inflorescences** *paniculate*, to 2 cm long, *terminal*; rachis 1x-branched, *c.* 1 mm diameter, round in cross-section. **Flowers:** *buds clove-shaped*, *c. 16 mm long*, *c. 10 mm diameter*, slender *tapering into c*. *5 mm pseudostalk*; *calyx lobes 4*, triangular, *c. 3 × 3 mm*, *clawed*, *not or only hyaline at margin* falling at anthesis; stamens many, becoming exserted to 10 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style to 15 mm, stout. **Fruits** *spherical* to *flask-shaped*, to 15 mm long, to 11 mm diameter, shortly pedicellate, smooth; *calyx rim to 8 × 12 mm*, *prominent*, *expanding*.

**Distribution.** Endemic to Borneo. Known in Sabah mainly from Mt. Kinabalu (e.g., *RSNB 5953*, *SAN 10634*, *Clemens 27830*, *SAN 28565*, *SAN 38098* and *Clemens 50870*) and in Sarawak from G. Murud and G. Mulu (e.g., *Burtt 5360*, *S 29891*, *S 30842* and *S 74657*). Also recorded from Brunei (e.g., *Wong WKM s.n.* and *BRUN 1384*).

**Ecology.** Local in upper montane forest, at 3000–3900 m altitudes on Mt. Kinabalu, between 1000–1500 m elsewhere.

## 4. **Syzygium anthicoides** P.S.Ashton

(Greek, -*oides* = resembling; a species with leaves similar to those of *Syzygium anthicum*)

Kew Bull. 61, 1 (2006) 108. **Type:** *Othman et al. S 41491*, Borneo, Sarawak Bt. Semusoh, Melatai, Balleh (holotype K; isotypes KEP, L, SAR).

Canopy tree to 25 m tall. **Bark** reddish brown, scaly. Parts glabrous. **Twigs** *1–2 mm diameter apically*, *markedly 4-ribbed*, grey-brown. **Leaves** *thinly leathery*, *drying grey-brown*, *slightly glistening and pitted above*, dull and sparsely minutely black dotted beneath; *blades* lanceolate, *6–10 × 2.5–4 cm*, base wedge-shaped, *apex to 1 cm acuminate*; lateral veins unequal, intermediate veins equally raised but shorter, *main lateral veins c. 9 pairs*, very slender, hardly elevated above, *elevated with intermediate veins beneath*; intercostal veins obscure above, evident beneath; intramarginal veins 1(or 2), 2–3 mm within margin, somewhat looped; *petioles slender*, *c. 7 mm long*. **Inflorescences** *paniculate*, to 5 cm long, terminal. **Fruits** spherical, *c*. 8 mm diameter, ripening purple, wrinkled on drying; calyx rim *c*. 2 mm diameter, shallow.

**Distribution.** Endemic to Borneo; known by two collections in Sarawak from G. Hijan, Sri Aman district (*S 46272*) and Bt. Semusoh, Kapit district (the type).

**Ecology.** In mixed dipterocarp forest.

## 5. **Syzygium anthicum** (Ridl.) Merr. & L.M.Perry
(meaning obscure)

Mem. Amer. Acad. Arts. & Sci. 18, 3 (1939) 165; Masamune *op. cit.* 523. **Basionym:** *Eugenia anthica* Ridl., J. Bot. 68 (1930) 11. **Type:** *Haviland 3213* (in part), Borneo, Sarawak, near Kuching (holotype K).

Treelet. Parts glabrous. **Twigs** *c*. 2 mm diameter apically, *bluntly quadrangular in cross-section*, finely cracked and papery, drying pale orange-brown. **Leaves** leathery, *drying* dull, orange- to dark rust-brown above, *distinctive orange-brown beneath*, *minutely pitted above*, *minutely verruculose beneath*; *blades narrowly elliptic-lanceolate*, *6–14 × 1.5–4 cm*, *base wedge-shaped*, apex *c*. 1 cm tapering acuminate; midrib furrowed above, rounded, slender but prominent beneath; *venation more or less obscure or main lateral veins and intramarginal vein bluntly raised beneath*; *lateral veins unequal*, main veins *c.* 12 pairs, irregularly spaced, arched and ascending, *intermediate veins few*, *shorter than the main lateral veins*; intramarginal veins 2–3 mm within margin, weakly looped; *petioles to 4 mm long*, *c.* 1.5 mm diameter, drying brown. **Inflorescence** a 7-flowered, congested terminal or axillary panicle to 1 cm long. **Flowers:** *buds goblet-shaped*, *to 18 mm long*, *to 8 mm diameter*, *broadly tapering from rim into the pseudostalk c. 1 mm diameter at base*; *calyx lobes 4*, *free*, *c*. *4 × 4 mm*, *obtuse triangular*, erect, spaced, early caducous; *stamens many*, exserting to *c*. 10 mm at anthesis, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c*. 20 mm long, slender. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known only in Sarawak from the type and *S 21273* from Bt. Lumut, Hose Mountains, Mujong, Balleh.

**Ecology.** One of Bornean rarest species, from lower montane mossy *kerangas* on the Kakus sandstone at *c.* 900 m altitude in the Hose Mountains, and an unknown habitat in W Sarawak.

## 6. **Syzygium antisepticum** (Blume) Merr. & L.M.Perry

(Greek, *anti-* = against, *sepein* = putrefying; referring to its reputed biochemical property in Java)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 159; Masamune *op. cit.* 523; Backer & Bakhuizen *f. op. cit.* 339; Argent *et al*. (eds.) *op. cit.* 468. **Basionym:** *Caryophyllus antisepticus* Blume *in* A. de Candolle, Prodr. 3 (1828) 262. **Type:** *Blume s.n.*, Java, *loc. incert.* (holotype L, *n.v.*; isotype (fragment) A). **Homotypic synonym:** *Calyptranthes aromaticus auct. non* A. St.-Hilaire (1824): Blume *op. cit.* (1827) 1092. **Heterotypic synonyms:** *Eugenia grata* Wight, Ill. Ind. Bot. 2 (1841) 15, Duthie *in* Hooker *f. op. cit.* 486, King *op. cit.* (1901) 100, Ridley *op. cit.* (1922) 739, M.R. Henderson *op. cit.* (1949) 233, Corner *op. cit.* (1997) 587, *Acmena grata* (Wight) Walp., Repert. 2 (1843) 181, *Syzygium gratum* (Wight) S.N.Mitra, Ind. For. 99 (1973) 100, Chantaranothai & Parnell *op. cit.* (1994) 70, Turner, Gard. Bull. Sing. 47, 2 (1996) 376, Parnell & Chantaranothai *op. cit.* 861; *E. macrorhyncha* Miq., Anal. Bot. Ind. 1 (1850) 21; *E. scolopophylla* Ridl., J. Bot. 68 (1930) 17, *S. scolopophyllum* (Ridl.) Masam. *op. cit.* 539; *S. ovatifolium* Merr. & L.M.Perry *op. cit.* (1939) 161, Coode *et al.* (eds.) *op. cit.* 238, *E. ovatifolia* (Merr. & L.M.Perry) J.A.R.Anderson *op. cit.* (1980) 278, ***syn. nov.***, **type:** *Clemens 28478*, Borneo, Sabah, Mt. Kinabalu, Tenompok (holotype A; isotypes BM, BO, K, L, NY).

Tree (5–)10–30(–40) m tall, (5–)10–30(–100) cm diameter; buttresses to 2 m tall or absent. **Bark** dark brown, flaky; inner bark red-brown. *Young parts glabrous*. **Twigs** *slender*, *c. 1 mm diameter apically*, *round* or *weakly 4-angular in cross-section*, *pale brown*. **Leaves** thinly leathery to leathery, *drying dark brown and sparsely pitted above*, *pale brown* and *obscurely gland-dotted beneath*; *blades ovate-elliptic*, *elliptic-lanceolate*, *3–11.5 × 1.5–4 cm*, broadest at or below the middle, *base rounded* or *acute*, *margin entire*, *apex acute*, acuminate or caudate, acumen to 2 cm long, blunt; midrib flat to furrowed above, raised beneath; *lateral veins unequal* or *subequal*, main ones *c.* 15 pairs, spaced 3–5 mm apart, *narrowly furrowed* or *slightly raised above*, *faint below*, intermediate veins less prominent and shorter than the main lateral veins; intramarginal veins 2, the inner ones 1–2 mm from the margin, the outer ones faint and close to margin, both looped or hardly looped; intercostal venation reticulate; *petioles slender*, *3–9 mm long*, 0.5–1 mm thick, grooved above, drying dark brown to black. **Inflorescences** axillary and terminal, *to 3 cm long*. **Flowers:** *bracteoles early caducous*; *buds*, *obovoid-cylindrical*; *hypanthium smooth*, *without milky bloom*, long-obconical, tapering toward the base, prolonged beyond the ovary, *c.* 6 mm long; *calyx lobes* 5(–6), *smooth*, subequal, *erect*, *triangular*; petals 5(–6), orbicular, pseudo-calyptrate, gland-dotted, *not prominently reflexed at anthesis*; stamens many, exserted to 5–10 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, 2-locular, ovules 7–16 per locule, style 6–12 mm long. **Fruits** globose, *c.* 1 cm diameter, whitish.

**Distribution.** SE India, Myanmar, Thailand, Sumatra, Peninsular Malaysia, Java and Borneo. In Borneo widespread and recorded in Sabah from Keningau, Kinabatangan, Lahad Datu, Ranau, Sandakan, Sipitang and Tawau districts (e.g., *Comber 4002*, *Clemens 28748*, *SAN 32906*, *SAN 40862*, *SAN 64751*, *SAN 79357*, *SAN 80386*, *SAN 129704* and *SAN 144438*) and in Sarawak from Bintulu, Kapit, Kuching, Lundu, Marudi, Miri and Simunjan districts (e.g., *Clemens 20957*, *S 25268*, *S 33616*, *S 44189*, *S 63367* and *S 76955*). Also reported from Brunei (e.g., *Wong WKM 1133*) and W, S and E Kalimantan (e.g., *Ambriansyah AA 2082*, *Meijer 2179*, *Endert 4828* and *Kostermans 8654*).

**Ecology.** Trees with the characters of *Syzygium antisepticum* seem to occupy a distinct habitat in Borneo (though typical *S. zeylanicum* also occurs with it), in hill and upper dipterocarp forest on the shale ridges at altitudes between 500–1500 m, occasionally also on

low rocky ridges; locally frequent. They are also found in mixed and *alan* peatswamp forest (e.g. *S 2727*, Loba Kabang FR, Sibu, Sarawak).

## 7. **Syzygium apiarii** P.S.Ashton

(Latin, *apiarius* = a beekeeper; commemorating J.H. Beaman, 1929–, American botanist and student of the Mt. Kinabalu flora)

Kew Bull. 61, 1 (2006) 108. **Type:** *J.H. Beaman 11470*, Borneo, Sarawak, G. Murud summit ridge (holotype K).

Shrub or much-branched small tree. Parts glabrous. **Twigs** rigid, many arising at zones of short internodes along the branches, *c.* 3 mm diameter apically, *sharply 4-winged in cross-section*, smooth, pale buff-brown. **Leaves** leathery, drying dull, pale yellow- to pinkish brown beneath, darker greenish- to purplish-brown above, dots and pits obscure; *blades broadly ovate to orbicular*, 1.5–6 × 1.2–4.5 cm, *base heart-shaped*, margin recurved, apex subacute to retuse; *lateral veins unequal*, *main ones c. 4 pairs*, with equally raised shorter intermediate veins, *distinctly elevated beneath*, more or less obscure or furrowed above as also the intercostal veins; intramarginal vein 1(or 2), 2–4 mm within margin, indistinct but prominently looped; petioles very short, stout, *c.* 1 mm diameter. **Inflorescences** to 10 mm long, terminal, congested, hardly branched; rachis slender narrowly winged. **Flowers:** *buds cylindrical*, *c.* 9 mm long, *c.* 3 mm diameter, *covered with milky bloom*, *warty*, *wrinkled on drying*, not glaucous, tapering to base; *bracteoles persisting to anthesis*, to 4 mm long, lorate, keeled; *hypanthium covered with milky bloom*; *calyx lobes 4*, *narrowly triangular*, *erect*, *thin*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known in Sabah from Mt. Kinabalu (e.g., *Poore H 240*) and in Sarawak from G. Murud (e.g., *S 26458*, *S 44469* and the type).

**Ecology.** In upper montane forest, at 2300–2400 m altitude.

## 8. **Syzygium aqueum** (Burm. *f.*) Alston

(Latin, *aqueus* = watery; presumably referring to the taste of the fruit)

Ann. Roy. Bot. Gard. Peradeniya 11 (1929) 204; Merrill & Perry *op. cit.* 170; Masamune *op. cit.* 523; Coode *et al.* (eds.) *op. cit.* 234; Argent *et al.* (eds.) *op. cit.* 468. **Basionym:** *Eugenia aquea* Burm. *f.*, Fl. Ind. (1768) 114, Merrill *op. cit.* (1921) 425, Ridley *op. cit.* (1922) 724, Burkill *op. cit.* 960, M.R. Henderson *op. cit.* 53, Kochummen *op. cit.* 244. **Type:** *Burmann herb.* (G?, *n.v.*). **Homotypic synonyms:** *Jambosa aquea* (Burm. *f.*) DC. *op. cit.* 288, *Malidra aquea* (Burm. *f.*) Rafin., Sylv. Tellur. (1838) 107, *Cerocarpus aqueus* (Burm. *f.*) Hassk., Flora 25, Beibl. 2 (1842) 36. **Heterotypic synonyms:** *Eugenia nodiflora* Aublet, Hist. Pl. Guiana 2 (1775) 140; *E. malaccensis auct. non* L.: Lour., Fl. Cochinch. (1790) 306; *Myrtus javanica* Blume *op. cit.* (1827) 1084; *Myrtus obtusissima* Blume *op. cit.* (1827) 1086, *Jambosa obtusissima* (Blume) DC. *op. cit.* 287; *E. alba* Roxb., Fl. Ind. edition Carey 2 (1832) 493; *Malidra timorensis* Zipp. *ex* Span., Linnaea 15 (1841) 204; *J. javanica* (Blume) Korth., Ned. Kruidk. Arch. 1 (1847) 200; *Gelpkia stipularis* Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 88; *J. ambigua* Blume *op. cit.* (1850) 96; *J. timorensis* (Zipp. *ex* Span.) Blume *op. cit.* (1850) 97; *E. obversa* Miq., An. Bot. Ind. 1 (1850) 18, Merrill *op. cit.* (1921) 431; *J. calophylla* Miq., Fl. Ned. Ind. 1 (1855) 423; *E. stipularis* (Blume) Miq. *op. cit.* (1855) 441; *E. mindanaensis* C.B. Rob., Philip. J. Sci. Bot. 4 (1909) 363; *Syzygium obversum* (Miq.) Masam. *op. cit.* 535.

Small tree. **Bark** smooth, grey-brown; inner bark yellow- to pink-brown. Branches diffuse, pendent, with hanging leaves. *Young parts glabrous or distinctly hairy*. **Twigs** *c. 3 mm diameter apically*, *round or somewhat angular in cross-section*, more or less powdery, *pale brown*. **Leaves** *thinly leathery to leathery*, *drying dull dark tawny above*, chestnut-brown beneath, minutely densely pitted above, *less densely dotted beneath*; *blades ovate-lanceolate to broadly elliptic-obovate*, *c. 12 × 4.5*(*9–19 × 4–7*) *cm*, *base heart-shaped*, *margin wavy*, apex bluntly acuminate; *lateral veins unequal*, *main ones 8–12 pairs*, *prominent throughout though more so beneath*, ascending, arched, *furrowed or not furrowed above*; intercostal venation evident on both surfaces; *intramarginal veins 3*, *main one well within margin*, *looped*. **Inflorescences** *paniculate*, *to 2 cm long*, *terminal or axillary*; rachis 1x-branched. **Flowers:** *buds narrowly jambu-shaped*, *to 11 mm long*, *to 9 mm diameter*, including the stout *c*. 5 mm pseudostalk, *with ring of 4 prominent*, *spreading*, *rounded subacute calyx lobes*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style long, prominent. **Fruits** top-shaped, *c.* 4 mm long, *c*. 3 cm diameter, white or pink, shiny, translucent.

**Vernacular name.** Sabah and Sarawak—*jambu air* (Malay).

**Distribution.** Native to S Asia but widely cultivated. In Borneo widespread though seldom collected. In Sabah recorded from Kota Belud, Ranau and Sandakan districts (e.g., *SAN 62114* and *SAN 116325*), in Sarawak from Kuching district (e.g., *Clemens 21970* and *S 14061*). Also recorded from W Kalimantan (e.g., *Hallier 1160*).

**Ecology.** A popular orchard tree.

**Uses.** The fruit has a watery, somewhat uninteresting taste.

## 9. **Syzygium arcanum** P.S.Ashton

(Latin, *arcanus* = hidden, closed; referring to the closed calyx)

Kew Bull. 61, 1 (2006) 108. **Type:** *P.S. Ashton S 18202*, Borneo, Sarawak, Ulu Sebako, Belaga district (holotype K; isotypes KEP, L, SAR, SING).

Tree 15 m tall, 30 cm diameter; buttresses thin, low. **Bark** red-brown, flaky. Parts glabrous. **Twigs** *at first sharply 4-ribbed*, *c. 2 mm diameter apically*, slender, *smooth to minutely wrinkled*, grey-brown. **Leaves** *papery to thinly leathery*, *drying dull grey-green above*, *paler beneath*, *minutely or not black dotted beneath*, pits above obscure; *blades elliptic-lanceolate*, *5–9 × 2–3.5 cm*, *base narrowly wedge-shaped*, *apex to 1.5 cm slender subcaudate*; *lateral veins equally raised* but *intermediate ones shorter*, *slender*, *equally elevated beneath*, hardly so above, *main lateral veins c. 10 pairs*, *subequal*, ascending; intercostal venation evident, lax; intramarginal veins 1(or 2), 1–2 mm within margin, shallowly looped; *petioles 3–7 mm long*, *slender*. **Inflorescence** axillary, to 2 cm long; rachis very slender, hardly branched, quadrangular. **Flowers:** *buds goblet-shaped*, *calyptrate*, *c. 12 mm long*, *c. 5 mm diameter*, *with snuffered apex*; hypanthium somewhat waisted beneath the slightly longer pseudostalk; *stamens many*, *anther locules parallel*; *ovary at the distal end of the flower bud*. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known with certainty only from the type.

**Ecology.** In mixed dipterocarp forest on clay soil at *c.* 300 m altitude.

## 10. **Syzygium aromaticum** (L.) Merr. & L.M.Perry

(Latinised Greek, *aromatikos* = aromatic; referring to the fragrant young shoots and flower buds)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 196; Backer & Bakhuizen *f. op. cit.* 342; Ashton *in* Dassanayake & Fosberg (eds.), Rev. Handb. Fl. Ceylon 2 (1981) 434; Chantaranothai & Parnell *op. cit.* 38; Verheij & Snijders, PROSEA 13 (1999) 211; Parnell & Chantaranothai *op. cit.* (2001) 832. **Basionym:** *Caryophyllus aromaticus* L., Sp. Pl. (1753) 735. **Lectotype** (Mc Vaugh & Howard, Fl. Lesser Antilles 5 (1989) 528)**:** *Herb. Clifford 207*, 'Caryophullus 1 in moluccas soloaridissimo' (LINN). **Synonyms:** *Eugenia caryophyllata* Thunb., Diss. (1788) 1; *Myrtus caryophyllus* Spreng., Syst. 2 (1825) 485; *Eugenia aromatica* (L.) Baill., Hist. Pl. 6 (1877) 311, Burkill, EPMP 1 (1935) 961, Kochummen *op. cit.* 246.

Tree to 20 m tall, with rounded crown. *Parts glabrous*; *young shoots strongly aromatic*. **Twigs** *c*. 4 mm diameter apically, *elliptic in cross-section*, *smooth*, *pale grey-brown*. **Leaves** leathery, drying dull grey-green above, paler yellowish green beneath, faintly pitted above, *pimpled beneath*; *blades obovate-oblong to elliptic*, *6–17 × 2.5–8 cm*, *base wedge-shaped*, apex acute to shortly bluntly acuminate, *broadest above the middle*; *lateral veins subequal or unequal*, *main ones c. 11 pairs*, *very slender*, *distinct but hardly and equally raised on both surfaces*, *furrowed above*, ascending; intercostal venation visible, *distinct above*; *intramarginal vein 1*, *1–3 mm within margin*, *hardly looped*; *petioles* slender, *c. 10 mm long*. **Inflorescences** panicles of 3-flowered cymes, *terminal or subterminal-axillary*, to 7 cm long; rachis slender, round in cross-section, 2x-branched. **Flowers:** *buds clove-shaped*, *to 15 mm long*, *to 6 mm diameter*; hypanthium cup-shaped, *tapering at base to long pseudostalk*; *calyx lobes* 4, *triangular*, *claw-like*; *stamens many*, white, *anther locules parallel*; *ovary at the distal end of flower bud*, 2-locular, style 3–4 mm long, stigma 2-lobed. **Fruits** *ellipsoid-obovoid*, *c.* 3 cm long, *c.* 1.5 cm diameter, with apical ring of recurved fleshy calyx lobes, ripening dark red. **Seeds** solitary, suboblong, to 1.5 cm long.

**Vernacular name.** Sabah and Sarawak—*cengkeh* (Malay).

**Distribution.** Native of the Moluccas (Maluku) and cultivated in a number of tropical and subtropical countries of S and SE Asia, Africa (Madagascar, Tanzania and Zanzibar) and Brazil (Bahia) having a more seasonal climates. In Borneo rarely collected; known by a few collections from Kuching and Mukah districts in Sarawak (e.g., *S 8311* and *S 58103*) and in Kalimantan (e.g., *Korthals s.n.* and *Ambriansyah AA 579*).

**Ecology.** In Maluku where the species occurs in the wild, it is a common understorey tree of hill forest at altitudes to 900 m.

**Uses.** Since ancient time, the clove (young flower bud and its extract) has been highly valued as a spice. By the early Middle Ages the spice become increasingly important in India, Middle East and Europe. In SE Asia, however, its main use was predominantly as herbal medicine for suppressing toothache, and as stimulant and carminative agents. More recently and because of its flavour and antiseptic properties, the essential oil (mainly eugenol) extracted from the cloves is used in soap, detergent, toothpaste and pharmaceutical as well as anti-bacterial products. In Indonesia, more than 90% of clove production is used to spice "*kretek*" cigarettes. (For details *cf.* Purseglove, J.W. *et al.* (1981). Spices. Vol. 2: 229–285 and Verheij & Snijders *op. cit.* PROSEA 13: 211–214).

## 11. **Syzygium attenuatum** (Miq.) Merr. & L.M.Perry

(Latin, *attenuatus* = slender; referring to the leaf tip)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 185; Masamune *op. cit.* 523; Coode *et al*. (eds.) *op. cit.* 234. **Basionym:** *Jambosa attenuata* Miq., Fl. Ind. Bat. 1, 1 (1855) 437. **Type:** *Junghun s.n.*, W Java, Ungaran (U Barcode U0005205, *n.v.*). **Homotypic synonym:** *Eugenia attenuata* (Miq.) Koord. & Valeton, Meded. Landspl. 40 (1900) 121, M.R. Henderson *op. cit.* (1949) 238, Burgess *op. cit.* 412, Kochummen *op. cit.* 183, J.A.R. Anderson *op. cit.* (1980) 273. **Heterotypic synonyms:** *Eugenia penangiana* Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 486; *E. purpuricarpa* Elm., Leafl. Philip. Bot. 4 (1912) 1435.

Small understorey tree. **Bark** *orange- or red-brown*, *becoming coarsely papery scaly*; inner bark red-brown. *Young parts glabrous*. **Twigs** slender, *round in cross-section*, *pale brown*, *smooth*. **Leaves** *densely somewhat obscurely pitted above*, *distinctly densely dotted beneath*, *drying dull greenish- to red-brown*; *blades elliptic to ovate-lanceolate*, *5–11 × 1.5–6 cm*, base wedge-shaped, *margin entire*, *apex c. 1.5 cm caudate*; *venation more or less obscure*, *hardly raised on either surface*; *lateral veins subequal*, *main ones c. 25 pairs*, *dense*, spreading; *intercostal venation obscure*; *intramarginal vein close to margin*, *hardly looped*; *petioles* slender, *c. 1 cm long*. **Inflorescences** *paniculate*, terminal, to 5 cm long; rachis slender, 2x-branched. **Flowers:** *buds clove-shaped*, *to 8 mm long*, *to 2 mm diameter*, slender, *tapering from apex to base with indistinct pseudostalk*, *with almost even obscurely 4-toothed calyx rim*, drying wrinkled, pale yellow-grey; petals flat, more or less hidden within calyx; *stamens many*, *anther locules parallel*; *ovary at the distal end of the flower bud*. **Fruits** *ellipsoid*, to 10 mm long, to 5 mm diameter, dull, smooth, with shallow calyx rim, drying pale buff, *ripening dark red*, often with milky bloom at first.

**Distribution.** Sumatra (inclusive Bangka), Peninsular Malaysia, Java, Borneo, the Philippines and ?Sulawesi. In Borneo common and widespread; recorded in Sabah from Beaufort, Keningau, Kinabatangan, Kota Belud, Kudat, Lahad Datu, Papar, Pensiangan, Ranau, Sandakan and Sipitang districts (e.g., *SAN 27231*, *SAN 32292*, *SAN 60563*, *SAN 78035*, *SAN 82270* and *SAN 136782*) and in Sarawak from Belaga, Bintulu, Kapit, Kuching, Lawas, Lundu, Marudi, Simunjan and Sri Aman districts (e.g., *Richards' Native Collector 2561*, *S 26554*, *S 35406*, *S 49017* and *S 63146*). Also known in Brunei (e.g., *Wong WKM 317*, *BRUN 1752*, *BRUN 2285*, *BRUN 15839* and *Prance 30617*) and Kalimantan (e.g., *Ambriansyah W21*, *Hallier 2161*, *Wiriadinata 1208*, *Kostermans 7983* and *bb 19790*).

**Ecology.** On clay and sandy soils in mixed and upper dipterocarp forest; at altitudes to 1900 m on Mt. Kinabalu, elsewhere to 1200 m.

**Notes.** One of the natural group which includes *Syzygium adenophyllum* and *S. napiforme* which are difficult to distinguish without flower or fruit, but whose salient characters are given in the keys. A distinct form is found on Mt. Kinabalu (e.g., *SAN 57802*, around power station) in which the leaves are more leathery, drying red-brown.

The Bornean form differs from that of Peninsular Malaysia and Sumatra in its shorter, few-flowered panicles, larger fruit and obscure leaf venation; but in the following collections the panicles are much branched and floriferous, the fruit to 7 × 5 mm, and the venation (*JBS 70* and *S 67512* excepted) distinctly raised beneath with the intercostal venation forming a fine net, in these respects resembling the type form: Sabah (*JBS 70*, *SAN 32362*, *SAN 35054* and *SAN 62202*); Sarawak (*S 22190*, *S 25673* and *S 67512*); Brunei (*Schatz et al. 3303*); W Kalimantan (*Laman et al. s.n.*). With the exception of the last, these were collected from upper dipterocarp forest at altitudes between 800–1400 m.

## 12. **Syzygium badescens** P.S.Ashton

(Latin, *badescens* = resembling the colour of leather; referring to the dry leaf and other parts)

Kew Bull. 61, 1 (2006) 111. **Type:** *Orolfo SAN 1818*, Borneo, Sabah, Lokapas-Bongawan forest, Kudat district (holotype K).

Tree to 13 m tall, 10 cm diameter. **Bark** brown. *Young parts glabrous*. **Twigs** 1–2 mm diameter apically, *round in cross-section*, smooth, *orange-brown*. **Leaves** thinly leathery, pale rust-brown and distinctly pitted above, *dull orange-brown* and obscurely dotted beneath; *blades elliptic-lanceolate*, 5–12 × 1.5–3.5 cm, base wedge-shaped, *margin entire*, *distinctly undulate*, *apex c. 12 mm subcaudate*; *lateral veins subequal* with the intermediate ones shorter, *main lateral veins c. 15 pairs*, *more or less obscure above*, *hardly raised beneath*, ascending; intercostal venation more or less obscure; *intramarginal veins* 1 pair, *1–2 mm within margin*, *hardly looped*; petioles slender, *c.* 6 mm long. **Inflorescences** and **flowers** unknown. **Infructescences** to 5 cm long, terminal or axillary, erect, hardly branched; rachises round in cross-section. **Fruits** ellipsoid, to 12 mm long, to 6 mm diameter, smooth, green, tapering abruptly to prominent *c*. 4 mm stout pseudostalk.

**Distribution.** Known only from the type.

**Ecology.** From a hillside at *c.* 100 m altitude.

## 13. **Syzygium bakoense** P.S.Ashton

(from Bako NP, near Kuching, Sarawak)

Kew Bull. 61, 1 (2006) 111. **Type:** *Yii S 42002*, Borneo, Sarawak, Bako NP, Kuching district (holotype K; isotypes KEP, L, SAR).

Subcanopy tree, *c.* 8 m tall. *Young parts glabrous*. **Twig** *c.* 3 mm diameter apically, gold-brown to cream, *smooth*, *indistinctly 4-ribbed*. **Leaves** *thinly leathery*, *drying dull*, *mauve-brown above*, *pink-grey beneath*, sparsely minutely dotted beneath, densely minutely pitted above; *blades narrowly elliptic*, *9–14 ×3–5.5 cm*, *broadest at or above the middle*, *base markedly wedge-shaped*, *apex to 8 mm broadly bluntly acuminate*; *lateral veins prominently unequal*, *main ones c. 8 pairs*, *each pair with one shorter but equally raised intermediate vein*, ascending, prominent beneath, *slightly elevated above*; *intercostal venation* lax, *elevated beneath*, *visible but hardly raised above*; intramarginal vein 1(or 2), 3–5 mm within margin, looped; *petioles* stout, *c. 10 mm long*, *c.* 3 mm thick, drying black. **Inflorescences** *paniculate*, *terminal*, to 4 cm long; rachis 2x-branched, round in cross-section; *bracts and bracteoles in single pair*, ovate, acute, to 2 × 2 mm, *caducous*. **Flowers:** *buds torch-shaped*, *to 6 mm long*, *to 4 mm diameter*; *hypanthium slightly waisted above the 3 mm tapering pseudostalk*; *calyx lobes* 4, ovate, acute, to 2 × 2 mm, unequal, *loosely clasping corolla*, *spreading but not becoming reflexed at anthesis*, *hyaline towards margins*; stamens many, *anther locules parallel*, *ovary at the distal end of flower bud*. **Fruits** (young) ellipsoid, *c.* 12 mm long, *c.* 8 mm diameter, smooth, with a 6 mm tall and 8 mm diameter crown of *c.* 3 × 4 mm hemispherical obtuse thick calyx lobes surmounting a collar.

**Distribution.** Endemic to Borneo; rare, so far known only in Sarawak from the Bako NP (e.g., the type).

**Ecology.** In *kerangas*-dipterocarp forest ecotone on a sandstone scarp and *kerangas* on a hillside.

## 14. **Syzygium bankense** (Hassk.) Merr. & L.M.Perry
(of Bangka Island, Sumatra)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 160; Merrill, Philip. J. Sci. 79, 4 (1950) 377; Backer & Bakhuizen *f. op. cit.* 339; Coode *et al.* (eds.) *op. cit.* 235; Argent *et al.* (eds.) *op. cit.* 468; Beaman & C. Anderson *op. cit.* 212. **Basionym:** *Microjambosa* (?) *bankensis* Hassk., Hort. Bogor. Descr. (1858) 276. **Type:** *sin. coll.*, *sin. num*., Cult. Hort. Bog., Java (holotype BO, *n.v.*). **Homotypic synonym:** *Eugenia bankensis* (Hassk.) Backer, Schoolfl. Java (1911) 508, J.A.R. Anderson *op. cit.* (1980) 278. **Heterotypic synonyms:** *Jambosa buxifolia* Miq., Fl. Ind. Bat. 2, 7 (1858) 1086, Suppl. 1 (1861) 311; *Eugenia besukiensis* (Hassk. *ex* Miq.) Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 226, *ibid.* 99 (1918) 21, *op. cit.* (1921) 426, *Syzygium besukiense* (Hassk. *ex* Miq.) Masam. *op. cit.* 524; *E. perparvifolia* Merr. *op. cit.* (1917) 220, *op. cit.* (1921) 432, *S. perparvifolium* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 162, Masamune *op. cit.* 536, ***syn. nov.***, **type:** *Foxworthy 454*, Borneo, Sarawak, Mt. Santubong, Kuching district (holotype PNH (destroyed); isotype K); *E. gaultherioides* Ridl., J. Bot. 68 (1930) 16, J.A.R. Anderson *op. cit.* (1980) 275, *S. gaultherioides* (Ridl.) Merr. & L.M.Perry *op. cit.* (1939) 161, Masamune *op. cit.* 529, Coode *et al.* (eds.) *op. cit.* 236, ***syn. nov.***, **type:** *Haviland 2057*, Borneo (holotype K).

Understorey to canopy tree; crown distinctively diffuse with minute leaves. **Bark** smooth to minutely flaky, dark grey-brown; inner bark light brown. Parts glabrous. **Twigs** *rigid*, *prominently narrowly 4-winged*, dark red-brown, *not fibrous flaky*; internodes *c.* 1 cm long. **Leaves** *dense but hardly or not overlapping*, leathery, drying grey-brown, dull, sparsely pitted above, *not* dotted but somewhat shagreened beneath; *blades broadly ovate*, *ovate-lanceolate* or *obovate*, *c. 1.5 × 0.8* (*0.5–4 × 0.4–1.8*) *cm*, *base broadly wedge-shaped or rounded not tapering to the petiole*, apex acute, acumen broad, blunt or absent; venation obscure, unraised or evident; *lateral veins unequal*, *main ones c. 11 pairs*, somewhat ascending, slightly furrowed above, *hardly raised beneath*, *intermediate veins obscure or few*; intercostal and intramarginal veins obscure; petioles slender, *c.* 1 mm thick. **Inflorescences** short and congested, axillary or terminal; rachis 2x-branched; to 2.5 cm long but flowers generally in dense clusters, *often with linear bracteoles*. **Flowers:** *buds oblong* though slightly swollen at apex, *c.* 3 mm long, *c.* 1.5 mm diameter, *bluish milky*, *warty more or less wrinkled*; pseudostalk obscure, *with 4 broadly ovate pointed cupped calyx lobes*; stamens many, exserted to 3 mm long, white, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 3 mm long. **Fruits** round, to 6 mm diameter, ripening whitish, with *c.* 2 mm diameter crown of erect clustered calyx lobes, more or less milky.

**Vernacular name.** Sarawak—*ubah ribu* (Malay, Iban).

**Distribution.** Sumatra (including Bangka), Borneo and the Philippines.

**Ecology.** Abundant in *kerangas*, and up through lower montane pole forest on peaty soils to the lower facies of upper montane forest; at altitudes to 1700 m on Mt. Kinabalu, to 1400 m elsewhere.

**Notes.** Though the publication of Hasskarl's *Macrojambosa bankensis* was predated by one month by that of Miquel's *Jambosa buxifolia*, the name *Syzygium buxifolium* can not be applied for this species because it is pre-occupied by *Syzygium buxifolium* Hook. & Arn.

(Bot. Beechy Voy. (1833) 187), a species from China (*cf*. Merrill & Perry, J. Arn. Arb. 39 (1938) 234 and Chen & Craven, Fl. China 13 (2007) 351).

This is the core lowland species of a group characterised by their tiny leaves and quadrangular distinctly albeit narrowly winged twigs. All are recognised as *ubah ribu*. Those that have been decribed from Borneo mountains are: *Syzygium gaultherioides* (Ridl.) Merr. & L.M.Perry from W to NE Sarawak and Brunei; *S. perparvifolium* (Merr.) Merr. & L.M.Perry from W Kalimantan and W Sarawak; *S. nummularium* from NE Sarawak and Brunei (see there); and *S. kinabaluense*, *S. exiguifolium* Merr. & L.M.Perry and *S. polycladum* Merr. & L.M.Perry from Mt. Kinabalu and sometimes on the NE Sarawak summits. In the present account, three species (*S. bankense*, *S. kinabaluense* and *S. nummularium*) are recognised, two of which (*S. bankense* and *S. kinabaluense*) have two distinct subspecies (see key below).

**Key to subspecies**

Leaves broadly ovate, 0.8–4 × 0.4–0.8 cm; venation obscure. Inflorescences axillary or terminal, 2x-branched, to 2.5 cm long……..

subsp. **bankense**

Synonyms: *Jambosa buxifolia* Miq. *op. cit.* (1858) 1086, *op. cit.* (1861) 311; *Eugenia bankensis* (Hassk.) Backer *op. cit.* (1911) 508, J.A.R. Anderson *op. cit.* (1980) 278; *Microjambosa besukiensis* Hassk. *ex* Miq. *op. cit.* (1861) 311; *E. besukiensis* (Hassk. *ex* Miq.) Merr. *op. cit.* (1917) 226, *op. cit.* (1918) 21, *op. cit.* (1921) 426; *Syzygium besukiense* (Hassk. *ex* Miq.) Masam. *op. cit.* 524.

Distribution as the species. In Borneo, recorded in Sabah from Kinabatangan, Kota Belud, Labuk Sugut, Lahad Datu, Papar, Pensiangan, Ranau, Sandakan and Tawau districts (e.g., *Kokawa & Hotta 5327*, *Beaman 10708*, *SAN 25533*, *SAN 89066*, *SAN 108803* and *SAN 120860*) and in Sarawak from Kapit, Kuching, Lawas, Lubok Antu, Marudi, Sri Aman and Tatau districts (e.g., *S 21534*, *S 35963*, *S 37243*, *S 47304* and *S 58250*). Also known in Brunei (e.g., *S 1091*) and W and E Kalimantan (e.g., *Endert 1584*, *Meijer 1982*, *Kessler PK 2671* and *Kostermans 9258*). Abundant in lowland, and less so in lower montane *kerangas*.

Leaves ovate-lanceolate or obovate, 0.5–0.7 × 0.4–0.6 cm; venation evident. Inflorescences densely congested, to 1.5 cm long, clustered at the first 2 or 3 twig nodes……..

subsp. **perparvifolium** (Merr.) P.S.Ashton, ***stat. nov.***

(Latin, *per-* = throughout, *parvi* = small, *folium* = leaf; consistently with tiny leaves)

Basionym: *Eugenia perparvifolia* Merr. *op. cit.* (1917) 220, *op. cit.* (1921) 432. Type: *Foxworthy 454*, Borneo, Sarawak, Mt. Santubong, Kuching district (holotype PNH, destroyed; isotype K). Homotypic synonym: *Syzygium perparvifolium* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 162, Masamune *op. cit.* 536. Heterotypic synonyms: *Eugenia gaultherioides* Ridl. *op. cit.* (1930) 16, J.A.R. Anderson *op. cit.* (1980) 275, ***syn. nov.***, **type:** *Haviland 2057*, Borneo, Sarawak, Bungoh Range, Kuching district (holotype K); *S. gaultherioides* (Ridl.) Merr. & L.M.Perry *op. cit.* (1939) 161, Masamune *op. cit.* 529, Coode *et al.* (eds.) *op. cit.* 236.

Endemic to Borneo; known in Sabah from Ulu Meligan, Sipitang district (e.g., *SAN 144177*) and in Sarawak from G. Santubong and Bungoh Range, Kuching district (e.g., *S 2920* and *S 8371*). Also recorded from Brunei (e.g., *Wong WKM 392* & *430*, *BRUN 1063* and *R.J. Johns 6517*) and Kalimantan (e.g., *Hallier 2037*).

Locally abundant in the lower facies of upper montane and lower montane *kerangas* forests, at 800–1600 m altitude.

## 15. **Syzygium baramense** (Merr.) Merr. & L.M.Perry
(from Baram district, Sarawak)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 189; Masamune *op. cit.* 524. **Basionym:** *Eugenia baramensis* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 218, *op. cit.* (1921) 426, J.A.R. Anderson *op. cit.* (1980) 274. **Type:** *Hose 399*, Borneo, Sarawak, Sg. Entuyut, Baram district (holotype PNH, destroyed; isotypes K, L Barcode L 0009406).

Tree to 40 m tall, to 80 cm diameter. Parts glabrous. **Twigs** in initial flush *narrowly but distinctly 4-winged*, *drying dark brown*, *peeling to mature cream-white* and *becoming round in cross-section*. **Leaves** thin-leathery, *drying dark red-brown*, paler beneath *with the veins distinctly darker*, not pitted above, *indistinctly gland-dotted beneath*; *blades narrowly elliptic*, *c. 4 × 1.5* (*2.5–14 × 1–5*) *cm*, *base wedge-shaped*, apex caudate, acumen to 1 cm long; *lateral veins unequal*, *distinct but hardly raised beneath*, furrowed above, spreading, *main ones c. 12 pairs*; intercostal venation obscure; intramarginal vein close to margin, hardly looped; petioles slender, *c.* 6 mm long. **Flowers** *in dense terminal or axillary clusters*; bracteoles minute; *buds top-shaped*, *to 3 mm long*, *to 2 mm diameter*, tapering to base, *without distinct pseudostalk*; *calyx lobes 4*, to *0.5 × 3 mm*, short, broad, subacute, *with narrowly hyaline margins*, *early caducous forming a thick-margined calyx rim*; stamens many, exserted to 3 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 8 mm long. **Fruits** *spherical*, to 1 cm diameter, *with small indistinct calyx rim*, *ripening greenish white*.

**Distribution.** Endemic to Borneo, but unknown in Sabah. In Sarawak, known from Belaga, Kuching, Limbang and Lundu districts (e.g., *Mjöberg 152*, *Haviland 1884*, *S 40979*, *S 43808*, *S 53877* and *S 55680*). Also recorded from Brunei (e.g., *Wong WKM 374*) as well as W, C and E Kalimantan (e.g., *Church et al. 403*, *Valkenburg JVV 1031*, *Kessler PK 2500* and *Mogea 4067*).

**Ecology.** Apparently uncommon, often found near streams on clay soils in mixed dipterocarp forest, at altitudes below 300 m.

## 16. **Syzygium barringtonioides** (Ridl.) Masam.
(Greek, *barringtonioides* = like genus *Barringtonia*, Lecythidaceae; referring to the leaf shape)

EPB (1942) 524 (*sphalm. barringtonioide*); Ashton *op. cit.* (2006) 111. **Basionym:** *Eugenia barringtonioides* Ridl., J. Bot. 66 (1930) 12, Burgess *op. cit.* 412. **Type:** *Moulton 6740*, Borneo, Sarawak, Sio Malit, Ulu Baram (holotype K; isotype SING). **Homotypic synonym:** *Cleistocalyx barringtonioides* (Ridl.) Merr. & L.M.Perry, J. Arn. Arb. 18 (1937) 332, Masamune *op. cit.* 520, Coode *et al*. (eds.) *op. cit.* 233.

Tree to 18 m tall, to 40 cm diameter. **Bark** smooth. *Parts glabrous*. **Twigs** *c. 3 mm diameter apically*, stout, *more or less sharply 4-ribbed in cross-section*, *yellowish- to chocolate-brown*. **Leaves** leathery, *drying purplish-brown*, shiny and obscurely pitted above, *dark rust-brown and densely pimpled beneath*; *blades elliptic-lanceolate*, *c. 22 × 6.5* (*15–28 × 4.5–7*) *cm*, *base wedge-shaped distinctly tapering into petiole*, apex acuminate, acumen to 2 cm long; *midrib rounded beneath*; *lateral veins unequal*, *main ones 14–18 pairs*, *prominent beneath*, *less so above and not furrowed*, somewhat ascending, *intermediate veins many*, *shorter than the main lateral veins*; intercostal venation visible on both surfaces, lax; intramarginal vein 3–6 mm within margin, looped; *petioles stout*, *c. 12 mm long*.

**Inflorescences** *paniculate*, terminal or axillary, *to 18 cm long*, *spreading*, *doubly branched*; rachis 4-ribbed, straight; bracts acicular, to 6 × 2 mm. **Flowers** white; *buds goblet-shaped*, *to 15 mm long*, *to 5 mm diameter*; hypanthium ellipsoid; *pseudostalk slender*, *to 5 mm long*; *calyx snuffer-like*, *lobes calyptrate*; *stamens many*, short, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 20 mm long. **Fruits** *spherical* or *top-shaped*, *to 18 mm diameter*, smooth, on 2 mm stout stalk, with *c. 5 mm diameter crown of reflexed calyx fragments*.

**Distribution.** Endemic to Borneo. Two varieties are recognised.

**Ecology.** In lowland forest along the banks of whitewater or muddy water rivers, at altitudes to 400 m.

**Key to varieties**

Flower buds goblet-shaped, *c.* 15 mm long, *c.* 5 mm diameter; calyx calyptrate, bursting open to exsert the *c.* 20 mm long style and many shorter stamens; pseudostalk slender, *c.* 5 mm long……

var. **barringtonioides**

Locally common along the banks of fast-flowing whitewater rivers, establishing below the flood line. The saplings are rheophytic, with narrower leaves and flood-swept branches.

In Sabah common and widespread, recorded in most districts (e.g., *SAN 24455*, *SAN 31181*, *SAN 49481*, *SAN 81434*, *SAN 108863*, *SAN 128346*, and many others); in Sarawak uncommon, so far known only from Kapit districts (e.g., *S 22916* and *S 50097*). Also known in Brunei (e.g., *Wong WKM 283*) and E Kalimantan (e.g., *Ambriansyah AA 1864* and *Kostermans 13669*).

Flower buds short goblet-shaped, *c.* 8 mm long, *c.* 4 mm diameter; calyx lobes 4, distinct, ovate-acute, *c.* 3 × 3 mm, papery and reflexed at anthesis; stamens many, *c.* 5 mm long; style as long as stamens; pseudostalk stout, *c.* 2 mm long…….

var. **quadrisepalum** P.S.Ashton

(Latin, *quadric-* = four-, *sepalum* = sepal; referring to the 4-lobed calyx)

Kew Bull. 61, 1 (2006) 113. Type: *P. Chai S 18946*, Borneo, Sarawak, Pelagus Rapids, Rejang, Kapit district (holotype K; isotypes KEP, L, SING).

Tree to 18 m, to 20 cm diameter. Bark smooth, brown, mottled; inner bark pink.

Apparently uncommon, occurring on the banks of muddy rivers in lowland forest.

Known in Sarawak from Pelagus Rapids, Kapit district (the type), Brunei (e.g., *BRUN 16799*) and W Kalimantan (e.g., *Burley et al. 2641*).

Notes. This variety amply demonstrate the unsustainability of *Cleistocalyx* as a genus.

## 17. **Syzygium beccarii** (Ridl.) Merr. & L.M.Perry

(Odoardo Beccari, 1843–1920, Italian doyen of Sarawak plant collectors and author of Wanderings in the Great Forests of Borneo)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 170; Masamune *op. cit.* 524. **Basionym:** *Eugenia beccarii* Ridl., J. Bot. 68 (1930) 12, J.A.R. Anderson *op. cit.* (1980) 274, Coode *et al.* (eds.) *op. cit.* 235. **Type:** *Beccari 2583*, Borneo, Sarawak, Matang (holotype K).

Small hardly buttressed tree, to 15 m tall. **Bark** warm purplish brown, smooth to patchily flaky; inner bark red-brown. *Parts glabrous*. **Twigs** *stout*, *round in cross-section*, *at least c. 3 mm diameter apically*, *red-brown*, somewhat powdery flaky. **Leaves** *thickly leathery*, drying dull purplish to tawny brown, minutely more or less obscurely pitted above, *obscurely or distinctly densely gland-dotted beneath*; *blades narrowly oblong-lanceolate* but very variable in size and shape, *c. 25 × 7.5* (*9–30 × 3–13*) *cm*, *base obtuse*, *heart-shaped to auriculate*, *margin prominently recurved*, apex acuminate, acumen *c.* 1 cm long; *lateral veins unequal*, *main ones c. 12 pairs*, visible but slender and hardly equally raised on both surfaces, *not furrowed above*, spreading; intercostal venation invisible; *intramarginal vein close to margin*, *hardly looped*; *petioles* stout, *short*, *2–3 mm long*. **Inflorescences** *terminal or axillary*, *to 5 cm long* but generally shorter; rachis 2x-branched, terete in cross-section. **Flowers:** *buds* narrowly goblet- to torch-shaped, *to 15 mm long*, *to 7 mm diameter*, tapering from apex to base, *without distinct pseudostalk*; calyx lobes 4, hemispherical, to 2 × 2 mm, obtuse, unequal, hugging and more or less enclosing the corolla; petals not falling at first; stamens many, exserted to 12 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style to 15 mm long. **Fruits** *cylindrical*, to 15 mm long, to 8 mm diameter, *with depressed apex and c. 2 mm diameter calyx rim and pore*.

**Distribution.** Endemic to Borneo. In Sabah, recorded from Kinabatangan and Lahad Datu districts (e.g., *Othman Bojo OB 29* and *SAN 49332*) and in Sarawak from Bintulu, Kapit, Kuching and Lubok Antu districts (e.g., *S 16241*, *S 22254*, *S 24607* and *S 52055*). Also known from Brunei (e.g., *Wong WKM 411*) and W, C and E Kalimantan (e.g., *Kessler PK 2434*, *Church 2730* and *bb 29043*).

**Ecology.** Frequent in lowland *kerangas* and lower facies of upper montane forests, at 1000–1700 m altitude.

## 18. **Syzygium bicostatum** P.S.Ashton

(Latin, *bis* = double, *costatus* = ribbed; referring to the 2-ribbed twig)

Kew Bull. 61, 1 (2006) 113. **Type:** *Banyeng & Ilias S 45062*, Borneo, Sarawak, base of Bt. Sadok, flowers (holotype K; isotypes KEP Barcode KEP 162051, L, SAR).

Canopy tree to 17 m tall, 50 cm diameter. **Bark** greyish white, smooth. *Young parts glabrous*. **Twigs** 3–5 mm diameter apically, *frequently with a pair of opposite ribs originating beneath the petioles*, smooth to powdery, pale brown. **Leaves** thickly leathery, *drying* glistening *dark chocolate-brown beneath*, *purplish black above*, *densely minutely pimpled throughout*; *blades* oblong-elliptic, 7–10 × 3.5–5.5 cm, base wedge-shaped, *margin entire*, apex sharply *c*. 5 mm acuminate; midrib prominent, sharp beneath; *lateral veins subequal*, main ones *c.* 20 pairs, *obscure* or *sometimes slender and finely raised equally*; intercostal venation obscure; *intramarginal vein close to margin*, *obscure*, *hardly looped*; petioles stout, *c.* 8 mm long, drying black. **Inflorescences** *paniculate*, *c.* 2 cm long, terminal or subterminal-axillary; rachis quadrangular in cross-section, stout; bracts triangular, *c.* 3 × 2 mm, somewhat recurved. **Flowers:** *buds pear-shaped*, *c*. *9 mm long*, *c. 8 mm diameter*, *slightly constricted above the stout tapering pseudostalk*; *calyx lobes 4*, ovate-triangular, subacute, *c.* 3 × 4 mm, *free*, *thick-margined*, cupped and appressed to corolla; stamens many, exserted to *c*. 5 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c*. 12 mm long. **Fruits** *ellipsoid*, *c.* 12 mm long, *c.* 6 mm diameter, smooth, *drying dark*, with *c.* 8 mm diameter calyx crown.

**Distribution.** Endemic to Borneo; known in Sarawak from various mountains in Belaga, Bintulu, Lawas, Limbang and Tatau districts (e.g., *S 1105*, *S 21958*, *S 32793*, *S 46358*, *S 56950* and *S 65785*).

**Ecology.** In mossy lower montane *kerangas* forest at 800–1320 m.

## 19. **Syzygium biniflorum** (Ridl.) P.S.Ashton, ***comb. nov.*** Plate 5C.

(Latin, *bini-* = twinned, *flos* = flower; referring to the paired flowers at the distal ends of inflorescence)

**Basionym:** *Eugenia biniflora* Ridl., Bull. Misc. Inform. Kew (1925) 80. **Type:** *C.J. Brooks 7103*, Sumatra, Lubok Tandin, Bencoolen [Bengkulen] (holotype K).

Understorey tree to 10 m tall. **Bark** blackish brown. *Young part glabrous*. **Twigs** *round in cross-section*, *dark brown*. **Leaves** *thin-papery*, *drying lightly satiny dark olive-brown*, *sparsely faintly gland-dotted beneath*; *blades obovate*, *elliptic or lanceolate*, (*9–*)*13–17* × (*3–*)*4–8 cm*, *margin entire*, apex slender acuminate, acumen *c.* 1 cm long; *lateral veins unequal*, main ones *c*. 18 pairs, slender, *equally raised on both surfaces as also the reticulate intercostal venation*, drying darker than the blade beneath, *intermediate lateral veins less distinct but also reaching intramarginal vein*; *intramarginal vein c. 1 mm within margin*, *hardly looped*; petioles (13–)20–25 mm long. **Inflorescences** *paniculate*, *rigid*, *c.* 5 cm long, terminal or subterminal-axillary, erect; rachis 1x-branched towards ends, side branchlets bearing 3 congested flowers, quadrangular, slender, at first with paired oblong-ovate hyaline bracts and bracteoles. **Flowers:** *buds urn-shaped*, *c.* 3 mm long, *c.* 2 mm diameter, *sessile*, *with 4 ovate-deltoid acute erect calyx lobes* around the base of the pointed corolla dome; *stamens c*. *25* with many staminodes, exserted to 4 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 4 mm long. **Fruits** *ellipsoid-obovoid*, *c.* 8 mm long, *c.* 6 mm diameter, smooth, *white ripening pink*, *with c. 1.5 mm diameter square crown of deltoid inturned calyx lobes*.

**Distribution.** Sumatra and Borneo. In Sabah recorded from the Crocker Range in Ranau and Tambunan districts (e.g., *SAN 91143* and *SAN 140753*) and in Sarawak from Bintulu, Kapit, Limbang and Sri Aman districts (e.g., *Nielsen 212*, *S 28007*, *S 42812*, *S 48186* and *S 69785*). Also known in C Kalimantan (e.g., *Mogea 3561* and *Mogea 4205*).

**Ecology.** Local, in mixed dipterocarp forest, apparently on fertile clay soils and lower montane forest, at altitudes to 1500 m.

**Notes.** Although the type has a short hardly branched rachis, the distinctive androecium, leaf and twig are unmistakeable. Close to *Syzygium skiophilum*; the many staminodes suggest that *S. skiophilum*, *S. caudatum*, *S. quadricostatum* and others with 8 stamens, formerly recognised as different species of a separate genus *Aphanomyrtus* Miq., have arisen independently by reduction.

## 20. **Syzygium borneense** (Miq.) Miq.

(from Borneo)

Fl. Ind. Bat. 1, 1 (1855) 453; Merrill & Perry, *op. cit.* (1939) 190; Masamune *op. cit.* 524; Coode *et al*. (eds.) *op. cit.* 235; Argent *et al.* (eds.) *op. cit.* 469; Parnell & Chantaranothai, *op. cit.* 838. **Basionym:**

*Eugenia borneensis* Miq., Anal. Bot. Ind. 1 (1850) 24, *t.* 7, Merrill *op. cit.* (1921) 426. **Type:** *Korthals s.n.*, Borneo, Kalimantan, G. Pamatton (holotype L Barcode L 0009408). **Homotypic synonym:** *Syzygium myrtillus* var. *borneense* (Miq.) Chantar. & J.Parn., Kew Bull. 48, 3 (1993) 605. **Heterotypic synonyms:** *Syzygium glaucescens* Blume *ex* Miq. and *S. obtusata* Blume *ex* Miq. *op. cit.* (1850) *nomina in syn.*; *Eugenia caryophyllaea auct. non* Wight: Miq. *op. cit.* (1850) 25, *incl.* var. β; *S. caryophyllaeum* Gaertn. var. β *obtusata* Miq. *op. cit.* (1856) 454; *E. microcalyx* Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 493, Ridley *op. cit.* (1922) 745, M.R. Henderson *op. cit.* (1949) 205, Kochummen *op. cit.* 202; *E. pseudosubtilis* King, J. As. Soc. Beng. 70, 2 (1901) 123, Ridley *op. cit.* (1922) 746, M.R. Henderson *op. cit.* (1949) 202, Kochummen *op. cit.* 212, *incl.* var. *platyphylla*, var. *subacuminata*; *E. ixorioides* Elmer, Leafl. Philip. Bot. 4 (1912) 1426; *E. litseaefolia* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 215, *op. cit.* (1921) 430, J.A.R. Anderson *op. cit.* (1980) 277; *S. hackenbergii* Diels, Bot. Jahrb. 60 (1926) 312, Merrill & Perry *op. cit.* (1939) 195, ***syn. nov.***, **type:** *Hackenberg 17*, Borneo, W Kalimantan, Sampit (holotype B, destroyed; fragment A); *E. irregularis* Craib, Bull. Misc. Inform. Kew (1930) 167, *S. irregulare* (Craib) Merr. & L.M.Perry, J. Arn. Arb. 19 (1938) 107, *E. microcalyx* Duthie var. *irregularis* (Craib) M.R. Hend. *op. cit.* (1949) 207; *S. litseaefolium* Merr. & L.M. Perry *op. cit.* (1939) 191, Masamune *op. cit.* 533.

Tree to 30 m tall, to 70 cm diameter; buttresses narrow, to 2 m tall. **Bark** grey- to pale orange-brown, smooth to flaky; inner bark pale brown. *Parts glabrous*. **Twigs** *c.* 2.5 mm diameter apically, *whitish*, slender, *round in cross-section*, *smooth*. **Leaves** thinly leathery, *drying dull mauve-brown above*, *dull milky grey-brown beneath*, *sparsely or not pitted above*, *faintly pale dotted or dotless beneath*; *blades elliptic-obovate*, *c. 7 × 3*(*5–13 × 2–5*) *cm*, *base wedge-shaped*, apex rounded or more or less acute; *lateral veins unequal*, *main ones 5–6 pairs*, *slender but distinctly raised throughout though more so beneath*, *furrowed above*, ascending; *intercostal venation indistinct*; *intramarginal vein 2*, *main vein 2–3 mm within margin*, *slightly looped*; petioles slender, to 1.5 cm long. **Inflorescences** *paniculate*, *terminal* or *subterminal-axillary*, to 9 cm long; *rachis 3x-branched*, 4-ribbed, spreading, the many flowers clustered around the endings; *paired bracteoles* small, triangular, *c.* 1 × 0.5 mm, *not falling at first*. **Flowers:** *buds pear-shaped*, *c. 2.5 mm long*, *c. 2 mm diameter*, *without distinct pseudostalk*; *calyx lobes 4*(or *5*), *vestigial*, shortly triangular, *c. 0.5 × 1.5 mm*, *hyaline at margin only*, in an obscure rim round the domed corolla at anthesis; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud.* **Fruits** *depressed-spherical to top-shaped*, to 15 mm long, to 12 mm diameter, smooth, drying dark, *ripening pink to blackish*; calyx rim *c*. 2 mm diameter, indistinct to shallowly 4-toothed.

**Distribution.** Peninsular Thailand, Peninsular Malaysia, throughout Borneo, the Philippines, Sulawesi. In Sabah recorded from Kinabatangan, Lahad Datu, Sandakan and Tawau districts (e.g., *SAN 21360*, *SAN 37520*, *SAN 51818*, *SAN 75196* and *SAN 124392*) and in Sarawak from Bau, Kuching, Lundu and Miri districts (e.g., *Hose 196*, *S 17296*, *Clemens 22295*, *S 29322*, *S 38691* and *S 49966*). Also known from Brunei (e.g., *Niga NN 48*, *Kirkup 736*, *Wong WKM 980* and *BRUN 18234*) and E and S Kalimantan (e.g., *Hallier 1388*, *Kessler PK 1728*, *Kostermans 4101* and *bb 29233*).

**Ecology.** Frequent, though not often collected, in mixed dipterocarp forest on sandy soils, and the ecotone to *kerangas*, including on ultramafic rocks, at altitudes to 600 m.

**Notes.** This variable species was previously often called by its synonyms: *Eugenia litseaefolia* Merr. (*Syzygium litseaefolium* (Merr.) Merr. & L.M.Perry) in Borneo, and *E. pseudosubtilis* King and *E. microcalyx* Duthie in Peninsular Malaysia. Lowland and montane varieties are formally recognised in continental Asia, but are not clearly distinguishable in Borneo where the species apparently does not reach above 800 m. In Thailand, Parnell & Chantaranothai (*op. cit.*) recognised *S. borneense* with *S. microcalyx* as a synonym, and *S. cinereum* (Kurz) Chantaranothai & Parnell with *S. pseudosubtilis* as a

synonym; but they differentiated the two in their key on a subtle difference in twig colour. I have not had the opportunity of examining the Thai material in sufficient detail to form an opinion on their decision in context of the variation observed in Borneo. I also reduce here *S. hackenbergii* Diels, based on *Hackenberg 17* from Sampit, W Kalimantan (holotype B, destroyed; fragment in A), a specimen with smaller than average leaves distinctly dotted above. *Eugenia embelioides* Ridl. (*S. embelioides* (Ridl.) Masam.), based on *Beccari 3354* from Danau Lamadjan (close to the Sarawak border), which was reduced to *S. korthalsianum* by Merrill and Perry, appears to represent a form of *S. borneense.*

## 21. **Syzygium brachypodum** Merr. & L.M.Perry

(Greek, *brachy* = short, *podo* = footed; referring to the short pseudostalk of the flower bud)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 179; Beaman & C. Anderson *op. cit.* 212. **Type:** *Elmer 20377*, Borneo, Sabah, Sandakan (holotype A; isotypes K, L Barcode L 0009407, NY, U Barcode U 0005208). **Homotypic synonym:** *E. brachypoda* (Merr. & L.M.Perry) J.A.R.Anderson *op. cit.* (1980) 274.

Small tree. **Bark** finely fissured, dark brown; inner bark pale red. *Young parts glabrous*. **Twigs** *stout*, *red-brown*, *smooth*, *more or less quadrangular in cross-section*. **Leaves** *thinly leathery*, drying dull mauve-brown above, yellowish rust beneath, obscurely pimpled above, *distinctly pimpled and black dotted beneath*; *blades elliptic to lanceolate*, *c. 10 × 4.5*(*8–25 × 3–9*) *cm*, *base heart-shaped to rounded*, apex acute or rounded; *lateral veins unequal*, prominently raised, more so above than beneath, *main ones 7–8 pairs*, ascending, prominent beneath, *furrowed above*; *intercostal venation obscure throughout*; *intramarginal veins 2*, *the main one well within margin*, *looped*; petioles short, drying black. **Inflorescences** *paniculate*, to 13 cm long, terminal; rachis quadrangular, *c.* 3 mm diameter at base, 3x-branched, each branch with 3 flowers; *bracteoles in single pair*, *falling very early*. **Flowers:** *buds broadly shortly goblet-shaped*, *c. 6 mm long*, *c. 5 mm diameter*, *hypanthium becoming cup-shaped at anthesis*; *pseudostalk short*; *calyx lobes 4*, *rounded*, *with hyaline margins*, 2 enveloping the other 2 in bud, *expanding but not becoming reflexed at anthesis*, persisting in fruit; stamens many, exserted to 6 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** ellipsoid, *c*. 10 mm long, *c.* 6 mm diameter, with *c*. 5 mm diameter calyx rim.

**Distribution.** Endemic to Borneo; known in Sabah from Kota Marudu, Lahad Datu, Ranau, Sandakan and Sipitang districts (e.g., *Beaman 8799*, *SAN 32588*, *SAN 39144*, *SAN 62506* and *SAN 99516*) and in Sarawak from Ulu Rejang, Belaga district (e.g., *S 29564*). Also known in E Kalimantan (e.g., *Ambriansyah AA 551* and *bb 12747*).

**Ecology.** Uncommon, in mixed dipterocarp forest on sandy soil and in *kerangas*, at altitudes below 400 m.

## 22. **Syzygium brachyrachis** Merr. & L.M.Perry

(Greek, *brachy* = short, *rachis* = axis; referring to the short inflorescence rachis)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 181; Coode *et al*. (eds.) *op. cit.* 235; Beaman & C. Anderson *op. cit.* 213. **Type:** *Clemens 30731*, Borneo, Sabah, Penibukan, Mt. Kinabalu (holotype A; isotypes BO, K, L Barcode L 0009409, NY, SING).

Subcanopy tree, to 12 m tall. **Bark** grey-brown, smooth or thinly peeling; inner bark thin orange. *Parts glabrous*. **Twigs** *pale grey-brown*, *slender*, *to 3 mm diameter apically*, *bluntly 4-ribbed in cross-section*. **Leaves** *thinly leathery*, *drying dull pale grey*, *wrinkled*, *densely minutely pitted above*, *pale rust-brown and densely black dotted beneath*; *blades elliptic-lanceolate*, *c. 9.5 × 3.5*(*6–15 × 2.5–4*) *cm*, *base wedge-shaped*, *margin not wavy*, apex acute or shortly bluntly acuminate; *lateral veins unequal*, *main ones c. 8 pairs*, ascending, slender but *prominent* though more so *beneath* (*sometimes furrowed above*); *intercostal venation lax*, visible; *intramarginal veins* 1(or 2), *3–5 mm within margin*, *looped*; petioles *c.* 1 cm long. **Inflorescence** *terminal or subterminal-axillary*, *c.* 2 cm long, slender, hardly branched, bearing to 5 flowers. **Flowers:** *buds broadly goblet-shaped*, *c. 10 mm long*, *c. 6 mm diameter*, *tapering with some initial constriction into pseudostalk*; *calyx lobes 4*, *distinct*, ovate, *at least 1 mm long*, at first cupped with the outer enfolding the inner ones, thick but *with wavy narrowly hyaline margins*, apparently falling early leaving a terminal rim; *anther locules parallel*; *ovary at the distal and of flower bud*, style long, persistent in fruit. **Fruits** (young) *spherical*, *c.* 18 mm diameter, smooth, *ripening purplish suffused on green*, *with c. 6 mm diameter apical calyx rim*.

**Distribution.** Endemic to Borneo; recorded in Sabah from Kinabatangan, Ranau and Sandakan districts (e.g., *Jamili SNP 3684*, *SAN 41928*, *Clemens 50264*, *SAN 53346* and *SAN 142963*), and in Sarawak from Kapit, Lawas, Marudi and Miri districts (e.g., *S 32920*, *S 36304*, *S 36401*, *S 40304* and *S 91588*). Also known in Brunei (e.g., *Dransfield 7128*) and C and E Kalimantan (e.g., *Burley 509*, *Meijer 2438* and *Kostermans 13714*).

**Ecology.** In upper dipterocarp forest at 700–1700 m altitude.

**Notes.** The calyx lobes of allied species persist into the ripe fruit; evidence for their early dehiscence is based on herbarium material, and needs checking in the field. *Syzygium minutiflorum* Miq., based on a Teijsmann collection from Bangka, may also be this species, in which case that name has precedence. More collections from Bangka are required. Specimen *S 91588* from Sg. Silat Basin, Sg. Tebokan, Marudi district in NE Sarawak is atypical in its *c*. 5 pairs of stout prominent beneath main lateral veins, but the short inflorescence and the flowers are as in this species.

## 23. **Syzygium bujangii** P.S.Ashton

(Hj. Bujang bin Sitam (born 1929), Sarawak Forest Officer 1947–1984 and a noted plant collector)

Kew Bull. 61, 1 (2006) 113. **Type:** *P.S. Ashton S 18356*, Borneo, Sarawak, Bintulu district, Ulu Sinrok, Similajau FR, in young fruit (holotype K; isotypes L, SAR, SING).

Subcanopy tree, *c.* 12 m tall, *c.* 10 cm diameter. **Bark** pale brown, smooth. *Parts glabrous*. **Twigs** *3–4 mm diameter apically*, *round in cross-section*, smooth, *yellow-brown*. **Leaves** leathery, *drying satiny rich rust-brown throughout*, densely pitted above, *sparsely dotted beneath*; *blades lanceolate*, *23–45 × 5–12 cm*, *base rounded or heart-shaped*, apex gradually tapering; *lateral veins unequal*, *main ones c. 20 pairs* with shorter intermediate veins, prominent beneath, *narrowly furrowed above*; intercostal venation evident, slightly raised beneath; *intramarginal vein 3–6 mm within margin*, somewhat looped; *petioles c. 3 mm long*, *stout*, blackish or partially corky cream. **Flowers** *rami- to cauliflorous*, pink; *buds urn-shaped*, *c. 10 mm long*, *c. 6 mm diameter*, hardly tapering; pedicels *c.* 5 mm long; *calyx lobes 4*, *hemispherical*, *c.* 5 × 4 mm, obtuse or subacute, *hyaline towards margins*,

*spreading and becoming reflexed at anthesis*; stamens many, exserted to 15 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 25 mm long. **Fruits** urn-shaped, *c.* 25 mm diameter, with *c.* 5 mm tall massive tubular calyx crown.

**Distribution.** Endemic to Borneo; known in Sarawak from Bintulu, Kuching and Miri districts (e.g., *Chew CWL 1337*, *S 13476*, *S 16570*, *S 18356*, *S 33618* and *S 34162*, and in Brunei (e.g., *Nielsen & Baslev 1010* and *Wong WKM 1561*).

**Ecology.** In mixed dipterocarp forest at low altitude on a variety of soils, and in mixed peatswamp forest, at altitudes below 400 m.

## 24. **Syzygium calyptrocalyx** P.S.Ashton

(Greek, *calyptra* = a veil, *calyx* = chalice; referring to the closed calyx lobes in bud)

*In* Craven, Biffin & Ashton, Blumea 51 (2006) 136. **Basionym:** *Cleistocalyx leucocladus* Merr. & L.M.Perry, J. Arn. Arb. 18 (1937) 336, *op. cit.* (1939) 197, Masamune *op. cit.* 521. **Type:** *Haviland & Hose 3382E*, Borneo, Sarawak, near Kuching, 31 Oct. 1894 (holotype A; isotypes BO, K, L Barcode L 0009333). **Heterotypic synonyms:** *Eugenia subrufa auct. non* King (1901): Ridley, J. Bot. 68 (1930) 15, J.A.R. Anderson *op. cit.* (1980) 280, *Syzygium subrufum* Masam. *op. cit.* 539; *E. havilandii auct. non.* Merrill (1917): J.A.R. Anderson, Gard. Bull. Sing. 20 (1963) 176, *p.p.*.

Tree. *Parts glabrous*. **Twigs** *c.* 2 mm diameter apically, *at first often pale brown* but *becoming distinct cream-white when older*, *round in cross-section*, smooth or minutely wrinkled. **Leaves** *thickly leathery*, *drying pale dull orange-brown*, minutely densely pitted above, *less densely obscurely dotted beneath*; *blades ovate to elliptic*, *c. 9 × 4.5*(*8–22 × 3.5–9*) *cm*, *base wedge-shaped*, *apex acute*, *acumen c. 8 mm long*, broad; *lateral veins subequal*, *main ones c. 10 pairs*, *hardly more or less equally raised above and beneath* or *unraised*, *minutely furrowed above and sometimes beneath*; *intercostal venation obscure*; *petioles c.* 6 mm long, *c.* 2 mm diameter, *partially cream-corky*. **Inflorescences** *racemose*, terminal or subterminal-axillary, to 5 cm long, singly branched. **Flowers:** *buds* broadly *goblet-shaped*, *to 6 mm long*, *to 4 mm diameter*, *with undivided snuffer-like pointed calyx apex* and *short tapering pseudostalk*; stamens many, at anthesis exserted to 3 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 4 mm long. **Fruits** *spherical*, to 1 cm diameter, *with c. 6 mm diameter prominent crown of broken calyx lobe pieces often reduced to a rim*.

**Distribution.** Endemic to Borneo; in Sabah recorded from Lahad Datu, Sandakan, Tawau and Tenom districts (e.g., *Kadir A 2746* and *SAN 21132*), and in Sarawak from Bau, Kuching, Lawas, Mukah, Sibu and Sri Aman districts (e.g., *S 9023*, *S 20858*, *S 32756*, *S 32844* and *S 83368*). Also known in W and E Kalimantan (e.g., *Main 1698*, *bb 20610* and *bb 20711*).

**Ecology.** In mixed peat swamp and *kerangas* forest.

**Notes.** Differing notably from *Syzygium havilandii*, which shares its habitat, by its eventually cream twig and petiole, and densely pitted lower as well as the upper surface of its more thickly leathery leaf blades. A new name, *S. calyptrocalyx* was required because *S. leucocladum* Merr. & L.M.Perry (*op. cit.* 1939) has precedence.

## 25. **Syzygium capitatum** (Merr.) Merr. & L.M.Perry

(Latin, *capitatus* = knobbed or head-shaped; referring to the densely flowered head-shaped inflorescence)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 150; Masamune *op. cit.* 525. **Basionym:** *Eugenia capitata* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 208, *op. cit.* (1921) 426. **Type:** *Native Collector* (*Bur. Sci.*) *2309*, Borneo, Sarawak, Mt. Santubong, near seashore (holotype PNH, destroyed; isotypes A, K). **Synonym:** *E. inophylla auct. non* Roxb.: Ridley, J. Bot. 68 (1930) 35, *p.p.*, *quoad specim. Beccari 3102*.

Small tree to 20 m tall, to 30 cm diameter; buttresses spreading. **Bark** roughly irregularly flaky, dark brown; inner bark dark brown. *Young parts glabrous*. **Twigs** stout, *round in cross-section*, *c*. 3 mm diameter apically, smooth, *dark grey-brown*. **Leaves** *papery*, *drying shiny purplish brown and densely pitted above*, *dull warm chocolate-brown often with darker midrib* and *pimpled beneath*; *blades oblong*, *c. 12 × 5*(*8–17 × 4.5–9*) *cm*, base broadly wedge-shaped, *margin entire*, apex subcaudate, acumen *c.* 12 mm long, downcurved; *lateral veins unequal* or *subequal*, *c.* 30 pairs, *slender*, *equally evident*, *hardly raised on either surface*; *intercostal venation obscure*; *intramarginal vein close to margin*, *hardly looped*; petioles *c.* 12 mm long, *c.* 2 mm diameter, drying black. **Inflorescences** *dense terminal heads c. 3 cm diameter* or *terminal*, *stout*, *hardly branched reduced panicles*, *c.* 15 mm long, with each flower subtended by 2 pairs of *c*. 1.5 × 2 mm triangular acute subpersistent bracteoles. **Flowers:** *buds top-shaped* or *obconical*, *c. 3 mm long*, *c. 2 mm diameter*, *without distinct pseudostalk*; *calyx lobes 4*, ovate-subacute, *c. 1.5 × 2 mm*, erect, *thick except at the hyaline margin*, clasping corolla; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *ellipsoid becoming spherical*, *c.* 20 mm long, *c.* 15 mm diameter, *light green*, smooth or faintly ribbed, sessile to 2 mm stoutly pedicellate, with *c.* 4 mm diameter prominent erect calyx rim.

**Distribution.** Endemic to Borneo; in Sabah known by a single collection from Ulu Sipitang, Sipitang district (*SAN 35143*) and in Sarawak recorded from Bintulu, Kuching, Marudi and Miri districts (e.g., *Beccari 3102*, *Ding Hou 557*, *S 3928*, *S 27217* and *S 42201*). Also known in NE Kalimantan (e.g., *Kostermans 8735*).

**Ecology.** In mixed dipterocarp forest and the *kerangas* ecotone on yellow sandy soils at low altitude, and in lower montane *kerangas*. Endangered.

**Notes.** Collections other than from W Sarawak differ in the presence of a distinct rachis, and the partial presence of single pairs of bracts; the double pairs arising through reduction of the internodes. The leaf is distinctive and serves to identify the species.

## 26. **Syzygium caryophylliflorum** (Ridl.) Merr. & L.M.Perry

(Latin, *caryophyllus* = Linnaeus' name for the clove tree, *florus* = flowered; with flowers resembling that of clove-tree, *Syzygium aromaticum*)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 173; Masamune *op. cit.* 525; Coode *et al.* (eds.) *op. cit.* 235. **Basionym:** *Eugenia caryophylliflora* Ridl. *op. cit.* (1930) 15, Burgess, TBS (1966) 412. **Type:** *Creagh s.n.*, Borneo, Sabah, *loc. incert.* (holotype K).

Small tree. *Young parts glabrous*. **Twigs** slender, *round in cross-section*, *golden-brown*, *early becoming finely cracked and flaky*. **Leaves** *drying glistening greenish above*, *dull yellow-brown beneath*, obscurely pitted above, *sparsely minutely dotted beneath*; *blades*

*elliptic-lanceolate*, *c.* 9 × 3.5(6–12 × 2.5–5.5) cm, base narrowly wedge-shaped, *margin slightly recurved*, *apex caudate*, *acumen to 1.5 cm long*; *lateral veins dense*, slender, main ones *c.* 20 pairs, *with many subequal intermediate veins*, *distinctly raised beneath*, *furrowed along crests above*, *ascending*; *intramarginal vein 1*, *close to margin*, *hardly looped*; *intercostal venation most visible above*; *petioles slender*, *c. 6 mm long*. **Inflorescences** *paniculate*, *terminal* or *subterminal-axillary*, *c. 10 cm long*, longer than leaves, 2x-branched, slender, many-flowered. **Flowers:** *buds clove-shaped*, *to 12 mm long*, *to 6 mm diameter*, *tapering into 8 mm slender pseudostalk*; pedicel *c*. 4 mm long; calyx lobes 4, ovate-subacute, *c*. 2.5 × 2.5 mm, cupped and clasping corolla, *falling off after anthesis*; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known with certainly only in Sabah from Kinabatangan, Ranau, Sandakan and Tawau districts (e.g., Sabah: the type, *SAN 26278*, *SAN 36623*, *SAN 53344* and *SAN 130269*).

**Ecology.** Apparently locally common on river and stream banks.

## 27. **Syzygium castaneum** (Merr.) Merr. & L.M.Perry Plate 5D.

(Latin, *castaneus* = chestnut-coloured; referring to the dry leaf)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 156; Masamune *op. cit.* 525; Coode *et al*. (eds.) *op. cit.* 235; Ashton, Kew Bull. 61, 1 (2006) 114. **Basionym:** *Eugenia castanea* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 212, *op. cit.* (1921) 426, M.R. Henderson, Gard. Bull. Sing. 12 (1949) 156, Kochummen, TFM 3 (1978) 185, J.A.R. Anderson *op. cit.* 274. **Lectotype** (Ashton 2006)**:** *Hose 359*, Borneo, Sarawak, Baram district (K).

Subcanopy tree or treelet; stilt roots few or absent. **Bark** dark red-brown, smooth, hoop-marked or somewhat powdery. *Young parts dark purplish-brown scurfy hairy*. **Twigs** endings slender, *distinctly narrowly 4-winged* or *rounded in cross-section*, dark-coloured. **Leaves** *thinly leathery*, *drying glistening dark purplish chocolate*, densely minutely pitted above, *obscurely pimpled beneath*; *blades obovate or lanceolate to oblong*, *c. 9 × 3.5*(*2.5–14 × 1–4*) *cm*, *often somewhat twisted to one side*, or *elliptic-lanceolate*, *3–5 × 1.2–1.6 cm*, *base wedge-shaped* equal or more or less unequal, *apex slender*, *subcaudate*, *acumen 8–12 mm long*; *lateral veins subequal*, *main ones 12–25 pairs*, spreading, or ascending, *slender but slightly raised and distinct throughout but more so above*; *intercostal venation dense*, *finely net-like* or not; *intramarginal vein close to margin*, *hardly looped*; petioles slender, 2–5 mm long. **Inflorescences** *paniculate*, 2–12 cm long, terminal or axillary; rachis 2x-branched, slender. **Flowers:** *buds club-shaped* or *clove-shaped*, *3–4 mm long*, *1.5–3 mm diameter*, *with slender pseudostalk*; *calyx lobes* (*4* or)*5*, *ovate-triangular but minute*, *free with thick margin*; stamens many, white, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to 3 mm long. **Fruits** *spherical*, 10–11 mm diameter, *with c. 3 mm diameter apical calyx rim* and *c*. 5 mm long slender stalk.

**Distribution.** Peninsular Malaysia and Borneo.

**Ecology.** Common in primary and secondary *kerangas* and mixed dipterocarp forest, and scrub vegetation on acid over white and yellow sands in the lowlands, sometimes near water; on the Niah limestone; also widespread in the lower facies of upper montane forest at 700–2300 m altitude.

**Notes.** A variable species, with two consistently distinct subspecies.

**Key to subspecies**

Twigs distinctly narrowly 4-winged. Leaves obovate, lanceolate or oblong, 2.5–14 × 1–4 cm, often somewhat twisted to one side, base more or less unequal; main lateral veins *c.* 17–25 pairs, spreading; intercostal venation finely net-like. Inflorescences *c.* 12 cm long; flower buds club-shaped, *c.* 4 mm long, *c.* 3 mm diameter……..

subsp. **castaneum**

Distribution as the species. In Borneo widespread, recorded in Sabah from Keningau, Kinabatangan, Kota Belud, Lahad Datu, Ranau, Sandakan, Sipitang and Tawau districts (e.g., *RSNB 4805*, *Beaman 9009*, *SAN 27985*, *SAN 37392*, *SAN 52015*, *SAN 123339*, and many others) and in Sarawak from Baram, Betong, Bintulu, Kapit, Kuching, Lawas, Limbang, Lubok Antu, Lundu, Marudi, Miri, Serian, Sri Aman and Tatau districts (e.g., *S 19019*, *S 26928*, *S 34808*, *S 43154*, *S 49479* and many others). Also recorded from Brunei (e.g., *Simpson 2069*, *Dransfield 6521*, and *BRUN 17256*) and from W, C and E Kalimantan (e.g., *Laman 804*, *Church 1186*, *Mahyar 1247*, *Sidiyasa 1638*, *Hallier 2063* and *Kostermans 12576*).

Ecology as the species.

Twigs rounded in cross-section. Leaves elliptic-lanceolate, 3–5 × 1.2–1.6 cm, not twisted to one side, base equal; main lateral veins *c.* 12 pairs, ascending; intercostal venation not net-like. Inflorescences to 2 cm long; flower buds clove-shaped, *c.* 3 mm long, *c.* 1 mm diameter……..

subsp. **altecastaneum** P.S.Ashton

(Latin, *alte* = high up; the high altitude *Syzygium castaneum*)

Kew Bull. 61, 1 (2006) 116. Type: *J.A.R. Anderson S 30941*, Borneo, Sarawak, Mulu NP, G. Api, Miri district (holotype K; isotype SAR).

Endemic to Sarawak, mainly confined to lower montane forest at 850–1300 m altitude, and have been recorded from Belaga, Kapit, Limbang and Miri districts (e.g., *S 26380*, *S 26389* and *S 52163*).

## 28. **Syzygium caudatilimbum** (Merr.) Merr. & L.M.Perry Fig. 14.

(Latin, *caudatus* = tailed, *limbus* = blade; referring to the caudate leaf apex)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 181; Masamune *op. cit.* 525; Coode *et al.* (eds.) *op. cit.* 235. **Basionym:** *Eugenia caudatilimba* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 216, *op. cit.* (1921) 426, Burgess *op. cit.* 412, J.A.R. Anderson *op. cit.* (1980) 274. **Type:** *Native Collector* (*Bur. Sci.*) *1169*, Borneo, Sarawak, *loc. incert.* (holotype PNH, destroyed; isotypes A, K). **Heterotypic synonyms:** *Eugenia verticilligera* Ridl., J. Bot. 68 (1930) 12, J.A.R. Anderson, Gard. Bull. Sing. 20 (1963) 176, *Syzygium verticilligerum* (Ridl.) Masam. *op. cit.* 541; *Eugenia* sp. 29, Kochummen *op. cit.* 234.

Canopy or subcanopy tree, *c.* 30 m tall, *c.* 50 cm diameter. **Bark** smooth, brown; inner bark red-brown, thin. *Young parts glabrous*. **Twigs** 2–3 mm diameter apically, *round in cross-section*, slender, *dark red-brown*, *glabrous*, *peeling in curled somewhat scurfy pink-brown strips at nodes*. **Leaves** *thickly leathery*, *drying dull red-brown above*, *golden-brown beneath*, obscurely small-pitted above, *more or less faintly black dotted beneath*; *blades ovate to lanceolate*, *5–17 × 1.5–8 cm*, *base wedge-shaped* to rounded, *margin recurved*, apex caudate, acumen *c.* 1 cm long; *midrib sharply prominent beneath*; *lateral veins just visible above*, *obscure beneath*, *unequal*, main ones *c.* 8 pairs, *not furrowed above*,

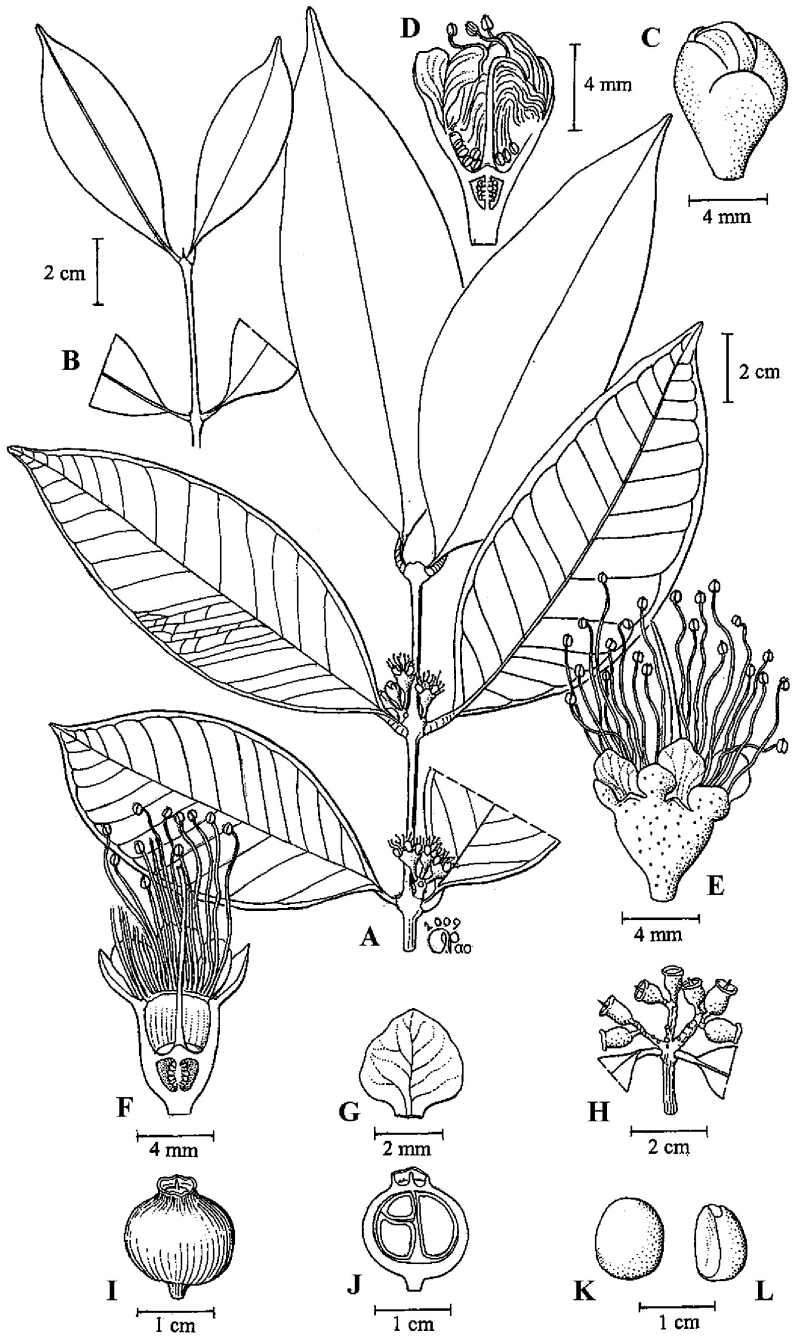


**Fig. 14.** *Syzygium caudatilimbum*. A, flowering leafy twig; B, distal part of twig showing apical bud; C, flower bud; D, longitudinal section of flower bud; E, open flower; F, longitudinal section of open flower; G, petal; H, infructescence; I, fruit; J, longitudinal section of fruit; K, abaxial view of seed; L, adaxial view of seed. (A from *FD BNB 10538*, B–D from *SAN 36598*, E–G from *FD BNB 10538*, H from *SAN 22100*, I–L from *SAN 92409*.)

*ascending*; *intercostal venation obscure*; *intramarginal vein well within margin*, *looped*; petioles *c.* 6 mm long. **Inflorescence** *a 1x-branched reduced panicle of dense flower clusters*, *c. 1 cm long*, *terminal or axillary*. **Flowers:** *buds somewhat clove-shaped*, *c. 8 mm long*, *c. 4 mm diameter*, with an indistinct hypanthium tapering *into stout pseudostalk twice its length*; *calyx lobes 4*, rounded, *c. 2 × 3 mm*, *thick with narrowly hyaline margins,* the 2 outer lobes enclosing the inner ones, falling as the fruit ripens; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical*, *c.* 12 mm diameter, smooth or sometimes shallowly ribbed, *crowned with c. 2 mm diameter repand raised rim of subpersistent calyx lobes*.

**Distribution.** Peninsular Malaysia and Borneo; in Sabah common and widespread and recorded from Beaufort, Keningau, Kinabatangan, Kuala Penyu, Labuk Sugut, Lahad Datu, Pitas, Ranau, Sandakan, Sipitang, Tambunan and Tawau districts (e.g., *SAN 26462*, *SAN 37732*, *SAN 69288*, *SAN 80430*, *SAN 99854*, *SAN 126077* and *SAN 131967*); in Sarawak known from Bintulu, Kapit, Kuching, Lawas, Limbang, Lundu, Marudi, Miri and Sri Aman districts (e.g., *Haviland 2925*, *S 8689*, *S 21134*, *S 33023*, *S 49480*, *S 51053*, *S 77211* and *S 83326*). Also known in Brunei (e.g., *Niga NN 26*, *S 2148*, *BRUN 3319*, *BRUN 5527*, *Dransfield 7280*, *Coode MC 7339*, *BRUN 15210* and *BRUN 18093*) and E Kalimantan (e.g., *Sauveur 80*, *Kostermans 5773*, *van Balgooy 5937* and *bb 29328*).

**Ecology.** Abundant tree of lowland *kerangas* and mixed dipterocarp forest on yellow sandy soils, including on ultramafic substrates, especially on leached humic soils on rocky narrow ridges at altitudes *c.* 2100 m on Mt. Kinabalu, to 1700 m elsewhere; occasional in mixed peat swamp forest in the lower Rejang and Saribas in Sarawak.

**Notes.** Kochummen's *Eugenia* sp. 29 (TFM 3 (1978) 214), described from sterile specimens (*KEP 67627*, *KEP 78697* and *KEP 79863*) from coastal Pahang and Terengganu, nevertheless almost certainly represents this species. It is one more example of the now well established Riau Pocket phytogeographic province whose strongest representation is down the east cost of Peninsular Malaysia and in NW Borneo.

## 29. **Syzygium caudatum** (Merr.) Airy Shaw

(Latin, *caudatus* = tailed; referring to the leaf tip)

Kew Bull. 4 (1949) 122. **Basionym:** *Tetraeugenia caudata* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 230, *op. cit.* (1921) 435, Masamune *op. cit.* 541. **Type:** *Hose 6*, Borneo, Sarawak, Mt. Trekan, Baram district (holotype K). **Heterotypic synonyms:** *Eugenia rhynchophylla* Merr., J. Str. Br. Roy. As. Soc. 79 (1918) 26, J.A.R. Anderson *op. cit.* (1980) 279, *Syzygium rhynchophyllum* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 189, Masamune *op. cit* 538, Coode *et al.* (eds.) *op. cit.* 235, ***syn. nov.***, **type:** *Haviland 2930*, Borneo, Sarawak, near Kuching (holotype PNH, ? destroyed; isotypes BO, K, L, SING); *S. aphanomyrtoides* Merr. & L.M.Perry *op. cit.* (1939) 190, *E. aphonomyrtoides* (Merr. & L.M.Perry) J.A.R.Anderson *op. cit.* (1980) 273, ***syn. nov.***, **type:** *Clemens 31535*, Borneo, Sabah, Mt. Kinabalu (holotype A; isotypes K, L Barcode L 0009584).

Canopy or subcanopy tree to 60 cm diameter. **Bark** orange-brown, smooth, hoop-marked. *Parts glabrous*. **Twigs** *c.* 1 mm diameter apically, slender*, slightly angled at first below nodes otherwise round in cross-section*, *pale grey-brown* or occasionally cream, smooth. **Leaves** thinly leathery, *drying dull greenish*, *densely distinctly pitted above* and *minutely pale dotted or pimpled beneath*; *blades lanceolate*, *c. 7 × 2.5*(*4–8 × 1.5–4*) *cm*, *base wedge-shaped*, apex caudate, acumen *c.* 1 cm long; *lateral veins unequal*, *main ones c. 6 pairs*, *hardly visible as also the intercostal venation on either surface*, *slightly furrowed above*,

spreading; *intramarginal veins* 2(or 3), *the main one 2–3 mm within margin*, *looped*; *petioles slender*, *c. 6 mm long*. **Inflorescences** paniculate, terminal or axillary, *c.* 3 cm long, slender, 2x-branched, few-flowered. **Flowers:** *buds club-shaped*, *c. 5 mm long*, *c. 2 mm diameter*, *with tiny paired of triangular bracteoles* and *distinct slender pseudostalk*; *calyx lobes 4*, *ovate-triangular*, minute, *thick*, *cupped*; *stamens 4*, *anther locules parallel*; *ovary at the distal end of flower bud*, style short. **Fruits** *ellipsoid*, *c.* 3.8 mm long, *c.* 2.5 cm diameter, *with c. 4 mm diameter apical calyx rim*, *ripening red*.

**Distribution.** Endemic to Borneo; in Sabah reported from Keningau, Kota Marudu, Ranau, Sandakan, Tambunan and Tenom districts (e.g., *RSNB 6*, *SAN 26427*, *SAN 27497*, *SAN 33903*, *SAN 38498* and *SAN 56732*) and in Sarawak from Baram, Belaga, Bintulu, Kapit, Kuching, Limbang, Marudi and Tatau districts (e.g., *S 37294*, *S 41323*, *S 43678*, *S 52248*, *S 63148*, *S 68915* and *S 69856*). Also recorded from Brunei (e.g., *Wong WKM 1499*, *Coode MC 6757*, *Dransfield 7347* and *BRUN 17977*) and C and E Kalimantan (e.g., *Sidiyasa 419*, *Mahyar 1060* and *bb 19152*).

**Ecology.** In mixed dipterocarp forest on yellow sandy and sandy clay soils near the coast, and on humic soils, at altitudes 650–1600 m, in upper dipterocarp forest and lower montane pole forest; on dacite in the Hose mountains and Usun Apau; basalt on the Linau-Balui plateau; ultramafics sometimes on Mt. Kinabalu; and on limestone in Mulu NP.

## 30. **Syzygium cephalophorum** (Ridl.) Merr. & L.M.Perry

(Greek, *cephalos* = head, *-phorum* = bearing; referring to the head-like flower clusters)

Mem. Amer. Acad. Art & Sci. 18, 3 (1939) 150; Masamune *op. cit.* 525. **Basionym:** *Eugenia cephalophora* Ridl., J. Bot. 68 (1930) 13, J.A.R. Anderson *op. cit.* (1980) 274. **Type:** *Haviland 2175/1684*, Borneo, Sarawak, near Kuching (holotype K).

Tree to 25 m tall. **Bark** dull brown. *Young parts glabrous*. **Twigs** *c.* 1 mm diameter apically, *round in cross-section*, *cream-white*. **Leaves** *leathery*, *drying not wrinkled*, *dull dark grey-tawny above*, *greenish tawny beneath*, *sparsely shallowly pitted above*, *sparsely minutely black dotted beneath*; *blades elliptic-lanceolate*, *c. 11 × 5*(*5–21 × 2.5–6.5*) *cm*, *base broadly wedge-shaped* or obtuse, *apex acuminate*; *lateral veins unequal*, *main ones c. 8 pairs*, *evenly spaced*, *each with 1 shorter fainter intermediate vein*, *evident and slightly raised below*, *furrowed above*, spreading; *intercostal venation evident below*, obscure above; *intramarginal veins* 1(or 2), *4–6 mm within margin*, *looped*; *petioles c. 9 mm long*. **Flowers** *in dense terminal clusters*, each with 2 pairs of bracteoles; young *buds obovoid*, *becoming torch-shaped*, *c. 7 mm long*, *c. 3 mm diameter*, broadly tapering continuously from apex, *without distinct pseudostalk*; *calyx lobes 4*, *hemispherical*, *c. 1 × 2 mm*, *with hyaline margins*, *not reflexed at and falling after anthesis*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** densely clustered, spherical, *c.* 6 mm diameter, with *c.* 5 mm wide somewhat reflexed calyx lip and *c*. 3 mm subpersistent style.

**Distribution.** Endemic to Borneo, rare; known only in Sabah from Kinabatangan, Lahad Datu, Ranau and Tawau districts (e.g., *SAN 17318*, *SAN 20657*, *SAN 36384* and *SAN 82166*).

**Ecology.** Apparently in mixed dipterocarp forest on fertile clay soils over shales and basic volcanic rock, at altitudes to 650 m.

## 31. **Syzygium chaii** P.S.Ashton

(Paul Chai P.K, 1941–, former Senior Forest Botanist at Kuching, major contributor to the Tree Flora project, and advisor for the expansion of the Sarawak parks system)

Kew Bull. 61, 1 (2006) 116. **Type:** *Nooteboom & Chai 02103*, Borneo, Sarawak, along Pamerario R., Bario, Miri district (holotype K; isotypes KEP Barcode KEP 162655, L, SAR).

Canopy tree, *c.* 20 m tall, *c.* 45 cm diameter, with low buttresses. **Bark** brown, flaky. *Young parts glabrous*. **Twigs** *c.* 3 mm diameter apically, *round in cross-section*, somewhat scurfy and striated, *drying chocolate-brown*. **Leaves** thinly leathery, *drying slightly glistening*, *pale chocolate-brown beneath*, dark purplish-chocolate above, *densely pitted above*, more or less obscurely densely dotted beneath; *blades ovate-elliptic*, *4–9.5 × 1.5–3.5 cm*, base wedge-shaped, *margin undulate*, *recurved*, *apex subcaudate*, *acumen c. 10 mm long*; *lateral veins* slender, dense, *subequal*, *main ones c. 15 pairs*, *hardly raised though most so beneath*, *more or less furrowed along their crests above*; *intercostal venation evident beneath*, obscure above; *intramarginal vein c. 1 mm within margin*, *hardly looped*; *petioles c. 8 mm long*. **Inflorescences** paniculate, terminal or subterminal-axillary, *c.* 8 cm long; rachis 2x-branched, ribbed; bracts and bracteoles minute. **Flowers:** calyx lobes 4. **Fruits** spherical, *c.* 8 mm diameter, smooth, ripening green, crowned by a *c.* 4 mm diameter crown of caducous, broadly ovate, subacute calyx lobes.

**Distribution.** Endemic to Borneo; confined to mountains of C and NE Sarawak in Kapit and Miri districts (e.g., the type and *S 37237*).

**Ecology.** In the lower facies of upper montane forest, at *c.* 1080 m altitude.

## 32. **Syzygium chloranthum** (Duthie) Merr. & L.M.Perry

(Greek, *chloro-* = green, *anthos* = flower; referring to the colour of the flower)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 173; Masamune *op. cit.* 526; Coode *et al.* (eds.) *op. cit.* 235. **Basionym:** *Eugenia chlorantha* Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 487, Ridley *op. cit.* (1922) 734, Burkill *op. cit.* (1935) 964, M.R. Henderson, Gard. Bull. Sing. 12 (1949) 107, Kochummen *op. cit.* 186, J.A.R. Anderson *op. cit.* (1980) 274. **Syntypes:** *Wallich 3581*, Singapore; *Griffith s.n.* & *Maingay 738*, Malacca (CAL, K). **Heterotypic synonyms:** *Eugenia hulletiana* King *op. cit.* 97; *Syzygium griseum auct. non* C.B. Rob.: Airy Shaw *op. cit.* (1949) 124; *Eugenia* sp. 32, Kochummen *op. cit.* 236.

Subcanopy tree to 30 m tall, *c.* 60 cm diameter, *with stilt roots*. **Bark** dark *red-brown*, smooth. *Young parts glabrous*. **Twigs** 2–3 mm diameter apically, slender, *elliptic in cross-section*, distinctly *golden- to rich rust-brown*, *smooth*. **Leaves** thinly leathery, *drying dark greenish brown*, *slightly glistening on both surfaces*, *with scattered pits above*, and *small black gland dots beneath*; *blades elliptic to lanceolate*, *c. 10 × 4.5*(*4–15 × 2.5–8*) *cm*, base wedge-shaped, *margin hardly* or *not recurved*, *apex subcaudate*, acumen *c.* 8 mm long; midrib usually somewhat raised on either side of its median furrow above; *lateral veins dense*, *slender*, *subequal*, main ones *c.* 25 pairs with shorter intermediate veins, slightly spreading, *hardly raised on both surfaces but more distinct beneath than above*; intercostal venation lax, visible throughout; *intramarginal vein close to margin*, *hardly looped*; *petioles c. 10 mm long*. **Inflorescences** *paniculate*, to 7 cm but usually *c.* 4 cm long, terminal but *mostly axillary*; rachis slender, round in cross-section, 1x-branched. **Flowers:** *buds broadly clove-shaped*, *to 10 mm long*, *to 5 mm diameter*, *tapering to base with slight waist at pseudostalk*; *calyx lobes* 4(or 5), broadly shortly ovate-hemispherical, subacute, cupped,

*hyaline towards margins*, *spreading and falling off at anthesis*; *stamens many*, *exserting* to 8 mm, *anther locules parallel*, pale greenish white, red-tinged; *ovary at the distal end of flower bud*. **Fruits** *spherical*, to 1.5 cm diameter, obscurely ribbed, *with prominently lobed c. 4 mm diameter calyx rim*, *ripening with purplish flush*.

**Distribution.** Vietnam and Thailand, Sumatra, Peninsular Malaysia, Singapore and Borneo. In Borneo common and widespread; in Sabah recorded from various disticts (e.g., *SAN 31270*, *SAN 32922*, *SAN 43610*, *SAN 57378*, *SAN 61331*, *SAN 82624* and *SAN 95854*), and in Sarawak from Belaga, Kapit, Kuching, Lawas, Lubok Antu, Lundu, Marudi and Simunjan districts (e.g., *S 17832*, *S 21235*, *S 34041*, *S 49985*, *S 73387* and *S 91543*). Also known in Brunei (e.g., *BRUN 182*, *Wong WKM 1661*, *Coode MC 6534* and *Dransfield 7360*) and Kalimantan (e.g., *Kessler PK 1766*, *bb 20656* and *bb 24622*).

**Ecology.** Common in mixed dipterocarp forest on a wide range of upland soils and in mixed peat swamp forest, and occasional on limestone and *kerangas*, at altitudes to 900 m.

## 33. **Syzygium christmannii** Merr. & L.M.Perry

(Gottlieb Friedrich Christmann, 1752–1836, German botanist and physician)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 185. **Type:** *Beccari 3251*, Borneo, Sarawak, *loc. incert.* (holotype K). **Homotypic synonyms:** *Eugenia christmannii* (Merr. & L.M.Perry) J.A.R.Anderson, Gard. Bull. Sing. 20 (1963) 175, *op. cit.* (1980) 274, Burgess *op. cit.* 412. **Heterotypic synonyms:** *Eugenia laevicaulis auct. non* Duthie (1878): Ridl., J. Bot. 68 (1930) 15, *Syzygium laevicaule* (Duthie) Masam. *op. cit.* 531; *Eugenia* sp. 14, Kochummen *op. cit.* 229.

Canopy tree to 60 cm diameter, with high stilt roots. **Bark** smooth, whitish. *Parts glabrous*. **Twigs** *c.* 4 mm diameter apically, *elliptic in cross-section*, *cream-gold*, smooth. **Leaves** *leathery*, *drying dull or glistening red-brown*, *more or less densely obscurely pitted above*, *dull rust-brown and sparely black dotted beneath*; *blades ovate-lanceolate*, *c. 9 × 3.5*(*8–20 × 2.5–6*) *cm*, *base wedge-shaped*, *apex acuminate*; *lateral veins unequal*, *prominent beneath*, *furrowed above*, *main ones c. 10 pairs*, ascending; *intercostal venation more or less evident on both surfaces*; *intramarginal vein* 1(or 2), *3–4 mm within margin*, *looped*; *petioles c. 10 mm long*, blackish. **Inflorescences** *paniculate*, *terminal or subterminal-axillary*, *c. 7 cm long*; rachis *c.* 2 mm diameter, 2x-branched, round or angled in cross-section, ascending. **Flowers:** *buds broadly goblet-shaped*, *c. 12 mm long*, *c. 8 mm diameter*, *tapering to a 4 mm stout pseudostalk*; *calyx lobes 4*, *broad but very short*, *longer than 1 mm*, *thick with wavy but hardly* or *not hyaline margin*, becoming reflexed, *forming an undulating rim round the domed corolla*; stamens many, exserted to 15 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style extending to 20 mm. **Fruits** *urn-shaped*, *c.* 15 mm long, *c.* 10 mm diameter, *with broad shallow recurved calyx rim*.

**Vernacular name.** Sarawak—*ubah jambu paya* (Iban).

**Distribution.** Peninsular Malaysia and Borneo. In Sabah uncommon, recorded from Beaufort, Nabawan, Ranau, Semporna and Tenom districts (e.g., *SAN 24310*, *SAN 63759* and *SAN 66711*) but widespread in Sarawak, known from Belaga, Julau, Kapit, Marudi, Mukah, Sarikei, Sibu and Sri Aman districts (e.g., *Richards 1016*, *S 3307*, *S 3331*, *S 9276*, *S 9703*, *S 19665* and *S 37209*). Also known in Brunei (e.g., *S 2855* and *Suzuki K 12874*) and Kalimantan (e.g., *Buwalda 7849* and *Kostermans 7894*).

**Ecology.** In *kerangas* and mixed peat swamp forest, also on floodplains and yellow sandy soils in mixed dipterocarp forest, at altitudes below 400 m.

## 34. **Syzygium claviflorum** (Roxb.) Wall. *ex* Steudel

(Latin, *clavi-* = club-like, *florus* = flowered; referring to the shape of the flower bud)

Nomencl. Bot. ed. 2, 2 (1841) 657; A.M. & J.M. Cowan & Cowan, Trees N. Bengal (1929) 67; Argent *et al.* (eds.) *op. cit.* 470; Parnell & Chantaranothai *op. cit.* 844; Ashton, Gard. Bull. Sing. 61, 1 (2009) 8. **Basionym:** *Eugenia claviflora* Roxb., Fl. Ind. edition Carey 2, 2 (1832) 488, Duthie *in* Hooker *f. op. cit.* 484, King *op. cit.* 107, Ridley *op. cit.* (1922) 742, M.R. Henderson *op. cit.* (1949) 252, Kochummen *op. cit.* 186. **Lectotype** (Ashton 2009)**:** *Wallich 3575B*, Myanmar, Chittagong (K). **Homotypic synonyms:** *Acmena claviflora* (Roxb.) Walp. Repert. 2 (1841) 181, *Acmenosperma claviflora* (Roxb.) Kausel, Ark. Bot. 3 (1957) 609. **Heterotypic synonyms:** *Eugenia leptantha* Wight, Ill. 2 (1841) 15, Duthie *in* Hooker *f. op. cit.* 484, Ridley *op. cit.* (1922) 741, *Acmena leptantha* (Wight) Walp. *op. cit.* 181, *Syzygium leptanthum* (Wight) Nied. *in* Engl. & Prantl., Nat. Pflanzenfam. 3 (1893) 85; *Jambosa clavata* Korth., Ned. Kruidk. Arch. 1 (1847) 201, *E. clavata* (Korth.) Merr. *op. cit.* (1917) 225, *op. cit.* (1921) 427, *S. clavatum* (Korth.) Merr. & L.M.Perry *op. cit.* (1939) 470, Masamune *op. cit.* 526, Beaman & C. Anderson *op. cit.* 214; *E. rhododendrifolia* Miq., Ann. Bot. Ind. 1 (1850) 19, *t.* 2, *incl.* forma *longifolia* Miq., 20, *t.* 3, *S. rhododendrifolium* (Miq.) Masam. *op. cit.* 538; *J. borneensis* Miq., Fl. Ind. Bat. 1 (1855) 434; *E. ruminata* Koord. & Valeton, Bull. Inst. Bot. Buitenzorg 2 (1899) 8, Bijdr. Booms. Java 6 (1900) 117.

Canopy tree to 40 m tall, to 60 cm diameter, hardly buttressed. **Bark** smooth with persisting oblique leaf scars to slightly patchily cracked and flaky; inner bark greyish purple. *Young parts glabrous*. **Twigs** slender with long straight internodes, *elliptic in cross-section*, *grey-brown*, *smooth*. **Leaves** *thinly leathery*, *drying yellow-brown*, *paler beneath*, *more or less densely pitted above*, *pale dotted beneath*; *blades elliptic-lanceolate*, *c. 10 × 4.5*(*8.5–25 × 3.5–7*) *cm*, base wedge-shaped, *margin often narrowly recurved sometimes wavy*, *apex broadly acute*, *acumen c. 8 mm long*; *lateral veins unequal*, *with fainter more or less shorter intermediate veins*, *slender but visible on both surfaces*, *more raised beneath*, furrowed above as also the intercostal venation, *main lateral veins c. 14 pairs*, indistinct above, slender but distinctly raised beneath; intercostal venation visible throughout; *intramarginal veins* 1 pair, *1–2 mm within margin*, *hardly looped*; *petioles c. 8 mm long*. **Inflorescences** *axillary*, usually *to 1 cm long*, slender, *congested*, *few-branched*. **Flowers:** *buds torch-shaped*, *to 12*(*–30*) *mm long*, *to 5 mm diameter*; *pseudostalk 3x as long as hypanthium length*, slightly tapering; *calyx lobes 4*(or *5*), *vestigial*, broadly triangular, subacute, *thick to margins*, becoming reflexed and caducous at anthesis forming a wavy rim; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *oblong-ellipsoid* or *occasionally spherical*, to 20 mm long, to 12 mm diameter, *drying pale straw-coloured*, slightly broader towards apex, with prominent apical cavity fringed by the short calyx lobes, *ripening purplish red*.

**Distribution.** NE India, Bangladesh, Myanmar, S China, Thailand, throughout Malesia to Australia. In Borneo, recorded in Sabah from Keningau, Kinabatangan, Kota Kinabalu, Kudat, Kuala Penyu, Lahad Datu, Papar, Ranau, Sandakan, Sipitang and Tawau districts (e.g., *Zainuddin 5012*, *SAN 35902*, *SAN 37173*, *SAN 67209*, *SAN 71510*, *SAN 80459*, *SAN 95135* and *SAN 115483*) and in Sarawak from Belaga, Limbang, Miri and Serian districts (e.g., *Hose 689*, *S 32287*, *S 35618*). Also known from Brunei (e.g., *BRUN 17402* and *BRUN 17447*) and Kalimantan (e.g., *Ambriansyah AA 2145*, *van Balgooy 6060* and *Kostermans 6697*).

**Ecology.** Locally frequent in *kerangas*, the outer margin of mixed peat swamp forest, and floodplains and on ultramafic substrate (in Kinabalu NP) at altitudes to 1500 m.

**Notes.** A variable species in leaf and flower size. In Borneo, two subspecies are recognised.

**Key to subspecies**

Twigs slender. Leaves thinly leathery, *c.* 10 × 4.5 cm, base wedge-shaped tapering into slender petiole; lateral veins furrowed above; intercostal venation more distinctly raised beneath. Flower buds *c.* 12(–30) mm long…….

subsp. **claviflorum**

Distribution as the species.

Twigs stout, *c.* 3 mm diameter apically. Leaves leathery, *c.* 13 × 6 cm, base obtuse to broadly wedge-shaped, hardly tapering into the stout petiole; lateral veins not furrowed above; intercostal venation more distinctly raised above. Flower buds *c.* 8 mm long……...

subsp. **tavaiense** P.S.Ashton

(of Bt. Tawai, Kinabatangan district, Sabah)

Gard. Bull. Sing. 61, 1 (2009) 8. Type: *Zainudin 5012*, Borneo, Sabah, Bt. Tawai FR, Kinabatangan district (holotype KEP; isotypes K, SAN).

Endemic to Bt. Tawai FR, known by two collections, the type and *Bojo & Cheksum Tawan OB 040*. In forest on ultrabasic substrate.

## 35. **Syzygium cleistocalyx** (Merr.) P.S.Ashton

(Greek, *cleistos* = closed, shut, *kalux* = calyx; referring to the calyptrate calyx)

Blumea 51, 1 (2006) 136. **Basionym:** *Eugenia cleistocalyx* Merr., Philip. J. Sci., C 13, 2 (1918) 98, *op. cit.* (1921) 427 [as a new name for *Jambosa nitida* Korth., Ned. Kruidk. Arch. 1 (1847) 202 & *Cleistocalyx nitidus* (Korth.) Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 84; *non E. nitida* Vell. (1829), *nec* Cambess. (1832), *nec* Duthie (1875); *non Syzygium nitidum* Benth., London J. Bot. 2 (1843) 221, *nec* Brongn. & Gris, Bull. Soc. Bot. France 12 (1865) 183]. **Type:** *Korthals s.n.*, Borneo, Kalimantan, on the banks of Banjarmasin R., at G. Bahai (holotype L Barcode L 0009334; photo K, rubbing A). **Synonyms:** *Eugenia nervosa auct. non* Lour. (1790): Miquel, Fl. Ind. Bat. 1, 1 (1856) 442; *E. nitida auct. non* Vell. (1829), *nec* Cambess. (1832), *nec* Duthie (1875): Burgess *op. cit.* 413, J.A.R. Anderson *op. cit.* (1980) 278, *p.p.*

Small tree. **Bark** smooth. *Parts glabrous*. **Twigs** stout, *sharply angled and grooved in cross-section*, *chocolate-brown*, smooth. **Leaves** leathery, *drying glistening dark purple-brown above*, *dull chocolate-brown beneath*, *obscurely pitted above*, *densely pimpled beneath*; *blades elliptic to lanceolate*, *c. 23 × 8.5 cm*, *base wedge-shaped*, apex acuminate, acumen *c*. 1 cm long, sharp; *midrib sharply ridged beneath*; *lateral veins unequal*, *prominent on both surfaces though more so beneath*, *shallowly furrowed above*, *main ones c. 22 pairs*, *with many shorter intermediate veins*, spreading; intercostal venation elevated on both surfaces; intramarginal veins 2, the main ones *c*. 4 mm within margin, not strongly looped; *petioles stout*, *c. 9 mm long*. **Inflorescences** *paniculate*, *to 15 cm long*, terminal or axillary, *rigid*, *erect*, *bearing short mostly subterminal branches*; rachis round or quadrangular in cross-section. **Flowers:** *buds goblet-shaped*, *to 7 mm long*, *c. 3 mm diameter*; *hypanthium spherical*; *pseudostalk slender*, *c. 3 mm long*; *calyx lobes united in bud into snuffer-like structure*, bursting at anthesis to expose stamens and style; *stamens many*, exserting to *c.* 6 mm long, anther locules parallel; *ovary at the distal end of flower*

*bud*, style *c.* 6 mm long. **Fruits** *spherical*, to 12 mm diameter, roughly ribbed, with *c.* 4 mm diameter rough apical crown.

**Distribution.** Endemic to Borneo. Widespread in Sabah and known from Beaufort, Keningau, Kinabatangan, Lahad Datu, Ranau, Sandakan, Tawau and Tenom districts (e.g., *Elmer 21702*, *SAN 25453*, *SAN 37196*, *SAN 53088*, *SAN 70939*, *SAN 81384*, *SAN 84816*, *SAN 93950*, *SAN 95432* and *SAN 146219*) and in Sarawak from Belaga, Lawas, Limbang, Marudi, Miri and Sibu districts (e.g., *S 24395*, *S 40654*, *S 40703*, *S 40727* and *S 40856*). Also recorded in Brunei (e.g., *BRUN 5122* and *Hotta 13037*) and Kalimantan (e.g., the type).

**Ecology.** Apparently uncommon, on floodplains and river banks, including behind the mangrove in the tidal reaches; also in the lower facies of upper montane forest at *c.* 1600 m altitude.

**Notes.** In the genus *Syzygium* the epithet *cleistocalyx* must be used because *nitidum* is pre-occupied by *S. nitidum* Benth. (London J. Bot. 2 (1843) 221).

## 36. **Syzygium confertum** (Korth.) Merr. & L.M.Perry.

(Latin, *confertus* = densely packed; referring to the flowers)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 177; Masamune *op. cit.* 526; Coode *et al.* (eds.) *op. cit.* 235; Argent *et al.* (eds.) *op. cit.* 470. **Basionym:** *Jambosa conferta* Korth., Ned. Kruidk. Arch. 1 (1847) 202, Merrill *op. cit.* (1921) 427. **Type:** *Korthals s.n.*, Borneo, Kalimantan, Pulau Lampai (holotype L Barcode L 0009418). **Homotypic synonyms:** *Microjambosa conferta* (Korth.) Blume *op. cit.* (1850) 118, *Eugenia conferta* (Korth.) Burgess *op. cit.* 412, J.A.R.Anderson *op. cit.* (1980) 275. **Heterotypic synonyms:** *Macrojambosa cuspidata* Blume *op. cit.* (1850) 119, *Jambosa cuspidata* (Blume) Miq. *op. cit.* (1855) 435; *Macrojambosa trifida* Blume *op. cit.* (1850) 118, *J. trifida* (Blume) Miq. *op. cit.* (1855) 435; *Eugenia densepunctata* Koord. & Valeton, Meded. Lands Pl. 40 (1900) 97; *E. calvinii* Elmer, Leafl. Philip. Bot. 4 (1912) 1419, Merrill *op. cit.* (1929) 216, *Syzygium calvinii* (Elmer) Masam. *op. cit.* 525; *E. corymbifera auct. non* Koord. & Valeton (1900): Ridl. *op. cit.* (1930) 14, *S. corymbiferum* (Ridl.) Masam. *op. cit.* 527.

Large canopy tree *c.* 30 m tall, *c.* 80 cm diameter. **Bark** becoming papery flaky, pale pinkish brown. *Parts glabrous*. **Twigs** *c. 3 mm diameter apically*, *stout*, *round or elliptic in cross-section*, *grey-brown*. **Leaves** leathery, *drying satiny mauve-brown above*, *dull yellowish- to chocolate-brown beneath*, *obscurely pitted above*, *not or densely pimpled beneath*; *blades elliptic to lanceolate*, *c. 9 × 3.5*(*7–14 × 3–7*) *cm*, *base wedge-shaped tapering into petiole*, *apex acuminate*, *acumen slender*, *c. 1 cm long*; *lateral veins unequal*, slender but raised on both surfaces, often prominent beneath, *main ones 10–12 pairs*, *ascending*, *not furrowed above*; *intercostal venation generally raised*, *more prominently above than beneath*; *intramarginal veins 1*(*or 2*), *main ones 2–3 mm within margin*, *looped*; petioles *c.* 11 mm long. **Inflorescences** *paniculate*, *to 10 cm long*, *terminal or subterminal-axillary*; rachis erect, sparingly 1–2x-branched, round in cross-section, *with flowers clustered at branchlet endings*. **Flowers:** *buds club-shaped*, *c. 5 mm long*, *c. 3 mm diameter*, *with spherical hypanthium on a distinct equally long pseudostalk*; *calyx lobes 4*, *distinct*, hemispherical, *c. 2 × 3 mm*, *subequal*, obtuse, *thick* to exposed edges, becoming inflexed along a narrow swollen rim at anthesis; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting *c.* 6 mm. **Fruits** *spherical*, *c.* 18 mm diameter, *shallowly ribbed*, *with c. 4 mm diameter apical calyx rim*.

**Distribution.** Sumatra, Java, Borneo and the Philippines (Palawan Is.). In Borneo widespread, known in Sabah from Keningau, Kinabatangan, Kota Belud, Kuala Penyu, Kudat, Lahad Datu, Papar, Ranau, Sandakan, Sipitang and Tawau districts (e.g., *RSNB 7091*, *SAN 16712*, *SAN 24226*, *SAN 30553*, *SAN 51095*, *SAN 53113*, *SAN 79733*, *SAN 83143* and *SAN 141816*) and in Sarawak from Belaga, Bintulu, Kapit, Lundu, Marudi, Miri, Serian, Simunjan and Sri Aman districts (e.g., *Beccari 3299*, *S 12779*, *S 13630*, *S 27033*, *S 34307*, *S 42205*, *S 68554* and *S 76916*). Also known in Brunei (e.g., *BRUN 9*, *BRUN 1074* and *BRUN 15250*) and E Kalimantan (e.g., *Kostermans 5304*, *Kostermans 7297* and *Kostermans 10638*).

**Ecology.** Common, in mixed dipterocarp forest on yellow sandy soil or near the coast; at altitudes to 1500 m on Mt. Kinabalu and the Crocker Range; also in floodplain forest.

## 37. **Syzygium conglobatum** (C.B.Rob.) Merr.

(Latin, *conglobatus* = joined sphere; referring to the dense fruit heads)

Philip. J. Sc. 79, 4 (1950) 383. **Basionym:** *Eugenia conglobata* C.B.Rob., Philip J. Sc. 4 (1909) 359, Merrill *op. cit.* (1923) 163. **Type:** *R.S. Williams 2359*, the Philippines, Mindanao, Sax River Zamboanga district (holotype PNH, destroyed; isotype K). **Heterotypic synonyms:** *Eugenia subsulcata* Elmer, Leafl. Philip. Bot. 4 (1919) 3095; *E. philippinorum* C.N.Sutherland, An. Jard. Bot. Madrid 56 (1998) 162.

Tree *c*. 12 m tall, *c*. 30 cm diameter. *Young parts glabrous*. **Twigs** *c*. 2 mm diameter apically, *grooved at first*, *becoming round in cross-section*, *pale brown*. **Leaves** *thinly papery*, *wrinkled on drying*, *dark greenish brown above*, *paler so and more or less densely black dotted beneath*; *blades elliptic or ovate*, *9–16 × 4–8 cm*, *base wedge-shaped abruptly terminating towards petiole*, apex acuminate, acumen *c*. 15 mm long, slender; *lateral veins unequal*, *main ones c. 8 pairs*, *irregularly spaced by occasional prominent intermediate veins*, ascending, *slender but distinctly raised beneath*, *medially shallowly furrowed above*; intercostal venation lax, elevated beneath, appearing somewhat parallel and perpendicular to midrib; *intramarginal vein 3–5 mm within margin* but irregular, *looped*; petioles 5–12 mm long. **Flowers** *in dense terminal and axillary clusters*; *buds broadly torch-shaped*, *c. 7 mm long*, *c. 5 mm diameter*, *tapering from apex to base*, *without distinct pseudostalk*; *calyx lobes 4*, *hemispherical*, *obtuse c.* 2 × 3 mm, *hyaline towards margins*, *not reflexed at and* falling after anthesis; stamens many, exserted to *c.* 3 mm *anther locules parallel*; *ovary at the distal end of flower bud*, style slender extended *c.* 6 mm. **Fruits** spherical, *c.* 12 mm diameter, drying wrinkled, with *c*. 6 mm diameter shallow calyx rim.

**Distribution.** Borneo and the Philippines. In Borneo rare, known by one collection (*SAN 116984*) from Ulu Segama FR, Lahad Datu district, E Sabah.

**Ecology.** In mixed dipterocarp forest at low altitude on montmorillonitic soils derived from basic volcanic substrate.

## 38. **Syzygium cornuflorum** P.S.Ashton Fig. 15.

(Latin, *cornu* = a horn, *florus* = flowered; referring to the cornet-shaped flower buds)

Kew Bull. 61, 1 (2006) 116. **Type:** *Soepadmo et al. FRI 41351*, Borneo, Sabah, Kinabatangan district, Sg. Meliau, Bukit Tawai FR (holotype K; isotypes KEP Barcode KEP 172742 & 172743, SAN, SAR, SING).

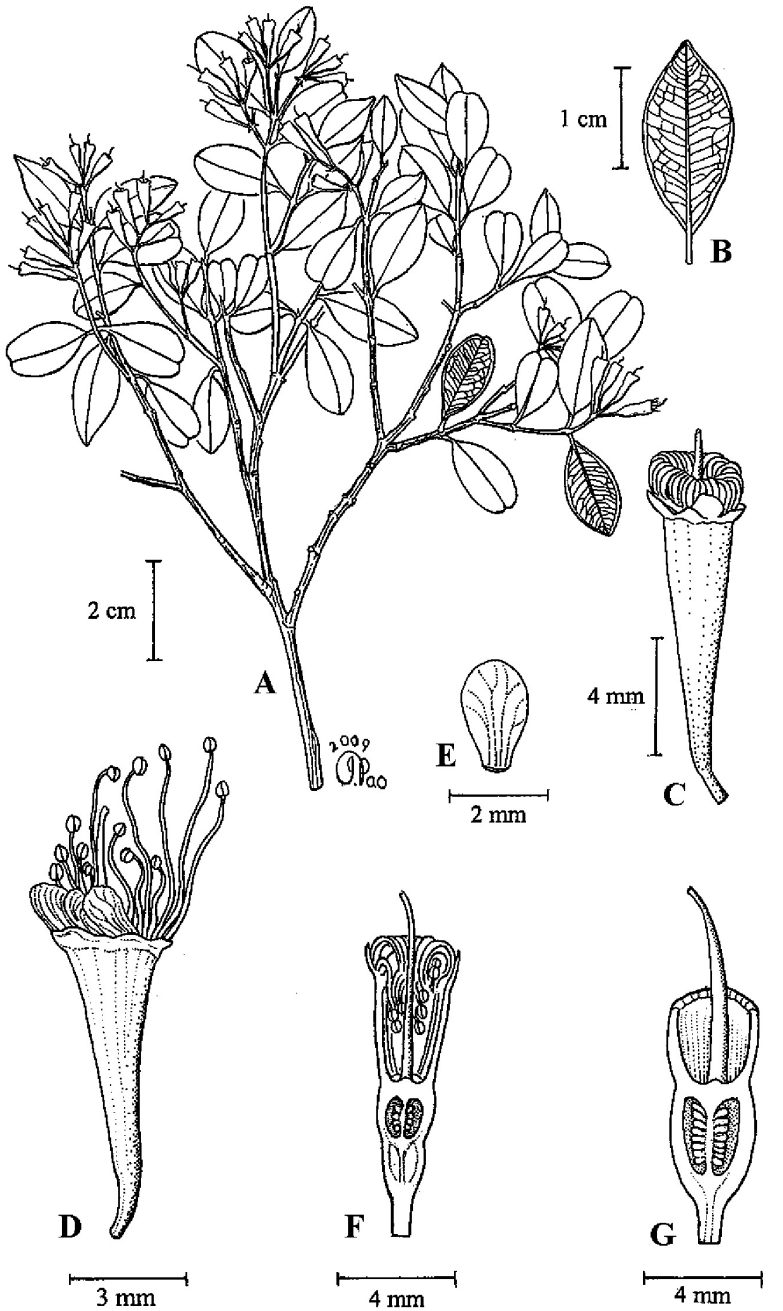


**Fig. 15.** *Syzygium cornuflorum*. A, flowering leafy twigs; B, detailed venation of lower leaf surface; C, flower bud with the petals removed; D, open flower with the petals removed; E, petal; F, longitudinal section of flower bud; G, longitudinal section of open flower with the petals and stamens removed. (A–C from *FRI 41351*, D–G from *A. Zainudin 5028*.)

Small tree *c*. 8 m tall, *c*. 13 cm diameter. **Bark** smooth, greyish; inner bark purplish brown. *Parts glabrous*. **Twigs** *4-ribbed*, *c*. 1 mm diameter apically, slender, dark chocolate-brown. **Leaves** *thinly leathery*, *drying pale grey-brown*, *not or sparsely faintly pitted or dotted*; *blades elliptic*, *1.5–2 × 0.9–1.2 cm*, *base wedge-shaped*, *margin flat*, *apex shortly bluntly acuminate*; *lateral veins slender*, *subequal*, main ones *c*. 10 pairs, ascending, *hardly elevated beneath*, *narrowly furrowed above*; intercostal venation obscure; intramarginal vein close to margin, hardly looped; *petioles slender*, *3–5 mm long*. **Inflorescences** *terminal or subterminal-axillary*, *c. 1 cm long*; rachis very slender, round in cross-section, *hardly branched*. **Flowers:** *buds cornet-shaped*, *c. 5 mm long*, *c. 2 mm diameter*, *tapering throughout*; *calyx lobes 4*, *vestigial*; *stamens c. 25*, exserted to *c*. 5 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 5 mm long. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known only in Sabah from the Bt. Tawai FR, Kinabatangan district (e.g., *Zainuddin 5028*, the type and *SAN 138823*).

**Ecology.** In montane forest on ultramafic substrate at about 1200 m altitude.

**Notes.** This small-leafed species, at once distinguished by its clustered flowers with cornet-shaped calyx, appears to be related to *Syzygium claviflorum* and *S. viridifolium*.

## 39. **Syzygium creaghii** (Ridl.) Merr. & L.M.Perry Plate 5E.

(Charles Vandeleur Creagh, Governor of British North Borneo 1888–1895, and amateur naturalist)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 164; Masamune *op. cit.* 527; Coode *et al.* (eds.) *op. cit.* 236. **Basionym:** *Eugenia creaghii* Ridl., J. Bot. 68 (1930) 14. **Lectotype** (here designated)**:** *Creagh 7*, Borneo, Sabah (K). **Heterotypic synonyms:** *Eugenia woodii auct. non.* Dummes (1912)**:** Merr., J. Str. Br. Roy. As. Soc. 86 (1922) 336, *op. cit.* (1929) 216, *Syzygium woodii* (Merr.) Masam. *op. cit.* 541.

Canopy tree, sometimes exceeding 60 cm diameter. **Bark** thinly flaky, pink-brown. *Young parts glabrous*. **Twigs** *stout*, *round in cross-section*, *pale grey-brown*, sometimes thinly flaky. **Leaves** leathery, *drying dull red-brown above*, *dull ochreous-brown and suede-like beneath*, *with scattered pits above*, *without dots beneath*; *blades narrowly elliptic*, *c. 40 × 11*(*18–45 × 6–16*) *cm*, *base heart-shaped* or rounded, apex acute, acumen broad, blunt; venation slender but equally distinct on both surfaces; *lateral veins prominent beneath*, *hardly unequal*, *c. 30 pairs*, intermediate veins more or less prominent and mostly meeting intramarginal vein, both furrowed above, spreading; intercostal venation almost invisible; *intramarginal vein 1–5 mm within margin*, *looped*; petioles stout, *c.* 6 mm, frequently cream-corky. **Inflorescences** densely few-flowered panicles, terminal, *c.* 2 cm long; rachis 2x-branched, or occasionally cauliflorous on trunk swellings. **Flowers:** *buds broadly torch-shaped*, *c. 21 mm long*, *c. 10 mm diameter* (including *c.* 5 mm stalk); hypanthium *tapering into equally long tapering pseudostalk*; *calyx lobes 4*, large, *rounded*, *thin-margined*, *spreading but not reflexed at anthesis*; stamens many, exserting to 2 cm, *anther locules parallel*; *ovary at the distal end of flower bud*, style to 3 cm long. **Fruits** usually ramiflorous, spherical, *c.* 15 mm diameter (young), grey-brown powdery, with *c*. 10 mm diameter crown of wavy calyx lobes.

**Distribution.** Endemic to Borneo; known in Sabah from Keningau, Kinabatangan, Kota Marudu, Lahad Datu, Pensiangan, Sandakan, Tawau and Tenom districts (e.g., *Jamili SNP 6716*, *Elmer 21361*, *SAN 32700*, *SAN 58500*, *SAN 75702*, *SAN 85015* and *SAN 130152*) and

in C Sarawak from Bt. Mersing, Tatau district (e.g., *S 21929* and *S 22365*). Also recorded in Brunei (e.g., *Dransfield 7148* and *Said 17340*) and E Kalimantan (e.g., *Endert 5237* and *Kostermans 6141*).

**Ecology.** Frequent in mixed dipterocarp forest on clay and sandy clay soil, especially on slopes in moist places; also in upper dipterocarp forest at *c.* 900 m altitude.

## 40. **Syzygium crypteronioides** P.S.Ashton

(Greek, *-oides* = -like; resembling *Crypteronia* Blume (*ubah semut*), Crypteroniaceae)

Kew Bull. 61, 1 (2006) 118. **Type:** *Ilias Paie S 26955*, Borneo, Sarawak, Bt. Senibong, Sempadi FR, Lundu district (holotype K; isotypes L, SAR).

Tree *c.* 11 m tall, *c.* 20 cm diameter. *Parts glabrous*. **Twigs** *c. 5 mm diameter apically*, *round in cross-section*, *smooth*, *yellow-brown*. **Leaves** thickly leathery, *drying satiny rust-brown beneath*, *greenish brown above*, *densely pitted above*, *without distinct dots beneath*; *blades lanceolate*, *20–25 × 6–8 cm*, *base broadly wedge-shaped*, *apex acute*, *acumen tapering gradually*; *lateral veins unequal*, *main ones c. 12 pairs*, *arched and ascending*, *slightly raised beneath*, *narrowly furrowed above*; intercostal venation barely visible, unraised; *intrmarginal vein 4–5 mm within margin*, *slightly looped*; *petioles stout*, *25–40 mm long*, *c.* 4 mm thick, *drying black*. **Inflorescences** *paniculate*, *ramiflorous*, *c. 10 cm long*; rachis 2x-branched; wrinkled on drying. **Flowers** white; *buds club-shaped*, *c. 4 mm long*, *c. 3 mm diameter*; *pseudostalk c. 3 mm long*, tapering, slender at base; *calyx lobes 4*, *broadly ovate*, *c. 1.5 × 2 mm*, subacute, *thick-margined*, clasping and hiding corolla except at apical pore; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known only from the type collection.

**Ecology.** In ecotonal dipterocarp forest–*kerangas.*

## 41. **Syzygium cuneiforme** Merr. & L.M.Perry

(Latin, *cuneus* = a wedge, *formis* = shaped; referring to the base of the leaf blade)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 152; Coode *et al*. (eds.) *op. cit.* 236. **Type:** *Clemens 32188*, Borneo, Sabah, Penibukan, Mt. Kinabalu (holotype K; isotypes BO, L Barcode L 0009419, NY). **Homotypic synonym:** *Eugenia cuneifomis* (Merr. & L.M.Perry) J.A.R.Anderson *op. cit.* (1980) 275.

Canopy tree, to 30 m tall, 60 cm diameter; bole deeply fluted towards base. **Bark** whitish to light brown mottled, becoming thinly flaky; inner bark brown. *Young parts glabrous*. **Twigs** *c. 6 mm diameter apically*, *stout*, *elliptic in cross-section*, smooth, *grey-brown*. **Leaves** *leathery*, *drying* satiny dark greenish brown above, *satiny dark yellow-brown beneath*, sparsely faintly pitted above, *sparsely dotted beneath*; *blades obovate*, *c. 17 × 7*(*14–22 × 7–10*) *cm*, base wedge-shaped, *margin entire*, *apex rounded or acute*; *lateral veins slender*, *subequal*, main ones *c*. 40 pairs, *distinct and slightly raised above*, *less so beneath* and *drying the same colour as the blade*, not furrowed above, spreading; intercostal venation somewhat visible above, invisible beneath; *intramarginal vein close to margin*, *hardly looped*; *petioles c. 15 mm long*. **Inflorescences** *paniculate*, to 10 cm long, terminal; rachis

stout, ridged, ascending; bracts ovate-acute, to 3 × 2 mm, cupped, persistent. **Flowers:** *buds narrowly pear-shaped-obconical*, *to 17 mm long*, *to 8 mm diameter*, *with prominent persistent clawed cupped bracteoles*; *hypanthium tapering into obscure pseudostalk*; *calyx lobes 4*, *short*, *broad*, *triangular*, *narrowly pointed*; *stamens many*, white, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** (young) *ellipsoid*, to 16 mm long, to 10 mm diameter, terminating abruptly at the basal bracteoles and the *c*. 8 mm wide crown of 4 acute calyx lobes.

**Distribution.** Endemic to Borneo; known in Sabah from Kinabatangan, Lahad Datu, Ranau, Sandakan and Tenom districts (e.g., *SAN 17755*, *SAN 42936*, *SAN 83126*, *SAN 131870* and *SFN 26502*) and in Sarawak from Bau, Bintulu, Kuching, Miri, Simunjan and Sri Aman districts (e.g., *S 4629*, *S 16565*, *S 21399*, *S 38622*, *S 39239* and *S 83499*). Also known in Brunei (e.g., *Dransfield JD 7246*) and E Kalimantan (e.g., *Burley et al. 867*).

**Ecology.** In primary mixed dipterocarp forest and secondary forest, mostly but not always on yellow clay and other more fertile soils, including ultrabasics in Sabah; also on limestone in W Sarawak; at altitudes to 1200 m. Apparently always local.

## 42. **Syzygium curtisii** (King) Merr. & L.M.Perry Plate 5F.

(Charles Curtis, 1852–1928, horticulturist who became Superintendent of Gardens and Forests, Penang, 1884–1903, great collector and founder of the Waterfall Gardens)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 182; Coode *et al*. (eds.) *op. cit.* 236; Chantaranothai, Thai For. Bull. (Bot.) 29 (2001) 59; Parnell & Chantaranothai *op. cit.* 847. **Basionym:** *Eugenia curtisii* King *op. cit.* 129, Ridley *op. cit.* (1922) 749, M.R. Henderson *op. cit.* (1949) 174, Kochummen *op. cit.* 188, J.A.R. Anderson *op. cit.* (1980) 275. **Lectotype** (Chantaranothai, 2001)**:** *Kunstler 6149*, Peninsular Malaysia, Perak (K; isolectotype SING). **Heterotypic synonyms:** *Eugenia coralina* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 207, *op. cit.* (1921) 427, *Syzygium coralinum* (Merr.) Masam. *op. cit.* 526; *E. holttumii* Ridl., J. Bot. 62 (1924) 296.

Canopy tree to 25 m tall, to 50 cm diameter; bole fluted towards base; buttresses to 1 m tall, thin, spreading. **Bark** *pink-brown*, thickly flaky to reveal bright orange-brown fresh surfaces; inner bark yellow-brown. *Twigs and inflorescences distinctly minutely purplish scurfy-warty though glabrous*. **Twigs** stout, *round in cross-section*, golden to reddish brown, becoming flaky. **Leaves** thinly leathery, *drying dull grey-greenish above*, *yellow-brown beneath*, *densely minutely but distinctly pitted above*, *densely black dotted beneath*; *blades elliptic-lanceolate*, *c. 10 × 5*(*6–11 × 2.5–6*) *cm*, base wedge-shaped, *margin not or hardly recurved*, *apex caudate*, *acumen c. 1.5 cm long*; *lateral veins slender*, dense, *c*. 26 pairs, *subequal with many intermediate veins*, the main veins equally raised with the midrib towards their bases, *slender but elevated*, *more so below than above*, not furrowed above, somewhat ascending; *intercostal venation hardly visible*; *intramarginal vein 1*, *close to margin*, *hardly looped*; *petioles* short, *c. 5 mm long*. **Inflorescences** paniculate, to 7 cm long, terminal or axillary; rachis round in cross-section. **Flowers** white; *buds club-shaped*, *to 6 mm long*, *to 3 mm diameter*, with round hypanthium *on c. 3 mm slender pseudostalk*, red-brown, rough and wrinkled; *calyx lobes* (*4 or*)*5*, *vestigial*, *to 0.5 × 2 mm*, *shortly triangular*, *free*, *blunt*, *thick*, appressed to the base of the domed corolla, caducous; stamens many, exserting to 3 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to 3 mm long. **Fruits** *subspherical* or bilobed, *c.* 8 mm long, *c.* 12 mm diameter, smooth or slightly ribbed, *with c. 2 mm diameter recurved calyx rim*; *ripening red*.

**Distribution.** Thailand, Sumatra, Peninsular Malaysia, Borneo. In Borneo, recorded in Sabah from Keningau district (e.g., *SAN 52624* and *SAN 113938*) and in Sarawak from Kapit, Kuching, Marudi, Miri and Simunjan districts (e.g., *Haviland 864*, *Noteboom & P. Chai 2139*, *Beaman 11813* and *S 28197*). Also known in Kalimantan (e.g., *Laman 1154* and *Laman 1309*).

**Ecology.** Uncommon, in mixed dipterocarp forest and old secondary forest on yellow sandy soils, occasional in *kerangas*, and upper dipterocarp forest at altitudes to 1200 m.

## 43. **Syzygium dasyphyllum** Merr. & L.M.Perry

(Greek, *dasy-* = stout, *phullon* = leaf; referring to the thickly leathery leaf blade)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 153. **Type:** *Clemens 31899*, Borneo, Sabah, Marai Parai, Mt. Kinabalu (holotype A; isotypes BO, L Barcode L 0009613, NY).

Tree. *Parts glabrous*. **Twigs** *stout*, *c. 3 mm diameter apically*, *round in cross-section*, smooth to minutely cracked, *rich red-brown*. **Leaves** *thickly leathery*, densely pitted above, *prominently gland-dotted beneath*, drying dull purplish brown above, chocolate-brown beneath; *blades elliptic to ovate*, *c. 13 × 12*(*12–22 × 7–16*) *cm*, *base obtuse or broadly wedge-shaped*, apex shortly abruptly bluntly acuminate; *lateral veins unequal*, *main ones 9–11 pairs*, raised throughout more so beneath, *shallowly furrowed above*, spreading; *intercostal venation obscure*; *intramarginal veins 2 pairs*, *the main one 5–7 mm within margin*, *looped*; petioles 4–8 mm long, very stout, drying blackish, narrowly flanged at twig insertion. **Inflorescences** *paniculate*, *axillary to ramiflorous*, *c. 5 cm long*; rachis stout, singly branched. **Flowers:** *buds jambu-shaped*, *c. 12 mm long*, *c. 10 mm diameter*, *without distinct pseudostalk*; *calyx lobes 4*, *ovate-acute*, *c. 4 × 4 mm*, *clasping the corolla then spreading and becoming reflexed at anthesis*; stamens many, exserted to 6 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 8 mm long. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known so far from Mt. Kinabalu; local in valleys (e.g., *Beaman 8148*, *Beaman 9865*, *SAN 21026* and *SAN 44681*).

**Ecology.** In the lower facies of upper montane forest at 900–2300 m altitude, apparently only on ultrabasic substrates.

## 44. **Syzygium durifolium** Merr. & L.M.Perry

(Latin, *durus* = hard, *folium* = leaf; referring to the texture and raised venation of the leaf blade)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 176. **Type:** *bb 17082*, Borneo, Kalimantan, de Mol, Semitau (holotype BO; isotype A). **Heterotypic synonym:** *Syzygium hallieri* Merr. & L.M.Perry *op. cit.* (1939) 176, ***syn. nov.*****, type:** *Hallier 1646*, Borneo, Kalimantan, G. Kenepai (holotype BO; isotypes L Barcode L 0009430, SING).

Canopy tree. *Young parts glabrous*. **Twigs** *c*. 3 mm diameter apically, *round* or *elliptic in cross-section*, *warm yellow-brown*, somewhat papery flaky. **Leaves** *thinly leathery*, *drying dull grey-brown above*, *dull ochreous and obscurely gland-dotted beneath*; *blades elliptic-ovate*, *c. 11 × 5*(*9–12 × 3–7*) *cm*, *base wedge-shaped*, margin recurved, apex shortly acuminate; *lateral veins unequal*, *main ones c. 11 pairs*, *distinct but hardly and equally*

*raised on each surface*, *not furrowed above*, spreading; *intercostal venation very distinct and reticulate on both surfaces*; *intramarginal veins 2*, *main one well within margin*, *looped*; *petioles c. 12 mm long*. **Inflorescences** *paniculate*, few-flowered, axillary, *c.* 3 cm long; rachis quadrangular in cross-section, hardly branching. **Flowers:** *buds goblet-shaped*, *to 12 mm long*, *to 6 mm diameter*, *distinctly glandular*, *sparsely warty on a tapering pseudostalk*; *calyx lobes 4*, *broadly ovate-triangular*, *c. 2 × 3 mm*, the inner 2 somewhat larger, acute, *cupped*, *spreading but not becoming reflexed at anthesis*; stamens many; *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted *c.* 6 mm long. **Fruits** unknown.

**Distribution.** Endemic to Borneo; recorded in Sabah from Bongawan FR, Papar district (e.g., *Abd. Rahim SAN A 396*) and in Sarawak from Semengoh FR, Kuching district (e.g., *S 37796* and *S 44084*). Also known in Brunei (e.g., *S 4866*) and W Kalimantan (e.g., *Zulkarnain 373*, *Hallier 1646* and *bb 17082*).

**Ecology.** Rare, in mixed dipterocarp forest on leached yellow sandy soils.

**Notes.** The Sabah and Sarawak collections, though matching the type in vegetative characters, differ in their smaller (*c.* 6 × 4 mm) more sparsely warty flower buds.

## 45. **Syzygium elliptilimbum** (Merr.) Merr. & L.M.Perry

(Latin, *ellipticus* = elliptic, *limbus* = blade; referring to the elliptic leaf blade)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 187; Masamune *op. cit.* 527; Coode *et al*. (eds.) *op. cit.* 236. **Basionym:** *Eugenia elliptilimba* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 211, *op. cit.* (1921) 428, J.A.R. Anderson *op. cit.* (1980) 275. **Type:** *Native Collector 254*, Borneo, Sarawak, *loc. incert.* (holotype PNH, (?) destroyed; isotypes A, K, L Barcode L 0009423, SING).

Canopy tree to 40 m tall, *c.* 1 m diameter, with low thin buttresses. **Bark** *smooth*, mauve-brown; inner bark red-brown. *Parts glabrous*. **Twigs** stout, *elliptic in cross-section*, smooth or cracked near nodes, *dark red-brown*. **Leaves** *thinly leathery to papery*, *drying wavy*, *more or less glistening on both surfaces*, *purplish brown above*, *duller rich red-brown beneath*, *pits above invisible*, *obscurely but densely pimpled on both surfaces*, *without gland-dots beneath*; *blades elliptic*, *c. 15 × 6.5*(*13–25 × 3.5–10*) *cm*, *base broadly wedge-shaped or rounded hardly tapering toward petiole*, apex acuminate, acumen *c.* 1 cm long; *lateral veins well spaced*; *unequal*, *with unequal intermediate veins*, *main ones 12–16 pairs*, *slender but distinctly raised on both surfaces*, *somewhat more so beneath as also the intercostal venation*, *not furrowed above*, *spreading*; *intramarginal veins 2*, *the main one 3–5 mm within margin*, *not prominently looped*; petioles stout, *c.* 9 mm long. **Inflorescences** *paniculate*, *terminal* or *subterminal-axillary*, to 13 cm long; rachis *c.* 3 mm diameter, slender, round in cross-section, much-branched; *bracteoles early caducous*. **Flowers** white; *buds obconical*, *4–6 mm long*, *2–3 mm diameter*, slender, *tapering into slender pseudostalk*; *calyx lobes vestigial*, *hemispherical*, *falling at anthesis* with their bases appressed in a rim round the corolla dome before anthesis; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to *c.* 4 mm long, slender. **Fruits** *spherical*, *c.* 12 mm diameter, smooth, *with c. 7 mm diameter calyx rim of short acute lobes*.

**Distribution.** Endemic to Borneo; known in Sabah from Keningau, Kinabatangan, Lahad Datu, Ranau, Sandakan and Tawau districts (e.g., *SAN 25333*, *SAN 38179*, *SAN 73069*, *SAN 97539*, *SAN 113019* and *SAN 128247*) and in Sarawak from Belaga, Bintulu, Kuching,

Lundu, Miri and Song districts (e.g., *Haviland 1987*, *S 34253*, *S 34980*, *S 39011*, *S 39023*, *S 39074*, *S 39121*, *S 39174* and *S 59463*). Also recorded from E Kalimantan (e.g., *Kostermans 7301* and *Kostermans 7666*).

**Ecology.** Locally common in mixed dipterocarp and secondary forest on yellow sandy soils, and primary and secondary mixed peat swamp forest, at low altitude.

## 46. **Syzygium elopurae** (Ridl.) Merr. & L.M.Perry

(of Elopura, the early name for Sandakan, Borneo, Sabah)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 177; Masamune *op. cit.* 528. **Basionym:** *Eugenia elopurae* Ridl., J. Bot. 68 (1930) 15, Burgess *op. cit.* 412. **Type:** *Creagh s.n.*, Borneo, Sabah, Sandakan (holotype K). **Heterotypic synonyms:** *Eugenia ambongensis* Ridl. *op. cit.* (1930) 16, *Syzygium ambongense* (Ridl.) Masam. *op. cit.* 523.

Tree. *Parts glabrous*. **Twigs** *c. 3 mm diameter apically*, *stout*, *round in cross-section*, smooth, *red-brown*. **Leaves** *leathery*, with scattered shallow pits above, *minutely white-dotted beneath*, *drying dull grey-green above*, *distinctly matt greenish to pinkish brown beneath*; *blades ovate-lanceolate*, *c. 14 × 5*(*9–20 × 3–9*) *cm*, *base wedge-shaped*, apex acuminate, acumen *c.* 2 cm long, slender, tapering; *lateral veins unequal*, main ones *c.* 10 pairs, *raised on both surfaces*, *more prominently so beneath*, *more or less shallowly furrowed above*, *somewhat ascending*; *intercostal venation more or less obscure*; *intramarginal veins* (*1 or*)*2*, *3–6 mm within margin*, *looped*; *petioles c. 11 mm long*. **Inflorescences** *racemose*, *densely flowered*, *terminal or axillary*, *c. 5 cm long*; rachis slender, round in cross-section, flower buds *c.* 3 at branch endings. **Flowers:** *buds club-shaped*, *c. 6 mm long*, *c. 3 mm diameter*, *with distinct slender pseudostalk* at least equal to hypanthium at anthesis; *calyx lobes 4*, *ovate*, subacute, *c. 2 × 2 mm*, *small but distinct*, *cuppewd and thick to exposed margins*, clasping corolla; stamens many, exserted to 6 mm long at anthesis, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 8 mm long. **Fruits** *spherical*, *c.* 17 mm diameter, smooth or shallowly ribbed, *with 4 mm diameter rim or erect crown of calyx lobes*.

**Distribution.** Endemic to Borneo; confined to Sabah, recorded from Beaufort, Kudat, Lahad Datu, Sandakan, Semporna, Sipitang and Tambunan districts (e.g., *SAN 16310*, *SAN 26362*, *SAN 30875*, *SAN 31727*, *SAN 34681*, *SAN 48180*, *SAN 72257*, *SAN 126622* and *SAN 135075*).

**Ecology.** Lowland forest, on ultramafic substrate in Kinabalu NP; rare and probably endangered.

## 47. **Syzygium erythranthum** Merr. & L.M.Perry

(Greek, *erythro* = red, *anthos* = flower; referring to the red stamens)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 166; Beaman & C. Anderson *op. cit.* 215. **Type:** *Clemens 33950*, Borneo, Sabah, Colombon R., Mt. Kinabalu (holotype A; isotypes BM, BO, L Barcode L 0009620, NY, SING).

Tree. *Young parts glabrous*. **Twigs** *c.* 3 mm diameter apically, stout, *round to obscurely angled in cross-section*, *distinctly cream-gold*, smooth. **Leaves** *leathery*, pitted above,

sparsely pimpled beneath, drying glistening tawny brown above, dull honey-brown beneath; *blades elliptic*, *7–16 × 3.5–7.5 cm*, *base abruptly broadly wedge-shaped*, *apex cuspidate*, *acumen c. 2 mm long*, *blunt*; *lateral veins unequal*, *main ones c. 10 pairs*, unraised above, hardly so beneath, spreading; *intercostal venation obscure*; *intramarginal veins 2 pairs*, *the main one c. 2 mm within margin*, *hardly looped*; petioles stout, *c.* 4 mm long, *c.* 3 mm diameter, drying black. **Inflorescences** *paniculate*, terminal or subterminal-axillary, *c.* 8 cm long; rachis stout, 1x-branched, ascending. **Flowers:** *buds narrowly obconical*, *c. 15 mm long*, *c. 8 mm diameter*, *without distinct pseudostalk*; *calyx lobes 4*, *ovate-acute*, *c. 2 × 2 mm*, *with hyaline margins*, *becoming rotate at anthesis*; *stamens many*, *brilliant crimson*, exserted to 14 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to 15 mm. **Fruits** ellipsoid or spherical, *c.* 22 mm long, *c.* 20 mm diameter, smooth, slightly tapering into a *c*. 1 mm stalk, with *c.* 12 mm diameter crown of prominent erect or repand calyx lobes.

**Distribution.** Endemic to Borneo; known only from Mt. Kinabalu, Sabah (e.g., the type, *Lugas LL 8*, *SFN 26680* and *SAN 46516*).

**Ecology.** In upper montane forest at 2100–2400 m altitudes, apparently rare.

## 48. **Syzygium eugeniforme** P.S.Ashton

(Latin. *forma* = shape; with leaf, twig and flower resembling those of *Eugenia reinwardtiana*)

Kew Bull. 61, 1 (2006) 118. **Type:** *Ilias Paie S 26308*, Borneo, Sarawak, Sg. Belaban, Lawas district (holotype K; isotypes L, SAR, SING).

Subcanopy tree. **Twigs** *round in cross-section*, *cream-white*. **Leaves** densely distinctly dotted beneath; *lateral veins unequal*, *main ones c. 9 pairs*; intermediate lateral veins irregularly placed, slender but raised beneath, *furrowed* or slightly raised *above*; intercostal venation dense, evident and slightly raised beneath. **Flowers** white, *in dense axillary clusters*, on *c.* 6 mm long cream peduncles; *buds jambu-shaped*, *c. 15 mm long*, *c. 10 mm diameter*, large, slightly constricted above the tapering pseudostalk; *calyx lobes 4*, *broadly ovate*, *c. 6 × 7 mm*, subacute, *spreading and becoming reflexed at anthesis*; stamens many, exserted to 15 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 18 mm long. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known only in Sarawak from Lawas district (e.g., the type, *S 26354* and *S 26360*).

## 49. **Syzygium faciflorum** P.S.Ashton Fig. 16.

(Latin, *fax* = the torch carried by the marathon runners, *flos* = a flower; referring to the torch-shaped flower bud)

Kew Bull. 61, 1 (2006) 118. **Type:** *J.A.R.Anderson & Ilias S 26472*, Borneo, NE Sarawak, Mt. Murud, Lawas district (holotype K; isotypes L, SAR, SING).

Gnarled tree or shrub, sometimes *c.* 10 m tall, usually smaller. *Young parts glabrous*. **Twigs** *c.* 2 mm diameter apically, *round in cross-section*, *smooth*, dark grey-brown. **Leaves** thickly leathery, dull, *drying yellowish brown*, *densely more or less obscurely dotted beneath*, *grey-*

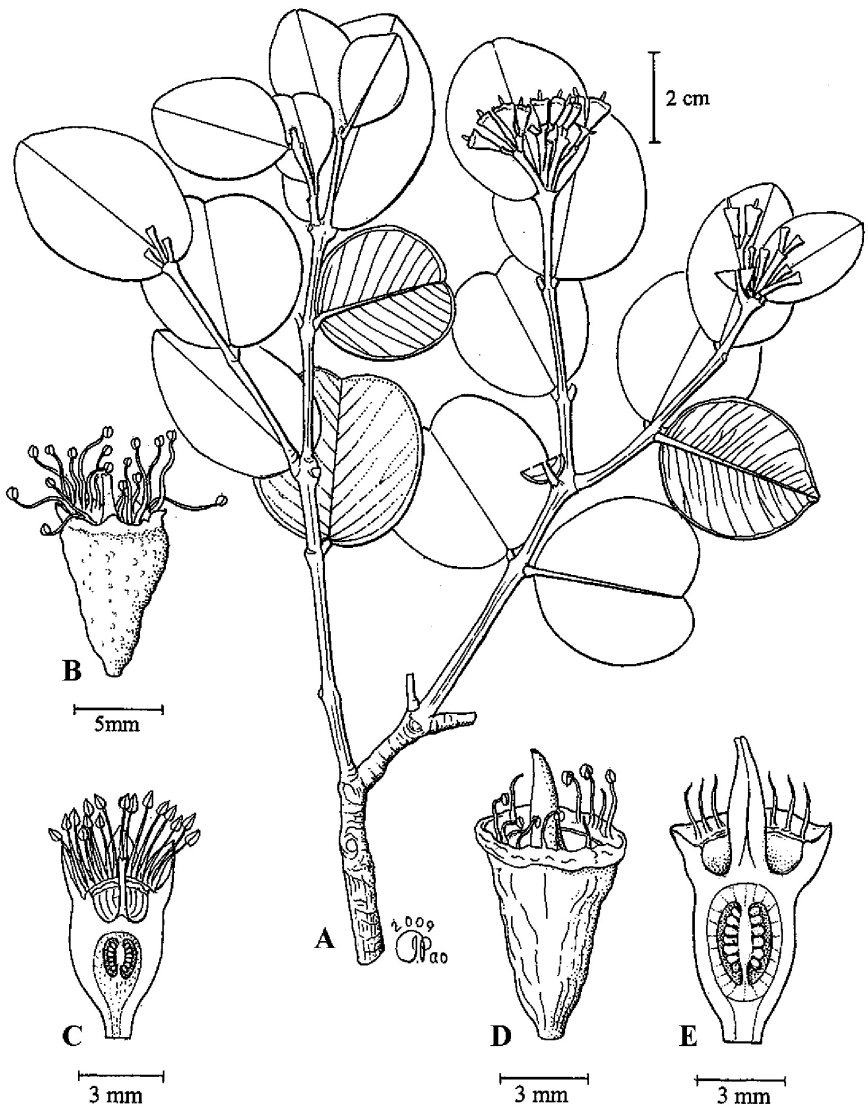


**Fig. 16.** *Syzygium faciflorum*. A, flowering leafy twig; B, open flower with the petals removed; C, longitudinal section of open flower with petals removed; D, young fruit; E, young fruit in longitudinal section. (A from *S 50993*, B from *S 50884*, C from *S 51167*, D–E from *S 50993*.)

*green pitted above*; *blades broadly ovate to elliptic*, *2–5 × 1–4 cm*, base heart-shaped to rounded, *margin slightly recurved*, apex rounded or notched, sometimes bluntly subacuminate; *lateral veins dense*, *unequal*, *hardly bluntly raised and more or less obscure beneath*, *obscure and not furrowed above*, main ones *c.* 8 pairs; *intercostal venation obscure*; *intramarginal veins obscure*, *close to margin*, *hardly looped*; petioles stout, *c.* 1 mm long. **Inflorescences** *paniculate*, *terminal*, *sometimes subterminal-axillary*, *c.* 4 cm long; rachis quadrangular in cross-section, 1x- or sparsely 2x-branched, branches concentrated towards endings, bearing many densely congested flowers. **Flowers** dark red; *buds torch-shaped*, *c. 10 mm long*, *c. 5 mm diameter*, *with c. 8 mm slender tapering pseudostalk*; hypanthium swollen; *calyx lobes 4*, *vestigial*, forming a rim round the domed corolla, pale and prominently wrinkled on drying; stamens many, filaments white, exserted to *c*. 5 mm at anthesis, *anther locules parallel*, *yellow*; *ovary at the distal end of flower bud*, style exserted to 5 mm long. **Fruits** (young) cornet-shaped, smooth, shortly pedicellate, with prominent expanding crown of calyx lobes, apparently similar to that of *Syzygium ampullarium* but smaller.

**Distribution.** Endemic to Borneo; recorded in Sabah from Kota Belud and Ranau districts (e.g., *Jacobs 5776*, *Clemens 27524*, *SAN 29187* and *SAN 68568*) and in Sarawak from Lawas, Marudi and Miri districts (e.g., the type, *Beaman & C. Anderson 11446*, *S 26385*, *S 26406*, *S 44467*, *S 50884*, *S 50993*, *S 51167* and *S 90354*).

**Ecology.** Locally common in upper montane forest at 1780–2500 m altitudes.

## 50. **Syzygium fastigiatum** (Blume) Merr. & L.M.Perry

(Latin, *fastigiatus* = bunched like a bundle of twigs; referring to the form of the terminal inflorescence)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 152; Coode *et al.* (eds.) *op. cit.* 236; Parnell & Chantaranothai *op. cit.* 851; Beaman & C. Anderson *op. cit.* 216. **Basionym:** *Calyptranthus fastigiata* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1090. **Type:** *Blume s.n.*, Java (holotype L; isotypes K, NY). **Homotypic synonyms:** *Caryophyllus fastigiatus* (Blume) Blume *in* DC. Prodr. 3 (1828) 262, *Eugenia fastigiata* (Blume) Koord. & Valeton *op. cit.* (1900) 104, M.R. Henderson *op. cit.* (1949) 190, Kochummen *op. cit.* 191, J.A.R. Anderson *op. cit.* (1980) 275. **Heterotypic synonyms:** *Calyptranthus floribunda* Blume *op. cit.* (1827) 1091, *Caryophyllus floribundus* (Blume) Blume *in* DC *op. cit.* 262; *Eugenia bracteolata* Wight, Ill. 2 (1841) 15, Duthie *in* Hooker *f. op. cit.* 488, King *op. cit.* 122, Ridley *op. cit.* (1922) 747, *Acmena bracteolata* (Wight) Walp., Rep. 2 (1843) 181, *Syzygium bracteolatum* (Wight) Masam. *op. cit*. 524; *E. confertiflora auct. non* A. Gray: Koord. & Valeton *op. cit.* 106, Merrill *op. cit.* (1921) 427, *Syzygium confertiflorum* (Koord. & Valeton) Masam. *op. cit.* 526; *E. sablanensis* Elmer, Leafl. Philip. Bot. 1 (1908) 328; *E. bibracteata* Greves, J. Bot. 61, Suppl. (1923) 18, *S. bibracteatum* (Greves) Merr. & L.M.Perry, J. Arn. Arb. 23 (1942) 249; *E. chloroleuca auct. non* King (1901): Ridl., J. Bot. 68 (1930) 35; *E. elmeri* Merr., PEB (1929) 218, *S. elmeri* (Merr.) Masam. *op. cit.* 528.

Main canopy tree to 25 m tall, *c.* 70 cm diameter. **Bark** pale buff to grey-brown, smooth or papery flaky; inner bark pale red-brown. *Young parts glabrous*. **Twigs** *c*. *2 mm diameter apically*, *round-compressed*, *bluntly quadrangular* or *with 4 slender but distinct sometimes twisted ribs in cross-section*, *yellowish brown*, usually smooth. **Leaves** *thinly leathery*, *wrinkled on drying*, *dull pale greenish tawny above*, *pale yellow-brown beneath*, densely pitted above, *obscurely or more prominently* (*juveniles*) *pimpled beneath*; *blades narrowly obovate*, *c. 12 × 5.5*(*6–15 × 3–6*) *cm*, base wedge-shaped tapering into petiole, *margin entire*, *apex rounded to shortly bluntly acuminate*; midrib sharply prominent beneath;

*lateral veins* dense, *subequal*, *c.* 25 pairs, *visible but hardly raised though more so beneath than above and with the midrib drying darker than the blade*, minutely furrowed above, spreading; intercostal venation visible beneath, obscure above; *intramarginal vein 1*, *hugging margin*, *hardly looped*; *petioles c. 11 mm long*. **Inflorescences** *paniculate*, terminal or subterminal-axillary, *c.* 10 cm long but very variable; rachis slender, ascending, 3x-branched; *bracts triangular*, *clawed*, *c.* 3 × 2 mm, prominent, *subpersistent*. **Flowers:** *buds narrowly obovoid*, *to 7 mm long*, *to 3 mm diameter*, *tapering from apex to base with indistinct pseudostalk*, broadening towards apex; *calyx lobes 4*, *short*, *broadly triangular*, erect, *falling to leave a many-toothed rim*; *bracteoles* 2, *prominent*, *cupped*, *persistent*; *stamens many*, *c.* 8 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting *c*. 4 mm. **Fruits** *obovoid*, *c*. 10 mm long, *c.* 5 mm diameter, *pale yellow-green*, slightly tapering to a shortly toothed calyx rim.

**Distribution.** Widespread in Indo-Burma and W Malesia including throughout Borneo. In Sabah known from most districts (e.g., *SAN 24960*, *SAN 25218*, *SAN 36441*, *SAN 42909*, *SAN 51956*, *SAN 65303*, *SAN 74454*, *SAN 87154*, *SAN 99383*, *SAN 117586* and many others and in Sarawak from Belaga, Bintulu, Kapit, Limbang, Lundu, Marudi, Miri, Song, Sri Aman and Tatau districts (e.g. *S 4225*, *S 19175*, *S 22332*, *S 39024*, *S 42603*, *S 44676*, *S 48989*, *S 64961*, *S 70814* and *S 81316*). Also recorded in Brunei (e.g., *Wong 190*, *Coode MC 6897*, *BRUN 15081*, *BRUN 15304* and *Prance 30599*) and W, C and E Kalimantan (e.g., *Burley 837*, *Wiriadinata 1340*, *Church 2404* and *Kostermans 21288*).

**Ecology.** Locally common in secondary forest and primary mixed dipterocarp forest on yellow sandy soils in the lowlands, and in upper dipterocarp forest at altitudes between 600–1500 m, to 2100 m on Mt. Kinabalu; including on ultrabasic substrates in Sabah.

## 51. **Syzygium filiforme** (Wall. *ex* Duthie) Chantar. & J.Parn. Plate 6A.

(Latin, *filiformis* = thread-like; referring to the slender pseudostalk of the flower bud)

Kew Bull. 48 (1993) 58, *op. cit.* (1994) 61; Parnell & Chantaranothai *op. cit.* 853. **Basionym:** *Eugenia filiformis* Wall. *ex* Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 478, Ridley *op. cit.* (1922) 740, Burkill *op. cit.* 967, M.R. Henderson *op. cit.* (1949) 145, Kochummen *op. cit.* 191. **Type:** *Wallich 3580*, Singapore, 1822 (holotype K). **Heterotypic synonyms:** *Eugenia capillaris* Wall., Cat. (1831) 3578, Penang, *nom. nud.*; *E. clavimyrtus* Koord. & Valeton var. *minor* Koord. & Valeton *op. cit.* 112; *Syzygium paraiense* Merr. & L.M.Perry *op. cit.* (1939) 169, Beaman & C.Anderson *op. cit.* 222; ***syn. nov.*, type:** *Clemens 32277*, Borneo, Sabah, Mt. Kinabalu, Marai Parai (holotype A; isotypes BM, BO, L Barcode L 0009659, NY).

Canopy tree, *c.* 20 m tall, *c.* 30 cm diameter, hardly buttressed. **Bark** smooth, dappled white, grey-brown and blackish; inner bark pink. *Young parts glabrous*. **Twigs** *c.* 2 mm diameter apically, slender, *round in cross-section*, *grey-brown*, smooth. **Leaves** thinly leathery, *densely black gland-dotted beneath*, *drying glistening grey-green throughout*, in *subsp. paraiense* often wrinkled; *blades elliptic-lanceolate*, *c.* 7 × 2.2(3–9 × 0.8–3.5) cm, base wedge-shaped tapering into petiole, *margin entire*, *apex acuminate*, *acumen slender*, *c. 2 cm long*; *lateral veins subequal*, *including the intermediate veins c. 30 pairs*, *distinct* but *very slender*, *elevated throughout*, spreading; *intercostal venation distinct*, *reticulate throughout*; *intramarginal veins 2 pairs*, *near margin but looped*; petioles slender, *c.* 6 mm long. **Inflorescences** *paniculate*, *6–10 cm long*, terminal, axillary to ramiflorous; rachis slender, to 2 mm diameter, angular in cross-section, 2–3x-branched. **Flowers:** *buds typically spindle-shaped*, *sometime spherical 10–15 mm long*, *2–4 mm diameter*; hypanthium *c.* 2 mm diameter, *on c. 8 mm filiform pseudostalk with or without distinct medial swelling*; calyx

lobes 4, ovate-acute, *c.* 2 × 2 mm, hyaline along margins, cupped against corolla, becoming reflexed at anthesis; stamens many, *anther locules parallel*; *ovary in a medial swelling of the pseudostalk*. **Fruits** ellipsoid-ovoid, 10–15 mm long, 8–12 mm diameter, smooth, with prominent patent apical calyx lobes; pedicel *c.* 5–7 mm long, slender.

**Distibution.** Thailand, Peninsular Malaysia, Singapore, W Java and Borneo.

**Ecology.** In lowland to lower montane forest at altitudes to 1500 m. In Borneo, often found in forest on ultramafic substrates.

**Notes.** Two subspecies are recognised.

**Key to subspecies**

Leaves not wrinkled on drying. Inflorescences terminal, axillary or ramiflorous, to 6 cm long; rachis slender, 2x-branched. Flower buds *c.* 10 mm long, *c.* 2 mm diameter, without distinct medial swelling. Fruits *c.* 15 mm long, *c.* 12 mm diameter; pedicel *c.* 7 mm long….....

subsp. **filiforme**

Widespread in Thailand, Peninsular Malaysia, Singapore, Brunei and W Java. In lowland and lower montane forest.

Leaves often wrinkled on drying. Inflorescences terminal, to 10 cm long; rachis stout, *c.* 2 mm diameter, 3x-branched, each branch 2-flowered. Flower buds *c.* 15 mm long, *c.* 4 mm diameter, with distinct medial swelling. Fruits (young) *c.* 10 mm long, *c.* 8 mm diameter; pedicel *c.* 5 mm long……..

subsp. **paraiense** (Merr. & L.M.Perry) P.S.Ashton, ***stat. nov.***

Basionym: *Syzygium paraiense* Merr. & L.M.Perry *op. cit.* (1939) 169, Beaman & C.Anderson *op. cit.* 222. Type: *Clemens 32277*, Borneo, Sabah, Mt. Kinabalu, Marai Parai (holotype A; isotypes BM, BO, L, NY).

Endemic to Borneo. In Sabah confined to Mt. Kinabalu and surrounding area in lower montane forest at 1200–1500 m, sometime over ultramafic substrates (e.g., *Clemens 40367*, *SAN 49307*, *SAN 49628*, *SAN 56251*, *SAN 60770* and *SAN 78688*), and in Sarawak recorded from Pulong Tao NP, Marudi district (e.g., *S 97849* and *S 98030*).

## 52. **Syzygium flagrimonte** P.S.Ashton

(Latin, *flagro* = burned, *mons* = mountain: Latinisation of G. Api in Sarawak, the type locality)

Gard. Bull. Sing. 61, 1 (2009) 9. **Type:** *Argent & Jermy 1017*, Borneo, Sarawak, G. Api, Mulu NP, Sarawak, summit ridge (holotype A; isotypes L, SING).

Shrub. *Young parts glabrous*. **Twigs** *c.* 1 mm diameter apically, *round in cross-section*, wrinkled, *drying blackish*. **Leaves** thinly leathery, *black dotted beneath*, *pitted above*, drying pale ochreous brown; *blades elliptic*, *1.5–3 × 1–2.2 cm*, base wedge-shaped, *margin entire not undulate*, *apex obtuse to subacuminate*; *lateral veins dense*, *subequal*, main ones 8–10 pairs, ascending, *obscure above*, *slender* but *distinctly elevated beneath*; intercostal venation obscure; *intramarginal vein within 1 mm of margin*; *petioles* slender, *c. 4 mm long*, drying black. **Inflorescences** *paniculate*. **Flowers** (post-anthesis) *c. 11 mm long*, *c. 4 mm diameter*, pale drying buff; *hypanthium c. 3 × 3 mm*, *tapering into a c. 1 mm diameter*

*slender pseudostalk*; *calyx lobes 4*, *deltoid*, *c. 0.8 × 0.8 mm*, *small but distinct around the calyx rim*; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted *c.* 4 mm. **Fruits** unknown.

**Distribution and ecology.** Endemic to Borneo; known only from the type, in upper montane forest on the exposed karst and rocky summit ridge of G. Api (fire mountain), Mulu NP, Sarawak at *c.* 1600 m altitude.

## 53. **Syzygium formosum** (Wall.) Masam.

(Latin, *formosus* = beautiful; referring to the large pink flowers)

EPB (1942) 528; Chantaranothai & Parnell *op. cit.* 62; Parnell & Chantaranothai *op. cit.* 853. **Basionym:** *Eugenia formosa* Wall., Pl. As. Rar. 2 (1831) 6, *t.* 108, Duthie *in* Hooker *f. op. cit.* 471, King *op. cit.* 80, Ridley, J. Str. Br. Roy. As. Soc. 79 (1918) 64, J. Fed. Mal. State Mus. 10 (1920) 90, Merrill *op. cit.* (1921) 428, Craib, Fl. Siam. Enum. 1 (1931) 641. **Homotypic synonym:** *Jambosa formosa* (Wall.) Walp., Repert. Bot. Syst. 2 (1843) 191, A.M. Cowan & Cowan, Trees North Bengal (1929) 66. **Type:** *Wallich 3609* (= Herb. East India Co.), Northern Pen. Myanmar, Martaban, Attaran (holotype K). **Heterotypic synonyms:** *Eugenia ternifolia* Roxb. [Hort. Bengal. (1814) 37, *nom. nud.*], Fl. Ind. edition Carey 2 (1832) 489, *Jambosa ternifolia* (Roxb.) Walp. *op. cit.* 9, plate 7, *E. formosa* Wall. var. *ternifolia* (Roxb.) Duthie *in* Hooker *f. op. cit.* 471, Craib *op. cit.* 641; *J. mappacea* Korth., Ned. Kruidk. Arch. 1 (1847) 200, *Syzygium mappaceum* (Korth.) Merr. & L.M.Perry *op. cit.* (1939) 164, ***syn. nov.***, **type:** *Korthals s.n.*, Borneo, Kalimantan, *loc. incert.* (holotype L Barcode L 0009653); *J. insignis* Blume *op. cit.* (1850) 100, *S. insigne* (Blume) Merr. & L.M.Perry *op. cit.* (1939) 163, Masamune *op. cit.* 530, ***syn. nov.***, **type:** *Korthals s.n.*, Borneo, Kalimantan, Martapura (holotype L Barcode L 0009632); *E. pseudoformosa* King *op. cit.* 83, Ridley *op. cit.* (1922) 725, M.R. Henderson *op. cit.* (1949) 69, Kochummen *op. cit.* 211, *S. pseudoformosum* (King) Merr. & L.M.Perry *op. cit.* (1939) 165, Chantaranothai & Parnell *op. cit.* (1994) 98, Turner *op. cit.* (1996) 381, Coode *et al.*(eds.) *op. cit.* 239, Parnell & Chantaranothai *op. cit.* 890, ***syn. nov.***, **lectotype** (Chantaranothai & Parnell, 1994)**:** *King's Collector 3401*, Peninsular Malaysia, Perak, Larut (K); *E. lilacina* Merr. *op. cit.* (1929) 219, *S. lilacinum* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 165, Masamune *op. cit.* 530, ***syn. nov.***, **type:** *Elmer 21280*, Borneo, Sabah, Tawau (holotype UC; isotypes A, K, L, NY, U).

Small understorey tree. **Bark** pale ochreous brown smooth, with green scrape. *Parts glabrous*. **Twigs** *at least 3 mm diameter apically*, *cream-white*, *round in cross-section*, *stout*, *smooth*. **Leaves** papery, *dull red-brown above*, *rich rust-brown beneath*, prominently pitted above, sparsely obscurely dotted beneath; *blades lanceolate*, *c. 26 × 8*(*12–27 × 4–9*) *cm*, *base heart-shaped or rounded abruptly ending into the petiole*, apex acuminate, acumen prominently tapering; *lateral veins unequal*, *main ones c. 14 pairs*, *raised on both surfaces but more so beneath*, ascending, *furrowed above*; intercostal venation distinct beneath, obscure above; *intramarginal veins 2*, *the main vein well within margin*, *looped*; *petioles c. 8 mm long*, *cream*, *corky wrinkled*. **Flowers** *in terminal or axillary clusters, pale pink*; peduncle of variable length; *buds jambu-shaped*, *to 13 × 9 mm*, *tapering into pseudostalk*; hypanthium to 20 × 15 mm at anthesis, large, tapering from apex into stalk; *calyx lobes 4*, *hemispherical*, *c. 4 × 6 mm*, *obtuse*, *unequal and overlapping at base*, *spreading and becoming reflexed at anthesis into a ring c. 35 mm diameter*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style prominent. **Fruits** ellipsoid or hemispherical, to 25 × 20 mm, tapering to base, with prominent calyx crown surrounding a central cavity.

**Distribution.** Peninsular Myanmar, Peninsular Thailand, Peninsular Malaysia, Java and Borneo. In Borneo widespread but apparently uncommon, recorded in Sabah from Lahad Datu, Penampang, Sandakan, Sipitang and Tawau districts (e.g., *SAN 15503*, *SAN 72335*,

*SAN 115503* and *SAN 126458*) and in Sarawak from Kuching and Serian districts (e.g., *Brooke 702*). Also known in Brunei (e.g., *Kirkup 613*, *Nielsen & Balslev 1010*, *Forman LLF 1178* and *BRUN 18507*) and Kalimantan (e.g., *Chai ITTO/BA 343* and *Kartawinata 883*).

**Ecology.** In moist valleys and by streams in mixed dipterocarp forest, on both sandy and clay soils at low altitude.

## 54. **Syzygium fossiramulosum** P.S.Ashton

(Latin, *fossa* = a ditch, *ramulosus* = twigged; referring to the grooved twigs)

Kew Bull. 61, 1 (2006) 121. **Type:** *J. Ah Wing SAN 39014*, Borneo, Sabah, Sekong Kecil, Sandakan district (holotype K; isotype SAN).

Subcanopy tree to 8 m tall, *c.* 12 mm diameter. **Bark** papery flaky, yellowish grey; inner bark yellow-brown. *Parts glabrous*. **Twigs** *2–3 mm diameter apically*, *stout*, *elliptic in cross-section*, *distinctly grooved below nodes between the petiole scars*, smooth, *pale yellow-brown*. **Leaves** thinly leathery, *drying yellow-brown beneath*, greenish brown above, somewhat wrinkled, pits and dots obscure; *blades lanceolate*, *20–35 × 4.5–8 cm*, *base narrowly wedge-shaped tapering into petiole*, apex tapering continuously into acumen; *lateral veins unequal*, *main ones c. 20 pairs*, unevenly spaced, *somewhat ascending*, *prominent beneath*, furrowed above, intermediate veins less prominent; intercostal venation lax, evident, hardly raised on either surface; *intramarginal vein 1*(*or 2*), *3–5 mm within margin*, *somewhat looped*; *petioles* stout, *c.* 10 mm long, *c.* 2 mm diameter, *corky*, *cream-white*. **Inflorescences and flowers** unknown. **Fruits** (young) cauliflorous, on trunk swellings, slender jambu-shaped, *c.* 25 mm long, *c.* 10 mm diameter on 10 mm pedicels; tapering into *c*. 2 mm slender pseudostalk; pedicels *c.* 10 mm long; calyx lobes 4, ovate-subacute, *c.* 5 × 7 mm, spreading; style exserted to 3.5 cm long.

**Distribution.** Endemic to Borneo; known in Sabah from Kinabatangan, Sandakan and Tongod districts (e.g., *Azmi RA 333*, *SAN 38978* and *SAN 96664*).

**Ecology.** Lowland forests, including on limestone, at altitudes below 400 m.

## 55. **Syzygium fulvotomentosum** P.S.Ashton

(Latin, *fulvus* = yellow-brown, *tomentosus* = tomentose; referring to the colour of the indumentum)

Kew Bull. 61, 1 (2006) 121. **Type:** *Sumbing SAN 125460*, Borneo, Sabah, Trus Madi, Tambunan district (holotype K; isotypes KEP Barcode KEP 163206, SAN).

Small tree to 8 m tall. *Young parts* (*twig*, *panicle*, *flower bud* and *fruit*), *at first*, *sparsely but distinctly coppery brown downy*. **Twigs** 2–3 mm diameter apically, *at first 4-ribbed*, *becoming round albeit finely ridged*, smooth, pale pink-brown. **Leaves** *with distinct small pointed buds in axils*, thin becoming wrinkled on drying, drying dark mauve-brown, sparsely dotted beneath, mauve-brown not pitted above; *blades narrowly elliptic to lanceolate*, *c. 16 × 5 cm*, *base wedge-shaped shortly tapering into petiole*, apex acuminate, acumen to 15 mm long, slender, tapering; *lateral veins unequal*, *main ones c. 10 pairs*, irregularly spaced with intermediate veins of varying length and prominence, ascending, *prominent beneath*, evident but furrowed above; intercostal venation reticulate, raised

beneath, visible above; intramarginal veins 1(or 2), 3–5 mm within margin, looped; petioles slender, *c.* 6 mm long. **Inflorescences** paniculate, terminal or axillary, *c.* 10 cm long; rachis angular, *c.* 3 mm diameter at base, 2–3x-branched. **Flowers:** *buds somewhat torch-shaped*, *c.* 10 mm long, *c.* 6 mm diameter, *tapering into c. 3 mm indistinct slender pseudostalk*; *calyx lobes 4*, *ovate*, *c. 4 × 5 mm*, subacute, *thick but hyaline towards margins*, *loosely spreading but not reflexed at anthesis*; stamens many, filaments slender, exserted *c.* 8 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to 12 mm, slender, persisting into fruit. **Fruits** depressed-globose, to 18 mm long, to 20 mm diameter, becoming minutely warty, with to 7 mm diameter prominent crown of *c.* 5 × 5 mm ovate subacute eventually reflexed calyx lobes.

**Distribution.** Endemic to Borneo; rare, known in Sabah from the northern Crocker range, Tambunan district (e.g., the type) and in Sarawak from Bt. Bakar, Katibas, Sibu district (e.g., *S 36355*). Also recorded in Brunei (e.g., *Coode 6437* and *BRUN 17776*).

**Ecology.** In primary and secondary forest near streams, at altitudes to 800 m.

## 56. **Syzygium fusticuliferum** (Ridl.) Merr. & L.M.Perry

(Latin, *fusticulus* = a little stalk, *ferum* = bearing; possibly referring to the shortish petiole)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 184; Masamune *op. cit.* 528. **Basionym:** *Eugenia fusticulifera* Ridl., J. Bot. 68 (1930) 33, M.R. Henderson *op. cit.* (1949) 246, Kochummen *op. cit.* 192. **Type:** *Beccari 3466*, Borneo, Sarawak, *loc. incert.* (holotype K).

Canopy tree to 70 cm diameter. *Young parts glabrous*. **Twigs** slender, *round in cross-section*, *brown*. **Leaves** thinly leathery, *drying shiny*, *chocolate-brown and densely pitted above*, *pale yellow-brown* and *more or less obscurely dotted beneath*; *blades elliptic*, *c. 6 × 3*(*5–20 × 3–10*) *cm*, base wedge-shaped shortly tapering into petiole, *margin flat*, *entire*, *apex acuminate*, *acumen to 10 mm long*, tapering; *lateral veins dense*, *subequal*, *c. 25 pairs*, spreading, *obscure and more or less minutely furrowed above*, *hardly raised but visible beneath*; *intercostal venation obscure*; i*ntramarginal vein 1*, *close to margin*, *hardly looped*; *petioles c. 7 mm long*. **Inflorescences** *paniculate*, to 4 cm long, terminal or axillary; rachis 2x-branched, *c.* 1 mm diameter, slender, becoming ridged; bracteoles broadly deltoid, not at first caducous. **Flowers:** *buds club-shaped*, *c. 14 mm long*, *c. 6 mm diameter*, smooth, *drying dark brown* becoming paler following anthesis; hypanthium spherical, *with 4*(–5, in which case 1 smaller), *hemispherical-subacute*, *c. 2 × 2 mm calyx lobes* surrounding an apical pore; *pseudostalk slender*, *c. 2x the length of hypanthium*; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** (young) *narrowly obovoid*, *c.* 15 mm long, *c.* 7 mm diameter, smooth, *dull*, *pale honey-brown*, truncate with *c.* 4 mm diameter crown of short erect calyx lobes.

**Distribution.** Peninsular Malaysia and Borneo. In Sabah known by a single collection (*SAN 43026*) from S part of Crocker Range, Tenom district; in Sarawak recorded from Belaga, Kapit, Lundu, Marudi and Miri districts (e.g., *S 8326*, *S 25777*, *S 34926*, *S 35382*, *S 35455*, *S 38223* and *S 48102*). Also known in W, C and E Kalimantan (e.g., *Church 980*, *Hallier 1313*, *Sidiyasa 1457*, *Endert 1568* and *Hallier 2202*).

**Ecology.** Uncommon; on yellow sandy soil mostly at altitudes 700–1700 m in the lower facies of upper montane forest; also on podsols in rocky places in the lowlands and in *kerangas* forest.

## 57. **Syzygium garcinifolium** (King) Merr. & L.M.Perry

(Latin, *Garcinia* (Clusiaceae) = the mangosteen tree, *folium* = leaf; with leaves resembling those of the mangosteen tree)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 167; Ashton, Kew Bull. 61, 1 (2006) 123. **Basionym:** *Eugenia garcinifolia* King *op. cit.* 90, Ridley *op. cit.* (1922) 730, M.R. Henderson *op. cit.* (1949) 83, Kochummen *op. cit.* 192. **Syntypes:** *King's Collector 4541*, *King Collectors 6974*, Peninsular Malaysia, Perak (CAL, K); *Beccari 365*, Sumatra (CAL, FI).

Large canopy tree, to 40 m tall, *c.* 1 m diameter, with tall thin buttresses and massive stilt roots to 5 m tall. **Bark** pale brown, thickly flaky. *Young parts glabrous*. **Twigs** *2–4 mm diameter apically*, stout, *round* (Borneo) *or bluntly angled in cross-section*, *cream to orange-brown*, smooth, *glabrous*. **Leaves** *leathery*, *drying strongly glistening metallic grey above with the venation standing out*, dull *red- or chocolate-brown and puckered or not beneath*, *sparsely pitted above*, *indistinctly dotted beneath*; *blades elliptic-obovate*, *c. 16 × 7.5*(*7–30 × 2.5–12*) *cm*, *base wedge-shaped tapering into petiole*, apex acuminate, acumen short, broad, bent down; *lateral veins unequal*, *main ones c. 11 pairs*, *slender but raised throughout though more so beneath*, spreading; *intercostal venation slender but distinctly raised and distinctly reticulate on both surfaces*; *intramarginal veins 3*, *main ones 4–8 mm within margin*, *looped*; petioles *c.* 1.5 cm long. **Inflorescences** *paniculate*, *terminal*, *c.* 7 cm long; rachis stout, quadrangular in cross-section, 3x-branched. **Flowers:** *buds urn-shaped*, *to 12 mm long*, *to 7 mm diameter*, without distinct pseudostalk; *calyx lobes 4*, *broadly ovate*, *c. 8 × 4 mm*, *cupped*, acute, *with hyaline margins*, *spreading and radiating or becoming reflexed at anthesis*, falling thereafter; *stamens* many, *pale cream-yellow*, exserting *c.* 15 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 18 mm long, prominently tapering. **Fruits** urn-shaped to spherical, *c.* 4 cm diameter, smooth; pedicel short, stout; calyx *c.* 15 mm diameter, *c.* 7 mm tall; rim saucer-shaped, to 20 mm diameter, style remnant prominent.

**Distribution.** Sumatra, Peninsular Malaysia and Borneo.

**Ecology.** Uncommon, in mixed dipterocarp forest on yellow sands, along low rocky ridges, and in *kerangas* forest.

**Notes.** Two varieties are recognised.

### Key to varieties

Leaf lower surface not puckered on drying; venation less prominent; intercostal venation less dense……

var. **garcinifolium**

Distribution as the species. In Borneo rare; known in Sarawak from G. Pueh, Lundu district (e.g., *S 34514*) and Lambir NP, Miri district (various ecological voucher specimens), and C Kalimantan (e.g., *Ridsdale PBU 37*).

Leaf lower surface puckered on drying; venation more prominent; intercostal venation more dense……...

var. **patentinervium** P.S.Ashton

(Latin, *patens* = standing out, *nervium* = veins; referring to the prominently raised leaf venation)

Kew Bull. 61, 1 (2006) 123. **Type:** *Singh & Noordin SAN 48490*, Borneo, Sabah, Tawau district (holotype K; isotypes KEP Barcode KEP 163193, L, SAN, SAR).

Sumatra and Borneo. In Borneo rare; known in Sabah by the type specimen; in Sarawak from Lambir NP (various ecological voucher specimens); and in E and S Kalimantan (e.g., *Amdjah 855* and *Kostermans 10370*).

## 58. **Syzygium georgeae** P.S.Ashton Fig. 17.

(Rena George, 1956–1994, formerly Assistant Forest Botanist of the Sarawak Forest Department)

Gard. Bull. Sing. 61, 1 (2009) 9. **Type:** *Soepadmo et al. FRI 41256*, Borneo, Sabah, Sg. Meliau, Tawai FR, Kinabatangan district (holotype SING; isotypes KEP Barcode KEP 165798, SAN, SAR).

A small tree with many scrambling branches, to 10 m tall, 15 cm diameter. **Bark** smooth, greyish white. Parts glabrous. **Twigs** 1–2 mm diameter apically, *dark-coloured*, *smooth*, slender, *at first distinctly narrowly 4-winged*. **Leaves** subsessile, *thinly leathery*, *satiny*, *drying golden-brown*, *finely black dotted beneath*, *dark yellow-brown and densely minutely pitted above*; *blades ovate-lanceolate*, *4.5–6 × 2–3.2 cm*, *base shallowly cordate*, *apex acute to subacuminate*; *venation distinct beneath*, *drying blackish*; *lateral veins subequal*, *slender and hardly raised beneath*, *distinctly furrowed above*, *main ones c. 11 pairs*; *intermediate veins many*, *irregularly branching among the dense*, *raised intercostal veins*; intramarginal vein *c.* 1 mm within margin, hardly looped; *petioles c. 1 mm long*, *drying black*. **Inflorescences** paniculate, terminal, *c.* 5 cm long; rachis *c.* 1 mm diameter, quadrangular in cross-section, bracts minute, caducous. **Flowers:** *buds club-shaped*, *c. 4 mm long*, *c. 3 mm diameter*, *with slender pseudostalk*; *calyx lobes 4*, *free*, *ovate-subacute*, *hyaline towards margins*, clasping corolla; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 3 mm long. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known only from the type from Tawai FR, Sabah.

**Ecology.** Common along a stony occasionally flooded river bank on ultramafic substrate.

**Notes.** Clearly related to *Syzygium castaneum*, but can be immediately distinguished from that variable species by its conspicuously different leaf shape with its venation distinctly furrowed on its upper surface. This is one more distinct sister ecospecies of ultramafic substrates, for which the Tawai FR provides the richest repository.

## 59. **Syzygium glabratum** (Blume) Veldkamp

(Latin, *glabratus* = without hairs; referring to the plant parts)

Blumea 48 (2003) 489. **Basionym:** *Myrtus glabrata auct. non* Sw.: Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1088. **Lectotype:** *Blume 561*, Java (L). **Homotypic synonyms:** *Jambosa glabrata* (Blume) DC, Prodr. 3 (1828) 287; *Clavimyrtus glabrata* (Blume) Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 113. **Heterotypic synonyms:** *Jambosa gracilis* Korth., Ned. Kruidk. Arch. 1 (1847) 202; *Clavimyrtus marginata* Blume *op. cit.* (1850) 115; *C. virens* Blume *op. cit.* (1850) 114; *J. marginata* (Blume) Miq., Fl. Ind. Bat. 1 (1855) 428; *J. virens* (Blume) Miq. *op. cit.* (1855) 128; *Eugenia fusiformis* Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 479, Ridley *op. cit.* (1930) 11, J.A.R. Anderson *op. cit.* (1980) 275; *E. blumeana* O.Kuntze, Rev. Gen. 1 (1891) 239; *E. virens* (Blume) Koord. & Valeton *op. cit.* (1900) 112, M.R. Henderson *op. cit.* (1949) 249, Burgess *op. cit.* 414, Kochummen *op. cit.* 222, J.A.R. Anderson *op. cit.* (1980) 280; *E. clavimyrtus* Koord. & Valeton *op. cit.* 110; *E. leptogyna* C.B.Rob., Philip. J. Sci. 4 (1909) 368; *Syzygium fusiforme* (Duthie) Merr. & L.M.Perry *op. cit.* (1939) 176, Masamune *op. cit.* 528; *S. virens* (Blume) Argent *et al. op. cit.* 473.

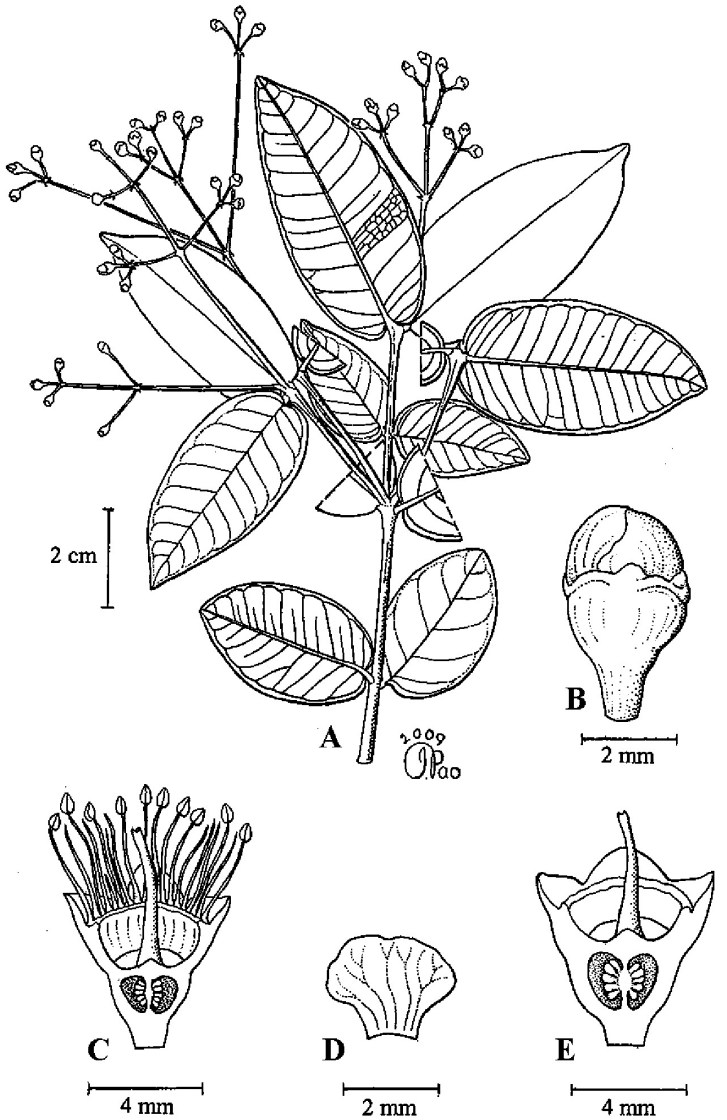


**Fig. 17.** *Syzygium georgeae*. A, flowering leafy twig; B, mature flower bud; C, longitudinal section of flower bud with the petals removed; D, petal; E, longitudinal section of mature flower bud with the petals and stamens removed. (A–B and D from *Cheksum CST 271*, C and E from *Kamaruddin KMS 3459.*)

Tree to 30 m tall, *c.* 70 cm diameter; bole fluted; buttresses *c.* 3 m tall. **Bark** grey- to pink-brown, appearing smooth, slightly shallowly flaky; inner bark thin, yellow-brown. *Parts glabrous*. **Twigs** *c*. 2 mm diameter apically, slender, *round in cross-section*, smooth, *pale brown*. **Leaves** *thinly leathery*, *minutely densely pimpled throughout*, *drying dull yellowish grey throughout*; *blades narrowly ovate*, *11–26 × 5–12 cm*, *base wedge-shaped abruptly tapering into the petiole*, *apex acuminate*, *acumen c. 1.5 cm long*, *tapering*, *slender*; *lateral veins unequal*, *main ones c. 9 pairs*, *raised on both surface more so beneath*, somewhat arched and ascending, intermediate veins obscure; *intercostal venation evident*, *delicate beneath*, *obscure above*; *intramarginal veins 2 pairs*, *the main one 1–2 mm within margin*, *looped*; *petioles c. 10 mm long*. **Inflorescences** paniculate, terminal, *c.* 5 cm long; rachis very slender, 1x-branched, ascending. **Flowers:** *buds clove-shaped*, *c.* 15 mm long, *c.* 5 mm diameter; hypanthium ellipsoid *on a c. 10 mm tapering pseudostalk*; *calyx lobes 4*, *ovate*, *c. 3 × 3 mm*, unequal, subacute, *thick but for the narrowly hyaline margin*, clasping corolla, falling after anthesis; pedicels long, slender; stamens many, exserted to *c.* 15 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 15 mm long. **Fruits** *ellipsoid*, *c.* 2 cm long, *c.* 1.75 cm diameter, smooth, with persistent sepal rim.

**Distribution.** Peninsular Malaysia, Borneo and the Philippines. In Borneo uncommon; known in Sabah from Sepilok FR, Sandakan district and Labuan (e.g., *Motley 106* and *SAN 37575*) and in Sarawak from Belaga, Kuching and Lundu districts (e.g., *Beccari 2236*, *S 35209* and *S 46754*). Also recorded in Brunei (e.g., *Davies Ecol. Voucher A326*, *Andulau FR*) and in E and S Kalimantan (e.g., *de Vogel 2037* and *Kostermans 5092*).

**Ecology.** Uncommon, in mixed dipterocarp forest, at altitudes below 850 m.

## 60. **Syzygium gladiatum** (Ridl.) Merr. & L.M.Perry

(Latin, *gladius* = the short stout sword of the Roman legionaries; referring to the almost parallel-sided slightly twisted leaf blade)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 181; Masamune *op. cit.* 529. **Basionym:** *Eugenia gladiata* Ridl., J. Bot. 68 (1930) 35. **Type:** *Haviland s.n.*, Borneo, Sarawak, Sipudang (holotype K).

Small tree to 15 m tall. **Bark** purplish brown, smooth to patchily flaky; inner bark red-brown. *Parts glabrous*. **Twigs** stout, *round in cross-section*, *c. 3 mm diameter apically*, *red-brown*, somewhat flaky. **Leaves** *thickly leathery*, drying dull purplish to tawny brown, *minutely obscurely pitted above*, *obscurely or distinctly dense dotted beneath*; *blades narrowly oblong-lanceolate*, *c. 25 × 7.5*(*9–30 × 3–13*) *cm*, *base obtuse*, *heart-shaped or auriculate*, *margin recurved*, apex acuminate, acumen *c.* 1 cm long; *lateral veins unequal*, *main ones c. 12 pairs*, visible on both surfaces, *not furrowed above*; intercostal venation invisible; *intramarginal vein close to margin*, *hardly looped*; *petioles 2–3 mm long*. **Inflorescences** paniculate, *c.* 12 cm long; rachis slender 3x-branched, spreading. **Flowers:** *buds torch-shaped*, *to 3 mm long*, *to 1.5 mm diameter*; *pseudostalk c. 1.5 mm long*; *calyx lobes 5*, *c. 0.5 × 3 mm*, *thin but not hyaline*; calyx rim waisted; stamens many, exserted to 5 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 7 mm long. **Fruits** *spherical*, to 15 mm long, to 8 mm diameter, *with depressed apex and c. 2 mm diameter calyx rim*.

**Distribution.** Endemic to Borneo; recorded in Sabah from Keningau, Kinabatangan and Kudat districts (e.g., *Kamarudin KMS 3342*, *SAN 69536* and *SAN 129975*) and in Sarawak

from Kapit, Kuching, Lundu and Simunjan districts (e.g., *S 5376*, *S 7179*, *S 42066*, *S 48173* and *S 48219*). Also known in C Kalimantan (e.g., *Ridsdale PBU 138* and *Church 819*).

**Ecology.** In mixed dipterocarp forest.

## 61. **Syzygium glanduligerum** (Ridl.) Merr. & L.M.Perry Plate 6B.

(Latin, *glandulus* = a small gland, *-gerus* = carrying; referring to the gland-like lumps on the leaf blade beneath)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 169; Masamune *op. cit.* 529. **Basionym:** *Eugenia glanduligera* Ridl., J. Bot. 68 (1930) 14, J.A.R. Anderson *op. cit.* (1980) 275. **Type:** *Haviland 2471/1977*, Borneo, Sarawak, near Kuching (holotype K).

Canopy tree to 60 cm diameter. *Young parts glabrous*. **Twigs** *round in cross-section*, rather stout, *red-brown*, more or less minutely flaky. **Leaves** *thinly leathery*, *drying glistening pink-brown above*, *dull red-brown with sparse minute black dots and large pale gland-like warty lumps beneath*; *blades elliptic-lanceolate*, *c. 11 × 5*(*7–26 × 1.5–12*) *cm*, *base wedge-shaped* tapering into petiole, apex sharply *c.* 1 cm slender acuminate; *lateral veins unequal*, *distinct but hardly raised*, *main ones c. 11 pairs*, spreading; *intercostal venation loosely reticulate*, *distinctly equally raised on both surfaces*; *intramarginal veins 2*, *the main one 2–4 mm within margin*, *looped*; *petioles somewhat stout*, *c. 8 mm long*. **Inflorescences** *paniculate*, to 4 cm long, terminal or rarely subterminal-axillary; rachis stout, round in cross-section, but drying wrinkled, ascending, 3x-branched. **Flowers:** *buds clove-shaped*, *to 15 mm long*, *to 8 mm diameter*, large; *pseudostalk tapering*, *pale waxy gland-dotted*; *calyx lobes 4*, *ovate-triangular*, *c. 5 × 4 mm*, subacute, *cupped*, *spreading but not becoming reflexed at anthesis*; stamens many, pink, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to 15 mm long, prominent. **Fruits** (young) urn-shaped, *c.* 13 mm long, *c.* 7 mm diameter, with prominent persistent erect calyx lobes.

**Distribution.** Endemic to Borneo; in Sabah known from Beaufort, Kinabatangan, Pitas and Sandakan districts (e.g., *SAN 17747*, *SAN 44755*, *SAN 77427*, *SAN 82009* and *SAN 121215*) and in Sarawak from Bau, Belaga, Kapit, Kuching, Lawas, Lundu, Marudi, Miri and Mukah districts (e.g., *S 15467*, *S 18631*, *S 19915*, *S 22889*, *S 34378*, *S 45991*, *S 48404*, *S 50329* and *S 66202*). Also recorded in Brunei (e.g., *Dransfield 7228* and *BRUN 18409*) and in W, C, and E Kalimantan (e.g., *Ambriansyah AA 950*, *Church 2570* and *Jarvie & Ruskandi 5910*).

**Ecology.** Locally scattered in mixed dipterocarp forest on leached especially sandy soils, in *kerangas*, in upper dipterocarp forest at altitudes to 1150 m, and on limestone karst summits.

## 62. **Syzygium gracilipaniculum** P.S.Ashton

(Latin, *gracilis* = slender, *paniculum* = a tuft; referring to the slender rachis of the inflorescence)

Kew Bull. 61, 1 (2006) 123. **Type:** *Paul Chai et al. S 37387*, Borneo, Sarawak, Kuching district, Bt. Braang, Pedawan. Limestone summit (holotype K; isotypes L, SAR).

Subcanopy tree to 16 m tall, 20 cm diameter. **Bark** grey-brown, smooth or rough. *Young parts glabrous*. **Twigs** 2–3 mm diameter apically, *round in cross-section*, grey-brown, *flaky*.

**Leaves** *thickly leathery*, *drying more or less satiny dark chocolate-brown throughout*, *pits and dots obscure*; *blades elliptic-obovate*, *4.5–9 × 1.8–5 cm*, base wedge-shaped tapering into petiole, *margin entire*, *narrowly recurved*, *apex notched to bluntly subacute*; *lateral veins subequal*, main ones *c.* 10 pairs, ascending, *slender and hardly raised on either surface though slightly more so beneath*; intercostal venation slightly raised on both surfaces; *intramarginal vein 2–3 mm within margin*, *somewhat looped*; petioles *c.* 3 mm long, *c.* 2 mm diameter. **Inflorescences** paniculate, terminal or axillary, *c.* 11 cm long; rachis 2x-branched, round in cross-section. **Flowers:** *buds club-shaped*, *c. 7 mm long*, *c. 4 mm diameter*; *pseudostalk c. 3 mm long*, slender somewhat tapering; *calyx lobes 4*, *free*, *ovate-acute*, *c. 3 × 4 mm*, *thick to margin*, clasping and concealing the corolla; stamens many, stamens exserted *c.* 3 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to *c.* 3 mm long. **Fruits** unknown.

**Vernacular names.** Sarawak—*ubar jellah* (Kenyah), *ubah gilenia* (Iban).

**Distribution.** Endemic to Borneo; known in Sarawak from Belaga, Kapit, Kuching, Lubok Antu and Marudi districts (e.g., *CWL 699*, *S 3937*, *S 3955*, *S 12595*, *S 29925*, *S 33870*, *S 36353*, *S 48493* and *S 51124*). Also recorded from W and E Kalimantan (e.g., *Mondi 172* and *Endert 2006*).

**Ecology.** On limestone summits, in mixed dipterocarp forest, and in lower montane *kerangas* forest at altitudes to 1550 m.

## 63. **Syzygium grande** (Wight) Walp.

(Latin, *grandis* = large; referring to the large leaf and flower bud)

Repert. 2 (1843) 180; Merrill & L.M. Perry *op. cit.* (1938) 112, *op. cit.* (1939) 176; Masamune *op. cit.* 529; Chantaranothai & Parnell *op. cit.* (1994) 68; Parnell & Chantaranothai *op. cit.* 858; Beaman & C. Anderson *op. cit.* 216. **Basionym:** *Eugenia grandis* Wight, Ill. Ind. Bot. 2 (1841) 17, Duthie *in* Hooker *f. op. cit.* 475, King *op. cit.* 91, Merrill *op. cit.* (1917) 214, *op. cit.* (1918) 21, *op. cit.* (1921) 428, Ridley *op. cit.* (1922) 729, Burkill *op. cit.* (1935) 968, M.R. Henderson *op. cit.* (1949) 87, Kochummen *op. cit.* 195, J.A.R. Anderson *op. cit.* (1980) 275. **Syntypes:** *Wallich 3603*, Myanmar, Mergui (K), *Griffith s.n.*, Sylhet (K). **Homotypic synonyms:** *Eugenia firma auct. non* DC. (1828): Wallich Cat. (1831) 3603, *nom. nud.*, *Jambosa firma* Blume *op. cit.* (1850) 108; *E. cymosa auct. non* Lam. (1789): Roxburgh, Fl. Ind. edition Carey 2 (1832) 492; *J. grandis* (Wight) Blume *op. cit.* (1850) 108. **Heterotypic synonyms:** *Syzygium megalophyllum* Merr. & L.M.Perry *op. cit.* (1939) 179, ***syn. nov.*, type:** *Creagh s.n.*, Borneo, Sabah (holotype NY; isotype K); *S. endertii* Merr. & L.M.Perry *op. cit.* (1939) 167, Beaman & C. Anderson *op. cit.* 215; ***syn. nov.*, type:** *Endert 1523*, Borneo, E Kalimantan (holotype BO).

Large tree to 30 m tall, 80 cm diameter, with dense dark crown of glossy leaves. **Bark** pale grey- to pink-brown, becoming cracked and flaky; inner bark pink-brown. *Parts glabrous*. **Twigs** *c. 3 mm diameter apically*, *stout*, *round in cross-section*, *pale brown*, *smooth*. **Leaves** *leathery*, *without pits or dots*, *drying somewhat glistening above*, *dull dark warm chocolate-brown beneath*; *blades elliptic-ovate*, *c. 16 × 9*(*12–20 × 6–10*) *cm*, *base wedge-shaped tapering into petiole*, apex bluntly broadly acuminate, down-curved; *midrib stout*; *lateral veins unequal*, *main ones c. 16 pairs*, *with long intermediate veins*, *distinctly raised throughout*, *prominent beneath*, *spreading*; *intercostal venation distinctly raised throughout*, lax; *intramarginal veins 1*(*or 3*), *3–6 mm within margin*, *looped*; petioles stout, *c.* 16 mm long. **Inflorescences** *paniculate*, *terminal or subterminal-axillary*, *c. 14 cm long*, *densely flowered*, rachis rather slender, round in cross-section, 2x-branched; *bracts lanceolate*, *c. 3*

*mm long*, *fugaceous*. **Flowers:** *buds pear-shaped c. 10 mm long*, *c. 6 mm diameter*, *with spherical hypanthium and prominent c. 8 mm tapering pseudostalk*; *calyx lobes 4*, *distinct*, *broadly ovate*, *c. 5 × 5 mm*, erect, *thick and hyaline at tips only*, strongly unequal, obtuse, overlapping one another; stamens many, cream-white or sometimes pink, exserted to 10 mm long at anthesis, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 12 mm long. **Fruits** *ellipsoid*, *c. 4 cm long*, *c. 3 cm diameter*, *smooth*, *drying dark*, with prominent *c.* 6 mm diameter apical calyx rim.

**Distribution.** SE India, Myanmar, Thailand, Peninsular Malaysia, Singapore and Borneo. In Borneo, recorded in Sabah from Kota Kinabalu, Kuala Penyu, Kudat, Lahad Datu, Ranau, Sandakan, Sipitang and Tambunan districts (e.g., *RSNB 4826*, *SAN 21668*, *SAN 41396*, *SAN 47647*, *SAN 52752*, *SAN 72334* and *SAN 121453*) and in Sarawak from Belaga, Kapit, Kuching, Lundu, Marudi, Miri, Sibu and Tatau districts (e.g., *S 14488*, *S 16184*, *S 41865*, *S 41944*, *S 42022*, *S 48426*, *S 53790* and *S 65439*). Also known in E Kalimantan (e.g., *van Balgooy 6095* and *bb 34288*).

**Ecology.** In forest on rocky sea shores, sandy beaches behind the *Casuarina*-belt, also, on soil between limestone rocks, and occasionally in upper dipterocarp forest on ultramafic substrate, at altitudes to 1700 m.

**Uses.** Frequntly planted as a roadside tree; its glossy dark crown providing welcome shade. Formerly effectively planted on Singapore as a fire-break.

## 64. **Syzygium griffithii** (Duthie) Merr. & L.M.Perry

(William Griffith, 1810–1845, surgeon in the British East India Company, explorer-naturalist of the eastern Himalaya, Tenasserim and Malacca)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 174; Masamune *op. cit.* 529; Coode *et al.* (eds.) *op. cit.* 236; Argent *et al.* (eds.) *op. cit.* 470. **Basionym:** *Eugenia griffithii* Duthie *in* Hooker *f. op. cit.* 481, King *op. cit.* 92, Ridley *op. cit.* (1922) 731, Merrill *op. cit.* (1929) 219, Burkill *op. cit.* 968, M.R. Henderson *op. cit.* 12 (1949) 120, Kochummen *op. cit.* 195, J.A.R. Anderson *op. cit.* 276. **Type:** *Griffith KD 2375*, Malacca (holotype CAL; isotype K). **Heterotypic synonyms:** *Eugenia subrufa* King *op. cit.* 102 (*incl.* var. *robusta*, *op. cit.* 103), Ridley *op. cit.* (1922) 733; *E. valetoniana* King *op. cit.* 112.

Large canopy tree to 35 m tall, to 70 cm diameter, sometimes with tall buttresses. **Bark** reddish brown, becoming flaky; inner bark pink-brown. *Parts glabrous*. **Twigs** *stout*, *c. 3 mm diameter apically*, *elliptic in cross-section*, *grey-brown*, *cracked at nodes*, *otherwise smooth*. **Leaves** thickly leathery, *drying dull greyish mauve-brown above*, *more or less darker beneath*, *with scattered pits above*, *without dots beneath*; *blades elliptic to narrowly oblong-lanceolate*, *c. 15 × 5*(*11–22 × 4–9*) *cm*, *base wedge-shaped abruptly tapering into petiole*, *apex obtuse or with acumen c. 1 cm long*, *broad*; *lateral veins unequal*, *main ones c. 12 pairs*, *basal pairs shorter than adjacent ones*, *spreading*, *raised beneath*, *distinctly furrowed above*; *intercostal venation obscure above*, *hardly visible beneath*; *intramarginal veins 2*, *the main ones 4–6 mm within margin*, *prominent*, *strongly looped*; *petioles c. 7 mm long*. **Inflorescences** *racemose* or paniculate, *mostly terminal but also axillary*; *rachis c. 5 cm long*, straight, erect, 2x-branched, terete, *with flowers densely clustered on branchlet endings*. **Flowers:** *buds clove-shaped*, *to 8 mm long*, *to 5 mm diameter*, tapering from apex to base with only slight waist below hypanthium; *pseudostalk slightly ribbed*; *calyx lobes* (*4 or*)*5*, *distinct*, *slightly unequal*, *c. 3 × 3 mm*, *thick*, *blunt*, *becoming reflexed and breaking off leaving a rim on at anthesis*; stamens many, *anther locules parallel*; *ovary at the distal*

*end of flower bud*, style exserted to 1 cm long. **Fruits** *spherical*, *c. 2 cm diameter*, smooth or very shallowly ribbed, *with small apical calyx rim*.

**Distribution.** Peninsular Malaysia and Borneo. In Borneo, widespread; known in Sabah from Beaufort, Kinabatangan and Sandakan districts (e.g., *SAN 16858*, *Elmer 20082*, *SAN 29880*, *SAN 39286*, *SAN 43108*, *SAN 49679* and *SAN 66986*), and in Sarawak from Kapit, Miri and Sri Aman districts (e.g., *S 22603*, *S 28168*, *S 36577*, *S 40228* and *S 44013*). Also recorded in Brunei (e.g., *BRUN 247*, *Coode 6829* and *Fuchs 21184*) and C Kalimantan (e.g., *Ridsdale PBU 47*).

**Ecology.** Common in mixed dipterocarp forest on yellow sands, less so in *kerangas*.

## 65. **Syzygium havilandii** (Merr.) Merr. & L.M.Perry

(George Darby Haviland, 1857–1901, first western doctor in Sarawak and avid plant and insect collector)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 193; Masamune *op. cit.* 529. **Basionym:** *Eugenia havilandii* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 222, *op. cit.* (1921) 428, Burgess *op. cit.* 412, J.A.R. Anderson, Gard. Bull. Sing. 20 (1963) 176, *p.p.*, *op. cit.* (1980) 276. **Type:** *Native Collector* (*Bur. Sci.*) *814*, Borneo, Sarawak, Rock road, Kuching (holotype PNH (? destroyed); isotypes A, K, L Barcode L 0009431).

Subcanopy tree to 15 m tall, with slender stilt roots. **Bark** *pale grey-brown*, *smooth*, hoop-marked. *Young parts glabrous*. **Twigs** 2–3 mm diameter apically, slender, *round in cross-section*, grey- to pink-brown, *flaky*. **Leaves** thinly leathery, *drying dull rich red-brown*, *clearly pitted above*, *faintly or not dotted beneath*; *blades elliptic* to *broadly lanceolate*, *c. 12 × 6*(*6–13 × 3–6.5*) *cm*, base broadly wedge-shaped tapering into petiole, *margin entire*, apex acuminate, acumen to 1 cm long, tapering; *lateral veins subequal*, *main ones c. 35 pairs*, *hardly raised beneath*, *narrowly furrowed above* and often on both surfaces, ascending; *intercostal venation obscure*; *intramarginal vein 1*, *c. 1 mm within margin*, *hardly looped*; petioles stout, *c.* 8 mm long. **Inflorescences** paniculate, terminal or subterminal-axillary; rachis *c.* 4 cm long, *c.* 2 mm diameter, quadrangular in cross-section, 3x-branched. **Flowers** *buds obconical*, *to 4 mm long*, *to 3.5 mm diameter*, *tapering to base without distinct pseudostalk*; *calyx lobes 4 or 5*, *distinct*, *shallowly triangular-acute*, *c. 0.5 × 3 mm*, *margin thick*; stamens many, shortly exserted at anthesis, *anther locules parallel*; *ovary at the distal end of flower bud*, style shortly exserted. **Fruits** *ellipsoid*, to 15 mm long, to 12 mm diameter, *drying dark*, smooth or slightly ribbed with more or less depressed apex and *c.* 2 mm diameter hardly raised calyx rim.

**Vernacular names.** Sarawak—*ubah kelabu* (Iban), *ubah lapit* (Kelabit).

**Distribution.** Endemic to Borneo; in Sabah recorded from Beaufort, Keningau, Lahad Datu, Papar, Sandakan, Sipitang and Tawau districts (e.g., *Berhaman AB 103*, *SAN 22250*, *SAN 36264*, *SAN 58497*, *SAN 73144* and *SAN 92167*), and in Sarawak from Betong, Daro, Julau, Kapit, Kuching, Lawas, Miri, Sibu and Sri Aman districts (e.g., *S 8555*, *S 19654*, *S 27827*, *S 30004*, *S 35386* and *S 46685*). Also known in Brunei (e.g., *BRUN 1215* and *Wong KM s.n.*) and in W, C, E and S Kalimantan (e.g., *Ridsdale PBU 10*, *Sidiyasa PBU 437* and *bb 32392*).

**Ecology.** Local; in mixed peatswamp forest and *kerangas* and the lower facies of upper montane forest at altitudes to 1330 m.

## 66. **Syzygium hirtum** (Korth.) Merr. & L.M.Perry Plate 6C.

(Latin, *hirtus* = shaggy/hairy; referring to the exposed living parts)

Mem. Amer. Acad. Arts & Sci. 18, 3 (239) 157; Coode *et al*. (eds.) *op. cit.* 237; Beaman & C. Anderson *op. cit.* 217. **Basionym:** *Jambosa hirta* Korth., Ned. Kruidk. Arch. 1 (1847) 200. **Type:** *Korthals s.n*., Borneo, Kalimantan, G. Sakumbang (L?, *n.v.*). **Homotypic synonym:** *Eugenia hirta* (Korth.) Burgess *op. cit.* 412, J.A.R. Anderson *op. cit.* (1980) 276. **Heterotypic synonyms:** *Jambosa rufo-tomentosa* Gibbs, J. Linn. Soc. Bot. 42 (1914) 77, *Eugenia rufo-tomentosa* (Gibbs) Merr. *op. cit.* (1917) 223, *op. cit.* (1921) 433, *op. cit.* (1929) 218, *Syzygium rufo-tomentosum* (Gibbs) Masam. *op. cit.* 538.

Subcanopy tree, to 20 cm diameter, without stilt roots. **Bark** smooth. *Exposed living parts more or less coarsely dark red-brown hairy*, *becoming sparse in fruit*, *fugaceous on leaf blade above*, *sparse and confined to venation beneath*. **Twigs** *c.* 3 mm diameter apically, *more or less coarsely dark red-brown hairy*, *elliptic in cross-section*, with long straight internodes. **Leaves** *distinctly though not densely more or less coarsely hairy on petiole and venation beneath*, thin, drying dull purple-brown and densely pitted above, dark rust-brown with blackish veins but without dots beneath; blades narrowly oblong or sometimes lanceolate, *c.* 22 × 7(12–24 × 2–14) cm, base heart-shaped to rounded ending abruptly into petiole, apex acuminate, acumen prominent, slender; *lateral veins unequal*, *main ones c. 25 pairs*, *slender*, *distinctly raised beneath*, *shallowly furrowed above*, somewhat ascending; intercostal venation distinctly raised beneath, scalariform and perpendicular to midrib; *intramarginal vein 1*(*or 2*) *pairs*, *2–3 mm within margin*, *hardly looped*; petioles stout, *c.* 3 mm long. **Inflorescences** paniculate, terminal; rachis *c.* 8 cm long, 2x-branched, round in cross-section. **Flowers** with *c.* 3 mm strip-like papery fugaceous bracteoles; *buds torch-shaped*, *to 15 mm long*, *to 8 mm diameter*, *tapering without a waist to base*; *calyx lobes 4 or 5*, *broadly ovate acute to subacuminate*, *c. 4 × 5 mm*, *spreading but not reflexed at anthesis*; stamens many, white, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 3 cm long, slender, whip-like. **Fruits** spherical, *c*. 8 mm diameter, with prominent crown of more or less persistent somewhat reflexed calyx lobes, ripening green with red flush.

**Distribution.** Sumatra and Borneo. In Borneo widespread and common; in Sabah known from most districts (e.g., *SAN 18505*, *SAN 29323*, *SAN 33155*, *SAN 43166*, *SAN 66782*, *SAN 77388*, *SAN 83958*, *SAN 91844* and *SAN 117782*) and in Sarawak from Kapit, Kuching, Lawas, Lundu, Marudi, Miri, Sarikei, Serian, Sri Aman and Tatau districts (e.g., *S 19972*, *S 41235*, *S 52507*, *S 78993*, *S 82241* and *S 91609*). Also recorded in Brunei (e.g., *Niga NN 367*, *Dransfield JD 7404* and *BRUN 17716*) and in W, C, E and S Kalimantan (e.g., *Burley 392*, *Church 1924*, *Wiriadinata 1221*, *de Vogel 1691*, *Kessler 2107* and *Kostermans 12679*).

**Ecology.** In mixed dipterocarp and lower montane forest on fertile clay soils, sometimes on ultramafic substrate, at altitudes to 1600 m.

## 67. **Syzygium hoseanum** (King) Merr. & L.M.Perry

(George Frederick Hose, 1838–1922, Anglican Bishop of Singapore, Labuan & Sarawak and naturalist)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 150; Masamune *op. cit.* 530. **Basionym:** *Eugenia hoseana* King *op. cit.* 106, Ridley *op. cit.* (1922) 733, M.R. Henderson *op. cit.* (1949) 103, Kochummen *op. cit.* 196, J.A.R. Anderson *op. cit.* (1980) 276. **Syntypes:** *Scortechini 163*, *Wray 2952*, *King's Collector 3407*, Peninsular Malaysia, Perak (CAL, K). **Synonym:** *Eugenia* sp. 2 (*quoad specim*. *FRI 8669*) Kochummen *op. cit.* 224.

Small tree to 15 m tall, to 20 cm diameter. **Bark** warm grey-brown, smooth to shallowly cracked. *Parts glabrous*. **Twigs** 3–4 mm diameter apically, stout, *white*, *round in cross-section*, smooth. **Leaves** *sparsely shallowly pitted above*, *minutely black dotted beneath*, *drying dull*, *pale purplish brown throughout*; *blades elliptic* or *obovate*, *c. 15 × 6*(*6–16 × 3.5–7*) *cm*, *base broadly wedge-shaped abruptly tapering into petiole*, *apex acuminate*, *acumen c. 1.5 cm long*; *lateral veins unequal*, *main ones c. 12 pairs*, *prominently raised throughout though more so beneath*, narrowly furrowed above, spreading; *intercostal venation evident beneath*, *more or less obscure above*; *intramarginal vein 1*(*or 2*) *pairs*, *3–6 mm within margin*, looped; petioles *c.* 7 mm long. **Inflorescences** *c. 2 cm long*, *terminal or axillary*; rachis slender, hardly branched, *the flowers densely clustered*. **Flowers** white, each subtended by 2 pairs of subpersistent *c.* 4 × 3 mm elliptic obtuse bracts; *buds* (near anthesis) *obconical*, *c. 9 mm long*, *c. 8 mm diameter*, *without distinct pseudostalk*; *calyx lobes 5*, *ovate-acute*, *c. 5 × 6 mm*, *with hyaline margins*; stamens many, exserted to 12 mm at anthesis, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 15 mm long. **Fruits** *spherical*, *c.* 14 mm diameter, slightly ribbed at first, *with shallow eventually caducous calyx crown*.

**Vernacular name.** Sarawak—*ubah rambat* (Brunei).

**Distribution.** Peninsular Malaysia and Borneo. In Borneo uncommon, known in Sarawak from Daro and Kuching district (e.g., *Haviland 2922*, *S 9004*, *S 35696* and *S 42209*) and in W Kalimantan (e.g., *Church 808*).

**Ecology.** Mostly but not always in forest not far from the coast, and on the banks of brackish rivers behind the mangrove, and in coastal mixed peat swamp and *kerangas*.

**Uses.** The bark has been used for tanning nets.

## 68. **Syzygium houttuynii** Merr. & L.M.Perry

(Martines Houttuyn, 1720–1798, Dutch naturalist and botanist)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1938) 168; Beaman & C. Anderson *op. cit.* 218. **Type:** *Clemens 32372*, Borneo, Sabah, Marai Parai, Mt. Kinabalu (holotype A Barcode A 71359; isotypes BO, L Barcode L 0009432, NY). **Homotypic synonym:** *Eugenia houttuynii* (Merr. & L.M.Perry) Burgess, TBS (1966) 412.

Small tree to 9 m tall. *Parts glabrous*. **Twigs** *c. 3 mm diameter apically*, *stout*, *elliptic-compressed or somewhat angular in cross-section*, *pale yellow turning early to pale brown*, smooth. **Leaves** thickly leathery though somewhat bullate, sparsely pitted above, pale dotted beneath, *drying purple-brown above*, *chocolate-brown beneath*, *glistening throughout*; *blades elliptic-obovate*, *c. 7 × 3*(*6–12 × 3.5–9*) *cm*, base wedge-shaped tapering into petiole, apex obtuse to shortly bluntly acuminate; *lateral veins unequal*, *main ones c. 6 pairs*, *evident and distinctly raised on both surfaces*, *shallowly furrowed within folds of the blade above*; intercostal venation evident; *intramarginal vein 2–4 mm within margin*, *somewhat* looped; petioles *c.* 5 mm long. **Inflorescences** *paniculate*, *c. 5 cm long*, *terminal or axillary*; rachis bluntly angular in cross-section, with few short branches. **Flowers** white; *buds club-shaped*, *c. 20 mm long*, *c. 10 mm diameter*, with only slight swelling at the hypanthium, *tapering into short slender pseudostalk*; *calyx lobes 4*, *ovate-subacute*, *c. 10 × 8 mm*, *unequal*, the outer ones folding over the inner ones and clasping the corolla, *becoming broadly obconical with rotate calyx lobes with hyaline margins*; stamens many, exserted to

10 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to 10 mm long. **Fruits** *spherical*, *c.* 7 cm diameter, *with prominent rimmed crown of reflexed calyx lobes*.

**Distribution.** Endemic to Borneo; in Sabah found only in Mt. Kinabalu (e.g., *RSNB 739*, *Clemens 10738*, *SAN 29274*, *SAN 48121* and *SAN 82996*) and in Sarawak recorded by one collection (*S 33595*) from Bt. Ubah Ribu, Lubok Antu district.

**Ecology.** In Sabah in upper montane forest at 2100–3700 m altitudes, and in Sarawak in forest on steep ridge at *c.* 750 m.

## 69. **Syzygium houttuyniifolium** P.S.Ashton

(Latin, *-folium* = leaf; with leaves similar to those of *Syzygium houttuynii*)

Kew Bull. 61, 1 (2006) 125 [*houttuyniifolia*]. **Type:** *Lai et al. S 68996*, Borneo, Sarawak, Belaga district, Ulu Kelayan, Usun Apau (holotype K; isotypes KEP Barcode KEP 24361, SAR).

Small tree to 10 m tall. **Bark** red-brown, somewhat flaky; inner bark red-brown. *Parts glabrous*. **Twigs** *stout*, *3–4 mm diameter apically*, *round in cross-section*, *dark brown*, *smooth*. **Leaves** thinly leathery, *drying dull*, dark yellow- to chocolate-brown beneath, darker purplish brown above, *sparsely more* or *less obscurely dotted beneath*, *distinctly densely pitted above*; *blades elliptic*, *8–13 × 3.5–5 cm*, *base wedge-shaped tapering into petiole*, apex acuminate, acumen *c*. 1 cm long tapering; *lateral veins unequal*, *main ones c. 10 pairs*, *distinctly raised beneath and drying darker than the blade*, *narrowly furrowed above*, spreading, with long but much more slender intermediate veins; intercostal venation lax, evident beneath more or less obscure above; *intramarginal vein 1*(*or 2*) *pairs*, *3–5 mm within margin*, *looped*; *petioles slender*, *10–15 mm long*. **Inflorescences** *paniculate*, *densely flowered*, *terminal or axillary*, *c. 4 cm long*; rachis *c*. 2 mm diameter at base, 2x-branched, round in cross-section. **Flowers:** *buds top-shaped c. 4 mm long*, *c. 3 mm diameter*, *with obscure pseudostalk*; *calyx lobes 4*, *distinct*, *broadly triangular*, *longer than 1 mm*, *thick*, *acute*, *erect*; *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to 2 mm at anthesis. **Fruits** unknown.

**Distribution.** Endemic to Borneo. Known with certainty only by two collections from the Usun Apau, Ulu Kelayan, Belaga district, Sarawak (e.g., the type and *S 68937*).

**Ecology.** In upper dipterocarp forest on dacite, at 850–920 m altitudes.

## 70. **Syzygium hypsipetes** Airy Shaw

(Greek, *hypsi* = on high, *petes* = from; referring to its high altitude habitat)

Kew Bulletin 4 (1949) 120. **Type:** *Richards' Collector 2102*, Borneo, Sarawak, Marudi district, Mt. Dulit (holotype K; isotypes A Barcode A 71360, L). **Homotypic synonym:** *Eugenia hypsipetes* (Airy Shaw) J.A.R.Anderson *op. cit.* (1980) 276.

Shrub. Parts glabrous. **Twigs** at first *c.* 1 mm diameter apically, *quadrangular in cross-section*, with very short internodes, dark grey-brown. **Leaves** thickly leathery, drying grey-brown above, yellow-brown beneath, glistening, brown pimpled beneath, obscurely pitted above; *blades broadly elliptic-obovate*, *10–30 × 5–15 mm*, *base wedge-shaped hardly*

*tapering into petiole*, apex obtuse or subacute; *lateral veins subequal*, *c. 20 pairs*, somewhat wavy and of varying lengths and prominence, *equally bluntly but distinctly raised on both surfaces*; intercostal venation obscure; intramarginal vein 1, close to margin, not looped; petioles slender, 3–4 mm long, 0.5 mm diameter. **Flowers** in dense terminal or subterminal clusters; *buds oblong*, *c. 6 mm long*, *c. 2.5 mm diameter*, *not warty*, *shiny*, drying black, tapering from apex through pseudostalk to base; *calyx lobes 4*, *ovate-triangular*, *acute*, *c. 1 × 1 mm*, *appressed*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known only in Sarawak from Bintulu, Kapit, Marudi and Miri districts (e.g., *S 8772*, *S 24856* and the type).

**Ecology.** The lower facies of upper montane forest on narrow sandstone ridges, at 1200–1900 m altitudes.

## 71. **Syzygium idrisii** P.S.Ashton

(Idris bin Mohd. Said, 1955–; 1993–2003, Forest Botanist, Forest Department, Brunei Darussalam, since 2004, lecturer, Universiti Kebangsaan Malaysia, Sabah)

Kew Bull. 61, 1 (2006) 125. **Type:** *I.M. Said BRUN 15242*, Borneo, Brunei, Andulau FR, fruiting (holotype K; isotype SING).

Canopy tree to 30 m tall, to 30 cm diameter; buttresses low, thin. **Bark** whitish, smooth to scaly; inner bark dark red. *Parts glabrous*. **Twigs** *c. 2 mm diameter apically*, *round in cross-section*, slender, *whitish*, *smooth or finely cracked*, with long internodes. **Leaves** thinly leathery, *without pits or dots though sometimes sparsely pimpled beneath*, *drying glistening pale grey-brown*; *blades narrowly elliptic or lanceolate*, *c. 14 × 5*(*7–17 × 2.5–6*) *cm*, *base wedge-shaped abruptly tapering into petiole*, margin narrowly recurved, *apex acuminate*, *acumen c. 1 cm*, slender; *lateral veins unequal*, *main ones c. 12 pairs*, ascending, very slender, *slightly raised beneath but visible only above*, intermediate veins short, more or less indistinct; *intercostal venation distinctly not net-like*, *more raised beneath than above*; *intramarginal veins 1*(*or 2*), *c. 2 mm within margin*, *hardly looped*; petioles *c.* 10 mm long, *c.* 2 mm diameter. **Inflorescences** *racemose*, *terminal or axillary*; *rachis to 4 cm long*, slender, singly branched, branchlets short, compressed-elliptic, drying dark. **Flowers:** *buds club- to bugle-shaped at anthesis*, *to 5 mm long*, *c. 2.5 mm diameter*, *including 2.5 mm tapering*, *slender pseudostalk*; *calyx lobes 4*, *ovate-deltoid*, *at least 1 mm long*, *acute*, *thick and hyaline only along margins*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical*, to 1 cm diameter, *with c. 3 mm diameter apical reflexed calyx rim*, smooth, *ripening green*.

**Distribution.** Endemic to Borneo. Known in Sarawak from the Lambir NP, Miri district (e.g., *S 24136*); in Brunei (e.g., the type, *Niga NN 101* and *BRUN 17441*); and one record from E Kalimantan (*Sidiyasa 447*).

**Ecology.** In mixed dipterocarp forest on deep yellow sandy soil. Apparently rare.

## 72. **Syzygium iliasii** P.S.Ashton Fig. 18.

(Ilias bin Paie, 1934–1986, Forest Officer, curator of the Sarawak Herbarium 1961–1986, and outstanding plant collector).

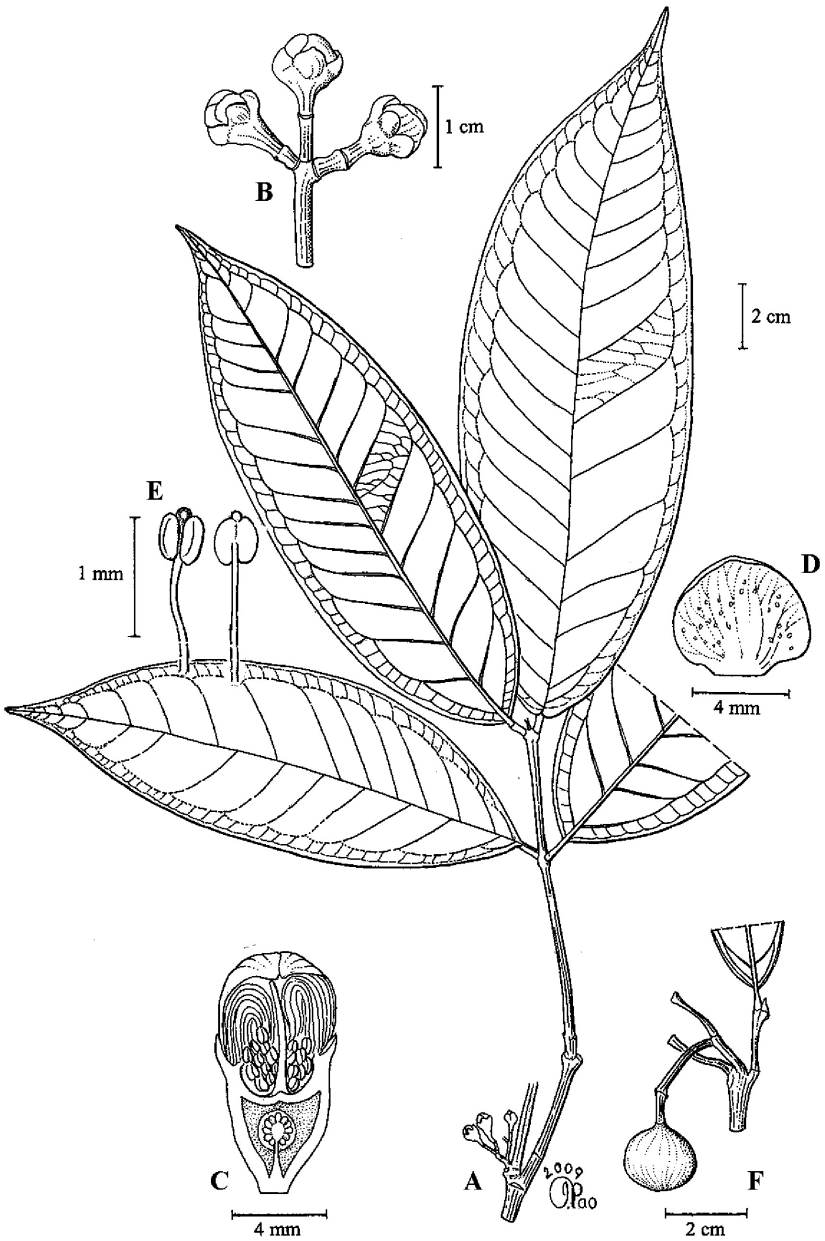


**Fig. 18.** *Syzygium iliasii*. A, flowering leafy twig; B, distal part of inflorescence; C, almost open flower in longitudinal section; D, petal; E, adaxial and abaxial view of stamens; F, fruit. (A–E from *S 64536*, F from *S 34263*.)

Kew Bull. 61, 1 (2006) 125. **Type:** *Ilias Paie & Azahari S 35647*, Borneo, Sarawak, Bt. Gaharu, Serian district (holotype K; isotypes L, SAR).

Subcanopy tree *c.* 7 m tall. **Bark** white. *Parts glabrous*. **Twigs** *1–2 mm diameter apically*, *slender*, *round in cross-section*, distinctly cream-white. **Leaves** papery, drying wrinkled, bright rust-brown beneath, warm brown above, *without distinct pits or dots*; *blades elliptic-obovate*, *c. 18 × 7*(*13–19 × 4.5–7*) *cm*, *base abruptly rounded or shallowly heart-shaped*, apex tapering acuminate; *lateral veins unequal*, *main ones c. 8 pairs*, *with short intermediate veins*, ascending, *prominent beneath*, *furrowed above*; intercostal venation distinct beneath, obscure above; *intramarginal veins 4–6 mm within margin*, *looped*; *petioles c. 3 mm long*, corky, whitish. **Inflorescences** paniculate, terminal, axillary or ramiflorous, *c.* 8 cm long; rachis singly branched, round in cross-section, slender. **Flowers** white, fragrant; *buds goblet-shaped*, *c. 7 mm long*, *c. 3 mm diameter* on *c*. 3 mm long pedicel, *with c. 3 mm slender*, *tapering pseudostalk*; *calyx lobes 4*, *broadly ovate*, *c. 2.5 × 3 mm*, acute, *with hyaline margins*, clasping corolla; *stamens many*, exserted to 6 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 10 mm long. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known only in Sarawak from Belaga, Lundu and Samarahan districts (e.g., the type, *S 15537*, *S 34263*, *S 35151*and *S 45374*).

**Ecology.** In mixed dipterocarp forest at 250–700 m altitudes, sometimes on sandy soil.

## 73. **Syzygium imperiale** P.S.Ashton

(Latin, *imperium* = majestic; in reference to the imperial-purple-drying leaf midrib beneath)

Kew Bull. 61, 1 (2006) 127. **Type:** *S. Andrews 794*, Borneo, Sabah, Danum Valley Rainforest Project Area, Lahad Datu district (holotype K; isotypes KEP Barcode KEP 163510, L, SAN, SAR).

Canopy tree to 60 cm diameter. *Young parts glabrous*. **Twigs** at first *c.* 4 mm diameter apically, *round in cross-section*, *smooth*, *warm brown*; internodes long and straight. **Leaves** thin, *drying dull golden-tawny with purple midrib beneath*, *pale tawny-grey above*, *densely pitted above and black dotted beneath or without distinct pits or dots*; *blades narrowly elliptic-oblong*, *c. 30 × 9*(*17–35 × 5–10*) *cm*, *base broadly wedge-shaped tapering more or less abruptly into petiole*, *margin entire*, *flat*, *apex shortly pointed-acuminate*; *lateral veins slender*, *subequal*, *main ones c. 8 pairs*, *with c. 20 pairs of intermediate veins*, *all prominent beneath* though slender, more or less undulate (dry leaf) *and shallowly furrowed above*; intercostal venation lax, slightly elevated beneath, obscure above; *intramarginal veins 1*(*or 2*) *pairs*, *2–3 mm within margin*, *hardly looped*; *petioles c. 10 mm long*, *c. 4 mm diameter*, *stout*. **Inflorescence** a terminal spike, *c.* 3 cm long; rachis round in cross-section. **Flowers:** *buds clove-shaped*, *to 15 mm long*, *c. 7 mm diameter*, hardly waisted, *pseudostalk distinct*; *calyx lobes 4*, *rounded*, *to 6 × 6 mm*; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** (young) *broadly pear-shaped*, *c.* 11 mm long, *c.* 10 mm diameter, smooth, *with c. 10 mm diameter prominent somewhat reflexed crown of calyx lobes*.

**Distribution.** Endemic to Borneo; known in Sabah from Kota Marudu and Lahad Datu districts (e.g., the type and *SAN 99542*) and in Sarawak from the Lambir Hills NP, Miri district (species code EUGEDB, vouchers nos. *1209-242*, *521-163*, *02936* and *02940*, Tree Demography Plot).

**Ecology.** In mixed dipterocarp forest on rich clay soils in the lowlands; rare.

## 74. **Syzygium incarnatum** (Elmer) Merr. & L.M.Perry
(Latin, *incarnatus* = flesh-coloured; referring to the red fruit)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 195; Masamune *op. cit.* 530; Merrill, Philip. J. Sci. 79, 4 (1950) 395; Coode *et al*. (eds.) *op. cit.* 237. **Basionym:** *Eugenia incarnata* Elmer, Leafl. Philip. Bot. 4 (1912) 1416, Merrill, Enum. Philip. Pl. 3 (1923) 167, J.A.R. Anderson, Gard. Bull. Sing. 20 (1963) 176. **Type:** *Elmer 13231*, the Philippines, Mt. Pulger, Palawan Isl. (holotype A). **Heterotypic synonyms:** *Syzygium punctulatum* Wall., Cat. (1831) 3583, *nom. nud.*, Masamune *op. cit.* 537, *Eugenia punctulata* (Wall.) King *op. cit.* 122, Ridley *op. cit.* (1922) 747 [*non Jambosa punctulata* Miq.], Merrill *op. cit.* (1921) 432; *E. cerina* M.R.Hend., Gard. Bull. Sing. 11 (1947) 322, *ibid.* 12 (1949) 168, Burgess *op. cit.* 412, 415, Kochummen *op. cit.* 185, J.A.R. Anderson *op. cit.* (1980) 274, Argent *et al*. (eds.) *op. cit.* 469, *S. cerinum* (M.R.Hend.) I.M.Turner *op. cit.* (1997) 17; *Eugenia* sp. 63, Kochummen *op. cit.* 244.

Canopy tree, to 25 m tall, to 50 cm diameter; bole cylindrical, becoming fluted and sometimes with short buttresses to 2 m tall and stilt roots. **Bark** red-brown, smooth, becoming powdery flaky; inner bark pale brown. *Young parts glabrous*. **Twigs** *1–2 mm diameter apically*, *slender*, *round in cross-section*, *smooth*, *grey-brown*. **Leaves** *thinly leathery*, *drying glistening pale tawny above*, *dull pale orange-brown beneath*, *pits obscure above*, *dots fine and scattered beneath*; *blades obovate to sometimes oblanceolate*, *c. 7 × 4.5*(*4–14 × 2.5–7*) *cm*, base wedge-shaped tapering into petiole, *margin entire*, *apex blunt to shortly acuminate*; *lateral veins dense*, *subequal*, *slender*, *hardly visible on either surface*, *not furrowed above*, spreading; intercostal venation obscure; *intramarginal vein close to margin*, *hardly looped*; petioles *c.* 10 mm long. **Inflorescences** *paniculate*, terminal, *c.* 12 cm long; rachis slender, round in cross-section, 3x-branched; *bracts and bracteoles broadly ovate*, *c. 1 × 1 mm*, subacute, *cupped*, caducous. **Flowers** white, densely clustered; *buds obconical*, *c. 9 mm long*, *c. 6 mm diameter*, *tapering into an indistinct c. 1 mm pseudostalk*; *calyx lobes 4*, *rounded*, *thick-margined*, *unequal*, 2 larger lobes enclosing 2 smaller ones, *appressed to and covering corolla but for an apical pore*, *falling at anthesis leaving a rimmed often shortly toothed cup-shaped hypanthium*; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *obovoid* with wide apical rim, *c.* 9 mm long, *c.* 6 mm diameter, becoming fleshy and spherical, smooth, *ripening white*.

**Vernacular name.** Sarawak—*ubah cangkeh* (Iban).

**Distribution.** Sumatra, Peninsular Malaysia, Borneo and the Philippines (Palawan Isl.). In Borneo widespread; known in Sabah from most districts (e.g., *P.F. Stevens 543*, *SAN 27152*, *SAN 36252*, *SAN 50641*, *SAN 65396*, *SAN 75361*, *SAN 80336*, *SAN 91112* and *SAN 130245*) and in Sarawak from Betong, Bintulu, Kapit, Kuching, Lawas, Marudi, Mukah, Sarikei, Serian, Sibu, Simunjan and Sri Aman districts (e.g., *Richards 1625*, *S 3278*, *S 12009*, *S 19125*, *S 32908*, *S 50444*, *S 59065*, *S 59454* and *S 73718*). Also recorded in Brunei (e.g., *BRUN 964*, *Wong WKM 970*, *BRUN 5028* and *Coode MC 7312*) and in W, C and E Kalimantan (e.g., *Ridsdale PBU 273*, *Hallier 3436*, *Kostermans 5715* and *Kostermans 13013*).

**Ecology.** Common, often abundant, in primary but mostly secondary *kerangas* and mixed peat swamp forest, less common in *alan*, *alan bunga* and *padang alan* peat swamp forest; frequent also in mixed dipterocarp and secondary forest on yellow sandy soils and in the lower facies of upper montane forest.

## 75. **Syzygium inophyllum** DC.

(Greek, *ino* = thread-like, *phullon* = leaf; referring to the slender intercostal venation of the leaf)

Prodr. 3 (1828) 260; Merrill & L.M. Perry *op. cit.* (1939) 188; Masamune *op. cit.* 530; Argent *et al.* (eds.) *op. cit.* 471. **Homotypic synonyms:** *Eugenia inophylla* (DC.) Roxb., Fl. Ind. edition Carey 2 (1832) 496, Wight, Ill. 2 (1841) 17, Duthie *in* Hooker *f. op. cit.* 480, King *op. cit.* 114, Ridley *op. cit.* (1922) 750, *op. cit.* (1930) 35, M.R. Henderson *op. cit.* (1949) 141, Kochummen *op. cit.* 197; *Acmena inophylla* (DC.) Wight, Icon Pl. Ind. Orient. 2 (1842) *t.* 623; *Jambosa inophylla* (DC.) Miq. *op. cit.* (1855) 433. **Lectotype** (designated here)**:** *Wallich 3600 ex Hort. Calc.* 1814 (K). **Heterotypic synonyms:** *Eugenia benardii* King *op. cit.* 115; *E. inophylla* (DC.) Roxb. var. *benardii* (King) Ridl. *op. cit.* (1922) 750, Kochummen *op. cit.* 197; *Syzygium inophyllum* DC. var. *benardii* (King) I.M.Turner *op. cit.* (1996) 377. **Syntypes:** *Scortechini 326*, Perak (K); *Ridley 8617*, Selangor (K); *Curtis 975* & *2845*, Penang (K).

Canopy tree to 25 m tall, to 40 cm diameter; bole fluted, with short buttresses and sometimes stilt-roots. **Bark** reddish brown, thinly flaky; inner bark brown. *Young parts glabrous*. **Twigs** *c.* 2 mm diameter apically, *round in cross-section*, *smooth*, *red-brown*. **Leaves** *leathery*, *densely obscurely dotted above*, *pimpled beneath*, *drying dark yellow-brown beneath*, *purplish brown and satiny above* and less so beneath; *blades elliptic-ovate*, *c. 10 × 5*(*7–16 × 2–8*) *cm*, base wedge-shaped tapering into petiole, *margin entire*, apex *c.* 1 cm slender-acuminate; *midrib prominent*, *rounded beneath*; *lateral veins dense*, *subequal*, *main ones* 30–40 pairs, *visible and finely raised throughout or sometimes finely furrowed above*, *spreading*; *intercostal venation as visible as the lateral veins*, *very slender*; *intramarginal vein close to margin*, *hardly looped*; petioles slender, *c.* 6 mm long. **Inflorescences** paniculate, terminal or axillary, *c.* 8 cm long; rachis slender, round in cross-section, 2x-branched. **Flowers:** *buds pear-shaped*, *c. 12 mm long*, *c. 6 mm diameter*; *hypanthium tapering to an c. 6 mm stout pseudostalk*; *calyx lobes 5*, *free*, *c. 5 × 3 mm*, *somewhat hyaline*, broadly triangular, subacute, *thick-margined*, early caducous leaving a waisted rim round the corolla base; stamens many, exserted to 5 mm at anthesis, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to 5 mm long. **Fruits** *spherical*, *c.* 2.5 cm diameter, slightly ridged, *with c. 9 mm diameter calyx rim*.

**Distribution.** Peninsular Malaysia to Maluku. In Borneo uncommon; known in Sabah from Semporna and Tawau districts (e.g., *SAN A 4131* and *SAN 48881*) and in Sarawak from Kuching, Mukah and Sibu districts (e.g., *Beccari 1201*, *Haviland 2929*, *Haviland 3220* and *S 5153*). Also recorded from W and E Kalimantan (e.g., *Ambriansyah AA 152*, *Hallier 1370*, *Kostermans 9319* and *bb 31634*).

**Ecology.** Near the coast, apparently along tidal waterways and in mixed peat swamp forest.

## 76. **Syzygium jaherii** Merr. & L.M.Perry

(Jaheri, *c*. 1857–1926, celebrated plant collector at Bogor Botanic Gardens)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 156. **Type:** *Jaheri s.n.*, Borneo, W Kalimantan, *loc. incert.* (holotype BO; isotype A Barcode A 71361).

Tree. Young twigs and panicles puberulent. **Twigs** *c.* 1 mm diameter apically, slender, *sharply quadrangular in cross-section*, smooth, dark grey-brown. **Leaves** *thinly leathery*, *densely minutely pitted above*, *sparsely so beneath*, drying dull grey-brown throughout; *blades narrowly elliptic to obovate*, *c. 5 × 3*(*3.5–7 × 1.5–2.5*) *cm*, base wedge-shaped

tapering into petiole, *apex c. 8 mm caudate*; *lateral veins dense*, *subequal*, *c.* 20 pairs, *more or less obscure*, ascending; *intercostal venation obscure*; intramarginal vein close to margin, not looped; petioles slender, *c.* 3 mm long. **Inflorescences** *axillary*, *fascicled*, *hardly branched*. **Flowers:** *buds obovoid-obconical*, *c. 3 mm long*, *c. 2 mm diameter*; *hypanthium tapering into more or less indistinct pseudostalk*; *calyx lobes 4*, *vestigial*, forming a rim round the corolla; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** unknown.

**Distribution.** Endemic to Borneo; so far known only by the type from W Kalimantan; to be expected from Sarawak but as yet unrecorded.

**Notes.** Differing from *Syzygium quadricostatum* notably in the congested axillary inflorescences and flowers, the many stamens, the shortly granular-puberulent young parts and rachises, and the apparent absence of a floral pseudostalk.

## 77. **Syzygium jambos** (L.) Alston

(The Latinised Malay name for *jambu*)

*In* Trimen, Handb. Fl. Ceylon 6, Suppl. (1931) 115; Merrill & L.M. Perry *op. cit.* (1938) 114 & 217, *op. cit.* (1939) 165; Masamune *op. cit.* 530 [sphalm. "*jambosum*"]; Merrill, Philip. J. Sci. 79, 4 (1950) 397; Backer *op. cit.* (1964) 344; Ashton *in* Dassanayake & Fosberg (eds.), Revised Handb. Fl. Ceylon 2 (1981) 427; PROSEA 2 (1991) 296; Chantaranothai & Parnell *op. cit.* (1994) 77; Coode *et al.* (eds.) *op. cit.* 237; Argent *et al.* (eds.) *op. cit.* 471; Parnell & Chanratanothai *op. cit.* (2002) 868; Beaman & C. Anderson *op. cit.* 218; Chen & Craven, Fl. China 13 (2007) 344. **Basionym:** *Eugenia jambos* L., Sp. Pl. (1753) 470, Miquel, Anal. Bot. Ind. 1 (1850) 17, Duthie *in* Hooker *f. op. cit.* 474, King *op. cit.* 82, Beccari, Nelle For. Born. (1902) 598, Merrill *op. cit.* (1921) 428, Ridley *op. cit.* (1922) 724, Merrill *op. cit.* (1923) 168, M.R. Henderson *op. cit.* (1949) 62, Kochummen *op. cit.* 247, Corner *op. cit.* (1997) 587. **Lectotype** (designated by Fawcett & Rendle, Fl. Jamaica, Dicots 3 (1926) 352)**:** *Herb. Herman* 2: 220, fig. 188, "in India" (BM). **Homotypic synonyms:** *Myrtus jambos* (L.) Kunth *in* von Humboldt, Bonpland & Kunth, Nov. Gen. Sp. 6 (1823) 144, *Jambosa jambos* (L.) Millsp., Publ. Field Columb. Mus., Bot. Ser. 2 (1896) 80. **Heterotypic synonyms:** *Jambosa vulgaris* DC. *op. cit.* 286, *nom. illg.*; *J. palembanica* Blume *op. cit.* (1850) 93; *J. leptostachya* Blume *op. cit.* (1850) 99, *Syzygium leptostachyum* (Blume) Merr. & L.M.Perry *op. cit.* (1939) 175, ***syn. nov.*, type:** *G. Mueller s.n.*, Borneo (holotype L Barcode L 0009640; fragment A); *Eugenia monantha* Merr., J. Str. Br. Roy. As. Soc. 79 (1918) 22, *op. cit.* (1921) 430, J.A.R. Anderson *op. cit.* (1980) 277, *S. monanthum* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 163; *S. merrillii* Masam. *op. cit.* 534, *nom. superfl.*, *syn. nov.*, **type:** *Haviland 2146*, Borneo, Sarawak, Belaga (holotype SING; isotype K).

Small tree to 10 m tall, *c.* 20 cm diameter. **Bark** smooth, warm grey-brown. *Parts glabrous*. **Twigs** *c. 4 mm diameter apically*, *grey-brown*, *more or less wrinkled and compressed but not truly ribbed*. **Leaves** thin, *drying dull tawny brown above*, *paler beneath*, wrinkled, with sparse tiny pits above and dots beneath; *blades narrowly elliptic*, *c. 15 × 5*(*8–26 × 1.5–5.5*) *cm*, *base wedge-shaped tapering into petiole*, *apex acuminate*, *acumen to 15 mm long*, *sharp*; *lateral veins unequal*, *main ones c. 7 pairs*, *somewhat ascending*, *raised beneath*, *furrowed above*, intermediate veins few; intercostal venation lax, distinctly elevated beneath, obscure above; *intramarginal veins 2*, *the main ones well within margin*, *looped*; *petioles c. 7 mm long*, *drying black*. **Inflorescences** *racemose*, *terminal*, *c. 2 cm long*; rachis singly branched, round in cross-section, bearing to 3 flowers. **Flowers:** *buds jambu-shaped*, *to 12 mm long*, *to 15 mm diameter*, *with tapering pseudostalk*; *calyx lobes 4*, *ovate*, *c. 12 × 10 mm*, acute, *papery towards margins*, cupped, *spreading and becoming reflexed* at *anthesis*; stamens many, exserting to 25 mm long, white, *anther locules parallel*; *ovary often truly inferior*, *at the distal end of flower bud*, style to 4 cm long, slender. **Fruits**

*pumpkin- to pear-shaped*, to 20 mm across, smooth, with prominent apical calyx collar, greenish white.

**Vernacular names.** Sarawak—*jambu puteh* or *jambu mawar* (Brunei, Malay).

**Distribution.** SE Asia, from S China to Malesia. Widely cultivated and naturalised in many tropical countries. In Borneo, both wild and cultivated populations occur; recorded in Sabah from Keningau, Kinabatangan, Kudat, Lahad Datu, Penampang, Ranau, Sandakan, Semporna and Tawau districts (e.g., *Sugau JBS 227*, *Wong WKM 2211*, *SAN 47290*, *SAN 65499*, *SAN 85097*, *SAN 99258*, *SAN 110443* and *SAN 135986*) and in Sarawak from Bau, Belaga, Lubok Antu, Marudi and Miri districts (e.g., *Haviland 2146*, *S 29338*, *S 42425*, *S 90455* and *S 91863*). Also known in Brunei (e.g., *Wong WKM 1327*, *Sands 5595*, *BRUN 6339* and *Dransfield JD 6984*) and in E and S Kalimantan (e.g., *Ambriansyah W 813*, *Kessler PK 1874* and *Kostermans 7740*).

**Ecology.** The wild type is found along white-water rivers over shale rocks, throughout inland Borneo, at altitudes to *c.* 700 m, establishing below the flood line and initially a rheophytic shrub with narrower leaves.

**Uses.** The fruit of the cultivated variety has crisp rose-scented flesh.

## 78. **Syzygium kalahiense** Korth.

(of Kalahei, Borneo, Kalimantan)

Nederl. Kruidk. Arch. 1 (1847) 205; Merrill & L.M. Perry *op. cit.* (1939) 188; Masamune *op. cit.* 531. **Type:** *Korthals s.n.*, Borneo, SE Kalimantan, *loc. incert.* (holotype L Barcode L 0009635; fragm. A). **Homotypic synonyms:** *Eugenia kalahiensis* (Korth.) Miq. *op. cit.* (1850) 23, *t.* 5, Merrill *op. cit.* (1921) 429; *Myrtus kalah* Miq. *op. cit.* (1850) 23. **Other synonym:** *Eugenia* sp. 10, J.A.R. Anderson, Gard. Bull. Sing. 20 (1963) 177 (*quoad specim. S 2615* & *S 1595*).

Canopy or subcanopy tree to 35 m tall, *c*. 50 cm diameter. **Bark** smooth; inner bark yellow-brown. *Young parts glabrous*. **Twigs** 1–2 mm diameter apically, slender, *round in cross-section*, *cream-white*, *smooth*. **Leaves** thinly leathery, *drying satiny shagreened tawny*, *sometimes densely pitted above*, *dull pale golden-brown and not dotted but densely minutely puckered beneath*; *blades narrowly elliptic*, *c. 12 × 4*(*7–13 × 2–6*) *cm*, base wedge-shaped tapering into petiole, *margin entire*, *hardly or not recurved*, *apex subcaudate to caudate*, *acumen to 15 mm long*; midrib stoutly raised with median furrow above; *lateral veins subequal*, dense, *c.* 28 pairs, *very slender and hardly raised beneath*, *more or less visible above*, spreading; intercostal venation obscure or only visible above, net-like; *intramarginal vein 1 pair*, *close to margin*, *not looped*; *petioles slender*, *c. 6 mm long*. **Inflorescences** racemose, terminal or mostly axillary, *c. 3 cm long*; rachis 2x-branched, slender, round in cross-section; bracts minute, paired, subpersistent, triangular. **Flowers** *buds shortly goblet-shaped*, *to 5 mm long*, *to 3 mm diameter*, *tapering into a short pseudostalk*; *calyx lobes 5*, *ovate-triangular*, *c. 0.5 × 1.5 mm*, *hyaline*, *tightly appressed to corolla to its apex*, *caducous*, *their bases forming a rim at anthesis*; stamens many, exserting to 3 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, *style exserting to c. 3 mm long*. **Fruits** *depressed-spherical*, to 15 mm long, to 23 mm diameter, smooth, *green*, *drying pale*, *calyx rim at first tubular*, *eventually small*, *truncate*.

**Distribution.** Endemic to Borneo; in Sabah recorded from Keningau, Kinabatangan, Kota Belud, Lahad Datu, Ranau, Sandakan, Sipitang, Tambunan and Tawau districts. (e.g., *Dransfield JD 6303*, *SFN 26667*, *SAN 32946*, *SAN 75752*, *SAN 83199*, *SAN 103502*, *SAN 115883* and *SAN 123940*) and in Sarawak from Kapit, Marudi, Sibu and Sri Aman districts (e.g., *Julaihi LJ 354*, *Chew CWL 471*, *S 2758*, *S 19655* and *S 24036*). Also known in Brunei (e.g., *BRUN 452*) and W, S and E Kalimantan (e.g., *Hallier 1267* and *Sidiyasa 1626*).

**Ecology.** In mixed dipterocarp forest and floodplains, mainly on clay rich soil at low altitude, but recorded also from peatswamp and hill forests, at altitudes to 1000 m.

## 79. **Syzygium khoonmengianum** P.S.Ashton

(Wong Khoon Meng; 1980–1987, Senior Forest Botanist, Forest Research Institute Malaysia; 1987–1991, Research Officer, Forestry Department, Brunei Darussalam; 1992–1996, Senior Forest Botanist, Sabah Forestry Department; 1996–2010, Professor, Institute of Biological Sciences, University of Malaya)

Kew Bull. 61, 1 (2006) 127. **Type:** *Wong WKM 2648*, Borneo, Sabah, Kaingeran, Tambunan district (holotype K; isotypes SAN, SAR).

Small tree. *Parts glabrous*. **Twigs** *c.* 1 mm diameter apically, slender, *at first 4-ribbed*, drying dark grey-brown, becoming whitish mottled. **Leaves** *thinly leathery*, drying grey-brown above, yellow-brown beneath, glistening, *obscurely brown dotted beneath*, *obscurely pitted above*; *blades obovate*, *2.5–3.5 × 1–1.8 cm*, base obtuse to shallowly heart-shaped, *apex c. 8 mm subcaudate*; *lateral veins subequal*, *many*, *dense*, *distinctly raised beneath*; *intercostal venation hardly raised above*, *distinctly so and forming a net beneath*; *petioles slender*, *c. 1 mm long*. **Inflorescences** short, terminal. **Flowers** unknown. **Fruits** *spherical*, *to 10 mm diameter*, *smooth*, *crowned by an up to 1 × 5 mm raised calyx rim*.

**Distribution.** Known only from the type collection.

**Ecology.** In lower montane forest at *c.* 1250 m altitude.

## 80. **Syzygium kiauense** (Merr.) Merr. & L.M.Perry Plate 6D.

(of Kiau, Kinabalu NP, Sabah, Borneo)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 162; Masamune *op. cit.* 531; Coode *et al.* (eds.) *op. cit.* 237; Beaman & C. Anderson *op. cit.* 218. **Basionym:** *Eugenia kiauensis* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 209, *op. cit.* (1921) 429, J.A.R. Anderson *op. cit.* (1980) 276. **Type:** *Clemens 10132*, Borneo, Sabah, Kiau, Mt. Kinabalu (holotype PNH, destroyed; isotype A Barcode A 69505).

Leaning river bank tree to 20 m tall, *c.* 40 cm diameter. **Bark** smooth, pale greenish to cream-brown; inner bark pale brown. *Parts glabrous*. **Twigs** *stout*, *more or less sharply quadrangular in cross-section*, pale grey-brown, smooth. **Leaves** *drying* wrinkled, *dull dark olive-brown above*, *pale dull greenish grey beneath*, *obscurely pitted above*, *sparsely distinctly brown dotted beneath*; *blades elliptic-obovate*, *c. 22 × 9*(*12–50 × 5–22*) *cm*, *base heart-shaped* ending abruptly toward petiole, apex acuminate, acumen *c.* 8 mm long, broad; venation prominent more so beneath than above; *lateral veins unequal*, *main ones c. 15 pairs*, *hardly furrowed above*, spreading; *intercostal venation distinct beneath*, *obscure above*; intramarginal veins 2, the main one well within margin but hardly looped; petioles

stout, *c.* 6 mm long, drying blackish. **Inflorescences** *paniculate*, *to 15 cm long and broad*, *terminal*; rachis stout, 2–3x-branched. **Flowers** *crowding the twig endings*; *buds urn-shaped*, *c. 12 mm long*, *c. 6 mm diameter*; hypanthium tapering to base without distinct pseudostalk; *calyx lobes 4*, *ovate*, *c. 3 × 4 mm*, subacute, *somewhat spreading* at anthesis, forming a *c.* 15 mm diameter disc; stamens many, exserting to 10 mm long, white, *anther locules parallel*; *ovary at the distal end of flower bud*, style extending to 25 mm long. **Fruits** ellipsoid to spherical, to 15 mm diameter, smooth, with prominent waisted crown of flared calyx lobes.

**Distribution.** Endemic to Borneo; recorded in Sabah from Mt. Kinabalu in Keningau, Ranau and Sipitang districts (e.g., *Chew et al. RSNB 1675*, *SAN 17366*, *Clemens 26155*, *SAN 25226*, *Clemens 26565* and *SAN 124036*) and in Sarawak from Belaga, Kapit and Marudi districts (e.g., *Nooteboom 02232*, *Chew CWL 1093*, *S 18281* and *S 36295*). Also known in Brunei (e.g., *BRUN 5225* and *SAN 17366*) and E Kalimantan (e.g., *Kostermans 7327*).

**Ecology.** Frequent along the banks of inland rivers, on clay soil and rocky banks, and in moist valleys in mixed and upper dipterocarp forest, at altitudes to 1600 m on Mt. Kinabalu where sometimes on ultramafic substrate.

## 81. **Syzygium kinabaluense** (Stapf) Merr. & L.M.Perry
(of Mt. Kinabalu, Sabah, Borneo)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 160; Masamune *op. cit.* 531; Coode *et al.* (eds.) *op. cit.* 237; Beaman & C. Anderson *op. cit.* 218. **Basionym:** *Eugenia kinabaluensis* Stapf, FMK (1894) 152, *t.* 11 *f.* 10–12, Merrill *op. cit.* (1921) 429, Burgess *op. cit.* 413, J.A.R. Anderson *op. cit.* (1980) 276. **Type:** *Haviland 1112*, Borneo, Sabah, Mt Kinabalu (holotype K). **Heterotypic synonyms:** *Syzygium exiguifolium* Merr. & L.M.Perry *op. cit.* (1939) 161, Beaman & C. Anderson *op. cit.* 216, ***syn. nov.***, **type:** *Clemens 33201*, Borneo, Sabah, Mt. Kinabalu, Marai Parai (holotype A; isotypes BO, K, L, NY); *S. polycladum* Merr. & L.M.Perry *op. cit.* (1939) 161, Beaman & C. Anderson *op. cit.* 223, ***syn. nov.***, **type:** *Clemens 30940*, Borneo, Sabah, Mt. Kinabalu, Penibukan (holotype A; isotypes BM, K, L, NY).

Small, much-branched tree. Parts glabrous. **Twigs** slender, *4-angled but hardly winged in cross-section*, much-branched, dark brown, smooth. **Leaves** thickly leathery, drying glistening grey-brown above, dull yellow-brown beneath, *sparsely pitted above*, *obscurely brown dotted beneath*; *blades variable in shape and size*, *almost round*, *ovate-obovate to oblong-elliptic*, *0.4–2 × 0.3–1.2 cm*, *base rounded abruptly joining petiole*, margin hardly rimmed, *apex rounded to shortly bluntly acuminate*; midrib raised or flat beneath; *lateral veins dense*, *unequal*, *main ones c. 11 pairs*, *distinct and slightly raised*, *more so beneath*, ascending, narrowly furrowed above, intermediate veins many the larger ones almost equal with the main lateral veins; intercostal venation invisible; intramarginal vein obscure, close to margin, hardly looped; petioles *c.* 3 mm long. **Flowers** densely clustered in terminal inflorescences; rachis usually distinct, at most 3 cm long; *buds cylindrical and swollen at apex to torch-shaped*, *4.5–8 mm long*, *c. 2.5 mm diameter*, slender, tapering at base without distinct pseudostalk, *ribbed and wrinkled*, *slightly warty*, *milky*; *calyx lobes 4*, *triangular*, *prominent*, *erect and pointed*; stamens many, exserted to 4 mm long, white, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** spherical, to 8 mm diameter, with *c.* 2 mm diameter crown of calyx lobes, ripening white.

**Distribution.** Endemic to Borneo.

**Ecology.** In upper montane forest, at (600–)1500–4000 m altitudes.

**Notes.** Three subspecies are recognised.

**Key to subspecies**

1. Leaves almost round to oblong-elliptic, 0.8–2 × 0.7–1.2 cm. Flower buds to 8 mm long…….. subsp. **kinabaluense**
   Found mainly in upper montane forest at altitudes 1500–4000 m. In Sabah recorded from Mt. Kinabalu in Keningau and Ranau districts (e.g., *RSNB 4504*, *Sinclair SFN 9115*, *SAN 21036*, *Car FD BNB 27626*, *Clemens 33054*, *SAN 38576*, *SAN 65174* and *SAN 66828*), and in Sarawak from G. Mulu NP, Miri district and G. Murud, Limbang district (e.g., *S 35823*, *S 37077*, *S 38753*, *S 44428* and *S 50863*).
   Leaves ovate-obovate, 0.4–1.5 × 0.3–0.5 cm. Flower buds 4–5.5 mm long……2

2. Leaf blades 0.5–1.5 × 0.3–0.5 cm; venation distinct; midrib raised beneath…….. subsp. **exiguifolium** (Merr. & L.M.Perry) P.S.Ashton, ***stat. nov.***
   **Basionym:** *Syzygium exiguifolium* Merr. & L.M.Perry *op. cit.* (1939) 161, Beaman & C. Anderson *op. cit.* 216. **Type:** *Clemens 33201*, Borneo, Sabah, Mt. Kinabalu, Marai Parai (holotype A; isotypes BO, K, L, NY).
   Known only in Sabah from Marai Parai and Panataran Basin on Mt. Kinabalu, Ranau district (e.g., the type and *Clemens 34207*) and Trus Madi FR, Keningau district (e.g., *SAN 71961*).
   Rare and apparently confined to the lower facies of upper montane forest on extreme ultramafic substrate at 1500–2100 m altitudes.
   Leaf blades 0.4–0.6 × 0.3–0.5 cm; venation obscure; midrib furrowed beneath…… subsp. **polycladum** (Merr. & L.M.Perry) P.S.Ashton, ***stat. nov.***
   **Basionym:** *Syzygium polycladum* Merr. & L.M.Perry *op. cit.* (1939) 161, Beaman & C. Anderson *op. cit.* 223. **Type:** *Clemens 30940*, Borneo, Sabah, Mt. Kinabalu, Penibukan (holotype A; isotypes BM, K, L, NY).
   Rare, known only by two other collections from Mt. Kinabalu (*Clemens 34208* and *Clemens 40692*) and one collection from G. Pagon in Brunei (*BRUN 2358*).

## 82. **Syzygium kudatense** P.S.Ashton Fig. 19.

(of Kudat district, Sabah, the locality of the type collection)

Kew Bull. 61, 1 (2006) 130. **Type:** *D. Brand SAN 30955*, Borneo, Sabah, Legatan, Kudat district (holotype K; isotypes KEP, L, SAR, SING).

Small tree *c.* 6 m tall, *c.* 10 cm diameter. **Bark** cream-coloured. *Parts glabrous*. **Twigs** *stout*, *4–6 mm diameter apically*, *prominently narrowly winged*, pale yellow-brown, smooth. **Leaves** leathery, *drying dull*, *yellowish brown beneath*, *pink-brown above*, pits and dots obscure; *blades lanceolate*, *16–25 × 3.5–7 cm*, *base deeply heart-shaped*, margin narrowly recurved, apex gradually tapering; *lateral veins unequal*, *main ones 12–16 pairs*, spreading or ascending, *prominent beneath*, *furrowed or slightly raised above*, intermediate veins shorter; intercostal venation evident on both surfaces, more so beneath; intramarginal vein 3–7 mm within margin, looped; petioles *c.* 2 mm long, drying black. **Flowers** *in terminal or axillary subsessile clusters*; *buds jambu-shaped*, *c. 15 mm long*, *c. 8 mm diameter*, *on c. 2*

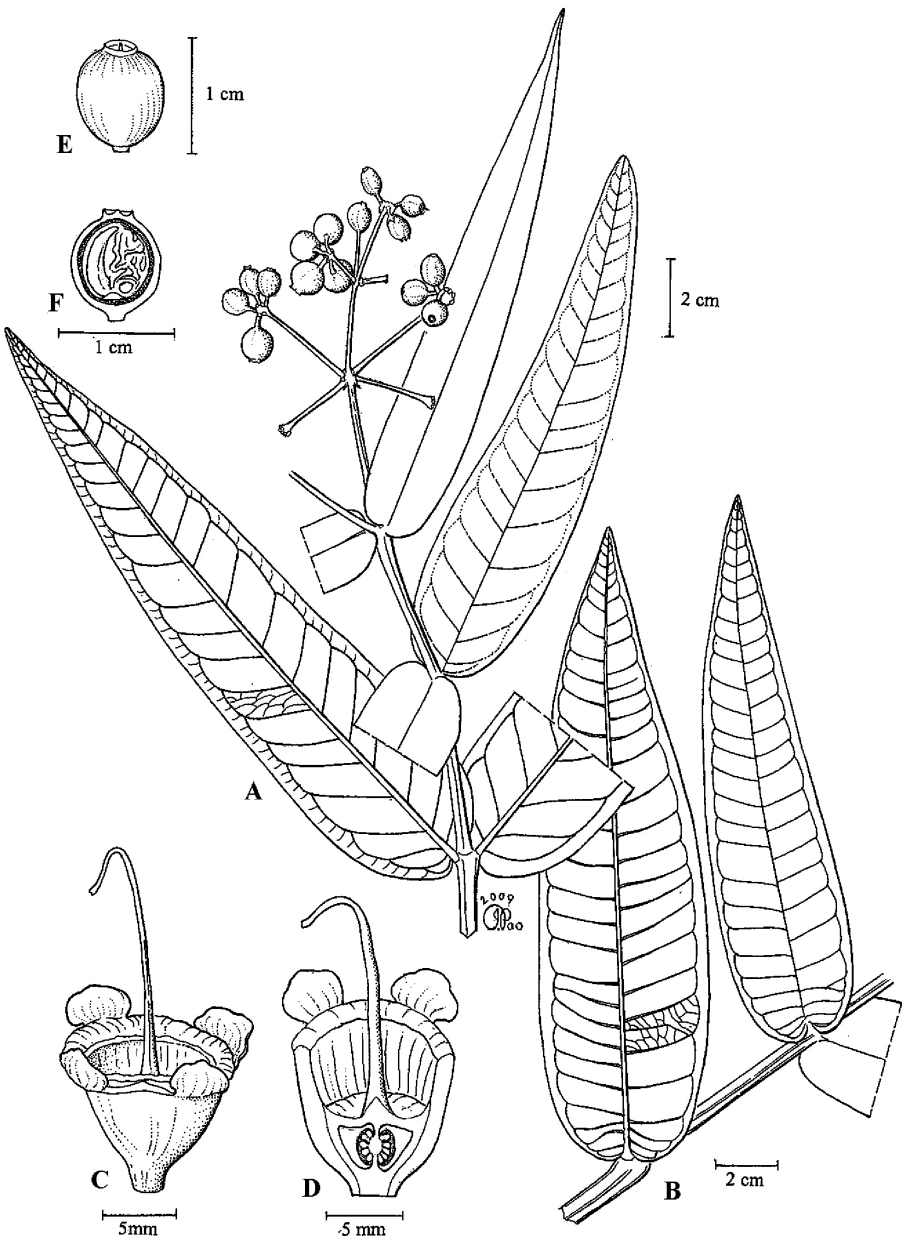


**Fig. 19.** *Syzygium kudatense*. A, fruiting leafy twig; B, leafy twig; C, young fruit; D, longitudinal section of young fruit; E, mature fruit; F, longitudinal section of mature fruit. (A, E–F from *SNP 4172*, B–D from *SAN 135020*.)

*mm pedicel*, *only slightly waisted beneath hypanthium*; *calyx lobes 4*, *unequal*, *rounded*, *c. 3 × 5 mm*, *spreading and becoming reflexed at anthesis*; stamens many, exserted to 10 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 15 mm long. **Fruits** spherical, *c.* 8 mm diameter.

**Distribution.** Endemic to Borneo; known only in Sabah from Kudat, Lahad Datu and Ranau districts (e.g., *Jamili SNP 4172*, *SNP 5416*, the type and *SAN 135020*).

## 83. **Syzygium kunstleri** (King) Bahadur & R.C.Gaur

(Hermann H. Kunstler, German plant collector employed by Calcutta Botanic Garden in Perak *c*. 1880–1886)

Ind. J. For. 1 (1978) 349. **Basionym:** *Eugenia kunstleri* King *op. cit.* 127, Ridley *op. cit.* (1922) 746, M.R. Henderson *op. cit.* (1949) 209, Kochummen *op. cit.* 199, J.A.R. Anderson *op. cit.* (1980) 276. **Syntypes:** *King's Collector 3310* & *3680*, Perak (K); *Curtis 179*, Penang (CAL, K). **Heterotypic synonyms:** *Eugenia albiramea* Merr., PEB (1929) 221, J.A.R. Anderson *op. cit.* (1980) 273, *Syzygium albirameum* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 190; *S. chrysanthum* Merr. & L.M.Perry *op. cit.* (1939) 192, Beaman & C. Anderson *op. cit.* 214, *E. chrysantha* (Merr. & L.M.Perry) J.A.R. Anderson *op. cit.* (1980) 274, ***syn. nov.***, **type:** *Maidin FD BNB 1746*, Borneo, Sabah, Kinabatangan (holotype A; isotype K); *S. stictophyllum* Merr. & L.M.Perry *op. cit.* (1939) 192, Beaman & C. Anderson *op. cit.* 226, ***syn. nov.***, **type:** *Clemens 50344*, Borneo, Sabah, Mt. Kinabalu, Penibukan (holotype A; isotypes BM, BO, K).

Canopy tree to 40 m tall, *c.* 60 cm diameter; bole fluted at base or with *c.* 4 m tall, *c.* 2 m wide thin buttresses. **Bark** whitish to orange-brown, smooth to cream-buff, papery, flaky; inner bark thick, fibrous, yellow-brown. *Parts glabrous*. **Twigs** *c.* 2 mm apically, *round in cross-section*, *pale grey-brown to cream-white*, *smooth*. **Leaves** thin, *drying dull dark purple to sometimes mauve-brown above*, *rich rust-brown to sometimes pink-brown or grey-brown beneath*, *densely distinctly minutely pitted above*, *similarly more or less distinctly gold-brown dotted or pimpled beneath*; *blades elliptic-oblong to obovate*, *11–16 × 3.5–6.5 cm*, *base wedge-shaped tapering into petiole*, *apex caudate*, *acumen c. 15 mm long*; *lateral veins unequal*, *main ones c. 7 pairs*, *very slender*, *slightly raised and usually drying slightly darker than the blade beneath*, generally slightly furrowed above; *intercostal venation indistinct*; *intramarginal vein 1 or 2*, *the main one 5–8 m within margin*, *looped*; petioles *c.* 14 mm long. **Inflorescences** *paniculate*, *terminal or subterminal-axillary*, to 10 cm long; *rachis* slender, angular, *2x-branched*, many-flowered. **Flower** *subtended by two minute narrowly triangular bracteoles*; *buds obconical*, *c. 3 mm long*, *c. 2 mm diameter*, *without distinct pseudostalk*; *calyx lobes obscure*, *forming a slightly 4-toothed rim*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical* to obovoid, *c.* 15 mm diameter, *smooth with small hardly raised apical calyx rim*.

**Distribution.** Peninsular Malaysia, Singapore and Borneo. In Borneo, recorded in Sabah from most districts (e.g., *SAN 25777*, *SAN 31212*, *FRI 41356*, *SAN 53530*, *SAN 88355*, *SAN 99905*, *SAN 103517* and *SAN 141027*) and in Sarawak also widespread (e.g., *Nooteboom 1931*, *S 22814*, *S 34924*, *S 54179*, *S 66096* and *S 82823*). Also known in Brunei (e.g., *Hemingway 286*, *BRUN 16843*, *BRUN 16893* and *BRUN 17459*) and in C and E Kalimantan (e.g., *Mahyar 3155*, van *Balgooy 5988*, *Kostermans 13244* and *bb 29347*).

**Ecology.** Locally common, on clay and leached sandy soils, mostly on slopes, in mixed dipterocarp forest at low altitude, and upper dipterocarp forest on Mt. Kinabalu including on ultamafic substrates, and on G. Murud at altitude *c.* 1700 m; also on limestone.

## 84. **Syzygium lambirense** P.S.Ashton
(of Lambir Hills NP, Sarawak)

Kew Bull. 61, 1 (2006) 130. **Type:** *Yii P.C. S 43106*, Borneo, Sarawak, Bukit Lambir summit, Miri district, 500 m, flowers (holotype K; isotypes KEP, L, SAR).

Treelet. *Young parts glabrous*. **Twigs** *c.* 2 mm diameter apically, *round in cross-section*, smooth, *dark brown*. **Leaves** *thickly leathery*, *drying satiny dark greenish brown*, *pitted above*, *without dots beneath*; *blades narrowly elliptic*, *4–9 × 1.5–3 cm*, *base narrowly wedge-shaped hardly tapering toward petiole*, *margin entire*, *recurved*, *apex narrowly rounded*; *lateral veins dense*, many, *subequal*, *main ones c. 10 pairs*, ascending, *raised beneath*, *less so above*; *intercostal venation finely reticulate*; *intramarginal vein c. 2 mm within margin*, *hardly looped*; *petioles* stout, *3–5 mm long*. **Inflorescences** *paniculate*, *terminal*, *c. 4 cm long*; rachis 1x-branched, ascending, wrinkled on drying. **Flowers:** *buds non-glandular*, *club-shaped*, *c. 12 mm long*, *c. 4 mm diameter*, *with c. 6 mm tapering somewhat slender pseudostalk*; *calyx lobes 4*, *rounded*, *c. 2 × 2 mm*, *thick but hyaline towards margins* near base, *clasping the base of the dome-shaped white corolla*, *spreading but not becoming reflexed at anthesis*; *stamens many*, exserted to 8 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to *c.* 8 mm long. **Fruits** *obovoid*, *c. 13 mm long*, *c. 10 mm diameter*, smooth, *ripening red*, drying wrinkled, with *c.* 6 mm diameter prominent calyx crown and *c*. 5 mm pedicel.

**Distribution.** Endemic to Borneo; known in Sarawak from the summit of Lambir Hills, Miri districts (e.g., *S 3042* and the type), Ulu Sg. Sipayan, Limbang district (e.g., *S 47647*) and possibly also from Ulu Melinau, Baram district (e.g., *S 1047*), and from G. Palung, in W Kalimantan (e.g., *Laman et al. TL 439*).

**Ecology.** On a narrow rocky sandstone ridge at 500 m altitude on Lambir Hills, and lower montane pole forest at 695 m altitude at G. Palung, where this small tree would form the main canopy.

## 85. **Syzygium leptostemon** (Korth.) Merr. & L.M.Perry
(Greek, *lepto* = thin, *stemon* = stamen; referring to the slender filaments)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 156; Masamune *op. cit.* 532; Chantaranothai & Parnell *op. cit.* 82; Coode *et al*. (eds.) *op. cit.* 237; Argent *et al.* (eds.) *op. cit.* 471; Parnell & Chantaranothai *op. cit.* 873. **Basionym:** *Jambosa leptostemon* Korth., Nederl. Kruidk. Arch. 1 (1847) 201. **Type:** *Korthals s.n.*, Borneo, Kalimantan, *loc. incert.* (holotype L, Barcode L 0062755). **Homotypic synonyms:** *Strongylocalyx leptostemon* (Korth.) Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 89, *Eugenia leptostemon* (Korth.) Miq., Fl. Ind. Bat. 1 (1855) 442, Merrill *op. cit.* (1921) 429, M.R. Henderson *op. cit.* (1949) 201, Kochummen *op. cit.* 199. **Heterotypic synonyms:** *Strongylocalyx leptostachyus* Miq. *op. cit.* (1855) 443; *Eugenia urceolata* King *op. cit.* (1901) 101, *non Jambosa urceolata* Korth. *nec. Syzygium urceolatum* (Korth.) Merr. & L.M.Perry; *E. subracemosa* Merr., J. Str. Br. Roy. As. Soc. 79 (1918) 23, *op. cit.* (1921) 433, *Syzygium subracemosum* (Merr.) Masam. *op. cit.* 539; *E. sandakanensis* Merr., J. Str. Br. Roy. As. Soc. 86 (1922) 335, EPB (1929) 216, J.A.R. Anderson *op. cit.* (1980) 279, *Syzygium sandakanense* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 155, Masamune *op. cit.* 539, Coode *et al*. (eds.) *op. cit.* 239, ***syn. nov.***, **type:** *Ramos 1466*, Borneo, Sabah, Sandakan (holotype PNH, *n.v.*; isotype A Barcode A 69556); *E. rotata* King *ex* Craib, Fl. Siam. Enum. 1 (1931) 660.

Canopy tree to 20 m tall, to 30 cm diameter, hardly buttressed. **Bark** smooth, warm-grey; inner bark pink-brown. *Young parts glabrous*. **Twigs** *2–3 mm diameter apically*, *elliptic or*

*slightly angled in cross-section near apex*, *pale orange-brown*, *smooth*. **Leaves** thinly leathery, *drying shagreened dark tawny*, *densely minutely pitted above*, *dull warm to yellow-brown and obscurely to minutely black dotted beneath*; *blades elliptic-obovate*, *c. 13 × 5*(*11–24 × 4.5–13*) *cm*, *base wedge-shaped tapering into petiole*, *apex caudate*, *acumen to 15 mm long*; *lateral veins unequal*, *equally raised but not prominent on both surfaces and often shallowly furrowed above*, *main ones 8*(*–14*) *pairs*; *intercostal venation evident but hardly raised*; *intramarginal veins 2*, *well within margin*, *looped*; petioles 5–12 mm long. **Inflorescences** *racemose*, *ramiflorous* behind leaves, *c.* 6 cm long but often shorter; rachis slender, 2x-branched. **Flowers:** *bracteoles in single pair*, *caducous*; *buds club-shaped*, *to 7 mm long*, *to 4 mm diameter*, *with short slender pseudostalk*; *calyx lobes 4*, *prominent*, *broadly ovate-acute*, *to 3 × 2 mm*, *loosely erect or spreading but not becoming reflexed at anthesis*, *margins hyaline*; stamens many, yellow, exserting to *c.* 5 mm *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to 10 mm long. **Fruits** ovoid-spherical, *c.* 15 mm across, ripening wine-red and juicy, ridged or corrugated on drying, with persistent prominent calyx lobes round calyx rim.

**Distribution.** Indo-Burma, Thailand, Peninsular Malaysia and Borneo. In Borneo widespread, recorded in Sabah from Beaufort, Keningau, Kinabatangan, Kota Belud, Kota Marudu, Lahad Datu, Ranau, Sandakan, Sipitang, Tawau and Tuaran districts (e.g., *Lugas LL 2681*, *Jamili SNP 6782*, *SAN 16630*, *SAN 21351*, *SAN 33076*, *SAN 85769* and *SAN 128422*) and in Sarawak from Belaga, Bintulu, Kapit, Kuching, Limbang, Samarahan, Song and Tatau districts (e.g., *Nooteboom & Chai 02287*, *S 16240*, *S 21838*, *S 36809*, *S 39019*, *S 48927*, *S 63612*, *S 64688* and *S 82828*). Also known from Brunei (e.g., *Middleton DJM 709* and *BRUN 17877*) and from C and E Kalimantan (*Wiriadinata 248*, *Ambriansyah Berau 809* and *Church et al. 1038*).

**Ecology.** Edaphically elective and locally common, on both sandy and clay-rich but always yellow soils and in moist places. In floodplains and on shallow peat as far into swamp forest as *alan* (phasic community 2); on and near river banks, at altitudes up to 1500 m in upper dipterocarp forest.

**Notes.** *Syzygium sandakanense* (Merr.) Merr. & L.M.Perry is here regarded as synonymous with *S. leptostemon*. Collections from Peninsular Malaysia show the full range of variation between the two entities.

## 86. **Syzygium leucocladum** Merr. & L.M.Perry

(Greek, *leuco-* = white, *clados* = twig; referring to the white-barked twigs)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 178; Coode *et al*. (eds.) *op. cit.* 237. **Basionym:** *Eugenia ambongensis* Ridl. var. *havilandii* Ridl., J. Bot. 68 (1930) 16; *Syzygium ambongense* (Ridl.) Masam. var. *havilandii* (Ridl.) Masam. *op. cit.* 523. **Type:** *Haviland 2147*, Borneo, Sarawak, Belaga, Rejang (holotype K; isotype SING). [See Notes below.]

Canopy tree to 80 cm diameter. **Bark** whitish green, smooth; inner bark pale brown. Parts glabrous. **Twigs** *c*. 3 mm diameter apically, *distinctly 4-angled in cross-section*, *conspicuously cream-coloured*, *glabrous*, *smooth*. **Leaves** *papery*, *drying wrinkled*, *dull tawny above*, *greenish brown beneath*, *densely pitted and pimpled above*, *conspicuously densely brown dotted beneath*; *blades elliptic*, *broadest in the basal half*, *c. 17 × 6*(*10–23 × 3.5–9*) *cm*, *base wedge-shaped abruptly joining the petiole*, *apex subcaudate*, *acumen slender*, *c. 1 cm long*; *lateral veins subequal*, *main ones c. 25 pairs*, *distinctly and equally*

*raised beneath*, furrowed above, somewhat ascending; *intercostal venation lax*, *obscure above*, *distinct beneath*; *intramarginal veins 2*, *the main one 2–3 mm within margin*, *looped*; *petioles c. 5 mm long*, *partially cream corky*. **Inflorescences** *paniculate*, to 11 cm long, *terminal*; rachis 3x-branched, bluntly quadrangular in cross-section. **Flowers:** *buds goblet-shaped*, *c. 6 mm long*, *c. 5 mm diameter*, *tapering into a c. 3 mm slender pseudostalk*; *calyx lobes 4*, *free*, *ovate*, subacute, *c. 2 × 2 mm*, *thick but with narrowly hyaline margin*, becoming reflexed at anthesis; stamens many, exserted to 3 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 4 mm long. **Fruits** *ellipsoid*, *c. 20 mm long*, *c. 14 mm diameter*, *with prominent apical ring of persistent calyx lobes*, *drying dark*.

**Distribution.** Endemic to Borneo; in Sabah known from Kinabatangan and Tawau districts (e.g., *SAN A 3413*, *SAN 37118* and *SAN 100322*) and in Sarawak from Belaga, Kapit and Miri districts (e.g., *S 18937*, *Clemens 21200*, *S 27864*, *S 35243* and *S 48011*). Also recorded from Brunei (e.g., *BRUN 18480*).

**Ecology.** In dipterocarp and secondary forest on clay soils; apparently rare.

**Notes.** Merrill & L.M. Perry (*op. cit.* (1939) 177 & 178) reduced *Eugenia embongensis* Ridl. to the synonymy of *Syzygium elopurae* (Ridl.) Merr. & L.M. Perry and upgraded the status of *E. ambongensis* Ridl. var. *havilandii* Ridl. to a species rank under *Syzygium.* Since the name "*S. havilandii* (Ridl.) Merr. & L.M. Perry" was predated by *S. havilandii* (Merr.) Merr. & L.M. Perry (based on *E. havilandii* Merr. 1917), the name *S. leucocladum* Merr. & L.M. Perry was proposed as a new name for the taxon.

## 87. **Syzygium leucoxylon** Korth.

(Greek, *leuco-* = white, *xylon* = tree trunk; referring to the white bark)

Ned. Kruidk. Arch. 1 (1847) 203; Miquel *op. cit.* (1855) 454; Merrill & L.M. Perry (1939) 193; Masamune *op. cit.* 532; Coode *et al.* (eds.) *op. cit.* 238. **Type:** *Korthals s.n.*, Borneo, Kalimantan, G. Pamatton (holotype L Barcode L 0009440; fragm. in A). **Homotypic synonym:** *Eugenia leucoxylon* (Korth.) Miq., Anal. Bot. Ind. 1 (1850) 26, *t.* 9, Merrill *op. cit.* (1921) 430, M.R. Henderson *op. cit.* (1949) 235, Burgess *op. cit.* 413, Kochummen *op. cit.* 199. **Heterotypic synonyms:** *Syzygium verecundum* Wall., Cat. (1831) 3579, *nom. nud.*, *ex* Masam. *op. cit.* 541 (*sphalm. vercundum*), *Eugenia verecunda* Duthie *in* Hooker *f. op. cit.* 496, King *op. cit.* 125, Ridley *op. cit.* (1922) 748, *op. cit.* (1930) 35, Kochummen *op. cit.* 199; *E. brevistylis* C.B.Rob., Philip. J. Sci. Bot. 6 (1911) 347; *E. alcinae* Merr., Philip. J. Sci. Bot. 10 (1915) 216, *op. cit.* (1921) 425, *op. cit.* (1923) 155, *op. cit.* (1929) 216, Burgess *op. cit.* 411, J.A.R. Anderson *op. cit.* (1980) 273, *S. alcinae* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 194, Masamune *op. cit.* 522, Merrill *op. cit.* (1950) 375, Coode *et al.* (eds.) *op. cit.* 234, Beaman & C. Anderson *op. cit.* 211.

Tree to 15 m tall, *c.* 30 cm diameter. **Bark** whitish grey, smooth with green scrape, eventually somewhat cracked and scaly; inner bark purplish brown. *Young parts glabrous*. **Twigs** *c*. 2 mm diameter apically, slender, *round in cross-section*, *conspicuous cream-white*, *smooth*. **Leaves** *drying pale yellowish to greyish green*, usually glistening above, *densely finely pitted above*, *densely finely black dotted beneath*; *blades elliptic-lanceolate or ovate*, *c. 7 × 4*(*4–8 × 1.5–4.5*) *cm*, base wedge-shaped tapering into petiole, *margin entire*, *narrowly recurved*, apex shortly acuminate, acumen to 15 mm long; *lateral veins dense*, *c. 30 pairs*, *subequal*, *slender but equally distinct on both surfaces*, *shallowly grooved above*, somewhat ascending; *intercostal venation evident above*, *less so beneath*, *in a fine but characteristic pale-drying lattice*; *intramarginal vein close to margin*, *hardly looped*; petioles slender, *c.* 7 mm long. **Inflorescences** *paniculate*, *terminal or subterminal-axillary*,

*c. 9 cm long*; rachis *c.* 2 mm diameter at base, round or bluntly quadrangular in cross-section, 2–3x-branched. **Flowers:** *buds club-shaped*, *to 4 mm long*, *to 2 mm diameter*, *with cup-like hypanthium tapering into c. 2 mm slender pseudostalk*; *calyx obscurely 4-toothed*, *lobes free*, *thick-margined*, *forming a prominent undulate rim*; stamens many, exserting to 3 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style to 3 mm long. **Fruits** *spherical*, *to 5 mm diameter*, smooth, *with c. 2 mm diameter raised calyx rim* and *c.* 2 mm slender stalk, *ripening blackish*.

**Distribution.** Peninsular Malaysia, Borneo and the Philippines. Widespread in Sabah, recorded from Beaufort, Keningau, Kota Belud, Kota Kinabalu, Kota Marudu, Kudat, Labuk Sugut, Papar, Penampang, Pitas, Ranau, Sandakan and Tawau districts (e.g., *SAN 20750*, *SAN 36040*, *SAN 40353*, *SAN 74158*, *SAN 80662*, *SAN 102554* and *SAN 135050*); rare in Sarawak known from Bau, Bintulu, Lundu and Sibu districts (e.g., *S 28008*, *S 29901*, *S 41829* and *S 66758*). Also known in Brunei (e.g., *BRUN 93*, *Wong WKM 160*, *S 12353*, *BRUN 15383* and *BRUN 16518*) and W, E and S Kalimantan (e.g., *Laman 560*, *Ambriansyah AA 592* and *bb 29634*).

**Ecology.** Locally common in coastal forests and along estuaries, including ultramafic substrates at G. Silam and inland at 1200–1500 m altitudes in Kinabalu NP, Sabah.

## 88. **Syzygium longiflorum** C.Presl

(Latin, *longus* = long, *flos* = flower; referring to the long flower bud)

Abh. Königl. Bohm. Ges. Wiss., Ser. 5, 3 (1845) 500, Bot. Bemerk. 70 (1846) 70; Masamune *op. cit.* 533; Merrill *op. cit.* (1950) 398. **Type:** *Cuming 1296*, the Philippines, Luzon, Cagayan Prov. (holotype BM; isotypes L Barcode L 0009641, fragment A). **Homotypic synonyms:** *Eugenia longiflora* (C. Presl) Fern.-Vill., Novis. App. Fl. Filip. (1880) 86, C.B. Robinson, Philip. J. Sci. Bot. 4 (1909) 366, Elmer, Leaf. Philip. Bot. 4 (1912) 1440, Merrill *op. cit.* (1923) 169, Ridley *op. cit.* (1930) 14, M.R. Henderson *op. cit.* (1949) 159, Kochummen *op. cit.* 201, Corner *op. cit.* (1997) 588. **Heterotypic synonyms:** *Myrtus lineata* Blume, Bijdr. Fl. Ned. Ind. Part 12 (1827) 1087, *non* Swartz 1788, *Jambosa lineata* (Blume) DC., Prodr. 3 (1828) 287, Miquel *op. cit.* (1855) 428, *Clavimyrtus lineata* (Blume) Blume *op. cit.* (1850) 116, *Eugenia lineata* (Blume) Duthie *in* Hooker *f. op. cit.* 487, *non* (Sw.) DC. (1828) 273, King *op. cit.* 99, Merrill *op. cit.* (1917) 226, *op. cit.* (1918) 20, *op. cit.* (1921) 430, Ridley *op. cit.* (1922) 738, Merrill *op. cit.* (1929) 216, Burgess *op. cit.* 413, J.A.R. Anderson *op. cit.* (1980) 277, *Syzygium lineatum* (DC.) Merr. & L.M.Perry *op. cit.* (1938) 109, *op. cit.* (1939) 172, Masamune *op. cit.* 532, Amshoff, Blumea 5 (1945) 499, Airy Shaw *op. cit.* (1949) 121, Backer *op. cit.* 343, Chantaranothai & Parnell *op. cit.* 83, Turner *op. cit.* (1996) 378, Coode *et al.* (eds.) *op. cit.* 238, Argent *et al.* (eds.) *op. cit.* 472, Parnell & Chantaranothai *op. cit.* (2002) 873, Beaman & C. Anderson *op. cit.* 219, Chen & Craven, Fl. China 13 (2007) 359. **Type:** *Blume s.n.*, Java (holotype L, *n.v.*); *M. cerasiformis* Blume *op. cit.* (1827) 1087, *E. cerasiformis* (Blume) DC. *op. cit.* 274, M.R. Henderson *op. cit.* (1949) 196, Kochummen *op. cit.* 185, *J. cerasiformis* (Blume) Hassk., Cat. Hort. Bogor. Alt. (1844) 262, Miquel *op. cit.* (1855) 433, *S. cerasiforme* (Blume) Merr. & L.M.Perry *op. cit.* (1939) 187, Chantaranothai & Parnell *op. cit.* 49, Turner *op. cit.* (1996) 372, Parnell & Chantaranothai *op. cit.* 841. **Type:** *Blume s.n.*, Java (holotype L, Barcode L 0009411); *C. latifolia* Blume *op. cit.* (1850) 117, *J. latifolia* (Blume) Miq. *op. cit.* (1855) 429. **Type:** *Korthals s.n.*, Borneo (*n.v.*); *J. teysmanni* Miq. *op. cit.* (1855) 429, *E. teysmanni* (Miq.) Koord. & Valeton, Bijdr. Booms. Java 6 (1900) 164, Merrill *op. cit.* (1921) 434, *S. teysmanni* (Miq.) Masam. *op. cit.* 540. **Type:** *S. coll.*, *s.n.*, Java (holotype L, Barcode L 0009642); *E. longicalyx* Ridl. *op. cit.* (1930) 11, *S. longicalyx* (Ridl.) Masam. *op. cit.* 533. **Type:** *Creagh s.n.*, Borneo, Sabah, *loc. incert.*, July 1896 (holotype K).

Small to medium-sized canopy tree, occasionally to 20 m tall, to 40 cm diameter; buttresses short thin; stilt-roots occasionally present. **Bark** red-brown, smooth becoming scaly; inner bark thin, grey-brown. *Young parts glabrous*. **Twigs** slender, *round in cross-section*, *pale*

*brown*, *at first smooth*, *becoming thinly cracked*. **Leaves** somewhat leathery, *drying dull throughout*, *dark tawny above*, *paler yellow-brown beneath* with the veins often darker, purplish, *obscurely pimpled above*, *sparsely minutely dotted beneath*; *blades narrowly elliptic to lanceolate*, *c. 6 × 3*(*3.5–8 × 1.5–4*) *cm*, base wedge-shaped tapering into petiole, *margin entire*, *apex caudate and curved down*; *venation visible but hardly and equally though distinctly raised below*, *more or less shallowly furrowed above though sometimes also distinctly raised*; *lateral veins dense*, *subequal*, *c. 15 pairs*, somewhat ascending; *intercostal venation lax*, *subparallel with main lateral veins*, hardly raised; *intramarginal vein 1*, *close to margin*, *hardly looped*; *petioles slender*, *c. 8 mm long*. **Inflorescences** *paniculate*, *terminal or subterminal-axillary*, *c. 6 cm long*, *hardly or not exceeding leaves*; rachis round in cross-section, slender, 3x-branched, spreading, many-flowered. **Flowers:** *buds clove-shaped*, *to 9 mm long*, *to 3 mm diameter*; *pseudostalk substantial*, *gradually tapering to base*; *calyx lobes 4*, *ovate-acute*, *c. 2 × 2 mm*, *unequal*, *thick*, *cupped around the prominent domed corolla*, *flaring at anthesis and falling after anthesis and in the young fruit*; *stamens many*, exserting to 8 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical*, or sometimes *ovoid to ellipsoid*, to 14 mm long, to 10 mm diameter, with *c.* 5 mm diameter crown of persistent erect calyx lobes, *ripening white*.

**Distribution.** SE India, Myanmar, Thailand, S China, Indo-China, Sumatra, Peninsular Malaysia, Singapore, Borneo, Java, Bali, the Philippines and Maluku (Ceram). In Borneo common and widespread; known in Sabah from Beaufort, Keningau, Kinabatangan, Kota Marudu, Kudat, Lahad Datu, Papar, Ranau, Sandakan, Sipitang, Tambunan and Tawau districts (e.g., *RSNB 4828*, *SAN 18805*, *SAN 24575*, *SAN 30137*, *SAN 48897*, *SAN 50037*, *SAN 75678*, *SAN 83789*, *SAN 115441* and *SAN 126508*) and in Sarawak from Baram, Belaga, Bintulu, Kapit, Kuching, Lawas, Limbang, Lubok Antu, Lundu, Marudi, Miri, Mukah, Serian and Tatau districts (e.g., *S 22244*, *S 30088*, *S 46396*, *S 49298* and *S 77251*). Also known in Brunei (e.g., *BRUN 463*, *BRUN 663*, *BRUN 2534*, *BRUN 6310* and *BRUN 16616*) and W, C and E Kalimantan (e.g., *Sidiyasa 1089*, *Ambriansyah 1210*, *Kessler PK 1980*, *Kostermans 12602* and *bb 16058*).

**Ecology.** Locally common in *kerangas*, also mixed peat swamp forest, river banks, organic soils on limestone karst summits, and upper dipterocarp forest on high ridges at altitudes 500–1200 m, up to1800 m on Mt. Kinabalu.

## 89. **Syzygium lunduense** (Merr.) Merr. & L.M.Perry
(from Lundu, W Sarawak)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 180; Masamune *op. cit.* 533. **Basionym:** *Eugenia lunduensis* Merr., J. Str. Br. Roy. As. Soc. 79 (1918) 25, *op. cit.* (1921) 430, J.A.R. Anderson *op. cit.* (1980) 277. **Type:** *Haviland 985*, Borneo, Sarawak, G. Gading, Lundu district (holotype SING; isotype K).

Small understorey tree *c.* 10 m tall, to 20 cm diameter. **Bark** pale brownish grey mottled, patchily thinly flaky. *Parts glabrous*. **Twigs** *c. 5 mm diameter apically*, *round* or *elliptic in cross-section*, *golden-brown becoming pale yellowish brown*, *smooth*. **Leaves** thinly leathery, drying dull tawny-brown, *sparsely obscurely pitted above*, *dull pale yellow brown sparsely dotted beneath*; *blades elliptic to obovate or ovate*, *c. 22 × 9*(*17–38 × 9–13*) *cm*, *base narrowly subcordate-rounded abruptly joining petiole*, apex shortly acuminate; *lateral veins unequal*, *main ones c. 11 pairs*, somewhat ascending, with intermediate veins of varying length, *furrowed above*, *prominent beneath*; *intercostal venation faint throughout*;

*intramarginal veins 1*(*or 2*), *4–6 mm within margin*, *looped*; petioles stout, *c.* 3 mm long, *c.* 3 mm thick, drying blackish. **Flowers** *in dense terminal clusters*; *buds c. 15 mm long*, *c. 6 mm diameter*, *at first torch-shaped*, *after anthesis becoming jambu-shaped with globose hypanthium and c. 10 mm long tapering pseudostalk*; *calyx lobes 4*, *distinct*, *rounded*, *broad*, *with wavy hyaline margin*, *becoming reflexed*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to *c.* 14 mm. **Fruits** unknown.

**Distribution.** Endemic to Borneo; in Sabah rare, known only by a single collection from Leila FR, Sandakan district (*i.e. SAN 37343*) and in Sarawak recorded from Kuching, Limbang, Lundu, Miri and Simunjan districts (e.g., *S 40771*, *S 59991* and *S 77263*). Also known in W, E and C Kalimantan (e.g., *Laman et al. 715* & *1048*, *de Vogel 2128* and *Kostermans 13527*).

**Ecology.** Quite common in moist valleys in mixed dipterocarp forest in the tree demography plot at Lambir Hills NP in Sarawak.

## 90. **Syzygium macromyrtus** (Koord. & Valeton) Merr. & L.M.Perry

(Greek, *macro* = large, Latin, *myrtus* = myrtle; referring to the large fruit)

Mem. Amer. Acad. Arts. & Sci. 18, 3 (1939) 169; Amshoff, Blumea 5, 3 (1945) 496; Backer *op. cit.* 337. **Basionym:** *Eugenia macromyrtus* Koord. & Valeton, Bijdr. Booms. Java 6 (1900) 109 [based on *Macromyrtus javanica* Miq., Fl. Ind. Bat. 1 (1855) 440], *non Syzygium javanicum* Miq. **Type:** *Junghuhn s.n.*, Java, Surakarta (holotype U, Barcode 0005217). **Heterotypic synonyms:** *Eugenia siphonantha* King *ex* Greves, J. Bot. 62, Suppl. (1924) 38, *Syzygium siphonanthum* (King *ex* Greves) Amshoff *op. cit.* 496, *in adnot.*

Canopy tree to 60 cm diameter, with many spreading stilt roots. **Bark** orange-brown, finely peeling. *Parts glabrous*. **Twigs** *c. 1 mm diameter apically*, *slender*, *round in cross-section*, *orange-brown*, *finely longitudinally flaky*. **Leaves** thin, *drying tawny throughout*, obscurely or dark pitted above, *not or sparsely gland-dotted beneath*; *blades lanceolate*, *c. 8.5 × 2.5*(*6–12 × 2–4.5*) *cm*, *base wedge-shaped tapering into petiole*, *margin prominently wavy*, apex subcaudate, acumen tapering; *lateral veins unequal*, *slightly raised on both surfaces though slightly furrowed above*, *very slender*, *very unevenly spaced*, *main ones c. 40 pairs*; intercostal venation visible on both surfaces; *intramarginal veins 2 pairs*, *the main one c. 2 mm within margin*, *looped*; petioles slender, *c.* 5 mm long. **Flowers** *in dense terminal and axillary clusters*; rachises short, slender, round in cross-section; *buds typically spindle-shaped*, *sometime trumpet-shaped*, *to 35 mm long*, *to 5 mm diameter*, minutely warty, drying ochreous-brown, *with long slender pseudostalk*; *hypanthium expanding abruptly at apex into the cup-shaped*, *obscurely 4-toothed*, *truncate calyx rim*; *stamens many*, *anther locules parallel*; *ovary in a medial swelling of the pseudostalk or at the distal end of the flower bud*. **Fruits** *fusiform c. 30 mm long*, *c. 10 mm diameter*, smooth, with prominent apical calyx rim.

**Distribution.** Sumatra, Java and Borneo. In Borneo, rare, recorded in Sarawak from Semengoh FR, Kuching district (e.g., Semengoh FR, Kuching district (e.g., *5620*), P. Bruit, Sibu district (e.g., *S 8046*) and Bt. Mersing, Tatau district (e.g., *S 13799*) and from Kalimantan (e.g., *Hallier 1305*, *Hallier 1328*, and *bb 7667*).

**Ecology.** Mostly on river banks and base-rich clay soils on slopes.

## 91. **Syzygium maingayi** Chantar. & J.Parn.

(Alexander Caroll Maingay, 1836–1869, surgeon and naturalist in Melaka)

Kew Bull. 48, 3 (1993) 605, *op. cit.* (1994) 84; Turner *op. cit.* (1996) 378; Parnell & Chantaranothai *op. cit.* 874 [*non Eugenia maingayi* Duthie = *Syzygium claviflorum* (Roxb.) *ex* Steud. var. *maingayi* (Duthie) Chantar. & J.Parn.)]. **Basionym:** *Eugenia oblongifolia* Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 491, King *op. cit.* 111, Ridley *op. cit.* (1922) 744, M.R. Henderson *op. cit.* (1949) 184, Kochummen *op. cit.* 204 [*non Syzygium oblongifolium* (Gillepsie) Merr. & L.M.Perry, Sargentia 1 (1942) 75]. **Type:** *Maingay KD 746*, Peninsular Malaysia, Malacca (holotype K).

Large canopy tree to 40 m tall, to 50 cm diameter, with short buttresses and sometimes stilt roots. **Bark** grey-brown, smooth; inner bark pinkish red. *Parts glabrous*. **Twigs** 2–3 mm diameter apically, *round or elliptic in cross-section*, *grey-brown*, *smooth*. **Leaves** *thinly leathery*, *drying dull mauve-grey above*, *glistening yellow-brown beneath*, *obscurely pitted above*, *sparsely black-dotted beneath*; *blades elliptic-oblanceolate*, *9–16 × 4–7 cm*, *base narrowly wedge-shaped tapering into petiole*, *margin recurved*, apex acuminate, acumen tapering, slender, *c.* 1 cm long; midrib sharply raised beneath; *lateral veins unequal*, *main ones 12–16 pairs*, *slender but raised on both surfaces more so beneath*, *not furrowed above*, ascending, *with many shorter immediate veins*; *intercostal venation invisible above*, distinct beneath; *intramarginal vein 1*, *c. 2 mm within margin*, *slightly looped*; *petioles c. 15 mm long*. **Inflorescences** paniculate, terminal or axillary, *c.* 15 cm long; rachis *c.* 3 mm diameter, 2x-branched, compressed towards base, somewhat ascending, many-flowered. **Flowers** white; *buds clove-shaped*, *c. 6 mm long*, *c. 2.5 mm diameter*, slender, *slightly constricted into the tapering pseudostalk*; *calyx lobes 4*, *vestigial*, subacute or shortly cuspidate, forming a shallow rim round the base of the domed corolla; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical*, *c. 15 mm diameter*, *with raised apical calyx rim*, *ripening green*.

**Distribution.** Thailand, Peninsular Malaysia and Borneo. Very rare in Borneo; known by a single collection in Sabah from Sepilok FR, Sandakan district (i.e. *SAN 93176*) and Andulau FR in Brunei.

**Ecology.** In mixed dipterocarp forest on sandy soil.

## 92. **Syzygium malaccense** (L.) Merr. & L.M.Perry

(from Malacca, Peninsular Malaysia)

J. Arn. Arb. 19 (1938) 215, *op. cit.* (1939) 154; Masamune *op. cit.* 533; Merrill *op. cit.* (1950) 401; Backer *op. cit.* 243; Ashton *op. cit.* 428; Chantaranothai & Parnell *op. cit.* 85; Parnell & Chantaranothai *op. cit.* 875; Beaman & C. Anderson *op. cit.* 219; Chen & Craven *op. cit.* 346. **Basionym:** *Eugenia malaccensis* L., Sp. Pl. (1753) 470, Duthie *in* Hooker *f. op. cit.* 471, King *op. cit.* 82, Koorders & Valeton *op. cit.* (1900) 55, Merrill *op. cit.* (1921) 430, Ridley *op. cit.* (1922) 724, Merrill *op. cit.* (1923) 170, M.R. Henderson *op. cit.* (1949) 46, Kochummen *op. cit.* 247, J.A.R. Anderson *op. cit.* (1980) 277. **Homotypic synonyms:** *Caryophyllus malaccense* (L.) Stokes, Bot. Mat. Med. 3 (1812) 72, *Myrtus malaccensis* (L.) Spreng., Syst. 2 (1825) 484, *Jambosa malaccensis* (L.) DC. *op. cit.* (1828) 286. **Type:** *van Rheede*, *Hort. Malab. 1* (*1678*) *29*, *t. 18*, "in India" [*fide* D.H. Nicolson *et al.*, Interpr. van Rheede's Hort. Malab. (1988) 195]. **Heterotypic synonyms:** *Eugenia macrophylla* Lam., Dict. (1789) 196, *Jambosa macrophylla* (Lam.) DC. *op. cit.* (1828) 286; *E. purpurea* Roxb., Fl. Ind. edition Carey 2 (1832) 483, *E. malaccensis* L. var. *purpurea* (Roxb.) Duthie *in* Hooker *f. op. cit.* 472; *J. domestica* Blume *op. cit.* (1850) 91.

Columnar dense-crowned unbuttressed tree, to 25 m tall, to 50 cm diameter. **Bark** smooth, grey-brown. *Parts glabrous*. **Twigs** 6–8 mm diameter apically, stout, *initially shouldered at internodes*, *round in cross-section*, *smooth*, *pale brown*. **Leaves** thinly leathery, drying dull honey-brown above, pale yellowish orange beneath, sparsely prominently pitted above, black dotted beneath; *blades oblong-obovate*, *c. 27 × 9*(*10–38 × 5.5–12*) *cm*, *base broadly wedge-shaped ending abruptly to petiole*, apex shortly broadly acuminate; *lateral veins unequal*, *main ones c. 10 pairs*, prominent though more so beneath, *shallowly furrowed above*, ascending; intercostal venation distinct on both surfaces; *intramarginal veins up to 3*, *5–8 mm within margin*, *looped*; *petioles stout*, *c. 10 mm long*, *more than 6 mm diameter*, drying black. **Inflorescences** *paniculate*, *terminal to ramiflorous*, to 1.5 cm long; rachis short, hardly branched. **Flowers:** *buds jambu-shaped*, *to 16 mm long*, *to 12 mm diameter*, *tapering to base of the indistinct pseudostalk*; *calyx lobes 4*, ovate, *c.* 7 × 7 mm, rounded or subacute, *with hyaline margins*, *spreading and becoming reflexed at anthesis*; *stamens many*, *c.* 15 mm long, *bright pink*, *anther locules parallel*; *ovary at the distal end of flower bud*, style to 2.5 cm long. **Fruits** ellipsoid or pear-shaped, to 7.5 mm long, to 5 cm diameter, white with pink stripes; flesh crisp, with a faint taste of cloves.

**Vernacular names.** Sarawak—*jambu merah* or *jambu lipa* (Malay), *kelupah* (Kelabit).

**Distribution.** Presumably originated in SE Asia, now cultivated thoughout the humid tropics especially in W Malesia, S Asia and the Pacific. In Borneo commonly planted in village orchards; recorded in Sabah from Beaufort, Kota Belud, Lahad Datu, Penampang, Ranau and Sandakan districts (e.g., *SAN A 3040*, *Clemens 30257*, *SAN 55049*, *SAN 85076* and *SAN 124722*) and in Sarawak from Kuching and Marudi districts (e.g., *H. Christensen 61*, *Hewitt 258* and *S 21432*). Also known from E and S Kalimantan (e.g., *Ambriansyah AA 359* and *Korthals s.n.*).

**Uses.** The large crisp-fleshed fruit, faintly tasting of cloves, is eaten raw and often used for preserves with other fruit.

## 93. **Syzygium medium** (Korth.) Merr. & L.M.Perry

(Latin, *medium* = in the middle; a species intermediate between two other known species in the genus)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 166; Masamune *op. cit.* 533; Coode *et al.* (eds.) *op. cit.* 238; Beaman & C. Anderson *op. cit.* 220. **Basionym:** *Jambosa media* Korth., Ned. Kruidk. Arch. 1 (1847) 199, Blume *op. cit.* (1850) 98, Miquel *op. cit.* (1850) 28, *op. cit.* (1855) 424, Merrill *op. cit.* (1921) 430. **Homotypic synonym:** *Eugenia media* (Korth.) Burgess *op. cit.* 413, J.A.R. Anderson *op. cit.* (1980) 277. **Type:** *Korthals s.n.*, Borneo, Kalimantan, Arenawe (holotype L, *n.v.*). **Heterotypic synonyms:** *Jambosa linearis* Korth. *op. cit.* (1847) 199, Miquel *op. cit.* (1856) 426, *excl. syn.*, Merrill *op. cit.* (1921) 430, *Syzygium lineare* (Korth.) Masam. *op. cit.* 532, *non S. lineare* Wall.; *S. pauciflorum* Merr. & L.M.Perry *op. cit.* (1939) 170, ***syn. nov.***, **type:** *Korthals s.n.*, Borneo, Kalimantan, G. Pamaton (holotype L, Barcode L 0009660).

Rheophytic shrub. *Parts glabrous*. **Twigs** slender, *round in cross-section*, *smooth*, yellowish cream. **Leaves** *opposite or partially in false whorls of threes*, wrinkled on drying and tawny pitted above, dull yellow-brown and minutely pimpled beneath; *blades narrowly elliptic-lanceolate*, *c. 7 × 1.5*(*5.5–14 × 0.7–3.5*) *cm*, *base narrowly wedge-shaped tapering into petiole*, apex tapering, blunt; *lateral veins unequal*, ascending, *slender but prominent beneath*, *not raised or furrowed above*, *main ones c. 12 pairs*; intercostal venation obscure above, visible beneath; *intramarginal veins 2*, *close to margin*, *looped*; *petioles c. 4 mm*

*long*. **Inflorescences** short, *few-flowered*, *terminal or axillary*. **Flowers:** *buds jambu-shaped*, *to 10 mm across*, *tapering from the c. 12 mm diameter hypanthium to the c. 5 mm long stout pseudostalk*; *calyx lobes 4*, *hemispherical*, *c. 4 × 7 mm*, *with thin wavy margin*, *spreading and becoming reflexed at anthesis*; stamens many, exserting to 12 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 14 mm long. **Fruits** *urn-shaped*, *c.* 15 mm long, *c.* 12 mm diameter, subsessile, tapering to *c.* 10 mm diameter beneath the flared calyx crown.

**Distribution.** Endemic to Borneo; widespread, known in Sabah from Kinabatangan, Lahad Datu, Ranau, Sandakan and Tawau districts (e.g., *Pereira JTP 324*, *SAN 41203*, *SAN 59564*, *SAN 82627* and *SAN 124799*) and in Sarawak from Kapit, Lawas, Lubok Antu and Song districts (e.g., *Zainuddin 4588*, *S 33066*, *S 33568*, *S 34069* and *S 54545*). Also recorded from Brunei (e.g., *BRUN 724*, *Jacobs 5584* and *BRUN 6648*) and in W, C and E Kalimantan (e.g., *Ridsdale PBU 374*, *Kessler PK 925*, *Mogea 3690*, *Kostermans 7089* and *bb 20635*).

**Ecology.** Common beneath the floodline of whitewater rivers; forming gregarious patches on shingle along the rapids.

## 94. **Syzygium monticolum** Merr. & L.M.Perry

(Latin, *monti-*, pertaining to mountain, *-colus*, residing on; referring to the habitat of the type locality)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 173, as "*monticola*". **Type:** *Hallier 2087*, Borneo, W Kalimantan, Sg. Kenepai (holotype L, *n.v.*; isotype BO).

Small tree. **Bark** smooth, closely fissured, orange-brown; stilt roots present. *Young parts glabrous*. **Twigs** 2–3 mm diameter apically, *round in cross-section*, slender, *pale brown*, *smooth*. **Leaves** *thickly leathery*, *drying glistening dark grey above*, *dull pale tawny-brown beneath*, *with scattered shallow pimples above and dense distinct minute pimples sometimes darkening as spots beneath*, *somewhat wrinkled*; *blades lanceolate*, *c. 9 × 4.5*(*8–15 × 4–8*) *cm*, base wedge-shaped shortly tapering, *margin entire*, *recurved*, apex caudate, acumen *c.* 1.5 cm long; *lateral veins subequal*, *c. 40 pairs*, intermediate veins more or less shorter, *slender but slightly raised on both surfaces*, *more or less minutely furrowed along crests above*; *intercostal venation obscure*; *intramarginal vein close to margin*, *hardly looped*; *petioles c. 5 mm long*. **Inflorescences** paniculate, axillary or terminal, to 7 cm long; rachis slender, 1(or 2)x-branched. **Flowers:** *buds green*, drying dark, smooth, *clove-shaped*, *c. 8 mm long*, *c. 3 mm diameter*, *on a slender tapering pseudostalk*; *calyx lobes 4*, *broadly ovate*, *to 2 × 1 mm*, obtuse, *margins hyaline*, appressed, becoming reflexed, cupped and falling off at anthesis; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical*, *c*. 1 cm diameter, smooth, *with c. 5 mm diameter flared calyx rim*.

**Distribution.** Endemic to Borneo; uncommon, recorded in Sarawak from Kapit and Miri districts (e.g., *S 40418*, *S 48016*, *S 48172*, *S 48227* and *S 63227*). Also known in Brunei (ecological voucher *S.J. Davies A656*, Andulau Forest Reserve), and W and E Kalimantan (e.g., *Hallier 1912*, *Hallier 2087*, *Endert 4299* and *Endert 4707*).

**Ecology.** In mixed dipterocarp forest on yellow sands, and lower montane forest over basic volcanic substrate.

## 95. **Syzygium moultonii** (Merr.) Merr. & L.M.Perry

(John Coney Moulton, 1886–1926, curator of the Sarawak Museum 1905–1915, collector and instigator of the Sarawak Museum Journal)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 151; Masamune *op. cit.* 534; Beaman & C. Anderson *op. cit.* 220. **Basionym:** *Eugenia moultonii* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 221, *op. cit.* (1921) 431. **Type:** *Native Collector 811*, Borneo, Sarawak, Tabawan Road and Rock Road, Kuching (holotype PNH, ? destroyed; isotypes A, L).

Canopy tree, to 20 m tall, *c.* 30 cm diameter. **Bark** smooth. *Parts glabrous*. **Twigs** *c. 3 mm diameter apically*, *4-ribbed in cross-section at first*, *early becoming round*, *yellowish brown*. **Leaves** thin, *drying dark mauve-brown above*, *orange-brown beneath*, *shiny and obscurely pimpled above*, *prominently darkly so beneath*; *blades oblanceolate*, *c. 16 × 5*(*6.5–18 × 3–6*) *cm*, *base narrowly wedge-shaped tapering into petiole*, *margin not wavy*, apex bluntly acuminate, acumen *c.* 1 cm long; *lateral veins c. 30 pairs*, *unequal*, *hardly raised throughout*; *intercostal venation obscure*; *intramarginal vein 1–2 mm within margin*, *looped*; petioles slender, 6–13 mm long. **Inflorescences** *paniculate*, *terminal or axillary*, *c.* 1.5 cm long; rachis short, rigid, short-branched, few-flowered. **Flowers:** bracteoles keel-shaped, *c.* 4 mm long, prominent, persistent; *buds narrowly obconical torch-shaped*, *c. 4 mm long*, *c. 2 mm diameter*, shiny, tapering, *without distinct pseudostalk*; *calyx lobes 4*, *hemispherical*, *c. 1 × 1 mm*, *not or hardly hyaline at margin*, strongly cupped; stamens many, exserting to *c.* 3 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** unknown.

**Distribution.** Endemic to Borneo; rare and apparently confined to the W Sarawak Plateau Sandstone of the Bako NP, Kuching district (e.g., *S 10469*, *S 16221* and *S 36414*).

**Ecology.** *Kerangas* forest on skeletal sandy soil.

## 96. **Syzygium muelleri** (Miq.) Miq.

(George Müller, 1790–1826, German soldier, administrator, and amateur naturalist employed by the Dutch East Indies company in W Kalimantan)

Fl. Ind. Bat. 1, 1 (1855) 453; Merrill & L.M. Perry *op. cit.* (1939) 186; Masamune *op. cit.* 534; Argent *et al.* (eds.) *op. cit.* 472. **Basionym:** *Eugenia mülleri* Miq., Anal. Bot. Ind. 1 (1850) 23, *t.* 6, Merrill *op. cit.* (1921) 431, *op. cit.* (1929) 216, M.R. Henderson *op. cit.* (1949) 186, Kochummen *op. cit.* 202, J.A.R. Anderson *op. cit.* (1980) 277. **Homotypic synonym:** *Syzygium obovatum auct. non* DC. (*op. cit.* (1828) 259)**:** Korth., Ned. Kruidk. Arch. 1 (1847) 259. **Type:** *Korthals s.n.*, Borneo, Kalimantan, Martapura, P. Lampei (holotype L Barcode L 0009445). **Heterotypic synonyms:** *Syzygium venulosum* Wall., Cat. (1831) No. 3585, *nom. nud*., Masamune *op. cit.* 540, *Eugenia venulosa* Duthie *in* Hooker *f. op. cit.* 490, King *op. cit.* 123, Ridley *op. cit.* (1922) 746, *op. cit.* (1930) 35. **Type:** *Wallich No. 3585*, Singapore, 1822 (K); *E. sarawacensis* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 214, *op. cit.* (1921) 433, J.A.R. Anderson *op. cit.* 279, *S. sarawacense* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 186, Masamune *op. cit.* 539, Coode *et al.* (eds.) *op. cit.* 239, ***syn. nov.***, **type:** *Native Collector 812*, Borneo, Sarawak, Kuching, Matang Road, 1 & 3 July 1911 (holotype PNH, ?destroyed; isotype A); *E. viburnifolia* Ridl. *op. cit.* (1930) 15, *S. viburnifolium* (Ridl.) Masam. *op. cit.* 541, ***syn. nov.***, **type:** *Haviland & Hose 3219*, Borneo, Sarawak, near Kuching (holotype K).

Main canopy tree, to 25 m tall, *c.* 50 cm diameter; buttresses thin, to 2 m tall; stilt roots sometimes present. **Bark** papery, flaky, whitish to pale yellow-brown; inner bark pink-brown. *Parts glabrous*. **Twigs** *slender*, *c. 2 mm diameter apically*, *round in cross-section*, *brownish*, *smooth or slightly cracked*. **Leaves** *thinly leathery*, *drying glistening purplish*

*brown above*, *grey-brown beneath*, *obscurely pitted above*, *faintly densely dotted beneath*; *blades broadly elliptic*, *c. 8.5 × 4*(*3.5–11 × 2–5*) *cm*, *base wedge-shaped tapering into petiole*, *apex rounded or subacuminate*, *acumen c. 5 mm long*, *blunt*; *midrib usually distinctly broadly raised*; *lateral veins unequal*, *main ones c. 6 pairs*, *the basal pair originating with intramarginal veins and continuing up to half the margin*, slender, *not furrowed above*, ascending, *equally hardly raised but distinct on both surfaces as the intercostal venation*; *intramarginal veins 2*, *the main one well within margin*, *looped*; *petioles c. 7 mm long*. **Inflorescences** *paniculate*, *terminal*, *lax to 9 cm long*; rachis 3x-branched, with the basal branches spreading to 4 cm. **Flowers:** *buds obconical torch-shaped*, *c. 4 mm long*, *c. 2.5 mm diameter*, slender, *tapering to c. 2 mm pseudostalk*; *calyx lobes 4*, *distinct*, *hemispherical*, *c. 1 × 1 mm*, *thick*, strongly cupped, appressed to base of domed corolla; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *broadly pear-shaped or sometimes ellipsoid*, to 12 mm long, *c.* 10 mm diameter, *green*, *drying dark*, somewhat tapering into a short stalk, shallowly ribbed, *more or less depressed at apex with c. 2 mm diameter small hardly rimmed cavity*.

**Distribution.** Sumatra (Bangka), Peninsular Malaysia, Singapore and Borneo. In Borneo, widespread, recorded in Sabah from Beaufort, Keningau, Lahad Datu, Papar, Sandakan, Semporna, Sipitang, Tawau and Tenom districts (e.g., *SAN 30079*, *SAN 32212*, *SAN 33746*, *SAN 34578*, *SAN 73157*, *SAN 81423*, *SAN 84379*, *SAN 106020* and *SAN 115639*) and in Sarawak from Bintulu, Kuching, Lundu, Marudi, Miri, Sibu and Simunjan districts (e.g., *S 16263*, *S 27829*, *S 38509*, *S 39265*, *S 39701* and *S 54488*). Also known in Brunei (e.g., *S 7856* and *BRUN 15642*) and Kalimantan (e.g., the type).

**Ecology.** Locally common, in primary and secondary peatswamp, *kerangas* and dipterocarp forests on shallow sandy soils; in the lowlands.

## 97. **Syzygium multibracteolatum** (Merr.) Merr. & L.M.Perry

(Latin, *multus* = many, *bracteolatus* = adorned with bracteoles; referring to the subpersistent bracteoles beneath each of the clustered flowers)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 158; Masamune *op. cit.* 534. **Basionym:** *Eugenia multibracteolata* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 219, *op. cit.* (1921) 431, J.A.R. Anderson *op. cit.* (1980) 277. **Type:** *Native Collector 2240*, Borneo, Sarawak, G. Santubong (holotype PNH, destroyed; isotype K, fragm. at A). **Heterotypic synonyms:** *Eugenia lobbii* Ridl. *op. cit.* (1930) 17, *Syzygium lobbii* (Ridl.) Masam. *op. cit.* 533.

Shrubby tree, *c.* 10 cm diameter, with pendent branches. Parts glabrous. **Twigs** *c*. 2 mm diameter apically, *prominently winged*, *dark orange-brown*, becoming flaky. **Leaves** leathery, obscurely pitted above, with dark pits beneath, drying dull rust above, brownish yellow beneath; *blades flat*, *ovate*, *c. 9 × 5*(*5–12 × 3.5–7*) *cm*, *base heart-shaped*, *margin hardly recurved*, apex acuminate, acumen *c*. 1 cm long, stout; *lateral veins more or less obscure*, *unequal*, *c. 10 pairs* with 1 intermediate vein between each pair, *slightly more raised beneath than above*; *not furrowed above*, intercostal venation obscure; intramarginal vein close to margin, not looped; petioles *c.* 2 mm long. **Inflorescences** paniculate, terminal or subterminal-axillary, *c.* 4 cm long; rachis *c.* 3 mm diameter, winged, rigid, pale brown. **Flowers:** *buds cylindrical to somewhat torch-shaped*, *c. 9 mm long*, *c. 3 mm diameter*, *without distinct pseudostalk*, *bluish milky* but not glaucous, *warty*, *subtended by a pair of c. 5 mm long foliose lanceolate bracteoles*; *calyx lobes 4*(*or 5*), *lanceolate-triangular*, *c. 2.5 × 1 mm*, *erect*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*.

**Fruits** ellipsoid or spherical, *c.* 8 × 6 mm, milky, becoming wrinkled on drying, with *c.* 3 mm diameter crown of erect calyx lobes.

**Distribution.** Endemic to Borneo. In Sabah rare, known from a single collection from Sipitang district (i.e., *SAN 144462*); in Sarawak widespread and recorded from Betong, Kuching, Lubok Antu, Lundu, Marudi, Miri, Simunjan, Song and Sri Aman districts (e.g., *S 10409*, *S 35667*, *S 36309*, *S 38361*, *S 43110*, *S 44292*, *S 54050* and *S 91360*). Also known in Brunei (e.g., *S 2180*) and Kalimantan (e.g., *Polak 252*).

**Ecology.** Locally frequent, in *kerangas* forest on rocky slopes and summits from low altitude to 1000 m, usually near the coast.

## 98. **Syzygium myrtifolium** (Roxb.) Walp.

(Latin, *myrtus* = myrtle, *folium* = leaf; with leaf similar to that of myrtle tree, *Myrtus L.*)

Repert. Bot. Syst. 2 (1843) 178; Miquel *op. cit.* (1850) 20, *op. cit.* (1855) 456; Merrill & L.M. Perry *op. cit.* (1939) 182; Masamune *op. cit.* 534. **Basionym:** *Eugenia myrtifolia* Roxb., Fl. Ind. edition Carey 2 (1832) 490, Duthie *in* Hooker *f. op. cit.* 483, Merrill *op. cit.* (1921) 431, Ridley *op. cit.* (1922) 750, *op. cit.* (1930) 35, *nom. illeg.*, *non* Salisb. (1796), *nec*. Sims (1821), *nec* Cambess. (1829). **Type:** ?*Roxburgh s.n.*, Cult. Hort. Bot. Calcutta, originated from Sumatra (?K). **Heterotypic synonyms:** *Calyptranthes oleina* Wight, Ill. Ind. Bot. (1841) *t.* 15, *Eugenia oleina* Wight *op. cit.* (1841) *t.* 15, *nom. nud.*, Craib, Fl. Siam. Enum. 1 (1931) 653, M.R. Henderson *op. cit.* (1949) 150, *Syzygium oleinum* Wall. *ex* Walp. *op. cit.* 178, Merrill *op. cit.* (1950) 406; *S. campanulatum* Korth., Nederl. Kruidk. Arch. 1 (1847) 204, Walpers, Ann. Bot. Syst. 2 (1851–1852) 630, Merrill *op. cit.* (1921) 426, Masamune *op. cit.* 525, Chantaranothai & Parnell *op. cit.* (1994) 47, Argent *et al.* (eds.) *op. cit.* 469, Parnell & Chantaranothai *op. cit.* 840, ***syn. nov.***, **type:** *Korthals s.n.*, Borneo, Kalimantan (holotype ?L, *n.v.*); *S. campanellum* Miq., Fl. Ind. Bat. 1 (1855) 451; *E. acuminatissima* (Blume) DC. var. *parva* Merr., Philip. J. Sci. 1, Suppl. (1906) 104, *E. parva* (Merr.) C.B.Rob., Philip. J. Bot. 4 (1909) 391; *E. sinubanensis* Elmer, Leafl. Philip. Bot. 4 (1912) 1424, *S. sinubanense* (Elmer) Diels *in* Engler's Bot. Jahrb. 57 (1922) 411.

Subcanopy tree *c.* 20 m tall, to 60 cm diameter; buttresses *c.* 2 m tall; stilt roots sometimes present. **Bark** smooth to papery flaky, grey to orange-brown; inner bark dark red. Parts glabrous. **Twigs** very slender, *at first quadrangular*, *later becoming round in cross-section*, *pink-brown*, *smooth*. **Leaves** *thinly leathery*, *drying more or less pale rust-brown and obscurely pitted above*, *paler and minutely dotted beneath*; *blades elliptic to lanceolate*, *c. 7.5 × 2.5 cm*, base wedge-shaped tapering into petiole, *apex caudate*, *acumen c. 12 mm long*; *lateral veins subequal*, *c.* 28 pairs, *slender*, *hardly raised*, *somewhat more prominent beneath than above*, furrowed along crests above; intramarginal veins 1(or 2), close to margin, not looped; *petioles slender*, *c. 6 mm long*. **Inflorescences** racemose, to 4 cm long, terminal or subterminal-axillary; rachis singly branched. **Flowers:** *buds club- becoming trumpet-shaped at anthesis*, *to 7 mm long*, *c. 3 mm diameter*, with a small round hypanthium *on a slender pseudostalk and 4 or 5 vestigial acute calyx lobes*; *stamens many*, brilliant cerise-red, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical or ellipsoid*, *to 9 mm diameter*, *juicy*, *drying black*; *calyx rim c. 4 mm diameter*, *reflexed*.

**Distribution.** NE India, Myanmar, Thailand, Sumatra, Peninsular Malaysia, Borneo and the Philippines. In Sabah infrequently recorded, known from Kudat, Lahad Datu, Labuk Sugut, Sipitang and Tawau districts (e.g., *SAN 47189*, *SAN 53402*, *SAN 79993*, *SAN 82214* and *SAN 111996*) and in Sarawak from Kapit, Kuching, Lundu, Serian and Simunjan districts (e.g., *Beccari 1641*, *Beccari 3544*, *Jacobs 5077*, *S 34466*, *S 36249*, *S 36374* and *S 46236*).

**Ecology.** In mixed and upper dipterocarp forest at altitudes to 1000 m, and secondary forest, mostly on sandy soil.

**Uses.** This species has become popular in cultivation in recent decades, especially in Singapore but widespread elsewhere also. Its dense neat bushy growth as a tall specimen shrub or hedge plant, good response to pruning, pretty dark red-brown young leaves and vivid flowers, combined with its vigorous performance on poor soils and ease of propagation, have made it a favourite with housing and highway developers.

## 99. **Syzygium myrtilloides** Merr. & L.M.Perry

(Greek, *-oides* = resembling; a species resembling *Syzygium myrtillus*)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 172; Beaman & C. Anderson *op. cit.* 220. **Type:** *Clemens 30958*, Borneo, Sabah, Penibukan, Mt. Kinabalu (holotype A; isotypes BM, BO, L Barcode L 0009446, NY). **Homotypic synonym:** *Eugenia myrtilloides* (Merr. & L.M.Perry) Burgess, TBS (1966) 413.

Small tree or shrub. *Young parts glabrous*. **Twigs** *c.* 1 mm diameter apically, slender, *at first 4-ribbed but soon become round in cross-section*, *flaky or smooth*, *grey-brown*. **Leaves** *thinly leathery*, *with scattered pimples above and brown dots beneath*, *drying dull grey-brown above*, *tawny beneath*; *blades elliptic to sometimes obovate*, *4.5–8 × 2–4.5 cm*, base wedge-shaped tapering into petiole, *margin entire*, *narrowly recurved*, *apex caudate*, *acumen c. 6 mm long*; *lateral veins subequal*, *c.* 50 pairs, *evident beneath otherwise obscure*, *hardly raised*, spreading; *intercostal venation more or less obscure*; *intramarginal vein 1*, *close to margin*, *hardly looped*; *petioles slender*, *c. 6 mm long*. **Inflorescences** paniculate, *c.* 4 cm long; rachis *c.* 1 mm diameter at base, very slender, 2x-branched; bracteoles linear, *c.* 2 mm long, caducous. **Flowers:** *buds shortly clove-shaped*, *c. 6 mm long*, *c. 3 mm diameter*, *with a 3 mm slender tapering pseudostalk*; *calyx lobes 4*, *ovate*, *subacute*, *thick to margin*, clasping corolla; stamens many, at anthesis exserted to 3 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical*, *c.* 15 mm diameter, *with small apical calyx rim*.

**Distribution.** Endemic to Borneo; very rare, known with certainty only from Mt. Kinabalu (e.g., the type, *RSNB 67*, *RSNB 141* and *Clemens 40644*).

**Ecology.** In ridge forest at 1000–1500 m altitude on Mt. Kinabalu, sometimes over ultramafic rock.

## 100. **Syzygium myrtillus** (Stapf) Merr. & L.M.Perry

(Latin, *myrtillus* = myrtle-like)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 171; Masamune *op. cit.* 535 (*sphalm. myrtillum*); Beaman & C. Anderson *op. cit.* 220. **Basionym:** *Eugenia myrtillus* Stapf, Trans. Linn. Soc. Bot. 4 (1894) 153, Merrill *op. cit.* (1921) 434, Burgess *op. cit.* (1966) 413, J.A.R. Anderson *op. cit.* (1980) 277. **Homotypic synonym:** *S. borneense* (Miq.) Miq. var. *myrtillus* (Stapf) Chantar. & J.Parn. *op. cit.* (1994) 45. **Type:** *Haviland 1109*, Borneo, Sabah, Mt Kinabalu, at *c.* 2900 m (holotype K). **Heterotypic synonyms:** *Eugenia ugoensis* C.B.Rob., Philip. J. Sc. Bot. 4 (1909) 389, Merrill *op. cit.* (1921) 431, *Syzygium ugoense* (C.B.Rob.) Masam. *op. cit.* 540; *E. subcaudata* Merr., Philip. J. Sc. Bot. 11 (1916) 21.

Small tree or shrub. *Young parts glabrous*. **Twigs** *round in cross-section*, *grey-brown*, *smooth or flaky*. **Leaves** *thinly leathery*, *drying rust- to pink-brown*, *glistening*, crowded on twigs; *blades obovate*, *c. 4 × 2.2*(*1–7 × 0.7–2.5*) *cm*, base shortly tapering into petiole, *margin entire*, *apex acute to subacuminate*; *lateral veins subequal*; *intercostal venation evident*; *intramarginal vein close to margin*, *hardly looped*; *petioles slender*, *c. 5 mm long*. **Inflorescences** and **flowers** unknown. **Fruits** white, *spherical*, *c. 15 mm diameter*, smooth, wrinkled on drying, *with c. 3 mm diameter*, *c. 1 mm high hardly lobed calyx rim*.

**Distribution.** Borneo and the Philippines. In Sabah recorded from Mt. Kinabalu (e.g., the type, *RSNB 4494*, *RSNB 4495*, *Carr 27495*, *SAN 28729*, *SAN 29072*, *SAN 29132*); in Sarawak known from G. Murud (e.g., *Native Collector s.n.*).

**Ecology.** Locally abundant in upper montane forest at 1600–3000 m altitude, especially on ultramafic substrate in Kinabalu NP.

## 101. **Syzygium napiforme** (Koord. & Valeton) Merr. & L.M.Perry

(Latin, *napus* = a turnip, *formis* = shape; referring to the shape of the fruit)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 183; Turner *op. cit.* (1996) 378; Beaman & C. Anderson *op. cit.* 221. **Basionym:** *Eugenia napiformis* Koord. & Valeton, Bull. Inst. Bot. Buitenz. 2 (1889) 7, Bijdr. Booms. Java 6 (1900) 120, M.R. Henderson *op. cit.* (1949) 247, Burgess *op. cit.* 413, Backer & Bakhuizen *f. op. cit.* 338, Kochummen *op. cit.* 203, J.A.R. Anderson *op. cit.* (1980) 277. **Type:** *Koorders s.n.*, W Java, Tjigenteng, Preanger Res. (holotype BO, *n.v.*).

Large canopy tree, to 35 m tall, *c.* 1 m diameter; buttresses to 2 m tall, thin. **Bark** reddish brown, becoming flaky; inner bark pink-brown. *Young parts glabrous*. **Twigs** *c*. 2 mm diameter apically, slender, *at first quadrangular but soon become round in cross-section*, *pale greyish*, *smooth*. **Leaves** *thinly leathery*, *drying dull pale grey-green*, *obscurely pitted above*, *sparsely black dotted beneath*; *blades elliptic to lanceolate*, *c. 8 × 3*(*4–12 × 1.5–6*) *cm*, base wedge-shaped tapering into petiole, *margin not undulate*, *entire*, *apex subcaudate*, *acumen c. 1 cm long*; *lateral veins subequal*, *dense*, *c*. 25 pairs, *visible but hardly raised beneath*, *obscure or slightly furrowed above*, somewhat ascending; intercostal venation obscure; *intramarginal vein close to margin*, *hardly looped*; *petioles slender*, *c. 1 cm long*. **Inflorescences** *paniculate*, *to 6 cm long*, *terminal or axillary*; *rachis hardly branched*. **Flowers** white; *buds slender clove-shaped*, *c. 12 mm long*, *c. 4 mm diameter*, *with long tapering pseudostalk c. 3x the length of hypanthium*, *minutely warty*, becoming *pale ochreous following anthesis*; *calyx lobes 4*(*or 5*), *shortly triangular to almost vestigial*, *c. 1 × 1 mm*, well-spaced, *hyaline towards margins*, reflexed at anthesis; *stamens many*, exserting to *c.* 4 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c*. 5 mm long. **Fruits** *obconical to carrot-shaped*, to 20 mm long, to 8 mm diameter, *pale ochreous-brown*, minutely pimpled.

**Distribution.** Peninsular Malaysia, Java and Borneo. In Sabah recorded from Beaufort, Kota Belud, Kuala Penyu, Lahad Datu, Ranau, Sandakan, Tambunan and Tenom districts (e.g., *RSNB 4170*, *SAN 37928*, *SAN 41297*, *SAN 57717*, *SAN 65014*, *SAN 76259*, *SAN 77621*, *SAN 78139* and *SAN 103437*), and in Sarawak from Kapit, Kuching, Lawas, Limbang, Lundu, Marudi, Miri, Serian and Tatau districts (e.g., *Nooteboom 02316*, *Purseglove 5343*, *S 8741*, *S 15544*, *S 22625*, *S 26344*, *S 30391* and *S 41228*). Also known in C and E Kalimantan (e.g., *Ambriansyah AA 1531*, *Meijer 2371* and *Kostermans 21529*).

**Ecology.** In lowland mixed dipterocarp forest on yellow sandy soils, upper dipterocarp and other lower montane forest at altitudes to 1800 m, and mixed peat swamp forest; also on ultramafic substrate in Kinabalu NP.

## 102. **Syzygium neriifolium** Becc. *ex* Merr. & L.M.Perry

(Latin, *nerium* = oleander, *-folius* = leaved; with leaves like those of oleander (*Nerium oleander* L., Apocynaceae), a common ornamental in Florentine gardens, where Beccari lived)

Nelle Foreste di Borneo (1902) 403, fig. 65, 5, (as *neerifolium*), *nom. nud.*; Merrill *op. cit.* (1921) 431, *nom. nud.*; Merrill & L.M. Perry *op. cit.* (1939) 151; Masamune *op. cit.* 535. **Type:** *Beccari 3862*, Borneo, Sarawak, banks of Entabei River (holotype FI; isotype K).

Small riverside shrub or tree. *Parts glabrous*. **Twigs** *c. 2 mm diameter apically*, *slender*, *round in cross-section*, *grey-brown*, *smooth*. **Leaves** thin, with scattered pimples above, *sparsely gland-dotted beneath*, *drying dull dark olive above*, *grey-green beneath*; *blades narrowly elliptic-lanceolate*, *10–15 × 1.3–2 cm*, *base wedge-shaped abruptly tapering into petiole*, apex slender acuminate; *lateral veins very slender*, *unequal*, *main veins c. 18 pairs*, 6–10 mm apart, *hardly raised and no more so beneath than above*, *more or less furrowed above*, spreading, *drying darker than the blade*; intercostal venation obscure; *intramarginal vein 1*, *c. 1 mm within margin*, *looped*; petioles 1–2 cm long. **Inflorescences** paniculate, terminal, *c.* 8 cm long; rachis *c.* 3 mm diameter at base, becoming shrivelled, 3x-branched, branches ascending, with subpersistent ovate cupped bracts. **Flowers:** *buds narrowly obovoid to oblong*, *c. 5 mm long*, *c. 2 mm diameter*, *without distinct pseudostalk*, *subtended by a pair of c. 3 × 2 mm ovate to triangular bracteoles*; *calyx lobes 4*, *ovate-acute*, *c. 1 × 1 mm*; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** unknown.

**Distribution.** Endemic to Borneo. Very rare, known only from the type and *S 68584* from the Saribas area in Sarawak.

**Ecology.** A rheophyte of the flood zone along the banks of fast flowing rivers.

**Notes.** More collections are needed to decide whether *Syzygium odoardoi* is truly distinct from this species.

## 103. **Syzygium nervosum** DC.

(Latin, *nervosus* = nerved; referring to the distinct leaf veins)

Prodr. 3 (1828) 260; Panigrahi & Mishra, Taxon 34 (1985) 298; Turner *op. cit.* (1997) 21. **Lectotype** (Panigrahi & Mishra, 1985)**:** *Roxburgh s.n.* [= M. Lambert, 1816), India (G-DC, *n.v.*; microf. CAL, *n.v.*). **Homotypic synonyms:** *Eugenia operculata* Roxb., Hort. Beng. (1814) 37, *nom. nud.*, Fl. Ind. edition Carey 2, 2 (1832) 486, Merrill *op. cit.* (1921) 431, Ridley *op. cit.* (1922) 754, M.R. Henderson *op. cit.* (1949) 264, Kochummen *op. cit.* 205, *Syzygium operculatum* (Roxb.) Nied. *in* Engler & Prantl., Nat. Pflanzenfam. 3, 7 (1893) 85, Masamune *op. cit.* 535 (*sphalm. operuculatum*), *Cleistocalyx operculatus* (Roxb.) Merr. & L.M.Perry, J. Arn. Arb. 18 (1937) 337, Masamune *op. cit.* 521, Argent *et al*. (eds.) *op. cit.* 464; *Cleistocalyx nervosum* (DC.) Kosterm., Bull. Bot. Soc. India 29 (1987) 17. **Heterotypic synonyms:** *Eugenia cerasoides* Roxb. *op. cit.* (1814) 92, *nom. nud.*, *op. cit.* (1832) 488, *Syzygium cerasoides* (Roxb.) Raizada, Ind. Forester 84 (1958) 478, *Cleistocalyx cerasoides* (Roxb.) I.M.Turner, Gard. Bull. Sing. 57 (2005) 26, **lectotype** (I.M. Turner, 2005)**:** *Icon.*

*Roxb. no. 2256* (K); *S. nodosum* Miq., Fl. Ind. Bat. 1, 1 (1855) 447, **type:** ?*Junghuhn 85*, Java (holotype U Barcode U 0004982).

Main canopy or occasionally emergent tree, to 40 m tall, *c.* 80 cm diameter; buttresses sharp, to 2.5 m tall. **Bark** grey-brown, smooth to thinly scaly; inner bark pink. *Parts glabrous*. **Twigs** *c.* 2 mm diameter apically, *round in cross-section*, *smooth*, *pale grey-brown*. **Leaves** *thin*, *wrinkled on drying*, *dull greenish tawny*, *fairly densely black dotted beneath*, *pitted above*; *blades mostly elliptic*, *c. 12 × 7*(*4–15 × 6–7*) *cm*, *base wedge-shaped tapering into petiole*, *apex broadly acuminate*; *lateral veins unequal*, *equally spaced*, *very slender but distinctly raised beneath*, *flat or furrowed above*, *main veins c. 13 pairs*; *intercostal venation lax*, *visible beneath only*; *intramarginal vein 1*(*or 2*) *pairs*, *3–6 mm within margin*, *looped*; *petioles c. 8 mm long*. **Inflorescences** *paniculate*, *ramiflorous behind leaves* or axillary, *c.* 8 cm long; rachis spreading with perpendicular branches, 2x-branched, slender. **Flowers:** *buds goblet-shaped*, *to 6 mm long*, *c. 4 mm diameter*, *with tapering quadrangular pseudostalk*; *calyx snuffer-like forming a helmet over the corolla*, *splitting off as a lid at anthesis leaving an even rim*, *lobes not or hyaline only at margin*; stamens many, exserting to 6 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style slender, *c.* 8 mm long. **Fruits** *ellipsoid to spherical to 10 mm long*, *to 8 mm diameter*, with *c*. 2 mm high prominent apical calyx rim, *ripening black*.

**Distribution.** From Indo-Burma and S China to Australia. In Borneo scattered; recorded in Sabah from Beaufort, Kota Belud, Lahad Datu, Papar, Ranau and Tambunan districts (e.g., *SAN A 3302*, *SAN A 3437*, *Clemens 30478*, *SAN 40265*, *SAN 41643*, *SAN 44668*, *SAN 77105* and *SAN 125613*) and in Sarawak from Lundu, Mukah and Sibu districts (e.g., *Haviland 2845*, *Beccari 3943* and *Purseglove P 4694*). Also known in Brunei (e.g., *BRUN 18165*) and W and E Kalimantan (e.g., *Kostermans 53*, *Sidiyasa 819* and *Hallier 1684*).

**Ecology.** Scattered in evergreen forest, especially in flood plains including shallow peat, and on moist undulating land on fertile clay soils in mixed dipterocarp forest.

## 104. **Syzygium nigricans** (King) Merr. & L.M.Perry

(Latin, *nigricans* = blackish; referring to the dark-drying leaf blade)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 194; Turner *op. cit.* (1996) 378, *op. cit.* (1997) 21; Argent *et al.* (eds.) *op. cit.* 472; Ashton *op. cit.* (2006) 130. **Basionym:** *Eugenia nigricans* King, J. As. Soc. Beng. 70, 2 (1901) 114, Ridley *op. cit.* (1922) 751, M.R. Henderson *op. cit.* (1949) 194, Kochummen *op. cit.* 203. **Type:** *Wray 2221*, Peninsular Malaysia, Perak (holotype CAL; isotypes K, SING).

Canopy tree, to 40 m tall, *c.* 1 m diameter; bole with buttresses to 2 m tall or sometimes fluted at base; stilt roots to 2 m tall. **Bark** grey-brown, becoming thinly flaky or scaly; inner bark red-brown. *Young parts glabrous*. **Twigs** *c.* 2 mm diameter apically, slender, *round in cross-section*, *smooth*, *dark brown*. **Leaves** leathery, *densely pitted above*, *obscurely dotted beneath*, *drying glistening above*, *slightly so beneath*, *warm dark red-brown throughout*; *blades elliptic or ovate*, *c. 8 × 4.5*(*6–14 × 2–6*) *cm*, base wedge-shaped tapering into petiole, *margin not recurved*, *entire*, *apex subcaudate or slender-acuminate*, *acumen to 8 mm long*; *lateral veins dense*, *c*. 30 pairs, *subequal*, spreading, *very slender though distinctly raised on both surfaces*, *more so beneath*, *as also the finely but sharply net-like intercostal venation*, *not furrowed above*; *intramarginal veins 1*(*or 2*), *close to margin*, *hardly looped*; *petioles c. 9 mm long*. **Inflorescences** paniculate, terminal, to 6 cm long; rachis slender, 3x-branched, spreading, many-flowered. **Flowers** white; bracteoles minute, subpersistent; *buds obconical tapering to base or goblet-shaped*, *to 8 mm long*, *to 3 mm diameter*, *with*

*hypanthium tapering into c. 5 mm slender pseudostalk*; *calyx lobes vestigial*, *apparently 5*, subacute, forming a rim, or sometimes ovate, *c.* 2 × 2 mm, subacute; *stamens many*, filaments much-curled, exserting to 4 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 4 mm long. **Fruits** *depressed-spherical*, *to 22 mm long*, *to 20 mm diameter*, lightly ribbed towards apex, *with slender calyx rim*, *ripening dark green or black*, *hard*.

**Distribution.** Peninsular Malaysia, Borneo and Sulawesi.

**Ecology.** In primary and secondary forest, on acid organic soils over karst limestone, on basalt and shale, in *kerangas*, mixed dipterocarp forest, mixed peatswamp forest, and in lower montane pole forest on ultramafic substrates, at altitudes to 1500 m.

**Notes.** Two subspecies are recognised.

**Key to subspecies**

Leaves drying dull dark (blackish) red-brown throughout, obscurely gland-dotted beneath; intercostal venation finely reticulate. Flower buds *c.* 8 mm long, *c.* 3 mm diameter. Fruits depressed spherical, to 20 mm long, to 22 mm diameter……...

subsp. **nigricans**

Occurring in Peninsular Malaysia and Borneo. In Borneo uncommon; recorded in Sarawak from Bau, Kuching, Marudi and Miri districts (e.g., *S 16200*, *S 27559*, *S 32016* and *S 36525*) and also in Brunei (e.g., *Wong WKM 1452* and *Ashton S 7836*).

Leaves drying glistening throughout, without gland-dots beneath; intercostal venation more densely reticulate. Flower buds *c.* 3 mm long, *c.* 1 mm diameter. Fruits spherical, *c.* 10 mm in diameter……..

subsp. **phaeophyllum** (Merr. & L.M.Perry) P.S.Ashton

(Greek, *phaeos* = brown, *phullon* = leaf; referring to the drying colour of the leaf blade above)

Kew Bull. 61, 1 (2006) 132. Basionym: *Syzygium leucoxylon* Korth. var. *phaeophyllum* Merr. & L.M.Perry *op. cit.* (1939) 194, Beaman & C. Anderson *op. cit.* 219. Type: *Tandom FD BNB 3316*, Borneo, Sabah, Kimanis (holotype A; isotype SAN).

In Borneo and Sulawesi. In Sabah known from Beaufort, Lahad Datu, Papar and Ranau districts (e.g., *SAN 21863*, *Clemens 32495*, *SAN 33607*, *FRI 41336*, *SAN 77019*, *SAN 78034, SAN 102994* and *SAN 124139*) and in Sarawak from Bintulu, Lawas, Miri, Serian and Sri Aman districts (e.g., *S 19105*, *S 24043*, *S 32064*, *S 33083*, *S 35703* and *S 39542*). Also known in Brunei (e.g., *BRUN 5023* and *SAN 17416*) and in E Kalimantan (e.g., *Meijer 2202* and *bb 35019*). Locally common, in lowland and lower montane *kerangas* forest at altitudes to 1500 m, including on organic soils on limestone, in mixed dipterocarp forest on yellow sandy soils, and on ultramafic substrates. Also recorded from phasic community 4, *padang paya*, at the centre of the Maludam peat swamp, Saribas in Seri Aman, Sarawak.

## 105. **Syzygium nigropunctatum** Merr. & L.M.Perry

(Latin, *nigro-* = black, *punctatus* = dotted; referring to the leaf undersurface)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 195. **Type:** *Teijsmann 8219*, Borneo, W Kalimantan, Sintang (holotype BO; isotypes K, L Barcode L 0009645).

Small tree. Parts glabrous. **Twigs** *c.* 1 mm diameter apically, slender, *at first sharply quadrangular in cross-section*, yellowish brown, smooth. **Leaves** *papery*, *clearly densely black pitted above and black pimple-dotted beneath*, drying dull grey-brown above, rust-brown beneath; *blades broadly elliptic-obovate*, *1.7–3 × 1–2 cm*, base wedge-shaped shortly tapering into petiole, *apex acute to bluntly acuminate*; *lateral veins c. 20 pairs*, *subequal*, *more or less obscure*, ascending; *intercostal venation obscure*; *intramarginal vein* close to margin, not looped, *obscure*; petioles slender, *c.* 3 mm long. **Inflorescences** paniculate, *c.* 6 cm long, mostly terminal, branching from base or rachis *c.* 1 cm long, branches *c.* 3 cm long. **Flowers** sessile; *buds pear-shaped*, *c. 4 mm long*, *c. 3 mm diameter*, *without distinct pseudostalk*; *calyx lobes 4*, *free*, *c. 0.4 mm short*, *broad*, *thick-margined*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** (young) *ovoid*, minutely pimpled, *with obscurely 4-lobed calyx rim*.

**Distribution.** Endemic to Borneo. Rare, known only in Sarawak from G. Dulit (i.e., *S 34856*) and in W Kalimantan (e.g., the type and *Mondi 72*).

**Ecology.** The single Sarawak collection was from the lower facies of upper montane forest, at *c.* 1200 m altitude.

## 106. **Syzygium nummularium** Airy Shaw

(Latin, *nummularius* = extremely rare; referring to the apparent rarity of the species)

Kew Bull. 4 (1949) 119. **Type:** *Richards' Collector 1981*, Borneo, Sarawak, Dulit Ridge (holotype K).

Spindly understorey tree. **Bark** finely flaky. **Twigs** *finely flaky*, *4-ribbed or 4-winged*, *spindly*. **Leaves** *in alternately over-lapping pairs along horizontal pendent twigs*; *blades almost round or rhomboidal*, *0.4–0.8 × 0.4–0.6 cm*, *base abruptly rounded or wedge-shaped*; *lateral veins unequal*, *main ones more than 8 pairs*, *distinctly raised beneath*, *intermediate veins obscure or few*. **Flowers** in small dense axillary clusters *with many strip-shaped bracteoles*; *buds ellipsoid-cylindrical*, *c. 4 mm long*, *c. 2 mm diameter*; *hypanthium warty*, *milky*; *calyx lobes 4*, *small*, *ovate*, *acute*, *hyaline*, *loose and erect around corolla*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** flask-shaped to spherical *c.* 6 mm diameter, with prominent crown of splayed calyx lobes; usually solitary.

**Distribution.** Endemic to Borneo. In Sabah known by a single collection from the Meliau Basin (i.e., *Webb et al. MB 806*) and in Sarawak from Limbang and Marudi districts (e.g., the type, *Richards 2417*, *S 48112* and *S 50810*). Also known in E Kalimantan (e.g., *Sidiyasa BRF 1677*).

**Ecology.** In the lower facies of upper montane forest, at 700–1600 m altitude, locally frequent but never abundant like several other members of the *Syzygium bankense* group.

## 107. **Syzygium oblanceolatum** (C.B.Rob.) Merr.

(Latin, *oblanceolatus* = inverted lance-shaped, broader above the middle; referring to the shape of the leaf blade)

Philip. J. Sc. 79, 4 (1950) 405; Ashton, Gard. Bull. Sing. 61, 1 (2009) 10. **Basionym:** *Eugenia oblanceolata* C.B.Rob., Philip. J. Sc. 4, C (1909) 400, Merrill *op. cit.* (1923) 173. **Type:** *Cuming 1676*, the Philippines, Samar, *loc. incert.* (holotype BM). **Heterotypic synonyms:** *Syzygium kihamense* Merr. & L.M.Perry *op. cit.* (1939) 150, *Eugenia kihamensis* (Merr. & L.M.Perry) Burgess *op. cit.* 412, ***syn. nov.***, **type:** *Endert 2341*, Borneo, E Kalimantan, W Kutei, near Kiham, Batu Bong (holotype BO, *n.v.*; isotype K); *S. petakense* Merr. & L.M.Perry *op. cit.* (1939) 150, Beaman & C. Anderson *op. cit.* 223, ***syn. nov.***, **type:** *Endert 4063*, Borneo, E Kalimantan, W Kutei, near Long Petak, Sept. 6, 1925, at *c.* 400 m (holotype BO, *n.v.*; isotypes K, L).

Tree, 10–25 m tall. *Young parts glabrous*. **Twigs** *3–4 mm diameter apically*, *stout*, with long internodes, *sharply 4-angled in cross-section*, *smooth*, *dark red-brown*. **Leaves** leathery or thinly leathery, *densely minutely pitted above*, *sparsely black-dotted beneath*, *drying dull rust-brown*, *paler above*; *blades oblanceolate or obovate-oblong or elliptic or oblanceolate-elliptic*, *8–24 × 3–8 cm*, *base wedge-shaped*, *subcordate to cordate*, *or cuneate tapering into petiole*, apex acute or obtuse or acuminate, acumen *c.* 5 mm long, broad, tapering, twisted down; *midrib rounded beneath*; *lateral veins unequal*, *main ones 6–25 pairs*, *prominent and distinctly raised more so beneath*, *furrowed along their crests above*, *drying darker than the blade beneath*, ascending, with few shorter intermediate veins; intercostal venation evident throughout; intramarginal vein 1–4 mm within margin, hardly raised, weakly looped; petioles stout, *c.* 5–9 mm long. **Inflorescences** *paniculate or cymose-paniculate*, axillary to ramiflorous; rachis 6–10 cm long, straight, erect, basal branches *c.* 6 cm long, distal branches shorter, quadrangular in cross-section. **Flowers** *in dense terminal clusters*, *subtended by 2 pairs of triangular bracteoles*; *buds obovoid to spherical*, *c. 4 mm long*, *c. 3 mm diameter*, *without distinct pseudostalk*; *calyx lobes 4*, *broadly ovate-acute*, *c. 2 × 3 mm*, *more or less warty*, *hyaline along margin*, *not reflexed at anthesis*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to 5 mm long. **Fruit** ripening white, ellipsoid, *c.* 15 mm long, *c.* 12 mm diameter, sessile, with *c.* 7 mm diameter prominent apical calyx crown.

**Distribution.** Borneo and the aseasonal eastern parts of the Philippines.

**Ecology.** In mixed dipterocarp forest on fertile clay loams including black volcanic soils and lower montane forest, at altitudes to 1700 m.

**Notes.** Three subspecies, *i.e.* subsp. *oblanceolatum*, subsp. *kihamense* and subsp. *kinabaluense* are recognised. In Borneo, only the last two subspecies are found. Subsp. *oblanceolatum* is endemic to the Philippines.

**Key to subspecies in Borneo**

Leaf blades oblanceolate or obovate-oblong, 12–24 × 4–8 cm, base wedge-shaped or cuneate; main lateral veins 8–14 pairs……...……

subsp. **kihamense** (Merr. & L.M.Perry) P.S.Ashton

Gard. Bull. Sing. 61, 1 (2009) 11. Basionym: *Syzygium kihamense* Merr & L.M.Perry *op. cit.* (1939) 150. Type: *Endert 2341*, Borneo, E Kalimantan, W Kutei, near Kiham, Batu Bong (holotype BO, *n.v.*; isotype K). Heterotypic synonym: *Syzygium petakense* Merr. & L.M.Perry *op. cit.* (1939) 150, Beaman & C. Anderson *op. cit.* 223. Type: *Endert 4063*, Borneo, E Kalimantan, W Kutei, near Long Petak, Sept. 6, 1925, at *c.* 400 m (holotype BO, *n.v.*; isotypes K, L).

Endemic to Borneo; known in Sabah from Keningau, Lahad Datu, Sipitang, Tawau and Tenom districts (e.g., *SAN 16622*, *SAN 27439*, *SAN 30139*, *SAN 31616*, *SAN 39968*, *SAN 91444* and *SAN 101325*) and in Sarawak from Dulit Range, Belaga district (e.g., *S*

*46761*). Also recorded in C, E and S Kalimantan (e.g., *Kessler PK 1032*, *Endert 2341*, *Endert 4063*, *Kostermans 6999* and *bb 13238*).

Leaf blades generally elliptic, 6.5–17 × 3.5–7.5 cm, base cuneate; main lateral veins 6–10 pairs……

subsp. **kinabaluense** P.S.Ashton

Gard. Bull. Sing. 61, 1 (2009) 12. Type: *J.S. Beaman 7939*, Borneo, Sabah, km 58 Kinabalu-Tambunan Rd., 5° 47'N, 116° 20'E, at *c.* 1450 m altitude (holotype K).

Apparently confined but quite common in lower montane forest, at 1400–1700 m altitude, on Mt. Kinabalu and the northern parts of Crocker Range in Sabah (e.g., *RSNB 4214*, *SFN 26942*, *SAN 28884*, *SAN 42835*, *SAN 48001* and *SAN 79580*).

## 108. **Syzygium oblatum** Wall. *ex* Steud.

(Latin, *oblatus* = almost spherical but broader than long; referring to the shape of fruit)

Nomencl. Bot. ed. 2 (1841) 657; A.M & J.M. Cowan, Trees N. Bengal (1929) 68; Merrill & L.M. Perry *op. cit.* (1939) 187; Masamune *op. cit.* 535. **Basionym:** *Syzygium oblatum* Wall., Cat. (1831) No. 3569, *nom. nud.*, *Eugenia oblata* Roxb., Hort. Beng. (1814) 37, *nom. nud.*, Fl. Ind. edition Carey 2 (1832) 493, Merrill *op. cit.* (1921) 431, Ridley *op. cit.* (1922) 749, M.R. Henderson *op. cit.* (1949) 136, Kochummen *op. cit.* 204, J.A.R. Anderson *op. cit.* (1980) 278, *p.p.* **Type:** *Wallich 3569*, Bangladesh, Chittagong (K). **Heterotypic synonyms:** *Eugenia comosa* Wall., Cat. (1831) No. 3566, *nom. nud.*; *Syzygium pulchellum* Wall., *ibid.* (1831) No. 3566, *nom. nud.*, *Jambosa pulchella* Miq., Fl. Ind. Bat. 1, 1 (1855) 422; *E. limnaea* Ridl., J. Str. Br. Roy. As. Soc. 79 (1918) 64, *p.p.*; *E. laxiuscula* Ridl., J. Fed. Mal. States Mus. 10 (1920) 133; *E. brantiana* M.R.Hend., Gard. Bull. Sing. 11 (1947) 313.

Shrub or small tree *c*. 25 m tall, shortly buttressed. **Bark** smooth to scaly, grey-brown. *Young parts glabrous*. **Twigs** 3–4 mm diameter apically, stout, *round in cross-section*, *smooth*, dark grey-brown. **Leaves** *thickly leathery*, *without pits above*, *distinctly brown dotted or pimpled beneath*, *drying dull chocolate-brown above*, *darker beneath*; *blades oblong-ovate*, *c. 11 × 5*(*8–12 × 3.5–6*) *cm*, base broadly wedge-shaped tapering into petiole, margin *entire*, narrowly recurved, apex acuminate, acumen *c.* 5 mm long, bent over; *lateral veins unequal*, *c. 20 pairs*, ascending, *evident but hardly raised beneath*, *narrowly furrowed above*, spreading; *intercostal venation obscure*; *intramarginal vein close to margin*, *not looped*; *petioles slender*, *c. 1 cm long*. **Inflorescences** paniculate, *terminal or subterminal-axillary*, *c.* 8 cm long; rachis *c.* 2 mm diameter at base, 3x-branched, round in cross-section. **Flowers** in dense clusters; *buds narrowly conical*, *c. 8 mm long*, *c. 4 mm diameter*, tapering from apex to base, *without distinct pseudostalk but pseudostalk becoming evident at anthesis*; *calyx lobes 5*, broadly triangular, *c. 0.5 mm long*, *vestigial*, *not or hyaline only at margin*, subpersistent into the young fruit; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to 9 mm long. **Fruits** *depressed-spherical*, *c. 12 mm long*, *c. 15 mm diameter*, smooth, *with c. 2 mm high and diameter raised funnel-like calyx rim*.

**Distribution.** Indo-Burma, Peninsular Malaysia and Borneo. In Borneo known by two collections, one from near Kuching, Sarawak (*Beccari 735*) and the other from W Kalimantan, north of the Kapuas valley (*DelMaar bb 2083*).

**Ecology.** Along tidal waterways, possibly more abundant than the collections imply.

**Notes.** The status of this species in Borneo is uncertain. In the only flowering collection (*Beccari 735*), the calyx lobes are vestigial, in this resembling *Syzygium inophyllum*. When

sterile, the leafy twig is difficult to distinguish from *S. acuminatissimum*, though the lateral veins are not or hardly furrowed above in that species.

## 109. **Syzygium odoardoi** Merr. & L.M.Perry

(Odoardo Beccari, 1843–1920, Florentine botanist extraordinaire of the Far East, especially Sarawak)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 151. **Type:** *Clemens 21633*, Borneo, Sarawak, Gaat, Ulu Rejang (holotype A; isotypes K, NY). **Synonyms:** *Eugenia riparia* Becc., Nelle Foreste di Borneo (1902) 524, fig. 65,4, *nom. nud.*, Merrill *op. cit.* (1921) 433, *nom. nud.*, *non* DC., *Syzygium riparum* (Becc.) Masam. *op. cit.* 538; *E. odoardoi* (Merr. & L.M.Perry) J.A.R.Anderson *op. cit.* (1980) 278.

Small riparian tree or shrub, or main canopy tree. *Young parts glabrous*. **Twigs** *3–4 mm diameter apically*, *slender*, *grey-brown*, *round in cross-section*, *smooth*. **Leaves** thin, *sparsely pimpled above*, *sparsely dotted beneath*, somewhat glistening above, *drying orange-brown beneath*; *blades oblanceolate*, *10–15 × 1.3–4 cm*, *margin entire*, *apex obtuse or shortly bluntly acuminate*; *lateral veins subequal*, *main ones c. 35 pairs*, 2–3 mm apart, ascending, generally drying darker than the blade beneath, *hardly raised*; *intramarginal vein close to margin*, *hardly looped*; *petioles at least 9 mm long*. **Inflorescences** *paniculate*; rachis 5x-branched, many-flowered. **Flowers:** *buds obconical*, *c. 6 mm long*, *c. 3 mm diameter*, *with c. 1 mm pseudostalk*; *calyx lobes 4*, *ovate*, *acute*, clasping corolla; *bracts and bracteoles subpersistent*, *c. 3 mm long*, acicular; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** (young?) *obovoid*, *c. 7 mm long*, *c. 3 mm diameter*, *with crown of calyx lobes*.

**Distribution.** Endemic to Borneo. In Sabah rare, known by a single collection (*SAN 107998*) from Tongod district; in Sarawak recorded from Belaga, Betong, Kapit, Marudi, Miri and Tatau districts (e.g., *S 17809*, *Clemens 21633*, *SFN 35640*, *S 37603* and *S 41705*). Also known in Brunei (e.g., *BRUN 5656* and *BRUN 18373*) and in W, C and E Kalimantan (e.g., *Sidiyasa & Arifin Z 1514*).

**Ecology.** Locally common along the banks of whitewater rivers below the flood line. Also in mixed dipterocarp forest on yellow sandy soils and hill dipterocarp forest at altitudes to 1400 m including on high ridges.

## 110. **Syzygium oligomyrum** Diels

(Greek, *oligo-* = few, *myrum* = juice; meaning unclear, possibly alluding the hard juiceless fruit)

Bot. Jahrb. 60 (1926) 313; Merrill & L.M. Perry *op. cit.* (1939) 184; Masamune *op. cit.* 535. **Type:** *Hackenburg 107*, Borneo, W Kalimantan, Sampit (holotype BO; isotype A). **Heterotypic synonyms:** *Eugenia ochneocarpa* Merr. *op. cit.* (1929) 217, Burgess *op. cit.* 413, J.A.R. Anderson *op. cit.* (1980) 278, *Syzygium ochneocarpum* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 184, Masamune *op. cit.* 535, Coode *et al.* (eds.) *op. cit.* 238, Beaman & C. Anderson *op. cit.* 221, ***syn. nov.***, **type:** *Elmer 21522*, Borneo, Sabah, Tawau (holotype UC; isotypes A, GH, NY).

Canopy tree, to 35 m tall, *c.* 1 m diameter; buttresses low. **Bark** dark red-brown and grey mottled, becoming cracked and eventually thickly flaky. *Young parts glabrous*. **Twigs** 2–3 mm diameter apically, *elliptic to round in cross-section*, *pale red- to buff-brown*, *smooth*. **Leaves** *thickly leathery*, *drying distinctly dull golden-brown beneath* (rust-brown slightly

satiny in juveniles), *dull greenish grey above*, *obscurely pitted above*, *more or less obscurely black-dotted beneath*; *blades elliptic-oblong*, *c. 11 × 5*(*7–20 × 2.5–10*) *cm*, base wedge-shaped tapering into petiole, *margin entire*, *apex broadly tapering*, *acumen c. 1 cm long*, acute or sometimes obtuse; venation obscure on both surfaces; *lateral veins slender*, *raised or narrowly furrowed above*, *raised beneath*, *main ones c. 25 pairs* (in juveniles), *subequal*, *spreading*; *intercostal venation obscure*; *intramarginal vein close to margin*, *hardly looped*; *petioles c. 10 mm long*, *c.* 2 mm thick. **Inflorescences** *paniculate*, *terminal or axillary*, *c. 6 cm long*; *rachis c.* 2 mm diameter, stout at base, *singly branched*. **Flowers:** *buds clove-shaped*, *c. 10 mm long*, *c. 4 mm diameter*, *not warty*, *the domed corolla set above an even calyx rim with 5 vestigial broad lobes*; *hypanthium tapering into an equal or somewhat longer more or less warty pseudostalk*, drying wrinkled; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *pear-shaped*, to 18 mm long, *c.* 12 mm diameter, smooth, *drying dull pale*, with *c.* 5 mm diameter short even calyx rim.

**Distribution.** Endemic to Borneo; widespread, recorded in Sabah from Keningau, Kinabatangan, Labuk Sugut, Lahad Datu, Pensiangan, Ranau, Sandakan, Sipitang, Tawau and Tongod districts (e.g., *SAN 18794*, *SAN 21493*, *SAN 30481*, *SAN 62977* and *SAN 72475*) and in Sarawak from Bintulu, Kapit, Kuching, Lawas, Limbang, Lubok Antu, Lundu, Marudi, Miri, Sibu, Song, Sri Aman and Tatau districts (e.g., *S 15563*, *Clemens 20958*, *Clemens 22279*, *S 37999*, *S 38746*, *S 40767*, *S 41556* and *S 46485*). Also known from Brunei (e.g., *BRUN 262*, *BRUN 858* and *BRUN 3315*) and throughout Kalimantan (e.g., *Dahri 34*, *Ambri & Ariffin W 520*, *Hallier 2192*, *Mogea 4227*, *Kostermans 6540*, *Kostermans 6648* and *bb 34323*).

**Ecology.** Common in mixed dipterocarp forest on yellow sandy soils, at altitudes below 400 m, and in upper dipterocarp forest to 1300 m; on ultramafic substrate in Kinabalu NP; occasional in mixed, rare in *alan* peat swamp forest.

## 111. **Syzygium pachyphyllum** (Kurz) Merr. & L.M.Perry

(Greek, *pachy-* = thick, *phullon* = leaf; referring to the leathery leaf blades)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 168; Masamune *op. cit.* 535; Turner *op. cit.* (1996) 379. **Basionym:** *Eugenia pachyphylla* Kurz, Prelim. Rep. For. Veg. Pegu (1875) App. A lxii, App.B 51, Ridley *op. cit.* (1922) 733, M.R. Henderson *op. cit.* (1949) 90, Kochummen *op. cit.* 206. **Type:** *Brandis 1337*, Myanmar (CAL, *n.v.*).

Small tree to 15 m tall. **Bark** pink-grey, cracking to scaly. *Parts glabrous*. **Twigs** 2–3 mm diameter apically, *round in cross-section*, *yellowish cream*, *smooth*. **Leaves** leathery, *faintly pitted above* and *black dotted beneath*, *drying dull purplish or chocolate-brown above*, *paler beneath*; *blades elliptic-obovate*, *c. 11 × 5*(*8–17 × 3.5–7.5*) *cm*, *base wedge-shaped tapering into petiole*, *apex shortly broadly acuminate*; *lateral veins unequal*, *main ones 10*(*–13*) *pairs*, *slender but slightly equally raised above and beneath*, *finely furrowed along crests above*, ascending; *intercostal venation obscure*; *intramarginal vein 1–3 mm within margin*, *looped*; petioles *c.* 8 mm long. **Inflorescences** *racemose*, *terminal or subterminal-axillary*, *c. 17 cm long*; rachis stout, erect, hardly branched. **Flowers** white; *buds narrowly obconical to clove-shaped*, *c. 10 mm long*, *c. 5 mm diameter*, *without distinct pseudostalk*, ribbed; *calyx lobes 4*, *hemispherical-obtuse*, *c. 2 × 2 mm*, *thick to margin*, somewhat spreading; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *ellipsoid-obovoid*, *c. 2.5 cm long*, *c. 2 cm diameter*, *drying dark*, smooth or shallowly ridged, crowned by persisting calyx lobes.

**Distribution.** Indo-Burma, Peninsular Malaysia and Borneo. In Borneo, widespread but rare; recorded in Sabah from Ranau, Sandakan and Tawau districts (e.g., *D.D. Wood 2072*, *SAN 6800*, *SAN 46075* and *SAN 51648*) and in Sarawak from Kuching, Lundu, Miri and Simunjan districts (e.g., *S 3011*, *S 13399*, *S 33516* and *S 42989*).

**Ecology.** An inland lowland species in Peninsular Malaysia. Little known in Borneo.

## 112. **Syzygium pachysepalum** Merr. & L.M.Perry

(Greek, *pachy* = thick, Latin, *sepalum* = sepal; referring to the thick calyx lobes)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 193; Beaman & C. Anderson *op. cit.* 221. **Type:** *Clemens 34385*, Borneo, Sabah, Colombon Basin, Mt. Kinabalu (holotype A; isotypes BM, BO, L Barcode L 0009650, NY). **Homotypic synonym:** *Eugenia pachysepala* (Merr. & L.M.Perry) Burgess *op. cit.* 413, J.A.R. Anderson *op. cit.* (1980) 278.

Canopy tree to 15 m tall, *c.* 30 cm diameter. **Bark** becoming rough, hardly flaking. *Young parts glabrous*. **Twigs** *2–3 mm diameter apically*, *round in cross-section*, *at first brown cinereous*, *becoming warm brown*, *flaky*. **Leaves** *thickly leathery*, folded up along the midrib, *without pits above*, *densely dotted beneath*, *drying dull purple-brown above*, *rust-brown beneath*; *blades elliptic-ovate*, *5.5–9 × 3.5–5 cm*, base wedge-shaped tapering into petiole, *margin entire*, apex shortly acuminate, acumen *c.* 5 mm long, down-turned; *midrib rounded beneath*; *lateral veins obscure above*, *evident but hardly raised beneath*, dense, *subequal*, main ones *c.* 26 pairs, spreading; *intercostal venation obscure*; *intramarginal vein 1 close to margin*, *not looped*; petioles stout, 5–8 mm long, *c.* 2 mm thick. **Inflorescences** paniculate, terminal or subterminal-axillary, *c.* 4 cm long; rachis *c.* 2 mm diameter, round in cross-section, 2x-branched, flowers densely clustered, with pairs of *c.* 5 mm long laciniate bracts and shorter bracteoles. **Flowers:** *buds clove-shaped*, *c. 8 mm long*, *c. 4 mm diameter*, *with distinct pseudostalk*; *calyx lobes 4*, *distinct*, *ovate*, *c. 2 × 3 mm*, cupped, *thick with median rib*, spreading and clawed at anthesis; stamens many, exserted to 5 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, styles *c.* 8 mm long. **Fruits** *spherical*, *c. 7 mm diameter*, smooth, *crowned by the persistent erect calyx rim*.

**Distribution.** Endemic to Borneo. In Sabah known from Keningau, Penampang, Ranau, Sipitang, Tambunan and Tenom districts (e.g., the type, *RSNB 4096*, *RSNB 4311*, *RSNB 4606*, *RSNB 7126* and *Fuchs 21494*) and in Sarawak from Belaga, Kapit, Marudi and Miri districts (e.g., *S 4205*, *S 40940* and *S 68930*). Also recorded from W Kalimantan (e.g., *bb 29026*).

**Ecology.** Local in pole forest on ridges at altitudes down to 300 m, and the lower facies of upper montane forest at 1000–2300 m, sometimes over ultramafic substrate in Kinabalu NP.

## 113. **Syzygium palawanense** (C.B.Rob.) Merr. & L.M.Perry

(from Palawan Isl., the Philippines)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 177; Masamune *op. cit.* 536; Coode *et al*. (eds.) *op. cit.* 238; Beaman & C. Anderson *op. cit.* 221. **Basionym:** *Eugenia palawanensis* C.B.Rob., Philip. J. Sci. Bot. 4 (1909) 377, Burgess *op. cit.* 413, J.A.R. Anderson *op. cit.* (1980) 278. **Neotype** (here designated)**:** *Reynoso & Majaducon PPI 24338*, the Philippines, Palawan: Mt Cleopatra Range, So. Calabayog, Brgy. Temabog, Puero Princesa (K). **Synonyms:** *Eugenia duthieana auct. non* King: Ridley, J. Bot. 68 (1930) 14, *Syzygium duthieanum* Masam. *op. cit.* 527.

Canopy tree to 30 m tall, *c.* 80 cm diameter. **Bark** smooth, eventually roughly scaly, red-brown; inner bark warm brown. *Parts glabrous*. **Twigs** *c. 3 mm diameter apically*, *stout*, *compressed and grooved*, *not angled in cross-section*, *grey-brown*, *smooth*. **Leaves** leathery, *drying dull tawny above*, *chocolate-brown beneath*, *densely obscurely pimpled above*, *obscurely dotted beneath*; *blades narrowly elliptic to lanceolate*, *c. 9 × 4*(*6–20 × 3–9*) *cm*, *base narrowly wedge-shaped long-tapering into petiole*, *apex caudate*, *acumen slender to 15 mm long*; *lateral veins unequal*, main ones *c*. 9 pairs, *basal pair longer than the others*, *raised thoughout but more prominent beneath*, *not furrowed above*, spreading; *intercostal venation faint*, *evident but hardly raised on either surface*; *intramarginal veins 2 or 3*, *the main one well within margin*, *looped*; petioles 5–10 mm long, drying black. **Inflorescences** *racemose*, *terminal but mostly axillary*, *c. 7 cm long*; rachis *c.* 2 mm diameter at base, generally slender, sparsely doubly branched, main branches straight, *flowers clustered at the tips*. **Flowers:** *buds broadly clove-shaped*, *to 8 mm long*, *to 5 mm diameter* (*including 4 mm pseudostalk*), becoming trumpet-shaped at anthesis; *calyx lobes 4*, *distinct*, *at least 1 mm long*, *rounded* and hiding corolla in bud, *thick*, breaking off at anthesis leaving an even rim; stamens many, short, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to 5 mm long. **Fruits** *spherical*, *to 11 × 11 mm*, smooth, *with c. 4 mm diameter apical calyx rim*.

**Distribution.** Borneo and Palawan Isl. (the Philippines). In Sabah widespread, recorded from Beaufort, Keningau, Kinabatangan, Kota Belud, Kudat, Lahad Datu, Ranau, Sandakan, Semporna, Sipitang, Tambunan, Tawau and Tenom districts (e.g., *SAN 3773*, *RSNB 7104*, *Elmer 20836*, *SAN 24576*, *SAN 26825*, *SAN 33813*, *SAN 62778* and *SAN 70711*) and in Sarawak from Kapit, Lubok Antu, Marudi, Sarikei and Tatau districts (e.g., *S 28381*, *S 30095*, *S 33851* and *S 41324*). Also known in Brunei (e.g., *BRUN 15245*) and E and S Kalimantan (e.g., *Kuswata 1189*, *Sidiyasa 2069* and *Kostermans 21565*).

**Ecology.** In mixed and upper dipterocarp forest, at altitudes to 1500 m, on sandy and other humic soils.

**Notes.** Since the type (*Curran For Bur. 3503*, PNH) was lost in the Manila Herbarium holocaust and Merrill and Perry noted it as the only specimen known from the Philippines, a recent collection from Palawan is here selected as the neotype.

## 114. **Syzygium paludosum** P.S.Ashton

(Latin, *paludosus* = of marshes; referring to its natural habitat)

Kew Bull. 61, 1 (2006) 132. **Type:** *Hj. Bujang S 20880*, Borneo, Sarawak, Sibu district, Sg. Mas, Loba Kabang FR, flowers (holotype K; isotypes L, SAR).

Small tree, *c.* 7 m tall. **Bark** smooth, reddish chocolate. *Parts glabrous*. **Twigs** 2–3 mm diameter apically, *round or at first quadrangular in cross-section*, *dark red-brown*, *scurfy with dense narrow thin upcurling flakes*. **Leaves** leathery, *drying dull chocolate-brown beneath*, *dull mauve-brown above*, *obscurely pitted above*, *not dotted beneath*; *blades narrowly elliptic-oblanceolate*, *8–16 × 3–6 cm*, *base wedge-shaped hardly tapering into petiole*, apex acuminate, acumen *c.* 8 mm long, tapering; *lateral veins unequal*, *main ones c. 15 pairs*, *slender but distinctly raised beneath*, hardly so or *shallowly furrowed above*, *with many less-elevated apically branching intermediates veins*; intercostal venation evident throughout, slightly elevated beneath, hardly so above; *intramarginal veins 1–2 mm within margin*, *hardly looped*; *petioles rather stout*, *c. 3 mm long*. **Inflorescences** paniculate,

terminal or subterminal-axillary, *c.* 15 cm long; rachis 2x-branched, with flowers clustered at endings. **Flowers** white; *buds clove-shaped*, *c. 7 mm long*, *c. 3 mm diameter*, *with 5 mm tapering pseudostalk*, finely ribbed; *calyx lobes* (*4 or*)*5*, *free*, *shallowly hemispherical*, *c. 1 × 2 mm or vestigial*; *stamens many*, exserted to 10 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 8 mm long. **Fruits** unknown.

**Distribution.** Endemic to Borneo; known only in C Sarawak from Binatang, Mukah and Sibu districts (e.g., the type, *S 2659*, *S 2741*, *S 14201*, *S 27822* and *S 77382*).

**Ecology.** Locally frequent, in mixed peat swamp forest; rare in mixed dipterocarp forest on deep yellow humic sands on coastal hills.

## 115. **Syzygium panzeri** Merr. & L.M.Perry

(Georg Wolfgang Franz Panzer, 1755–1829; German botanist)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 162; Coode *et al.* (eds.) *op. cit.* 238. **Type:** *Verhoef 67*, Borneo, Kalimantan, Kg. Baharu, Tanah Bumbuh (holotype BO; isotype L Barcode L 0009451).

Small tree. Parts glabrous. **Twigs** *slender*, *c. 2 mm diameter apically*, *narrowly but prominently and continuously winged*, *at first pale brown becoming whitish*, smooth. **Leaves** thinly leathery, pits above obscure, dots beneath scattered, drying dull grey-green above, yellowish green beneath; *blades elliptic-lanceolate*, *8–14*(*–22*) *× 2.5–8 cm*, *base rounded to heart-shaped terminating abruptly into petiole*, apex with gradually tapering slender acumen; *lateral veins unequal*, *main ones 10–15 pairs*, *raised on both surfaces*, *more prominent beneath*, *furrowed along the crests above*, intermediate veins less prominent than main veins beneath; intercostal venation obscure above, evident beneath; intramarginal vein 3–5 mm within margin, looped; petioles stout, *c.* 1 mm long. **Flowers** *in terminal or axillary clusters*; *buds subsessile*, *broadly jambu-shaped*, *c. 15 × 8 mm*, *tapering into stout pedicel with 2 minute linear apical bracteoles*; *calyx lobes 4*, *broadly orbicular*, *spreading and becoming reflexed at anthesis*; stamens many, exserted to *c.* 15 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c*. 2 cm long. **Fruits** unknown.

**Distribution.** Endemic to Borneo; in Sabah recorded from Keningau, Kudat, Kuala Penyu and Lahad Datu districts (e.g., *Andrews 734*, *Dransfield 6324A*, *SFN 19272*, *SAN 108376* and *SAN 114897*) and in Sarawak from Kapit and Marudi districts (e.g., *S 43346*, *S 52038* and *S 72444*). Also known in Brunei (e.g., *Dransfield 7218A*) and E and S Kalimantan (e.g., *Church 2526* and *Endert 4305*).

**Ecology.** Rare, in mixed lowland and upper dipterocarp forest on fertile clay loams, at altitudes to 1600 m.

## 116. **Syzygium paradoxum** (Merr.) Masam.

(Latin, *paradoxus* = strange; referring to the unexpected snuffer-shaped calyx)

EPB (1942) 536. **Basionym:** *Eugenia paradoxa* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 210, *op. cit.* (1921) 432, J.A.R. Anderson *op. cit.* (1980) 278. **Type:** *Native Collector* (*Bur. Sci.*) *365*, Borneo, Sarawak (holotype K). **Homotypic synonym:** *Cleistocalyx paradoxus* (Merr.) Merr. & L.M.Perry, J. Arn. Arb. 18 (1937) 331.

Small tree. *Parts glabrous*. **Twigs** *stout*, *at least 3 mm diameter apically*, *round in cross-section*, *grey-brown*, *smooth*. **Leaves** *thinly leathery*, *drying glistening dark red-brown with scattered pits above*, *dull rich rust-brown with blackish veins and tiny dots beneath*; *blades obovate to elliptic*, *c. 8.5 × 3*(*5–20 × 2–7*) *cm*, *base shallowly heart-shaped to rounded ending abruptly at the petiole*, *margin flat*, apex rounded or notched; *lateral veins unequal*, *main ones c. 10 pairs*, *with many intermediate veins unequal to the main veins and distinctly bifurcating towards their ends*, slender, *hardly raised though more prominent beneath*, *not furrowed above*, slightly ascending; intercostal venation visible on both surfaces; *intramarginal veins 3 pairs*, *the main one 2–3 mm within margin*, *hardly looped*; *petioles longer than 4 mm*. **Inflorescences** terminal, *c.* 1 cm long; rachis slender, each bearing to 3 flowers, the adjacent axils shooting thus imbedding flowers between two leafy twigs. **Flowers:** *buds club-shaped*, *to 14 mm long*, *to 4 mm diameter*; hypanthium spherical and distinct from the long tapering pseudostalk; *calyx lobes united into an apical papery snuffer waisted at base*, *breaking off at anthesis leaving an even rim*; *stamens many*, exserting to 12 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to 12 mm long. **Fruits** *top-shaped*, *to 14 mm long*, *to 9 mm diameter*, with wide calyx rim and persisting style, *ripening black*.

**Distribution.** Endemic to Borneo. Recorded in Sarawak from Bintulu and Kuching districts (e.g., the type, *Haviland 1832* and *S 59465*). Also known in Brunei (e.g., *BRUN 839*) and W Kalimantan (e.g., *Mondi 54*).

**Ecology.** Apparently very local, along the banks of sluggish rivers on peaty alluvium.

## 117. **Syzygium paucipunctatum** (Koord. & Valeton) Merr. & L.M.Perry

(Latin, *pauci-* = few-, *punctatus* = dotted; referring to the sparsely gland-dotted leaf undersurface)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 169; Beaman & C. Anderson *op. cit.* 222. **Basionym:** *Eugenia paucipunctata* Koord. & Valeton, Bull. Inst. Bot. Buitenz. 2 (1889) 8, Bijdr. Booms. Java 6 (1900) 100, Burgess *op. cit.* 413, *non E. paucipunctata* Merr. (Philip. J. Sci. C 10 (1915) 215, *nec. Cleistocalyx paucipunctatus* Merr. & L.M.Perry, J. Arn. Arb. 18 (1937) 336). **Type:** *Zollinger s.n.*, S Sumatra (BO).

Subcanopy tree, hardly buttressed. **Bark** grey-brown, smooth; inner bark reddish. *Young parts glabrous*. **Twigs** 2–3 mm diameter apically, *distinctly quadrangular in cross-section*, *mauve-brown*, smooth. **Leaves** leathery, *without pits above*, *obscurely black dotted beneath*, drying dull olive-green above, brownish beneath; *blades elliptic*, *c. 12 × 5*(*10–34 × 4–12*) *cm*, *base heart-shaped to rounded terminating abruptly at petiole*, apex acuminate, acumen tapering, *c.* 1 cm long; *lateral veins unequal*, *main ones c. 12 pairs*, *slender but distinctly raised throughout*, *more prominently so beneath*, *more or less shallowly furrowed along the crests above*, ascending; *intercostal venation obscure above*, *distinct beneath*; intramarginal veins 1(or 2) pairs, 3–5 mm within margin, looped; petioles stout, *c.* 2 mm long. **Inflorescences** *paniculate*, terminal or axillary, *c.* 8 cm long; rachis *c.* 2 mm diameter, 2x-branched; *bracts and bracteoles in single pairs*, *early caduceus*, elliptic postulate, *c.* 3 × 2 mm. **Flowers:** *buds clove-shaped*, *c. 6 mm long*, *c. 3 mm diameter*; hypanthium tapering; pseudostalk *c.* 4 mm long, slender; *calyx lobes 4*, *c. 1 × 2 mm*, *shortly triangular*, *obtuse*, *with hyaline margins*, *spreading but not becoming reflexed at anthesis*; stamens many, exserted to 9 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.*

10 mm long. **Fruits** (young) narrowly obovoid, *c.* 15 mm long, *c.* 8 mm diameter, with prominent *c.* 5 mm diameter calyx rim.

**Distribution.** Borneo and Java. In Borneo, recorded in Sabah from Keningau, Kota Belud, Lahad Datu, Ranau, Sipitang and Tawau districts (e.g., *SAN 4073*, *SAN 28732*, *SAN 30392*, *SAN 30408*, *SAN 33046*, *SAN 46188*, *SAN 48954* and *SAN 54373*) and in Sarawak from Kanowit, Kapit, Lundu and Miri districts (e.g., *S 19272*, *S 28317*, *S 52091*, *S 53739* and *S 53741*). Also known in E Kalimantan (e.g., *Kessler PK 1025* and *Kostermans 4920*).

**Ecology.** In mixed dipterocarp forest on fertile clay soils over limestone and basic and intermediate volcanic substrates, mostly on moist lower slopes and near rivers.

## 118. **Syzygium pendens** (Duthie) I.M.Turner

(Latin, *pendens* = hanging; referring to the branches)

J. Sing. Nat. Acad. Sci. 22–24 (1997) 22. **Basionym:** *Eugenia pendens* Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 475, King *op. cit.* 94, Ridley *op. cit.* (1922) 726, Burkill *op. cit.* 972, M.R. Henderson *op. cit.* (1949) 71, Kochummen *op. cit.* 209. **Syntypes:** *Griffith 2439*, *Maingay 747*, Peninsular Malaysia, Malacca (CAL, K).

Understorey or canopy tree, to 60 cm diameter. *Young parts glabrous*. **Twigs** *c.* 2 mm diameter apically, slender, *round in cross-section*, *pale grey-brown*. **Leaves** *thin papery*, *drying dull*, *prominently densely black-dotted throughout*, *pale tawny above*, *darker beneath*; *blades elliptic*, *c. 14 × 6*(*10–18 × 4.5–10*) *cm*, *base wedge-shaped tapering into petiole*, apex acuminate, acumen slender, *c.* 15 mm long; *lateral veins unequal*, *main ones c. 12 pairs*, *slender but distinctly raised on both surfaces as also the lattice-like intercostal venation*, *furrowed above*, spreading; *intramarginal veins 3*, *the main one 3–5 mm within margin*, *looped*; petioles slender, *c.* 10 mm long. **Inflorescences** *paniculate*, terminal to ramiflorous, *c.* 2 cm long; rachis slender, round in cross-section, hardly branched, few-flowered; bracts and bracteoles small, at first persistent. **Flowers:** *buds stoutly goblet-shaped*, *to 11 mm long*, *to 7 mm diameter*, *tapering to short but distinct pseudostalk*, often on an *c.* 1 cm long pedicel; *calyx lobes 4*(*or 5*), *prominent*, *hemispherical*, *thick but somewhat hyaline towards margins*, *opening and spreading to c. 28 mm but not becoming reflexed at anthesis*; stamens many, exserted to 8 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 14 mm long. **Fruits** pumpkin-shaped, *c.* 20 mm long, *c.* 22 mm diameter, slightly corrugated when dry, opening on *c.* 7 mm prominent stalk, dull, smooth, fleshy, with prominent apical calyx rim bearing the reflexed expanded calyx lobes.

**Distribution.** Peninsular Malaysia and Borneo. In Sabah recorded from Keningau, Kinabatangan, Labuk Sugut, Ranau and Semporna districts (e.g., *Doinis DS 806*, *FMS 44445*, *SAN 92535*, *SAN 95101*, *SAN 64842* and *SAN 135952*) and in Sarawak from Kapit, Lawas and Miri districts (e.g., *S 19617*, *S 31582* and ecological voucher specimens EUGEED Tree *No. 3405–081* in the Lambir Hills NP Field Herbarium. Also known in Brunei (e.g., *Suzuki 12299*) and E Kalimantan (e.g., *Sidiyasa 473* and *Kostermans 21171*).

**Ecology.** Scattered in mixed dipterocarp forest on sandy clay and leached clay soils and the edge of mixed peatswamp forest, at altitudes to 850 m.

## 119. **Syzygium penibukanense** Merr. & L.M.Perry

(from Penibukan, village on the lower slopes of the Mt. Kinabalu massif, Sabah)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 153; Beaman & C. Anderson *op. cit.* 222. **Type:** *Clemens 30535*, Borneo, Sabah, Penibukan, Mt. Kinabalu (holotype A; isotypes BM, BO, K, L Barcode L 0009452). **Synonym:** *Eugenia penibukanensis* (Merr. & L.M.Perry) Burgess *op. cit.* 413.

Understorey tree, *c.* 12 m tall, *c.* 10 cm diameter. **Bark** smooth, brown; inner bark red. *Parts glabrous*. **Twigs** *c. 4 mm diameter apically*, *stout*, *round* or elliptic *in cross-section*, *pale grey*, *smooth*. **Leaves** *subsessile*, *drying dull red-brown above*, *very dull almost felt-like rust-brown beneath*, densely faintly pitted above, *sparsely dotted beneath*; *blades ovate-lanceolate*, *c. 30 × 10*(*25–50 × 8–12*) *cm*, *base auriculate to heart-shaped abruptly ending at the short stout petiole*, margin recurved, apex acute, acumen blunt; *lateral veins unequal*, *main ones c. 30 pairs*, slender and not prominent but more so beneath than above, *furrowed above*, spreading; intercostal venation indistinct; *intramarginal vein 1*, *2–3 mm within margin*, *looped*. **Flowers** *cauliflorous on trunk swellings*, few on short rachises; *buds jambu-shaped*, *to 30 mm long*, *to 15 mm diameter*, *with short tapering pseudostalk*; *calyx lobes 4*, *broadly triangular*, *to 25 mm diameter*, *spreading at anthesis*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to 15 mm long. **Fruits** bowl-shaped, to 30 mm long, to 12 mm diameter, with persistent spreading calyx lobes, ripening purple.

**Distribution.** Endemic to Borneo. In Sabah widespread, known from Kinabatangan, Kota Belud, Kota Marudu, Lahad Datu, Ranau, Tawau and Tenom districts (e.g., *Lugas LL 132*, *Lugas LL 2884*, *Clemens 26735*, *SAN 96679*, *SAN 145963* and *SAN 146281*) and in Sarawak recorded from Lambir Hills NP, Miri district (ecological voucher specimens).

**Ecology.** In mixed dipterocarp forest on sandy soils near the coast and on ultramafics, and in upper dipterocarp forest at 700–1500 m altitudes.

## 120. **Syzygium peregrinum** (Blume) Merr. & L.M.Perry Plate 6E–F.

(Latin, *peregrinus* = hinterland; possibly referring to the remote location of Korthals' expedition in Kalimantan)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 154; Masamune *op. cit.* 536; Merrill *op. cit.* (1950) 408; Beaman & C. Anderson *op. cit.* 223. **Basionym:** *Jambosa peregrina* Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 92, Miquel *op. cit.* (1855) 426, Merrill *op. cit.* (1921) 432. **Type:** *Korthals s.n.*, Borneo, Kalimantan, G. Sekumbang (holotype L Barcode L 0009661). **Heterotypic synonyms:** *Eugenia tawaensis* Merr. *op. cit.* (1929) 220, J.A.R. Anderson *op. cit.* (1980) 280, *Syzygium tawaense* (Blume) Masam., *op. cit.* 539.

Understorey tree, to 7 m tall. *Parts glabrous*. **Twigs** *c*. 3 mm diameter apically, *distinctly cream-yellow*, *elliptic in cross-section*, *smooth*. **Leaves** thinly leathery, *drying dull pale mauve-grey and obscurely pitted above*, *pale chocolate-brown with scattered pimples beneath*; *blades narrowly elliptic*, *c. 17 × 16*(*7–18 × 2–7*) *cm*, *base wedge-shaped terminating fairly abruptly at petiole*, *apex acuminate*, *acumen c. 15 mm long*; *lateral veins unequal*, *main ones c. 12 pairs*, slender but distinctly raised beneath, hardly or not so and more or less deeply furrowed above, somewhat ascending; *intercostal venation obscure above*, *distinct beneath*, *not distinctly net-like*; *intramarginal veins 1*(*or 2*) *pairs*, *4–6 mm within margin*, *looped*; *petioles c. 8 mm long*, *distinctly whitish corky*. **Inflorescences** *paniculate*, *axillary to ramiflorous*, *c.* 7 cm long but often shorter; rachis 2x-branched.

**Flowers:** *bud stoutly club-shaped*, *c. 8 mm long*, *c. 5 mm diameter*; *hypanthium tapering abruptly into the short pseudostalk*; *calyx lobes 4*, broadly ovate-hemispherical, subacute to notched, *with hyaline margin*, *loosely clasping corolla*, *not prominently reflexing and falling at anthesis or persisting into fruit*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *almost spherical but broader than long*, *c. 13 mm diameter*, *with c. 9 mm diameter prominent rim of reflexed calyx lobes*, *ripening white*.

**Distribution.** Borneo and the Philippines. In Borneo, widespread in Sabah and recorded from Kinabatangan, Kota Belud, Kota Marudu, Kudat, Labuk Sugut, Lahad Datu, Penampang, Pensiangan, Tawau and Tenom districts (e.g., *Sugau JBS 56*, *SAN 37687*, *SAN 89227*, *SAN 91694*, *SAN 110711*, *SAN 120204* and *SAN 125242*); and in Sarawak from Lawas, Marudi, Miri, Serian, Simunjan and Tatau districts (e.g., *S 02090*, *S 13772*, *S 21816*, *S 28408* and *S 34335*). Also known in E Kalimantan (e.g., *Kessler PK 1356* and *Meijer 1963*).

**Ecology.** Uncommon, in mixed dipterocarp forest on clay soils on low hills, and upper dipterocarp forest at altitudes to 1500 m on Mt. Kinabalu.

## 121. **Syzygium perspicuinervium** (Merr.) Masam.

(Latin, *perspicue* = distinctly, *-nervium* = nerved; referring to the prominent venation of the leaf blade)

EPB (1942) 537. **Basionym:** *Eugenia perspicuinervia* Merr., PEB (1929) 218, Burgess *op. cit.* 413, *sphalm. perspicuinervis*. **Type:** *Elmer 21682*, Borneo, Sabah, near Tawau (holotype A; isotypes K, L Barcode L 0009454). **Homotypic synonym:** *Cleistocalyx perspicuinervius* (Merr.) Merr. & L.M.Perry, J. Arn. Arb. 18 (1937) 332, Masamune *op. cit.* 521, Coode *et al.* (eds.) *op. cit.* 234, Beaman & C. Anderson *op. cit.* 207.

Subcanopy tree. *Parts glabrous*. **Twigs** *c. 3 mm diameter apically*, with long internodes, *compressed-quadrangular in cross-section*, *dark brown*, smooth. **Leaves** thinly leathery, *more or less intricately bullate*, *drying dull mauve-brown and densely minutely black pimpled beneath*, *satiny dark red-brown and indistinctly pitted above*; *blades narrow elliptic to oblanceolate*, *c. 25 × 8*(*10–32 × 4–12*) *cm*, *base wedge-shaped terminating abruptly at petiole*, margin narrowly recurved, apex with *c.* 1 cm slender acumen; *midrib rounded beneath*; *lateral veins unequal*, *main ones c. 22 pairs*, *not darker than the blade*, *with less prominent intermediate veins of subequal length*, *prominently raised throughout though more so beneath*, *more or less medially furrowed above*, spreading; intercostal venation lax, distinctly raised; intramarginal vein 3–4 mm within margin, looped; *petioles stout*, *c. 6 mm long*, drying black. **Inflorescences** *racemose*, reduced, terminal, *c. 1 cm long*; rachis 1x-branched. **Flowers:** *buds* (young) *clove-shaped*, *c. 3 mm long*, *c. 1.5 mm diameter*, *with distinct pseudostalk*; *calyx lobes united in a snuffer-like cap*; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical*, *c.* 15 mm diameter, subsessile, markedly rough and ribbed; pedicel short; *calyx rim c. 3 mm diameter*, *prominent*.

**Distribution.** Endemic to Borneo. Uncommon, recorded in Sabah from Kota Marudu, Pitas, Sandakan and Tawau districts (e.g., the type, *SAN 18780*, *SAN 54602*, *SAN 81376*, *SAN 91340* and *SAN 121332*) and in Sarawak from G. Api, Mulu NP (e.g., *S 4617*). Also known in Brunei (e.g., *BRUN 5122* and *BRUN 17102*) and Kalimantan (e.g., *Church 2805*).

**Ecology.** Mixed dipterocarp forest on fertile clay loam soils, including the base of limestone karst, at low altitudes.

## 122. **Syzygium petrophilum** Merr. & L.M.Perry

(Greek, *petros* = a rock, *-philum* = loving; referring to the natural habitat of the species)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 195; Beaman & C. Anderson *op. cit.* 223. **Type:** *Clemens 40082*, Borneo, Sabah, Colombon Basin, Mt. Kinabalu (holotype A; isotypes BM, BO, L Barcode L 0009663, NY).

Small tree, *c.* 9 m tall. **Bark** flaky. *Young parts glabrous*. **Twigs** *c.* 1 mm diameter apically, slender, *round in cross-section when young*, *grey-brown*, *smooth*. **Leaves** *obscurely densely dotted throughout*, *drying dull tawny-grey*; *blades elliptic-oblong*, *3–6 × 1.5–2.5 cm*, base wedge-shaped hardly tapering to petiole, *margin entire*, *not undulate*, *apex shortly bluntly acuminate*; *lateral veins dense*, *subequal*, *main ones c. 27 pairs*, *visible throughout*, *more prominent beneath*, ascending; intercostal venation obscure; *intramarginal vein 1*, *c.* 1 *mm within margin*, *hardly looped*; *petioles slender*, *5–7 mm long*. **Inflorescences** *paniculate*, *axillary*, *to 4 cm long*; rachis 1x-branched, few-flowered; bracts and paired bracteoles small, triangular. **Flowers:** *buds obconical*, *c. 4 mm long*, *c. 2.5 mm diameter*, *without distinct pseudostalk*; *calyx lobes 4*, *vestigial*, broad, subacute, *free*, *with thick margin*; *stamens c. 10*, short, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical*, *c. 8 mm diameter*, smooth, glistening, sessile, *with small low calyx rim*.

**Distribution.** Endemic to Borneo; apparently confined to Mt. Kinabalu, Sabah (e.g., the type and *Clemens 40145*).

**Ecology.** Lower montane forest over ultramafic substrate at 1500–1800 m altitudes.

## 123. **Syzygium phryganodes** Merr. & L.M.Perry

(Greek, *phrygana* = a twiggy undershrub; referring to the habit of the species)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 178. **Type:** *Endert 5262*, Borneo, E Kalimantan, W Kutei, Kombeng (holotype BO, *n.v.*; isotypes K, L)

Small tree, *c.* 5 m tall. **Bark** smooth, whitish. *Parts glabrous*. **Twigs** *c*. 2 mm diameter apically, *quadrangular towards tips otherwise round in cross-section*, *cream-brown*, early minutely fissured and becoming powdery flaky. **Leaves** *thickly leathery*, *drying glistening throughout*, *more or less obscurely minutely black dotted beneath*, *densely distinctly or obscurely pitted above*; *blades obovate or oblanceolate 1.5–4.7 × 0.8–4 cm*, *base narrowly wedge-shaped tapering into petiole*, *margin narrowly recurved*, apex rounded to notched; *lateral veins unequal*, *main ones 6–8 pairs*, ascending, *very slender but somewhat raised and drying paler than blade beneath*, *obscure above*; intercostal venation obscure; *intramarginal vein c. 0.5 mm within margin*, *hardly looped*; petioles slender, 2–3 mm long. **Inflorescences** paniculate, *terminal or axillary*, *c.* 5 cm long; rachis *c.* 1 mm diameter at anthesis, 1–2x-branched. **Flowers:** *buds goblet-shaped*, *c. 3 mm long*, *c. 2 mm diameter*, smooth, *tapering beneath hypanthium into c. 2 mm long pseudostalk*; *calyx lobes 4*, *not or hyaline only at margin*, *triangular*, acute, *c. 1.5 × 2 mm*; *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** (young) *urn-shaped*, smooth.

**Distribution.** Endemic to Borneo, Uncommon, known in Sabah from the mountains in Sipitang district (e.g., *SAN 139419*) and in NE Sarawak from Lawas district (e.g., *S 0993*, *BRUN 5604*, *S 32949* and *S 33053*). Also known in E Kalimantan (the type).

**Ecology.** On rocky ridges in lowland and lower montane *kerangas*, at 150–1500 m altitudes.

## 124. **Syzygium polyanthum** (Wight) Walp.

(Greek, *poly-* = many, *-anthos* = flowered; referring to the conspicuous ramiflorous clustered flowers in bloom)

Repert. Bot. Syst. 2 (1843) 180; Merrill & L.M. Perry *op. cit.* (1938) 108, *op. cit.* (1939) 155; Masamune *op. cit.* 537; Merrill *op. cit.* (1950) 409; Backer & Bakhuizen *f. op. cit.* 339; Turner *op. cit.* (1996) 380; Chantaranothai & Parnell *op. cit.* (1994) 95; Coode *et al*. (eds.) *op. cit*. 238; Corner *op. cit.* (1997) 590; Argent *et al*. (eds.) *op. cit*. 472; Parnell & Chantaranothai *op. cit.* (2002) 887; Beaman & C. Anderson *op. cit.* 223. **Basionym:** *Eugenia polyantha* Wight, Ill. Ind. Bot. 2 (1841) 17, Duthie *in* Hooker *f. op. cit.* 496, King *op. cit.* 103, Koorders & Valeton *op. cit.* (1900) 90, Ridley *op. cit.* (1922) 742, Merrill *op. cit.* (1929) 216, Burkill *op. cit.* 973, M.R. Henderson *op. cit*. (1949) 211, Burgess *op. cit*. 413, 415, Kochummen *op. cit*. 210, J.A.R. Anderson *op. cit.* (1980) 279. **Type:** *Griffith s.n.*, Myanmar, Mergui (holotype K). **Heterotypic synonyms:** *Myrtus cymosa* Blume *op. cit.* (1827) 1086, *non* Spreng. (1825), *Syzygium cymosum* (Blume) Korth., Kruidk. 1 (1847) 202, *non* DC. (1828); *Eugenia microbotrya* Miq. *op. cit.* (1850) 27, *t.* 10, Merrill *op. cit.* (1921) 430, *S. microbotryum* (Miq.) Masam. *op. cit*. 534; *E. pamatensis* Miq. *op. cit.* (1850) 22, Merrill o*p. cit.* (1921) 432, *S. pamatense* (Miq.) Masam. *op. cit*. 536; *E. junghuhniana* Miq. *op. cit.* (1855) 444; *E. lucidula* Miq. *loc. cit.* (1855) 444; *E. nitida* Duthie *in* Hooker *f. op. cit.* 496; *E. atropunctata* C.B.Rob., Philip. J. Sc. 4C (1909) 385; *E. lambii* Elm., Leafl. Philip. Bot. 4 (1912) 1436; *E. balsamea* Ridl. *op. cit.* (1922) 754, *non* Wight (1841); *E. aff. luzonensis* J.A.R.Anderson *op. cit.* (1963) 176, *non* Merrill (1906).

Canopy tree to 30 m tall, to 60 cm diameter; bole becoming ribbed towards the base; buttresses short. **Bark** pale orange-brown mottled, becoming finely fissured then powdery scaly; inner bark thick, pink. *Young parts glabrous*, *weakly aromatic*. **Twigs** slender, *elliptic in cross-section*, *smooth*, *becoming pale orange-brown* to cream. **Leaves** thinly leathery, drying dull grey-green to purplish and obscurely pitted above, yellowish grey to red-brown and *densely obscurely pimpled beneath*; *blades elliptic-obovate*, *c. 13 × 6*(*7–18 × 2.5–8*) *cm*, *base wedge-shaped tapering into petiole*, apex shortly acuminate; *lateral veins unequal*, *prominent though more so beneath*, *narrowly furrowed along ridges above*, main ones *c.* 10 pairs; *intercostal venation evident throughout*; *intramarginal veins 3*, *well within margin*, *looped*; petioles *c.* 12 mm long. **Inflorescences** paniculate, *terminal or generally ramiflorous behind leaves*, *c.* 10 cm long; rachis slender, lax, 2x-branched, branches *c.* 5 cm long, spreading. **Flowers:** *buds broadly clove-shaped*, *to 4 mm long*, *c. 3 mm diameter*, *tapering into a short pseudostalk*; *calyx lobes 4*, *ovate-triangular*, acute, *c. 1.5 × 2 mm*, *not or hyaline only at the margin*, erect, becoming reflexed, wrinkled and breaking off after anthesis; stamens many, exserted to 4 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to 4 mm long. **Fruits** *spherical to ellipsoid*, *to 12 mm diameter*, *greenish white*, *ripening pink to purple-black*, *with small hardly raised calyx rim*.

**Vernacular names.** Sarawak—*daun salam* (Malay), *jarang* (Brunei-Tutong), *bengkang* (Iban).

**Distribution.** Throughout the evergreen forests of Indo-Burma, Sundaland and the Philippines. In Borneo widespread; recorded in Sabah from Beaufort, Keningau, Kinabatangan, Kota Belud, Kuala Penyu, Lahad Datu, Papar, Penampang, Ranau, Sandakan, Semporna, Sipitang and Tawau districts (e.g., *FD BNB 7383*, *SAN 21767*, *SAN*

*28140*, *SAN 36486*, *SAN 37216* and *SAN 77781*) and in Sarawak from Julau, Kuching, Lubok Antu, Lundu, Miri, Mukah and Song districts (e.g., *Haviland 1567*, *S 8020*, *Fuchs 21240*, *S 25761*, *S 31127*, *S 34044*, *S 34639* and *S 42039*). Also known in Brunei (e.g., *Wong WKM 64*, *BRUN 230*, *BRUN 855* and *BRUN 17271*) and in W, E and S Kalimantan (e.g., *Mahyar 894*, *Hallier 1946*, *Kostermans 5246* and *Kostermans 21700*).

**Ecology.** Frequent in mixed dipterocarp forest and secondary forest on both sandy and clay soils in the lowlands and on hillsides, but especially in floodplains and shallow peat swamp, and on river banks, at altitudes to 1500 m.

**Uses.** The fruit is eaten but is astringent, and the leaves are used for flavouring.

## 125. **Syzygium pontianakense** Merr. & L.M.Perry
(from Pontianak, W Kalimantan)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 178. **Type:** *Rachmat s.n.*, Nov. 28, 1923, cult. Hort. Bog. XI.B.IX.164 (from Teijsmann's seed collection, no. incert., W Kalimantan) (holotype BO). **Homotypic synonym:** *Eugenia pontianakensis* (Merr. & L.M.Perry) J.A.R.Anderson *op. cit.* (1980) 279.

Small to canopy tree, to 30 cm diameter; buttresses steep, narrow, to 70 cm tall; stilt roots present. **Bark** smooth, cream-white, eventually becoming papery flaky, pale orange. *Parts glabrous*. **Twigs** 2–3 mm diameter apically, *round in cross-section*, *conspicuous whitish*, *smooth*. **Leaves** leathery, *drying shiny chocolate-brown above*, *glistening and paler beneath*, contrasting with pale twig, *not pitted above*, *occasionally sparsely pimpled beneath*; *blades elliptic*, *c. 13 × 5*(*8–22 × 2.5–9*) *cm*, *base wedge-shaped shortly tapering into petiole*, *apex caudate*, *acumen slender*, *c. 1.5 cm long*; *lateral veins unequal*, *prominent thoughout but more so beneath*, *main ones 9–11*(*–15*) *pairs*, *with distinct shorter intermediate veins*, *raised with shallow median furrows above*, somewhat ascending; *intercostal venation distinctly raised on both surfaces but not distinctly net-like*; *intramarginal veins 3*, *main one c. 4 mm within margin*, *hardly looped*; *petioles c. 10 mm long*, drying black. **Inflorescences** *paniculate*, to 8 cm (mostly *c.* 4 cm) long, occasionally terminal but *mostly axillary*; rachis slender, lax, 2x-branched. **Flowers:** *buds clove-shaped*, *c. 8 mm long*, *c. 3.5 mm diameter*, *hypanthium vase-shaped at anthesis*, *tapering into c. 4 mm slender pseudostalk*; *calyx lobes 4*, *free*, *triangular*, *thick*, sparsely minutely warty, *clasping the corolla*; *stamens many*, exserting to 6 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 6 mm long. **Fruits** *ellipsoid*, to 20 mm long, to 15 mm diameter, smooth, with *c.* 5 mm diameter apical *calyx* rim, *ripening green*.

**Distribution.** Endemic to Borneo, widespread. In Sabah recorded from Lahad Datu, Lamag, Nabawan, Ranau and Tawau districts (e.g., *SAN 34090*, *SAN 47655*, *SAN 92034*, *SAN 104338* and *SAN 124797*) and in Sarawak from Bintulu, Kapit, Kuching, Lubok Antu, Miri, Simanggang and Tatau districts (e.g., *Beccari 3470*, *Purseglove 5137*, *S 19859*, *S 19893*, *S 24593*, *S 33808* and *S 33903*). Also known in Brunei (e.g., *S 5941*, *Coode MC 7228*, *Coode MC 7272* and *BRUN 17418*) and in W, C, E and S Kalimantan (e.g., *Goverse & Andriansyah Berau 482*, *Wiriadinata 713*, *Church & Mahiyar 904*, *Kessler PK 2786*, *Kostermans 21421* and *Tuke 94256*).

**Ecology.** Frequent on leached soils in mixed dipterocarp forests at low altitudes, and occasionally on high ridges to 800 m.

## 126. **Syzygium praestantilimbum** P.S.Ashton

(Latin, *praestans* = outstanding, *limbus* = a blade; referring to the enormous leaf with prominent veins)

Gard. Bull. Sing. 61, 1 (2009) 12. **Type:** *BRUN 18339*, Borneo, Brunei, path to Bukit Teraja, Labi (holotype SING).

Treelet to 8 m tall, occasionally reaching the canopy, *c.* 60 cm diameter, with drooping branches bearing the huge leaves on long internodes. *Young parts glabrous*. **Twigs** *c*. 3 mm diameter apically, *round to compressed in cross-section*, *dark warm brown*, *flaky or smooth*. **Leaves** leathery, *dull*, *drying mauve-brown and obscurely minutely pitted above*, *rust-brown and obscurely minutely dotted beneath*; *blades elliptic*, *c. 25 × 14*(*20–35 × 12–16*) *cm*, *base wedge-shaped terminating abruptly at petiole*, apex slender-acuminate, acumen *c.* 12 mm long; *lateral veins unequal*, *main ones c. 17 pairs with a few shorter less prominent intermediate veins*, *deeply furrowed above*, prominent beneath; intercostal venation lax, more or less distinctly raised beneath, hardly furrowed above; *intramarginal veins 1*(*or 2*) *pairs*, *c. 6 mm within margin*, *somewhat looped*; *petioles stout*, *c. 12 mm long*, *c. 3 mm thick*, drying black. **Inflorescences** *paniculate*, *c. 4 cm long*, terminal or axillary; rachis round in cross-section, singly branched; flowers clustered at branch endings; *bracts and bracteoles in double pairs*, *ovate-deltoid*, acute, *c. 2 × 2 mm*, *subpersistent*. **Flowers:** (post-anthesis) *obovoid to top-shaped*, *c. 5 mm long*, *c. 4 mm diameter*, *without distinct pseudostalk*; *calyx lobes 4*, *deltoid*, *c. 2 × 2 mm*, *hyaline at margins*, *not becoming reflexed at anthesis*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to *c.* 4 mm long. **Fruits** spherical (young), *c.* 6 mm diameter, subsessile, densely clustered, wrinkled on drying, ripening pinkish white.

**Distribution.** Endemic to Borneo. Known only by the type (*BRUN 18283*) from Andulau FR in Brunei and from sterile collections (Field herbarium numbers *AG 02747*, *AG 03847*, *AG 3210-058*) from the large research plot in the Lambir Hills NP, Miri, Sarawak.

**Ecology.** Local but sometimes abundant as an understorey tree, in mixed dipterocarp forest on deep yellow sandy soils.

## 127. **Syzygium prasiniflorum** (Ridl.) Merr. & L.M.Perry

(Latin, *prasini-* = grass-green, *florus* = flowered; referring to the flower colour noted on the type specimen)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 194; Masamune *op. cit.* 537. **Basionym:** *Eugenia prasiniflora* Ridl., J. Bot. 68 (1930) 35, J.A.R. Anderson *op. cit.* (1980) 279. **Syntypes:** *Haviland 2109/1622*, *Haviland & Hose 3381*, Kuching (K); *Haviland & Hose 3217A*, Niah (K). **Synonym:** *Eugenia aff. havilandii auct. non* Merrill (1917)**:** J.A.R. Anderson, Gard. Bull. Sing. 20 (1963) 176, *p.p.*

Subcanopy tree, to 30 cm diameter, with stilt roots. **Bark** brownish grey, becoming scaly; inner bark dark brown. Parts glabrous. **Twigs** *at first somewhat 4-angular in cross-section*, *grey-brown*, *smooth*. **Leaves** *thinly leathery*, *generally slightly glistening*, *grey-brown and sparsely pitted above*, *rust-brown and sparsely obscurely or not dotted beneath*; *blades elliptic*, *c. 8.5 × 4.5*(*4–10 × 1.5–5*) *cm*, *base wedge-shaped tapering into petiole*, *margin narrowly recurved*, *apex bluntly subcaudate or obtuse*, acumen to 15 mm long; midrib slender but prominent beneath; *lateral veins dense*, *subequal*, *main ones c. 18 pairs*, *very*

*slender but equally visible on both surfaces or somewhat more so beneath*, spreading; intercostal venation obscure; intramarginal veins 1, hardly looped, close within margin; *petioles c. 10 mm long*. **Inflorescences** paniculate, to 7 cm long, terminal; rachis slender, 3x-branched, sharply quadrangular in cross-section, branchlets short. **Flowers:** *buds small*, *club-shaped*, *c. 5 mm long*, *c. 2 mm diameter*, *with spherical hypanthium on 3 mm slender pseudostalk*; *calyx lobes 5*, *very short*, triangular-acute, *c.* 0.5 × 1.5 mm, somewhat clawed, broad, *becoming vestigial and forming a rim after anthesis*; stamens and style not seen; *ovary at the distal end of flower bud*. **Fruits** *spherical*, to 18 mm diameter, slightly ribbed, *with c. 5 mm diameter obscure calyx rim*, *ripening hard*, *dark green or red*.

**Distribution.** Endemic to Borneo; widespread but rare. In Sabah recorded from Kinabatangan and Labuk Sugut districts (e.g., *SAN 133970*) and in Sarawak from Kuching, Marudi, Mukah and Serian districts (e.g., the syntypes, *S 16957* and *S 23705*). Also known in Brunei (e.g., *S 1198*, *S.J. Davies ecol. vouchers A106* and *B820*) and W and C Kalimantan (e.g., *Sidiyasa PBU 415* and *Hallier 1993*).

**Ecology.** Apparently very local, in mixed and *alan* peat swamp forest, *kerangas* and occasionally mixed dipterocarp forest on dry humic sandy soils, at low altitude.

## 128. **Syzygium pterophorum** Merr. & L.M.Perry

(Greek, *ptero-* = wing, *-phorum* = bearing; referring to the winged twigs)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 158; Beaman & C. Anderson *op. cit.* 224. **Type:** *Clemens 34380*, Borneo, Sabah, Colombon R., Mt. Kinabalu (holotype A; isotypes BM, BO, K, L, NY).

Canopy tree, *c.* 15 m tall. Parts glabrous. **Twigs** *c.* 3 mm diameter apically, *narrowly winged*, smooth, *dark brown*. **Leaves** thinly leathery, with scattered pits above and dots beneath, drying dull rust-brown, yellow-brown beneath; *blades ovate-lanceolate*, *4–13.5 × 1–4 cm*, *corrugated*, *base heart-shaped terminating abruptly at petiole*, *margin recurved*, apex slender-acuminate; *lateral veins unequal*, *main ones c. 15 pairs*, *slender but distinctly raised throughout more prominent beneath*, *slightly furrowed above*; intercostal venation obscure above, distinct beneath; intramarginal vein 2–3 mm within margin, looped; petioles 1–2 mm long. **Inflorescences** paniculate, terminal or axillary, *c.* 4 cm long; rachis *c.* 2 mm diameter, winged, rigid, with flowers clustered on short lateral branches; *bracteoles persisting to anthesis*. **Flowers:** *buds cylindrical*, *c. 6 mm long*, *c. 3 mm diameter*, sessile, *warty and milky*; *calyx lobes 5*, *narrowly triangular*, *erect*; stamens white, many, exserted to 6 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to 8 mm long. **Fruits** unknown.

**Distribution.** Endemic to Borneo; so far only known in Sabah from Mt. Kinabalu, Crocker Range and Ulu Meligan in Ranau, Sipitang and Tambunan districts (e.g., *SAN 29470*, *Clemens 31300*, *Clemens 33047*, *SAN 50694* and *SAN 66841*).

**Ecology.** Common in low stature lower montane ridge forest at 1200–1700 m altitudes, including on ultrabasic substrate.

## 129. **Syzygium punctilimbum** (Merr.) Merr. & L.M.Perry Plate 7A–B.

(Latin, *puncti-* = dotted, *limbus* = blade; referring to the dotted leaf undersurface)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 194; Masamune *op. cit.* 537; Coode *et al*. (eds.) *op. cit.* 239; Beaman & C. Anderson *op. cit.* 224. **Basionym:** *Eugenia punctilimba* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 217, *op. cit.* (1921) 432, J.A.R. Anderson *op. cit.* (1980) 279. **Type:** *Clemens 10888*, Borneo, Sabah, Marai Parai Spur, Mt. Kinabalu (holotype PNH, destroyed; isotype A). **Heterotypic synonyms:** *Eugenia andersonii* Ridl., J. Bot. 68 (1930) 36, *Syzygium andersonii* (Ridl.) Masam. *op. cit.* 523.

Canopy tree, *c.* 20 m tall, *c.* 35 cm diameter. **Bark** pale brown, smooth, hoop-marked; inner bark red. Sapwood pink. Parts glabrous. **Twigs** *c.* 2 mm diameter apically, stout, *obscurely quadrangular in cross-section*, early becoming round, *smooth* when fresh but drying wrinkled, grey-brown. **Leaves:** *thickly leathery*, *drying dull purplish brown and densely pitted above*, *red-brown and densely minutely black-dotted beneath*; *blades obovate-oblanceolate to elliptic*, *c. 8.5 × 4.5*(*1.2–9 × 1–5*) *cm*, base shallowly heart-shaped to broadly wedge-shaped shortly tapering into petiole, margin somewhat recurved, *apex bluntly acute to rounded*; *lateral veins dense*, *slender*, *subequal*, *c. 40 pairs*, *obscure above*, *evident beneath*, ascending; *intercostal venation obscure*; intramarginal vein 1, close to margin, hardly looped; *petioles stout*, *very short*, *c. 1 mm long*. **Inflorescences** *congested racemes*, *terminal*, *to 2 cm long*; rachis *c.* 2 mm diameter, quadrangular in cross-section, singly branched, rigid. **Flowers:** *buds obconical*, *c. 4 mm long*, *c. 3 mm diameter*, stout, tapering, *pseudostalk indistinct*; *calyx lobes 4*, *broadly ovate*, subacute, *c. 0.5 × 1.5 mm*, *with thick margins*, clasping corolla in bud, becoming vestigial and forming a rim at anthesis; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style short. **Fruits** *ellipsoid becoming depressed-spherical*, to 15 mm diameter, smooth, *becoming chocolate-brown*, *with obscure c. 2 mm diameter calyx rim*.

**Distribution.** Endemic to Borneo. In Sabah recorded from Keningau, Kinabatangan, Labuk Sugut, Ranau, Sandakan, Tambunan and Tawau districts (e.g., *SAN 7914*, *Beaman 9382*, *SAN 16000*, *SAN 28722*, *SAN 49681*, *SAN 51494*, *SAN 60300*, *SAN 79550* and *SAN 83120*) and in Sarawak from Belaga, Bintulu, Kapit, Kuching, Lawas, Limbang, Lundu, Marudi, Miri, Serian, Simunjan, Song and Sri Aman districts (e.g., *Anderson 183*, *Chew CWL 392*, *S 0979*, *Nooteboom 1811*, *Beccari 2136*, *S 9519*, *S 26469*, *S 35314*, *S 35950*, *S 36127*, *S 38191*, *S 38218*, *S 39305*, *S 44466*, *S 47930* and *S 48953*). Also known in Brunei (e.g., *BRUN 2374*, *Coode MC 7439*, *Coode MC 7470* and *Symington FMS 35577*) and W and E Kalimantan (e.g., *Mohizah ITTO/BA 729*, *Laman 1352*, *Kostermans 12887* and *Kostermans 13140*).

**Ecology.** Locally common in the lower facies of upper montane forest at 1400–2500 m altitudes, and on dry rocky ridges down to *c.* 300 m; occasional in poorly drained *kerangas* in W Sabah; sometimes on ultramafic substrate on Mt. Kinabalu and in the Meliau basin, and on limestone summits in Sarawak.

## 130. **Syzygium pustulatum** (Duthie) Merr.

(Latin, *pustulatus* = with small boils; referring to the brown dotted leaf undersurface)

Philip. J. Sc. 79 (1950) 421; Turner *op. cit.* (1996) 381, *op. cit.* (1997) 23; Chantaranothai *op. cit.* (2001) 58; Parnell & Chantaranothai *op. cit.* 891. **Basionym:** *Eugenia pustulata* Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 495, King *op. cit.* 127, Merrill *op. cit.* (1921) 432, Ridley *op. cit.* (1922) 736, Burkill *op. cit.* 973, M.R. Henderson *op. cit.* (1949) 188, Kochummen *op. cit.* 212. **Type:** *Maingay 751*, Peninsular Malaysia, Malacca (holotype CAL, *n.v.*; isotype K). **Heterotypic synonyms:** *Eugenia perpuncticulata* Merr. *op. cit.* (1929) 220, *Syzygium perpuncticulatum* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 179, Masamune *op. cit.* 536, 537, ***syn. nov.***, **type:** *Elmer 21223*, North Borneo (= Sabah),

Tawau district (holotype UC; isotypes A, GH, L Barcode L 0009449); *E. perpuncticulata* Merr. var. *brachythyrsa* Merr. *op. cit.* (1929) 220, *S. perpuncticulatum* (Merr.) Merr. & L.M.Perry var. *brachythyrsum* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 179, ***syn. nov.***, **type:** *Elmer 21273*, Sabah, near Tawau (holotype UC; isotypes A, GH, L Barcode L 0009453).

Subcanopy tree; buttresses to 1.5 m tall, narrow. **Bark** initially smooth, cream to pale brown, becoming thick and long powdery flaky; inner bark pink-brown. *Parts glabrous*. **Twigs** *c. 2 mm diameter apically*, slender, *round in cross-section*, *at first dark*, *smooth*, *becoming pale golden-brown*, pimpled and minutely wrinkled. **Leaves** thin, *drying dull rich tawny pale greenish yellow*, *sparsely obscurely to distinctly dotted or pitted above*, *more or less distinctly and finely densely brown dotted beneath*; *blades narrowly elliptic-lanceolate*, *c. 15 × 5*(*7–25 × 2–7*) *cm*, *base narrowly wedge-shaped tapering into petiole*, *margin not wavy*, apex subcaudate, acumen to 1.5 cm long; *lateral veins unequal*, *main ones c. 14 pairs*, *slender but prominent beneath*, *prominently furrowed above*, so are the intramarginal veins, *somewhat ascending*; intercostal venation visible throughout; *intramarginal vein 1*(*or 2*) *pairs*, *3–6 mm within margin*, *looped*; petiole slender, to 9 mm long, often wrinkled. **Inflorescences** paniculate, to 4 cm long, terminal or axillary; rachis 2x-branched, spreading, angular in cross-section; bracts and bracteoles ovate, subacute, *c.* 2 × 2 mm, thick, cupped, falling early. **Flowers:** *buds broadly pear-shaped*, *c. 6 mm long*, *c. 4 mm diameter*, *without distinct pseudostalk*; *calyx lobes 4*, broad acute, *c. 3 × 3 mm*, *thick and hyaline only at margins*, tapering abruptly to base; stamens many, white, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *ellipsoid-obovoid*, *c. 13 mm long*, *c. 10 mm diameter*, *drying dark*, with prominent *c*. 6 mm diameter apical ring of calyx lobes.

**Distribution.** Peninsular Malaysia, Singapore and Borneo. In Sabah widespread and common, known from Beaufort, Keningau, Kinabatangan, Kota Belud, Kudat, Kuala Penyu, Lahad Datu, Ranau, Sandakan, Sipitang and Tawau districts (e.g., *Elmer 21237*, *SAN 37012*, *SAN 51809*, *SAN 56316*, *SAN 65442*, *SAN 77006* and *SAN 97462*) and in Sarawak from Baram, Belaga and Marudi districts (e.g., *S 3604*, *Jacobs 5317*, *S 34743* and *S 46905*). Also known in E Kalimantan (e.g., *Laman 1060* and *Laman 1224*).

**Ecology.** In mixed and upper dipterocarp forest on fertile clay loam soils, at altitudes to 1600 m on Mt. Kinabalu.

## 131. **Syzygium pycnanthum** Merr. & L.M.Perry

(Greek, *pycno-* = dense, compact, *anthos* = flower; referring to the densely flowered inflorescence)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 168; Amshoff, Blumea 5, 3 (1945) 500; Backer & Bakhuizen *f. op. cit.* 344; Chantaranothai & Parnell *op. cit.* (1994) 100; Turner *op. cit.* (1996) 381, *op. cit.* (1997) 23; Parnell & Chantaranothai *op. cit.* 892; Beaman & C. Anderson *op. cit.* 225. **Basionym:** *Myrtus densiflora* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1087. **Type:** *Blume s.n.*, C Java, Nusa Kambangan Isl. (holotype L, *n.v.*). **Homotypic synonyms:** *Jambosa densiflora* (Blume) DC., Prodr. 3 (1828) 287, Korthals, Ned. Kruidk. Arch 1 (1847) 200, Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 93, Miquel, Fl. Ind. Bat. 1, 1 (1855) 416, *Eugenia densiflora* (Blume) DC. *op. cit.* 287, *in syn.*, *E. densiflora* (Blume) Miq., Anal. Bot. Ind. 1 (1850) 17, Duthie *in* Hooker *f. op. cit.* 473, King *op. cit.* 84, Merrill *op. cit.* (1918) 21, *op. cit.* (1921) 427, Ridley *op. cit.* (1922) 728, M.R. Henderson *op. cit.* (1949) 78, Kochummen *op. cit.* 189, J.A.R. Anderson *op. cit.* (1980) 275, van Steenis, Rheophytes of the World (1981) 313, Corner *op. cit.* (1997) 585, *Syzygium densiflorum* (Blume) Masam. *op. cit.* 527, Coode *et al.* (eds.) *op. cit.* 236, *non S. densiflorum* Wight & Arn. (1834). **Heterotypic synonyms:** *Eugenia corymbosa* Roxb., Fl. Ind. edition Carey 2, 2 (1832) 497, *non* Lam. (1789); *E. foxworthyi* Ridl. *op. cit.* (1922) 728, *non* Elmer (1912), *E. foxworthiana* Ridl., Fl. Pen. Mal. 5, Suppl. (1925) 308,

*Syzygium foxworthianum* (Ridl.) Merr. & L.M.Perry *op. cit.* (1939) 168, Masamune *op. cit.* 528, Airy Shaw *op. cit.* (1949) 120, Chantaranothai & Parnell *op. cit.* (1994) 63, Turner *op. cit.* (1996) 375, *op. cit.* (1997) 19, Coode *et al.* (eds.) *op. cit.* 236, Parnell & Chantaranothai *op. cit.* 854, Beaman & C. Anderson *op. cit.* 216, ***syn. nov.***, **type:** *Foxworthy s.n.*, Peninsular Malaysia, Pahang, Bt. Goh FR (*n.v.*).

River bank tree, to 15 m tall, *c.* 50 cm diameter, usually leaning and branching low with dark glossy leaves. **Bark** dark grey-brown, smooth or becoming pale buff-brown flaky. *Young parts glabrous*. **Twigs** *c.* 3 mm diameter apically, *round in cross-section*, *pale brown*, *smooth*. **Leaves** leathery, *drying dull mauve-brown and obscurely densely pimpled above*, *orange-brown and sparsely but distinctly brown dotted beneath*; *blades elliptic*, *ovate or rarely obovate*, *c. 14 × 6*(*11–20 × 2–8*) *cm*, *base wedge-shaped tapering into petiole*, *apex acuminate*, *acumen slender tapering*, *to 12 cm long*; *midrib not sharply angled beneath*; *lateral veins somewhat unequal*, *somewhat raised but not prominent on both surfaces*, ascending, *main ones c. 15 pairs* but variable; *intercostal venation visible above*, *obscure beneath*; *intramarginal veins 1 or 2*, *1–3 mm within margin*, *looped*; *petioles to 8 mm long*. **Inflorescences** *paniculate*, *terminal or subterminal-axillary*, *c.* 7 cm long; rachis *c.* 3 mm diameter, round in cross-section, 2x-branched, brown gland-dotted, many-flowered; *bracteoles in single pairs*, *early caducous*. **Flowers:** *buds torch-shaped*, *6–15 mm long*, *3–10 mm diameter*, gradually tapering from calyx to base, *without distinct pseudostalk* or *tapering abruptly into a slender pseudostalk*; *calyx lobes 4*, *broadly ovate*, acute, *c. 3 × 6 mm*, *unequal*, *with hyaline margins*, *loosely clasping corolla*, *spreading but not reflexed at anthesis*; stamens many and dense, *c.* 10 mm long, pink or white, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to 2 cm long. **Fruits** spherical, *c.* 7–10 mm across, tapering gradually to base, with *c.* 15 mm diameter spreading ring of persistent hemispherical calyx lobes, ripening pink-suffused.

**Distribution.** Peninsular Thailand, Sumatra, Peninsular Malaysia, Java, Borneo, Bali, Sulawesi and Maluku (Morotai).

**Ecology.** On and near alluvium river banks and lakesides, its masses of pink to white flowers attracting a variety of butterflies and other insects. Recorded elsewhere from within mixed dipterocarp forest, on shingle banks and below flood line along whitewater rivers. On Mt. Kinabalu at altitudes up to 1700 m, including on ultramafic substrate.

**Notes.** Two varieties, var. *angustifolium* and var. *pycnanthum* are recognised.

**Key to varieties**

Rheophytic shrub. Leaves narrower, 7–17 × 2–4 cm; intramarginal vein one. Flowers smaller, tapering abruptly into a slender pseudostalk……
var. **angustifolium** (Ridl.) P.S.Ashton

(Latin, *angustus* = narrow, *folium* = leaf; with narrow leaf)

Basionym: *Eugenia densiflora* (Blume) Miq. var. *angustifolia* Ridl., FMP 1 (1922) 729, M.R. Henderson *op. cit.* (1949) 79, Kochummen *op. cit.* 189, van Steenis *op. cit.* 313. Syntypes: *Ridley s.n.*, Peninsular Malaysia, Perak, Ulu Temayo (K) and *R.H. Yapp s.n.*, Peninsular Malaysia, Kelantan, bank of Sg. Kelantan (K). Heterotypic synonyms: *Eugenia foxworthyi* Ridl. *op. cit.* (1922) 728, *non* Elmer (1912), *E. foxworthiana* (Ridl.) Ridl. *op. cit.* (1925) 308, *Syzygium foxworthianum* (Ridl.) Merr. & L.M.Perry *op. cit.* (1939) 168, Masamune *op. cit.* 528, Airy Shaw *op. cit.* (1949) 120, Chantaranothai & Parnell *op. cit.* (1994) 63, Turner *op. cit.* (1996) 375, *op. cit.* (1997) 19, Coode *et al.* (eds.) *op. cit.* 236, Parnell & Chantaranothai *op. cit.* 854, Beaman &

C. Anderson *op. cit.* 216; *syn. nov.*, type: *Foxworthy s.n.*, Peninsular Malaysia, Pahang, Bt. Goh FR (*n.v.*).

Peninsular Thailand, Peninsular Malaysia and Borneo. In Borneo, recorded in Sabah from Beaufort, Kinabatangan and Tawau districts (e.g., *Arsat 1346*, *SAN A 3453* and *SAN 33229*) and in Sarawak from Kapit, Kuching and Marudi districts (e.g., *Richards 2628*, *Beccari 2838*, *S 5769*, *Clemens 21626* and *S 29849*). Also known in Brunei (e.g., *Johns 7246*). Locally abundant on shingle banks and elsewhere below the floodline along whitewater rivers. It is doubtful whether this is more than a rheophytic phenotype of the type variety, or a juvenile form.

Non-rheophytic tree. Leaves larger and broader, 11–20 × 4–8 cm; intramaginal veins two. Flowers larger, without distinct pseudostalk……..

var. **pycnanthum**

Distribution as the species. In Borneo common and widespread; known in Sabah from Keningau, Labuk Sugut, Lahad Datu, Pensiangan, Ranau, Sandakan, Sipitang and Tenom districts (e.g., *RSNB 4072*, *SAN 47653*, *SAN 73534* and *SAN 78600*) and in Sarawak from Bintulu, Kapit, Kuching, Lubok Antu, Marudi, Miri, Mukah and Song districts (e.g., *Chew CWL 1061*, *Nooteboom & Chai 01770*, *S 10105*, *S 22910* and *S 39851*). Also known in Brunei (e.g., *Sands 5593*, *Jacobs 5604* and *Argent 91113*) and Kalimantan (e.g., *Church 210*, *Ambriansyah AA 951*, *Wiriadinata 1228*, *Endert 2396* and *Kessler PK 2750*). In mixed dipterocarp forest on or near alluvium river banks and lakesides. On Mt. Kinabalu at altitudes to 1700 m, including on ultramafic substrate.

## 132. **Syzygium pyrifolium** (Blume) DC.

(Latin, *pyri-* = pear-like, *folius* = leaved; with leaves resembling those of pear-tree)

Prodr. 3 (1828) 261; Korthals, Ned, Kruidk. Arch. 1 (1847) 204; Miquel *op. cit.* (1855) 457; Merrill & L.M. Perry *op. cit.* (1939) 182; Masamune *op. cit.* 537; Amshoff *op. cit.* 498; Backer & Bakhuizen *f. op. cit.* 341; Chantaranothai & Parnell *op. cit.* (1994) 100; Turner *op. cit.* (1996) 381, *op. cit.* (1997) 23; Parnell & Chantaranothai *op. cit.* 892. **Basionym:** *Calyptranthus pyrifolia* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1090. **Type:** *Blume s.n.*, W Java, Mt. Salak (L, *n.v.*). **Homotypic synonym:** *Eugenia pyrifolia* (Blume) Duthie *in* Hooker *f. op. cit.* 487, King *op. cit.* 99, Ridley *op. cit.* (1922) 738. **Heterotypic synonyms:** *Eugenia laevigata* Miq., Anal. Bot. Ind. 1 (1850) 25, *t.* 8, Merrill *op. cit.* (1921) 429, *non* DC. (1828), *Syzygium laevigatum* (Miq.) Miq. *op. cit.* (1855) 457, Merrill & L.M. Perry *op. cit.* (1939) 188, Masamune *op. cit.* 532, ***syn. nov.***, **type:** *Korthals 21a*, Borneo, Kalimantan, ? Doesoen (holotype L, Barcode L 0009637); *E. tumida* Duthie *in* Hooker *f. op. cit.* 487, Craib, Fl. Siam. Enum. 1 (1931) 665, M.R. Henderson *op. cit.* (1949) 161, Kochummen *op. cit.* 221, Corner *op. cit.* (1997) 592; *E. javensis* Koord. & Valeton, Bull. Inst. Bot. Btzg 2 (1899) 7; *E. salaccensis* Koord. & Valeton, Bijdr. Booms Java 6 (1900) 144, Merrill *op. cit.* (1921) 433; *E. striata* Koord. & Valeton *op. cit.* (1900) 145.

Unbuttressed canopy tree, to 20 m tall, *c.* 40 cm diameter. **Bark** smooth. Parts glabrous. **Twigs** *c. 2 mm diameter apically*, *at first quadrangular* but often early becoming round in cross-section, *smooth*, rich golden-brown. **Leaves** *thinly leathery*, *drying dark chocolate-brown*, *frequently shiny without pits above*, *honey-brown dull or satiny more or less distinctly densely minutely pimpled or dotted beneath*; *blades elliptic*, *ovate-lanceolate or sometimes obovate*, *c. 10 × 5*(*4–14 × 2–6*) *cm*, base wedge-shaped shortly tapering into petiole, *apex typically caudate to subacute*, *acumen c. 10 mm long*; *lateral veins subequal*, *dense*, *slender*, *subequally elevated but more or less distinctly furrowed along the ridges above* (less consistently so in Borneo), *main ones c. 12 pairs*; intercostal venation net-like, less distinct than lateral veins but more so beneath than above; intramarginal vein close to margin, hardly looped; *petioles slender*, *c. 10 mm long*. **Inflorescences** paniculate, to 5 cm long, terminal or axillary; rachis slender, 2x-branched, with minute subpersistent paired

bracts and bracteoles. **Flowers** fragrant; *buds clove-shaped*, *to 7 mm long*, *c. 2.5 mm diameter*, *slender and narrowly tapering into tapering pseudostalk*, with a distinct medial constriction; corolla dome-shaped, falling off as a lid at anthesis; *calyx lobes 4*, *shortly ovate-triangular*, *c. 2 × 2 mm*, *thick*, acute, *broadly hyaline towards margins*, *persisting into fruit*; *stamens many*, exserted *c.* 8 mm long, *anther locules parallel*; *ovary at the distal and of flower bud*, style *c.* 8 mm long. **Fruits** *depressed spherical*, *c.* 2 cm long, *c.* 2.5 cm diameter, *with prominently raised apical rim or occasionally crown of calyx lobes*, *ripening greenish brown*.

**Distribution.** Thailand, Sumatra, Peninsular Malaysia, Borneo, the Philippines, Java, Bali eastward to Timor. In Borneo widespread but uncommon; recorded in Sabah from Beaufort, Kota Belud, Labuk Sugut, Ranau, Sandakan, Sipitang and Tawau districts (e.g., *SAN 29975*, *SAN 47818*, *SAN 66775*, *SAN 76209* and *SAN 84777*) and in Sarawak from Bau, Kuching, Lundu, Marudi and Mukah districts (e.g., *S 20042*, *Clemens 20592*, *S 48700*, *S 54149* and *S 57227*). Also known in Brunei (e.g., *Niga Ningkat 43* and *Simpson 2018*) and in Kalimantan (e.g., *Burley 3027* and *Kostermans 9730*).

**Ecology.** In mixed dipterocarp and secondary forest at low altitudes on fertile clay soils.

**Notes.** The following collections, from *kerangas*, mixed peat swamp forest and the lower facies of upper montane forest along ridges at *c.* 1000 m altitude, differ in their more leathery chocolate-brown drying leaf blade and shorter inflorescence, but in other characters including flower and fruit appear to be this species: *SAN 86228* from Sipitang district, Sabah; *S 33872* from Bt Peninjau, Lanjak-Entimau, Lubok Antu district and *S 45033* and *S 45084* from Bt Sadok, Sri Aman district, Sarawak; and *BRUN 178* from Belait, Brunei.

## 133. **Syzygium quadricostatum** P.S.Ashton

(Latin, *quadri-* = four-, *costatus* = ribbed; referring to the four-ribbed twig)

Kew Bull. 61, 1 (2006) 134. **Type:** *B. Lee S 39956*, Borneo, Sarawak, Sg. Jelini, Linau-Balui, Belaga district (holotype K; isotypes L, SAR).

Canopy tree to 15 m tall, *c.* 30 cm diameter. **Bark** purplish brown, powdery, pock-marked; inner bark bright orange scrape and purplish brown fibrous. Parts glabrous. **Twigs** 1–2 mm diameter apically, *sharply 4-ribbed*, *dark brown*, at first smooth, early peeling. **Leaves** leathery, *drying dull mauve-brown*, *sparsely minutely black-dotted beneath*, pitted above; *blades subobovate*, *elliptic or lanceolate*, *2–5 × 1–2.5 cm*, base wedge-shaped tapering into petiole, *apex narrowly obtuse*; *lateral veins unequal*, *slender*, *faintly visible beneath*, *usually hardly so or minutely furrowed above*, *main veins c. 8 pairs*, ascending; intercostal venation obscure; intramarginal vein 1, *c.* 0.5 mm within margin, shallowly looped; petioles slender, *c.* 3 mm long. **Inflorescences** *paniculate*, *to 3.5 cm long*, *terminal or subterminal-axillary*; *rachis 3x-branched*. **Flowers:** *buds goblet-shaped*, *c. 4 mm long*, *c. 3 mm diameter*; *pseudostalk distinct*, *slender c. 2 mm long*; *calyx lobes* (*4 or*)*5*, *distinct*, *at least 1 mm long*; *shortly acute*, *thick to margin*; stamens *c.* 10, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical*, *c. 14 mm diameter*, *with c. 4 mm diameter apical calyx rim*, *ripening deep bluish purple*, *slightly milky*.

**Distribution.** Endemic to Borneo. In Sabah recorded from the Crocker Range, Keningau district and Mt. Kinabalu, Ranau district (e.g., *RSNB 909*, *SAN 33875*, *Clemens 39346*, *SAN 72063* and *SAN 85949*) and in Sarawak from Belaga, Kapit, Limbang, Lubok Antu, Marudi

and Miri districts (e.g., *S 13956*, *S 30429*, *S 39545*, *S 40904*, *S 44113*, *S 46734* and *S 60063*). Also known in Brunei (e.g., *Kirkup DK 871*, *BRUN 1050* and *Coode MC 7567*) and E Kalimantan (e.g., *Kostermans 7489*).

**Ecology.** In the lower and upper facies of upper montane forests at 800–3000 m altitudes, including on the Mulu limestone, occasionally lower in *kerangas*, mostly on slopes and near streams.

## 134. **Syzygium racemosum** (Blume) DC.

(Latin, *racemosum* = densely clustered like a bunch of grapes; referring to the spreading much-branched inflorescence)

Prodr. 3 (1828) 261; Merrill & L.M. Perry *op. cit.* (1939) 189; Amshoff, Blumea 5 (1945) 498; Backer & Bakhuizen *f. op. cit.* 341. **Basionym:** *Calyptranthus racemosa* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1089. **Type:** *Blume s.n.*, Java, *loc. incert.* (L, *n.v.*). **Heterotypic synonyms:** *Syzygium angkolanum* Miq. *op. cit.* (1855) 448, ***syn. nov.***, **type:** *Junghuhn s.n.*, Sumatra, Upper Angkola (holotype U Barcode U 0005201; isotypes L Barcode L 0009582, U Barcode U 0005200); *S. zippelianum* Miq. *op. cit.* (1855) 449, ***syn. nov.***, **type:** *Zippelius s.n.*, W Java, Mt. Malabar (holotype U, *n.v.*); *S. javanicum* Miq. *op. cit.* (1855) 461, Merrill & L.M. Perry *op. cit.* (1939) 188, ***syn. nov.***, **type:** *Horsfield s.n.*, Java, Surakarta (holotype U Barcode U 0005214); *S. expansum* Wall., Cat. (1830) No. 3567, *nom. nud.*, Masamune *op. cit.* 528, *Eugenia expansa* (Wall.) Duthie *in* Hooker *f. op. cit.* 491, *nom. illeg.*, *non* Spring *ex* Mart. (1837), King *op. cit.* 113, Ridley *op. cit.* (1922) 745, *op. cit.* (1930) 15, ***syn. nov.***, **type:** *Wallich Cat. 3567*, Peninsular Malaysia, Penang (holotype K-W); *S. euneuron* Miq. *op. cit.* Suppl. (1861) 314, *E. euneura* (Miq.) Craib, Fl. Siam. Enum. 1 (1931) 640, ***syn. nov.***, **type:** *Diepenhorst HB 2880*, W Sumatra, Priaman Prov. (holotype U Barcode U 0005213); *E. jamboloides* Koord. & Valeton, *op. cit.* (1900) 136; *E. robinsoniana* Ridl., J. Fed. Malay States Mus. 4 (1909) 13, *op. cit.* (1922) 734, ***syn. nov.***, **type:** *Ridley s.n.*, Peninsular Malaysia, Pahang, Telom (holotype K); *E. evansii* Ridl., J. Fed. Malay. States 10 (1920) 134, Ridley *op. cit.* (1922) 747, ***syn. nov.***, **type:** *Evans s.n.*, Peninsular Malaysia, Pahang, G. Senyum (holotype K); *E. brunneoramea* Merr. *op. cit.* (1929) 217, ***syn. nov.***, **type:** *Elmer 21123*, Borneo, Sabah, Tawau (holotype UC; isotype L Barcode L 0009412); *S. calcimontanum* P.S.Ashton, Kew Bull. 61, 1 (2006) 114, ***syn. nov.***, **type:** *Tan & Wright S 27274*, Borneo, Sarawak, G. Subis (holotype K; isotype SAR); *S. tenuicorticum* P.S.Ashton *op. cit.* (2006) 140, ***syn. nov.***, **type:** *Chew CWL 710*, Borneo, Sarawak, Mt. Maja, Bau district (holotype K; isotypes L, SAR).

Small or canopy tree to 30 m tall, to 40 cm diameter; buttresses to 2 m tall; stilt roots present. **Bark** at first light grey-brown and whitish mottled, becoming brown with thick long powdery flakes. *Parts glabrous*. **Twigs** endings *c.* 2 mm diameter apically, slender, *round in cross-section*, *pale yellowish cream or golden- or grey-brown to red-brown*, *smooth becoming minutely pimpled and wrinkled*. **Leaves** *thinly leathery*, *drying dull purple-brown above*, *chocolate-brown beneath*, *obscurely sparsely pitted above*, *minutely distinctly dotted beneath*; *blades narrowly elliptic-lanceolate to elliptic-ovate*, *13–15 × 4–7 cm*, *base round or broadly wedge-shaped tapering into or abruptly terminating at petiole*, apex acuminate, acumen to 2 cm long, slender; *lateral veins very fine*, *unequal*, main ones *c.* 18 pairs, spreading, arched, dense, *evident and slightly raised on both surfaces*, *slightly more so beneath*; *intercostal venation visible throughout*, *forming a distinctly raised net beneath*, dense; *intramarginal veins 1*(*or 2*) *pairs*, *1–2 mm within margin*, *hardly looped*; petioles slender, 3–8 mm long. **Inflorescences** paniculate, to 5 cm long, *terminal or axillary*, rarely ramiflorous; rachis slender, round with spreading branchlets bearing the many flowers bunched at the endings. **Flowers:** *buds clove-shaped becoming trumpet-shaped at anthesis*, *c. 6 mm long*, *c. 3 mm diameter*, *only slightly waisted*, *tapering to the slender pseudostalk*; *calyx lobes 4*, *vestigial or at most c. 0.5 × 2 mm*, *hyaline only at*

*margin*, *early caducous*, *eventually forming a rim round base of the domed corolla*; corolla splitting off as a cap at anthesis; stamens white, many, radiating on *c.* 10 mm straight filaments, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to *c.* 8 mm long, slender. **Fruits** *spherical*, *to 2 cm diameter*, *with eventually inconspicuous calyx rim*.

**Distribution.** Java and Borneo. In Borneo, widespread in Sabah and recorded from Beaufort, Keningau, Kinabatangan, Kota Marudu, Lahad Datu, Ranau, Sandakan, Semporna, Sipitang and Tawau districts (e.g., *SAN 33186*, *SAN 35184*, *SAN 37044*, *SAN 41037*, *SAN 43114*, *SAN 53001*, *SAN 78746*, *SAN 103627*, *SAN 106880* and *SAN 177036*) but apparently less so in Sarawak and known from Bau, Kapit, Kuching, Lundu, Marudi, Song and Tatau districts (e.g., *Sugau 174*, *Beccari 1851*, *Ridley 12263*, *S 30782* and *S 64673*). Also known in Brunei (e.g., *BRUN 18458*) and E and S Kalimantan (e.g., *Sidiyasa 468*, *Kessler PK 1763*, *Endert 1805* and *Kostermans 9500*).

**Ecology.** In mixed dipterocarp forest and secondary forest, on low hills on clay and sandy clay soils and in floodplains and limestone habitat.

**Notes.** In Borneo, two subspecies are recognised.

**Key to subspecies**

Tree to 30 m tall, to 40 cm diameter. Leaf base broadly wedge-shaped; petiole to 8 mm long. Inflorescence to 5 cm long. Not restricted to limestone habitat……
subsp. **racemosum**
Distribution as the species.

Small tree to 10 m tall, to 10 cm diameter. Leaf base broadly rounded; petiole to 4 mm long. Inflorescence to 3 cm long. Restricted to limestone habitat……..
subsp. **calcimontanum** (P.S.Ashton) P.S.Ashton, ***stat. nov.***
Basionym: *Syzygium calcimontanum* P.S.Ashton *op. cit.* (2006) 114. Synonym: *S. tenuicorticum* P.S.Ashton *op. cit.* (2006) 140.
Endemic to Sarawak and so far known only from a few collections from G. Subis, G. Setiak near G. Daya and G. Maja, Bau districts (e.g., *Chew CWL 710*, *S 27274* and *S 38634*). Apparently restricted to karst limestone habitat.

## 135. **Syzygium ramiflorum** Airy Shaw Plate 7C & D.

(Latin, *ramus* = branch, *-florus* = flowered; referring to the position of the inflorescences)

Kew Bull. 4 (1949) 118; Coode *et al.* (eds.) *op. cit.* 239. **Type:** *Richards 1309*, Borneo, Sarawak, Mt. Dulit, Marudi district (holotype K).

Small understorey tree, to 10 m tall. **Bark** smooth. *Parts glabrous*. **Twigs** *to 4 mm diameter apically*, *slender*, *grey-brown*, *at first shallowly ribbed*, *later becoming round in cross-section*. **Leaves** thinly leathery, *drying wrinkled*, *pale shagreened and more or less sparsely dotted beneath*, *rust-brown above*; *blades oblong-lanceolate*, *c. 30 × 6*(*15–40 × 3.5–9*) *cm*, *base broadly wedge-shaped or rounded shortly tapering into petiole*, *margin not wavy*, apex acuminate, acumen slender, tapering, to 4 cm long; *lateral veins unequal*, *main ones c. 13 pairs*, spreading, *indistinct or furrowed above*, *slender and hardly raised beneath*; *intercostal venation obscure above*, *visible beneath*; *intramarginal veins 3–5 mm within*

*margin*, *looped*; *petioles c. 12 mm long*, *c.* 2 mm thick, corky or drying black. **Inflorescences** *very short*, *terminal or axillary*. **Flowers** magenta, *in dense clusters*; *buds obconical to jambu-shaped*, *to 12 mm long*, *to 8 mm diameter*, *tapering to c. 5 mm pseudostalk*; *calyx lobes 4*, *ovoid-hemispherical*, *c. 6 × 8 mm*, cupped, subacute, *hyaline towards margin*, *spreading and becoming reflexed at anthesis*; stamens many, magenta, exserting to 20 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 20 mm long, slender. **Fruits** (young) obovoid, *c.* 10 mm long, *c.* 6 mm diameter, smooth, with *c*. 5 mm diameter short calyx rim.

**Vernacular name.** Sarawak—*ubah keruin* (Kayan?).

**Distribution.** Endemic to Borneo. Uncommon, known in Sarawak from Kapit and Marudi districts (e.g., the type and *S 33323*) and from Brunei (e.g., *BRUN 3153* and *Wong WKM 1201*).

**Ecology.** In mixed dipterocarp forest on sandy clay soil, and upper dipterocarp forests at *c.* 1000 m altitude.

## 136. **Syzygium rejangense** Merr. & L.M.Perry Plate 7E & F.
(from Rejang R., Sarawak)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 162; Coode *et al.* (eds.) *op. cit.* (1996) 239. **Type:** *Clemens 21204*, Borneo, Sarawak, Kapit & Ga'at, Ulu Batang Rajang R. (holotype A; isotype NY). **Homotypic synonym:** *Eugenia rejangensis* (Merr. & L.M.Perry) Burgess *op. cit.* 415, J.A.R. Anderson *op. cit.* (1980) 279, *sphalm. rejangense*. **Heterotypic synonym:** *Syzygium tetragonocladum* Merr. & L.M.Perry *op. cit.* (1939) 153, ***syn. nov.***, **type:** *Beccari 2785*, Borneo, Sarawak, Nov. 1866 (holotype FI).

Large tree overhanging whitewater rivers, with spreading branches with large shiny hanging leaves; juveniles rheophytic, often remaining as shrubs with linear leaves and flood swept branches; buttresses low. **Bark** smooth. *Parts glabrous*. **Twigs** *c.* 4 mm diameter apically, *prominently 4-winged*, *dark brown*, smooth. **Leaves** leathery, *drying shiny dark brown above*, *dull rich rust-brown below*, *shallowly pitted above*, *dotted beneath*; *blades lanceolate*, *c. 35 × 7*(*30–40 × 6–9*) *cm* (narrower as rheophytic juveniles), *base auriculate to rounded ending abruptly at petiole*, margin recurved, apex subcaudate, acumen prominently tapering, *c.* 3 cm long; *lateral veins unequal*, *main ones c. 20 pairs*, *prominent more so beneath than above*, *slightly furrowed above*, spreading; intercostal venation indistinct; intramarginal vein 1, 2–3 mm within margin, looped; *petioles* very stout, *c. 5 mm long*. **Inflorescences** *paniculate*, *to 25 cm long*, terminal, ascending, many-flowered; rachis *c.* 6 mm diameter at base. **Flowers:** *buds cylindrical-obovoid*, *to 12 mm long*, *to 5 mm diameter*, *somewhat tapering towards base into a c. 1 mm short pseudostalk*; *calyx lobes 4*, *free*, *triangular*, *c. 2 × 2 mm*, *erect acute*, *thick*, *hyaline along margins*, *spreading at anthesis*; *stamens many*, white, exserting to *c.* 1 cm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 2 cm long, slender tapering. **Fruits** *ellipsoid*, *c.* 15 mm long, *c.* 10 mm diameter, *drying dark*, with prominent spreading calyx lobes.

**Distribution.** Endemic to Borneo. In Sabah widespread, recorded from Keningau, Kinabatangan, Kota Belud, Penampang, Pensiangan, Ranau, Sipitang and Tawau districts (e.g., *J.T. Pereira et al. JTP 316*, *SAN 19582*, *SAN 32191*, *SAN 65227*, *SAN 72116*, *SAN 77446* and *SAN 122105*) and in Sarawak from Belaga, Kapit, Lawas, Limbang, Lubok Antu, Marudi, Miri and Song districts (e.g., *S 21199*, *S 31513*, *S 34917*, *S 41362*, *S 54811*, *S*

*63271*, *S 76316* and *S 91896*). Also known in Brunei (e.g., *Wong WKM 240*, *BRUN 470*, *BRUN 473* and *Wong WKM 1154*) and W, C and E Kalimantan (e.g., *Kato et al. 169*, *Mahyar UW 946*, *van Valkenbourg JVV 1260*, *Endert 4074* and *Jarvie et al. 5571*).

**Ecology.** Abundant along the banks of whitewater rivers throughout the hills, at altitudes to 700 m. On clay rich soils on stable banks, establishing below the flood line.

## 137. **Syzygium remotifolium** (Ridl.) Merr. & L.M.Perry

(Latin, *remotus* = widely spaced, *-folius* = leaved; referring to the distantly positioned leaves due to the long internodes)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 188; Masamune *op. cit.* 538. **Basionym:** *Eugenia remotifolia* Ridl., J. Bot. 68 (1930) 36, Burgess *op. cit.* 413, J.A.R. Anderson *op. cit.* (1980) 279. **Type:** *Haviland & Hose 3216*, Borneo, Sarawak, near Kuching, 31 Aug. 1894 (holotype K).

Tree. *Parts glabrous*. **Twigs** 1–2(–3) mm diameter apically, *round in cross-section*, *pale pink-brown*, *smooth*. **Leaves** thinly leathery, *not pimpled nor pitted or dotted on both surfaces*, *drying chocolate-brown above*, *generally leaden-brown with darker veins beneath*, *glistening throughout*; *blades ovate*, *c. 10 × 5*(*8–18 × 3.5–9*) *cm*, *base wedge-shaped tapering into petiole*, margin wavy, *apex acuminate*, *acumen to 15 mm long*, *tapering*, downtwisted; *lateral veins somewhat unequal*, *main ones 8–10 pairs*, *evident but barely elevated on either surface*, somewhat ascending; *intercostal venation obscure above*, *distinct beneath*; *intramarginal veins 3 pairs*, *the main one 4–12 mm well within margin*, *prominently looped*, tapering to the base like paired basal veins, the 2 other slender and closer to margin; petioles slender, *c.* 4 mm long, drying black. **Inflorescences** paniculate, *terminal*, *c.* 8 cm long; rachis quite stout, round in cross-section, 2x-branched, the flowers densely clustered on the short ultimate branchlets; *bracteoles early caducous*. **Flowers:** *buds clove-shaped*, *c. 6 mm long*, *c. 3 mm diameter*, with spherical apparently calyptrate apex and *c. 3 mm pseudostalk*; *calyx lobes 4–5*, *vestigial*, *hemispherical*, *hyaline at margin*, *appressed to corolla*, *dehiscing at anthesis*, or *calyptra breaking off leaving a rim round the corolla dome*; stamens many, exserted to *c.* 5 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 6 mm long. **Fruits** unknown.

**Distribution.** Endemic to Borneo, scattered but widespread. In Sabah recorded from Keningau, Kuala Penyu, Lahad Datu, Pensiangan, Ranau, Sandakan, Semporna and Tenom districts (e.g., *SAN 29763*, *SAN 46181*, *SAN 56293*, *SAN 66288*, *SAN 72069*, *SAN 97100* and *SAN 136159*) and in Sarawak from Kapit, Kuching, Marudi, Miri and Sibu districts (e.g., *S 16526*, *S 28787*, *S 46918* and *S 76993*). Also known in Brunei (e.g., *Wong WKM 599*) and W and E Kalimantan (*Church & Mahyar 756*, *Kostermans 4103* and *bb 35353*).

**Ecology.** In mixed dipterocarp forest on leached organic yellow soils on a variety of substrates, at low altitude.

## 138. **Syzygium rheophyticum** P.S.Ashton Fig. 20.

(Greek, *rhoeos-* = pertaining to rivers, *phyton* = a plant; referring to the natural habitat of the species)

Kew Bull. 61, 1 (2006) 134. **Type:** *A. Zainudin et al. 4580*, Borneo, Sarawak, Ulu Katibas, Song (holotype K; isotype KEP).

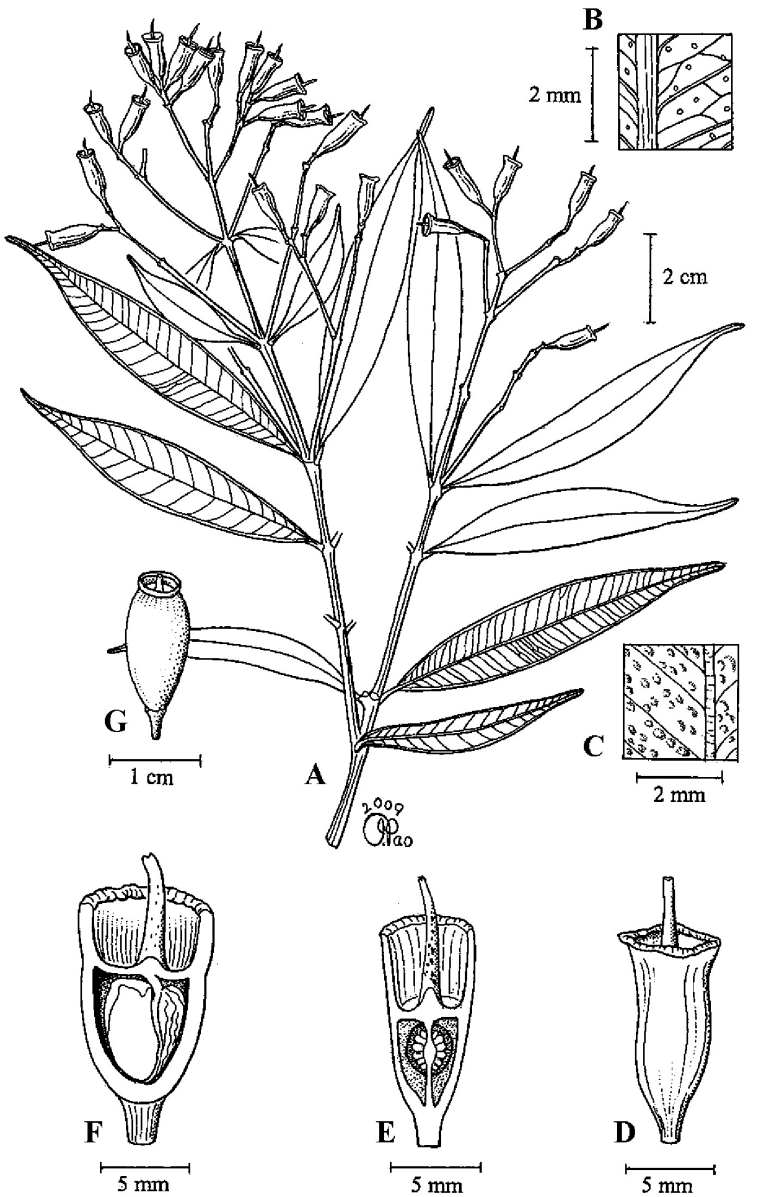


**Fig. 20.** *Syzygium rheophyticum*. A, fruiting (young) leafy twig; B, detailed venation of gland-dotted lower leaf surface; C, pitted upper leaf surface; D, young fruit; E, longitudinal section of young fruit; F, longitudinal section of older fruit; G, older fruit. (A–E from *S 64678*, F–G from *A. Zainudin 4580.*)

Rheophytic shrub. All parts glabrous. **Twigs** 1–2 mm diameter apically, *somewhat quadrangular below nodes*, *otherwise round in cross-section*, smooth, pale yellowish brown. **Leaves** thin, drying dull to slightly glistening, pale yellowish to greenish brown, obscurely but more or less densely pimpled above, minutely black-dotted beneath; *blades strap-shaped*, *3.5–9 × 0.5–1.5 cm*, base gradually tapering into petiole, *apex subcaudate*, *acumen c. 15 mm long*; *lateral veins subequal*, *dense*, ascending, *evident*, *hardly raised but slightly more so beneath*, main ones *c.* 15 pairs; *intercostal venation visible beneath*, *obscure above*; intramarginal vein 1, *c.* 1 mm within margin, not looped; petioles slender, *c.* 3 mm long. **Inflorescences** and **flowers** unknown. **Fruits** narrowly urn-shaped, *c.* 12 mm long, *c.* 6 mm diameter, tapering to base, hardly constricted to *c.* 5 mm diameter calyx rim and pore; style exserted to 6 mm long, subpersistent.

**Distribution.** Endemic to Borneo; known in Sarawak from upland river areas between Batang Lupar and Batang Rajang in Song and Sri Aman districts (e.g., the type, *S 41975* and *S 64678*) and from Ulu Barito in W Kalimantan (e.g., *Ridsdale PBU 152*).

**Ecology.** Locally abundant rheophytes on shingle banks and outcrops below the flood line of whitewater rivers.

## 139. **Syzygium roseomarginatum** (C.B.Rob.) Merr. & L.M.Perry

(Latin, *roseo-* = pink-, *marginatus* = edged; referring to the leaf blade margin)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 191; Beaman & C. Anderson *op. cit.* 225. **Basionym:** *Eugenia roseomarginata* C.B.Rob., Philip. J. Sc. 4 (1909) 390. **Type:** *Merritt & Darling For. Bur. 13975*, the Philippines, Luzon, Mt. Piao, Ilocos Norte (holotype ?PNH, destroyed; isotype A). **Heterotypic synonym:** *Syzygium mindoroense auct. non Eugenia mindoroensis* C.B.Rob. (1909), *nec S. mindoroense* (C.B.Rob.) Merr. (1950)**:** Masamune *op. cit.* 534.

Unbuttressed canopy tree, *c.* 30 m tall, *c.* 70 cm diameter. **Bark** whitish to pale pink-brown, becoming patchily shallowly flaky; inner bark thin, pale brown. *Parts glabrous*. **Twigs** *1–2 mm diameter apically*, *round in cross-section*, *slender*, *grey-brown*, *smooth*. **Leaves** thinly leathery, *without visible pits or dots*, *drying wrinkled*, *dull or satiny mauve-brown*, *somewhat darker above*; *blades lanceolate*, *c. 6 × 2*(*5–11 × 1.5–4*) *cm*, *base narrowly wedge-shaped gradually tapering into petiole*, apex subcaudate, acumen *c.* 12 mm long, slender; *lateral veins unequal*, ascending, *main ones c. 14 pairs*, irregularly spaced, intermediate veins sometimes not reaching the margin, *obscure or more or less distinct beneath*, *minutely shallowly furrowed above*; intercostal venation laxly net-like; *intramarginal vein 1*, *c. 1 mm within margin*, *distinctly looped*; *petioles* slender, *c. 7 mm long*. **Inflorescences** paniculate, *terminal*, *c.* 5 cm long; rachis slender, 3x-branched, round in cross-section, spreading, at first with prominent paired *c.* 4 mm claw-like bracts and bracteoles. **Flowers:** *buds narrowly obconical*, *to 6 mm long*, *to 3 mm diameter*, hardly waisted; *pseudostalk indistinct*; *calyx lobes 4*, *short*, *vestigial*, *not hyaline*, subacute, forming a thickened rim round the domed corolla; corolla splitting off as a cap at anthesis; stamens many, yellow, exserted to 3 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 5 mm long. **Fruits** *spherical*, *c.* 10 mm diameter, smooth, *ripening apple-red*, *with c. 2 mm diameter shallow crown of reflexed calyx lobes*.

**Distribution.** Borneo and the Philippines. In Borneo recorded in Sabah from Kota Belud, Labuk Sugut, Ranau, Sandakan, Sipitang and Tawau districts (e.g., *SAN 18807*, *SAN 28766*, *SAN 28983*, *SAN 36050*, *SAN 44697*, *SAN 49848*, *SAN 58827*, *SAN 73802*, *SAN 83622*, *SAN*

*93999*, *SAN 94980*, *SAN 96880* and *SAN 99830*) and in Sarawak from Belaga, Marudi and Miri districts (e.g., *S 3921*, *S 35818*, *S 39497* and *S 72406*). Also known in Brunei (e.g., *BRUN 261*, *BRUN 514* and *BRUN 3273*) and E Kalimantan (e.g., *Endert 5263* and *Kostermans 5960*).

**Ecology.** Locally common, on ridges near the coast in mixed dipterocarp forest on humult yellow soils and the ecotone to *kerangas*; also in upper dipterocarp forest near Mt. Kinabalu at 500–1500 m altitudes over ultramafic rock, and in lower montane *kerangas* and on limestone karst summits.

## 140. **Syzygium rostratum** (Blume) DC.

(Latin, *rostratus* = beaked; referring to the prominent acumen of the leaf apex)

Prodr. 3 (1828) 261; Merrill & L.M. Perry *op. cit.* (1939) 170; Backer & Bakhuizen *f. op. cit.* 341; Coode *et al.* (eds.) *op. cit.* 239; Beaman & C. Anderson *op. cit.* 225. **Basionym:** *Calyptranthus rostrata* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1092. **Type:** *Blume s.n.*, W Java (L, *n.v.*). **Homotypic synonyms:** *Jambosa rostrata* (Blume) Miq. *op. cit.* (1855) 436, *Eugenia rostrata* (Blume) Burgess *op. cit.* 414, J.A.R. Anderson *op. cit.* (1980) 279. **Heterotypic synonyms:** *Jambosa tenuicuspis* Miq. *op. cit.* (1855) 431, *Eugenia tenuicuspis* (Miq.) Koord. & Valeton *op. cit.* (1900) 129.

Small to medium-sized canopy or subcanopy tree, to 15 m tall. **Bark** smooth grey-brown; inner bark thin, brown. *Young parts glabrous*. **Twigs** slender, *round in cross-section*, *smooth*, *grey-brown*. **Leaves** *drying glistening dark tawny above*, *paler beneath*, *densely minutely pitted above*, *densely more or less faintly brown dotted beneath*; *blades elliptic or lanceolate*, *c. 6 × 2.5*(*4–8 × 1–3*) *cm*, base wedge-shaped tapering into petiole, *margin entire*, *apex caudate*, *acumen generally more than 1/3 the length of leaf blade*; *lateral veins subequal*, *dense*, *main ones c. 25 pairs*, *equally visible and distinctly raised but slender on both surfaces*, spreading; *intercostal venation typically densely finely reticulate*, *distinct on both surfaces*; *intramarginal vein 1*, *close to margin*, *hardly looped*; *petioles slender*, *c. 7 mm long*. **Inflorescences** paniculate, terminal or axillary, *c.* 6 cm long; rachis 2x-branched, lax, slender, with minute collar-like bracts, many-flowered. **Flowers:** *buds club-shaped*, *c. 8 mm long*, *c. 3 mm diameter*, *including c. 5 mm slender hardly tapering pseudostalk*; *calyx lobes 4*, *broadly semicircular but appearing vestigial in young buds*, obtuse or subacute, *thick*; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical to obovoid*, *to 12 mm long*, *c. 8 mm diameter*, *at first with flared calyx lobes but caducous*, *with small*, *obscure calyx rim in ripe fruit*, *drying pale*.

**Distribution.** Sumatra, Borneo and Java. In Borneo widespread but local, known in Sabah from Keningau, Kota Marudu, Kudat, Labuk Sugut, Lahad Datu, Penampang, Pensiangan, Ranau, Sandakan and Tawau districts (e.g., *RSNB 1959*, *SAN 21324*, *Clemens 34473*, *SAN 38406*, *Clemens 40997*, *SAN 52601*, *SAN 60628*, *SAN 95840* and *SAN 111947*) and in Sarawak from Bintulu, Kapit, Kuching, Lundu, Marudi, Sri Aman and Tatau districts (e.g., *S 13166*, *S 48481*, *S 50651*, *S 51979* and *S 60032*). Also known in Brunei (e.g., *Wong WKM 140* and *BRUN 421*) and in W and C Kalimantan (e.g., *Ridsdale PBU 169*, *Sidiyasa PBU 612* and *Church 1899*).

**Ecology.** In mixed dipterocarp forest on sandy soils and fertile clay loams and in hill to upper dipterocarp and lower montane forest, and upper montane forest at altitudes to 2400 m on Mt. Kinabalu; sometimes over ultramafic rock.

## 141. **Syzygium rosulentum** (Ridl.) Merr. & L.M.Perry
(Latin, *rosulens* = pinkish; referring to the dry leaf)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 150; Masamune *op. cit.* 538; Coode *et al*. (eds.) *op. cit.* 239. **Basionym:** *Eugenia rosulenta* Ridl., J. Bot. 68 (1930) 34, J.A.R. Anderson *op. cit.* (1980) 279. **Type:** *Ridley s.n.*, Borneo, Sarawak, G. Matang, by reservoir, Jan. 6, 1915 (holotype K).

Subcanopy, occasionally canopy tree, to 40 m tall, to 1 m diameter but usually smaller; plank buttresses *c.* 2.5 m tall. **Bark** orange- to purplish brown, initially striated, becoming narrowly flaky; *inner bark* thick, fibrous, *bright rusty red*. *Young twigs and inflorescences often densely minutely purplish hairy* or *sometime glabrous*. **Twigs** 2–3 mm diameter apically, *round* to compressed *in cross-section*, *grey-brown* or dark. **Leaves** *drying dull dark purplish black above*, *glabrous and dull purplish brown beneath with black veins*, not or minutely obscurely pitted above, more or less blackish dotted beneath; *blades broadly elliptic-obovate*, *c. 14 × 7*(*9–20 × 5–10*) *cm*, *base wedge-shaped tapering into petiole*, apex abruptly acuminate, acumen slender, *c.* 1 cm long; *lateral veins unequal*, *main veins c. 17 pairs*, more prominent than equally long intermediate veins, prominent beneath, *furrowed above*, spreading; *intercostal venation obscure above*, *evident beneath*; *intramarginal veins 1* (*or 2*), *the main one well within margin*, *looped*; petioles 12–18 mm long. **Inflorescences** *paniculate*, terminal or axillary, *c. 8 cm long*; rachis stout, 2x-branched, quadrangular in cross-section, *with two pairs of c. 2 × 0.5 mm triangular bracteoles*; branches short with clustered flowers. **Flowers:** *buds*, shiny, *obovoid to top-shaped*, *to 4 mm long*, *to 3 mm diameter*, *without distinct pseudostalk*; *calyx lobes 4*, *triangular*, *erect*, ribbed towards base, *hyaline only near margin*, *subtended by 2 pairs of subpersistent decussate deltoid bracteoles*; stamens many, *white*, exserted to *c.* 5 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserted to *c.* 5 mm long. **Fruits** spherical, to 10 mm diameter, shiny, ripening white or pink, strongly ridged, with prominent *c.* 5 mm diameter crown-like apical calyx remnant.

**Vernacular name.** Sarawak—*ubah samak* (Malay, Iban).

**Distribution.** Endemic to Borneo; recorded in Sabah from Beaufort, Kinabatangan, Kuala Penyu, Ranau, Sandakan, Sipitang and Tenom districts (e.g., *SAN 16967*, *SAN 39289*, *SAN 53331*, *SAN 77714*, *SAN 77753*, *SAN 93652*, *SAN 97389*, *SAN 100246* and *SAN 126617*) and in Sarawak from Kapit, Kuching, Lubok Antu, Marudi, Miri and Simunjan districts (e.g., *S 11201*, *S 20126*, *S 29078*, *S 34811*, *S 39008*, *S 39253* and *S 41283*). Also known in Brunei (e.g., *BRUN 531*, *BRUN 575*, *BRUN 5005* and *Sands 5900*) and W, C and E Kalimantan (e.g., *Church 656*, *Laman TL 1017*, *Church 1829*, *Mogea 2009* and *Kostermans 12594*).

**Ecology.** Widespread and locally common, on sandy clay and deep yellow sandy soil in mixed dipterocarp forest, at altitudes below 700 m; on ultrabasic substrates in Sabah.

**Uses.** The bark provides one of the best sources of tannin for fishing nets.

## 142. **Syzygium rugosum** Korth.
(Latin, *rugosus* = wrinkled; possibly referring to the leaf blade beneath)

Ned. Kruidk. Arch. 1 (1847) 204; Merrill & L.M. Perry *op. cit.* (1939) 185; Masamune *op. cit.* 538; Argent *et al.* (eds.) *op. cit.* (1997) 473. **Type:** *Korthals s.n.*, Borneo, S Kalimantan, Karau, Sg. Dusun

(holotype L, Barcode L 0009673). **Homotypic synonym:** *Eugenia. rugosa* (Korth.) Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 224, *ibid.* 79 (1918) 21, M.R. Henderson *op. cit.* (1949) 244, Kochummen *op. cit.* 215, *non* Ruiz & Pav. *ex* DC. (1828). **Heterotypic synonyms:** *Syzygium rigidum* Wall., Cat. (1831) 3581, *nom. nud.*; *Eugenia varians* Miq., Anal. Bot. Ind. 1 (1850) 21, *p.p.*; *E. motleyi* Ridl., J. Bot. 68 (1930) 33, *S. motleyi* (Ridl.) Masam. *op. cit.* 534; *E. goodenovii auct. non* King (1901): Ridley *op. cit.* (1930) 15, *S. goodenovii* (Ridl.) Masam. *op. cit.* 529.

Canopy tree *c.* 35 m tall, *c.* 1 m diameter but usually smaller; buttresses *c.* 2 m tall. **Bark** reddish brown, flaky; inner bark warm brown. *Young parts glabrous*. **Twigs** *slender*, *c. 2 mm diameter apically*, *round in cross-section*, smooth or *flaky*, pale brown. **Leaves** leathery, *usually glistening throughout*, *drying leaden grey-brown*, *minutely puckered* (*shagreened*) *and sparsely or not dotted beneath*, densely finely pimpled above; *blades elliptic*, *ovate or lanceolate*, *5–10 × 2–4 cm*, base wedge-shaped tapering into petiole, *margin entire*, narrowly recurved, apex subcaudate, acumen *c.* 12 mm long; *lateral veins dense*, *subequal*, *main ones c. 35 pairs*, *not furrowed above*, *obscure or very slender and slightly elevated beneath*; *intercostal venation obscure*; *intramarginal vein close to margin*, *hardly looped*; petioles slender, *c.* 8 mm long. **Inflorescences** terminal or axillary, *c.* 2 cm long; rachis slender, singly branched, quadrangular in cross-section. **Flowers:** *buds broadly club-shaped*, *c. 6 mm long*, *c. 4 mm diameter*, *tapering into short indistinct pseudostalk*; *calyx lobes 4* or 5, *shallowly triangular*, *c. 1 × 3 mm*, *acute*, *thick-margined*, *not ribbed*; stamens many, exserting to 8 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to 5 mm. **Fruits** *narrowly obovoid*, *c. 15 mm long*, *c. 7 mm diameter*, *ripening dark red*, drying blackish, with persisting distinct *c.* 2 mm pseudostalk and *c.* 3 mm diameter apical pore surrounded by a rim of persisting calyx lobes.

**Distribution.** Peninsular Malaysia and Borneo. In Borneo, known in SW Sarawak from Kuching, Lundu, Samarahan and Sri Aman districts (e.g., *S 9411*, *S 14982*, *S 25287*, *S 25394*, *S 25679*, *S 26267*, *S 26925*, *S 42068*, *S 42559*, *S 45909* and *S 62283*) and in E and S Kalimantan (e.g., the type, *Motley 665*, *Motley 786*, *Motley 834* and *Kostermans 9607*).

**Ecology.** Locally common in primary and secondary mixed dipterocarp forest on leached yellow sandy and sandy clay soil, and the ecotone to *kerangas*, at altitudes below 800 m.

## 143. **Syzygium samarangense** (Blume) Merr. & L.M.Perry
(from Semarang, C Java)

J. Arn. Arb. 19 (1938) 115 & 216, *op. cit.* (1939) 167; Masamune *op. cit.* 538; Argent *et al.* (eds.) *op. cit.* 473; Parnell & Chantaranothai *op. cit.* (2002) 896; Beaman & C. Anderson *op. cit.* 226; Chen & Craven *op. cit.* (2007) 345. **Basionym:** *Myrtus samarangensis* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1084. **Type:** *Horsfield Myrt 1*, Java, *ex* HLB (holotype L; isotype K). **Homotypic synonym:** *Jambosa samarangensis* (Blume) DC., Prodr. 3 (1828) 286, Blume *op. cit.* (1850) 95. **Heterotypic synonyms:** *Eugenia javanica* Lam., Encycl. 3 (1789) 200, Duthie *in* Hooker *f. op. cit.* 474, King *op. cit.* 81, Merrill *op. cit.* (1921) 428, Ridley *op. cit.* (1922) 726, M.R. Henderson *op. cit.* (1949) 74, Kochummen *op. cit.* 247, J.A.R. Anderson *op. cit.* (1980) 376, *Syzygium javanicum* (Lam.) Masam. *op. cit.* 530, *nom. illeg.*, *non S. javanicum* Miq. (1855); *E. alba* Roxb., Hort. Beng. (1814) 39, *nom. nud.*, Fl. Ind. edition Carey 2 (1832) 493; *Jambosa obtusissima* DC. *op. cit.* (1828) 287; *J. samarangensis* (Blume) DC. var. *heteromorpha* Blume *op. cit.* (1850) 96.

Orchard tree to 20 m tall, with low buttresses. **Bark** smooth, grey-brown. *Parts glabrous*. **Twigs** 2–3 mm diameter apically, *round in cross-section* or at first bluntly 4-ribbed, *smooth*, *brown*. **Leaves** *thin papery*, *drying dull or glistening*, *dark tawny above*, *yellow-brown beneath*, *minutely pitted above*, *densely indistinctly pimpled beneath*; *blades elliptic*,

*lanceolate or oblanceolate*, *c. 17 × 6*(*7–22 × 4–11*) *cm*, *base narrowly rounded or wedge-shaped abruptly joining petiole*, *margin not recurved*, *apex bluntly acuminate*; *midrib not sharply angled*; *lateral veins unequal*, *main ones c. 10 pairs*, *slender but distinctly raised on both surfaces though more slender beneath*, arched, ascending, *sometimes slightly furrowed above*; *intercostal venation evident on both surfaces*; *intramarginal veins 2*, *main one 4–7 mm within margin*, *looped*; *petioles c. 5 mm long*, *to 3 mm diameter*. **Inflorescences** *paniculate*, *c.* 3 cm long, *terminal to axillary-ramiflorous*, few-flowered; rachis 1x-branched. **Flowers:** *buds jambu-shaped*, *to 13 mm long*, *c. 8 mm diameter*, *tapering into c. 6 mm long pseudostalk*, becoming trumpet-shaped at anthesis; *calyx lobes 4*, *hemispherical*, *c. 6 × 7 mm*, *hyaline towards margins*, overlapping and enclosing corolla, *spreading and becoming reflexed into c. 15 mm rosette at anthesis*; stamens many, exserting to 25 mm long, white, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 40 mm long. **Fruits** pear-shaped, *c.* 4.5 mm long, *c.* 6 cm diameter, with wide calyx crown or depressed ring, ripening greenish white to red.

**Vernacular names.** Sarawak—*jambu puteh* (Brunei), *jambu mawar* (Malay), *jambu ayer mawar* (Malay).

**Distribution.** Presumably native in SE Asia. Current distribution extends from India, Bangladesh, Andaman Isl. to SE Asia and the Pacific. In Borneo, widely cultivated in orchards and home gardens (e.g., *Telado 1918*, *FD BNB 3050*, *FD BNB 5476*, *SAN 33508* and *SAN 103151*) and in Sarawak recorded from Kapit and Kuching districts (e.g., *Ridley 12264*, *Clemens 21198* and *Clemens 21202*). Also known in Brunei and Kalimantan (e.g., *Korthals s.n.*).

**Uses.** A comestible fruit the flesh of which is fluffy in texture, and the least tasty among *jambu*.

## 144. **Syzygium scortechinii** (King) Chantar. & J.Parn. Plate 8A.

(Rev. Benedetto Scortechini, 1845–1886, Italian missionary and plant collector in Perak, Peninsular Malaysia)

Kew Bull. 48 (1993) 609, *op. cit.* (1994) 107; Turner *op. cit.* (1996) 382, *op. cit.* (1997) 26; Parnell & Chantaranothai *op. cit.* (2002) 898. **Basionym:** *Eugenia scortechinii* King, J. As. Soc. Beng. 70, 2 (1901) 85, Ridley *op. cit.* (1922) 725, M.R. Henderson *op. cit.* (1949) 66, Kochummen *op. cit.* 216. **Lectotype** (Chantaranothai & Parnell, *op. cit.* 1993)**:** *Maingay KD 736*, Peninsular Malaysia, Malacca (K). **Heterotypic synonyms:** *Jambosa insignis* Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 100, *p.p.*, *quoad specim. Korthals s.n.*, *Syzygium insigne* (Blume) Merr. & L.M.Perry *op. cit.* (1939) 163, ***syn. nov.***, **type:** *Korthals s.n.*, Borneo, Kalimantan, Martapura (holotype L Barcode L 0009632); *Eugenia heteroclada* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 218, Burgess *op. cit.* 412, J.A.R. Anderson *op. cit.* (1980) 276, *S. heterocladum* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 163, Masamune *op. cit.* 530, Coode *et al.* (eds.) *op. cit.* 237, Beaman & C. Anderson *op. cit.* 217, ***syn. nov.***, **type:** *Clemens 10137*, Borneo, Sabah, Mt. Kinabalu, Kiau, Nov. 30, 1915 (holotype PNH, destroyed; isotypes A, K); *E. kingii* Merr., J. Str. Br. Roy. As. Soc. 79 (1918) 22, *op. cit.* (1921) 429, J.A.R. Anderson *op. cit.* 276, *S. kingii* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 163, Masamune *op. cit.* 531, Coode *et al.* (eds.) *op. cit.* 237, ***syn. nov.***, **type:** *Ridley 9071*, Borneo, Sarawak, Bongaya, Dec. 1897 (holotype SING; isotype K); *E. scortechinii* King var. *parvifolia* Ridl. J. Bot. 68 (1930) 11, *p.p.*, *S. scortechinii* (King) Chantar. & J.Parn. var. *parvifolium* (Ridl.) Masam. *op. cit.* 539.

Understorey tree. **Bark** smooth, grey-brown. *Parts glabrous*. **Twigs** *cream-white or golden brown*, smooth, slender but stouter *with 4 distinct shoulders at the nodes*, *the shoulders continuing variably as blunt angles down the otherwise c. 2 mm diameter round tapering*

*internodes*. **Leaves** *drying dull dark tawny-brown above*, *pale greenish brown beneath*, *densely minutely pitted above*, *faintly dotted beneath*; *blades elliptic*, *narrowly obovate or ovate-lanceolate*, *variable in size*, *c. 18 × 6*(*8–20 × 2.5–7*) *cm*, *base heart-shaped or rounded abruptly joining petiole*, apex acuminate, acumen tapering to 3 cm long; *venation including intercostal veins distinct on both surfaces*; *lateral veins unequal*, *main ones c. 12 pairs*, *more prominent beneath*, *furrowed above*, spreading; intramarginal vein 1(or 2) pairs, the main one 2–3 mm within margin, somewhat looped; *petioles c. 4 mm long*, *drying blackish*. **Flowers** few *in dense terminal clusters*; *buds jambu-shaped*, *to 15 mm across including distinct c. 3 mm pseudostalk*; *calyx lobes 4*, *ovate*, *c. 7 × 9 mm*, unequal, obtuse, *hyaline towards margin*, *spreading and becoming reflexed at anthesis to 20 mm diameter ring*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to 15 mm long, prominent. **Fruits** top-shaped, *c.* 20 mm across, smooth, with *c.* 15 mm diameter prominent calyx ring; style persistent, *c.* 25 mm long, slender.

**Distribution.** Peninsular Thailand, Peninsular Malaysia, Borneo and Maluku (Seram, Morotai and Kai). In Borneo widespread, known in Sabah from Beaufort, Keningau, Kinabatangan, Kota Belud, Kota Marudu, Kudat, Labuk Sugut, Lahad Datu, Papar, Penampang, Ranau, Sandakan, Sipitang and Tawau districts (e.g., *FD BNB 4830*, *SAN 25071*, *SAN 28930*, C*lemens 31121*, *SAN 32175*, *SAN 37766*, *SAN 48491*, *SAN 79417*, *SAN 109745* and *SAN 135230*) and in Sarawak from Kuching, Limbang, Lubok Antu, Lundu, Marudi, Miri and Tatau districts (e.g., *S 13321*, *S 17656*, *S 24069*, *S 32926* and *S 33850*). Also known in Brunei (e.g., *Forman LL 1028*, *Dransfield 4415* and *BRUN 5714*) and C and E Kalimantan (e.g., *Goverse Berau 485*, *Endert 3517* and *Jarvie 5800*).

**Ecology.** Among the most abundant species occurring in Borneo. In mixed dipterocarp forest and secondary forest mostly on yellow clay soils, also upper dipterocarp forest; at altitudes to 1600 m on Mt. Kinabalu.

## 145. **Syzygium selukaifolium** P.S.Ashton

(*selukai* = Iban name for a certain species of *Goniothalamus* (Annonaceae), *-folius* = leaved; with leaves resembling that of *selukai* tree)

Kew Bull. 61, 1 (2006) 136. **Type:** *E. Wright & Othman Ismawi S 32558*, Borneo, Sarawak, Ulu Medamit, Limbang district (holotype K; isotypes L, SAR, SING).

Canopy tree, *c.* 25 m tall, *c.* 50 cm diameter; bole fluted; buttresses *c.* 1 m tall, stout. **Bark** dark brown, flaky. *Parts glabrous*. **Twigs** *c*. 5 mm diameter apically, stout with long internodes, *round in cross-section*, *smooth to shallowly flaky*, *dark brown*. **Leaves** thickly leathery, *drying dull dark olive-brown and densely obscurely pimpled below*, *paler slightly glistening not pitted above*; *blades lanceolate*, *20–35 × 8–13 cm*, *base wedge-shaped distinctly tapering into petiole*, margin recurved, apex shortly tapering acuminate; *lateral veins subequal*, *main ones c. 30 pairs*, *hardly raised though more so beneath*, *with a few slightly less prominent equally long intermediate veins*; intercostal venation more or less evident but hardly raised; intramarginal veins 1, 2–3 mm within margin, hardly looped; *petioles stout*, *c. 6 mm long*, *c. 4 mm thick*. **Inflorescences** paniculate, axillary, *c.* 10 cm long; rachis *c.* 2 mm diameter at base, 2x-branched, lax, ribbed. **Flowers** clustered; *buds torch-shaped*, *c. 12 mm long*, *c. 4 mm diameter*, tapering from apex to base, slender; *pseudostalk indistinct*; *calyx lobes 4*, *broadly triangular*, *c. 2 × 4 mm*, *thick*, subacute; *stamens many*, exserted at anthesis to 8 mm long, *anther locules parallel*; *ovary at the distal*

*end of flower bud*, style *c.* 8 mm long. **Fruits** *spherical*, *c. 13 mm diameter*, smooth, *with c. 3 mm collar bearing an c. 8 mm diameter crown of reflexed calyx lobes*.

**Distribution.** Endemic to Borneo; rarely collected, known in Sarawak from Limbang and Marudi districts (e.g., the type, *S 34819*, *S 34835*). Also recorded from Brunei (e.g., *Hussain Hj. Osman HUS 3*).

**Ecology.** In lower montane and lowland *kerangas*, at altitudes to 1000 m.

## 146. **Syzygium silamense** P.S.Ashton
(from G. Silam ultramafic hill near Lahad Datu, Sabah)

Kew Bull. 61, 1 (2006) 136. **Type:** *M.A. Mujin SAN 31785*, Borneo, Sabah, G. Silam, Lahad Datu district (holotype K).

Canopy tree, *c.* 10 m tall, *c.* 8 cm diameter. **Bark** shallowly fissured, corky, brown. Parts glabrous. **Twigs** *sharply narrowly 4-winged in cross-section*, 3–4 mm diameter apically, smooth, yellow-brown. **Leaves** subsessile, *thinly leathery*, *drying dull matt yellowish green beneath*, *slightly glistening and darker above*, sparsely minutely dotted beneath, densely distinctly pitted above; *blades oblong-ovate*, *10–12 × 4–6 cm*, *base shallowly heart-shaped*, *apex acute to subacuminate*; *lateral veins* dense, slender, *subequal*, *main ones c. 16 pairs*, each with *several intermediate veins* of varying length, *distinctly raised beneath*, *hardly so above*; intramarginal vein 1–2 mm within margin, hardly looped; *petioles very short*, *c. 2 mm long and thick*. **Inflorescences** paniculate, terminal, *c.* 4 cm long; rachis 1x-branched, 4-ribbed. **Flowers** unknown. **Fruits** (young) urn-shaped, *c.* 5 mm long, *c.* 4 mm diameter, smooth, with *c.* 4 mm diameter apical calyx rim bearing 4 shallow lobes; style exserted to 4 mm long.

**Distribution and ecology.** Known only from the type specimen, from lower montane forest on ultramaphic substrate at altitude *c.* 850 m.

## 147. **Syzygium skiophilum** (Duthie) Airy Shaw
(Greek, *skio-* = shade-, *-philum* = -loving; in allusion to its understorey habitat)

Kew Bull. 4 (1949) 124. **Basionym:** *Eugenia skiophila* Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 486. **Type:** *Maingay s.n.*, Peninsular Malaysia, Penang Hill (holotype CAL, *n.v.*; isotype K). **Homotypic synonym:** *Aphanomyrtus skiophila* (Duthie) Valeton, Rep. Spec. Nov. Regn. Veg. 4 (1907) 235. **Heterotypic synonyms:** *Pseudoeugenia perakiana* Scort., J. Bot. 23 (1885) 153, King *op. cit.* 133, *sphalm. perakensis*, Ridley *op. cit.* (1922) 755, Kochummen *op. cit.* 250, Turner *op. cit.* (1996) 383, *op. cit.* (1997) 24; *Aphanomyrtus camphorata* Valeton, Ann. Jard. Bot. Buitenz. Suppl. 2 (1898) 149, *t.* 8; *Syzygium filicaudum* Merr. & L.M.Perry *op. cit.* (1939) 189, ***syn. nov.***, **type:** *Endert 3680*, Borneo, E. Kalimantan, W Kutei, near Kemul, Oct. 28, 1925, at *c.* 1100 m (holotype BO; isotype L).

Understorey shrub or treelet. **Bark** blackish brown. *Young parts glabrous*. **Twigs** slender, *round in cross-section*, *smooth*, *dark brown*. **Leaves** *drying somewhat wrinkled*, *dull dark yellow-brown above*, *dull rust-brown beneath*, *densely minutely pitted above*, *sparsely pale brown punctate beneath*; *blades elliptic-lanceolate*, *7–9 × 2.5–3 cm*, base wedge-shaped ending abruptly at petiole, *margin entire*, *wavy*, narrowly recurved, *apex prominently caudate*, *acumen slender*, *c. 15 mm long*; *lateral veins subequal*, dense, *main ones c. 45*

*pairs*, *visible but slender and hardly raised on both surfaces*, *not furrowed above*, spreading; *intercostal venation just visible beneath*, *obscure above*; *intramarginal vein 1*, *close to margin*, *hardly looped*; *petioles slender*, *3–6 mm long*. **Flowers** *terminal and axillary in subsessile clusters*; bracts subpersistent, linear, *c.* 3 mm long; *buds urn-shaped*, *c.* 5 mm long, *c.* 3 mm diameter, *tapering into c. 1 mm short pseudostalk*; *calyx lobes 4*, *minute*, ovate-triangular, subacute, cupped; *stamens 8*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *ellipsoid*, *c.* 6 mm long, *c.* 4 mm diameter, *ripening bright red*, *drying pale*.

**Distribution.** A little known species of Peninsular Malaysia and Borneo. In Borneo uncommon, known with certainty only in Sarawak from G. Sirau, Serian district (e.g., *S 35871*) and E Kalimantan (e.g., *Jaheri 1003*, *Endert 3680* and *Endert 4185*).

**Ecology.** In upper dipterocarp forest at *c.* 1100 m altitude, and on sandy soil in mixed dipterocarp forest.

## 148. **Syzygium soepadmoi** P.S.Ashton Fig. 21.

(E. Soepadmo, 1937–, doyen of Malesian plant systematists)

Kew Bull. 61, 1 (2006) 136. **Type:** *Soepadmo et al. FRI 41353*, Borneo, Sabah, Bt Tawai FR, Kinabatangan district (holotype K; isotypes KEP, SAN, SAR, SING).

Tree, *c.* 40 m tall, *c.* 50 cm diameter. **Bark** greyish, flaky; inner bark brown. *Young parts glabrous*. **Twigs** *slender*, *2–3 mm diameter apically*, *round in cross-section*, *dark grey-brown*, slightly shiny, *becoming minutely cracked and flaking*. **Leaves** *thickly leathery*, *drying glistening throughout*, *mauve-brown and shallowly pitted above*, *rust-brown and faintly dotted beneath*; *blades elliptic*, *6.5–11 × 3–3.5 cm*, base wedge-shaped shortly tapering into petiole, *margin entire*, apex acuminate, acumen *c.* 1 cm long; midrib stout, raised but not sharp beneath; *venation obscure*; *lateral veins unequal*, *main ones c. 10 pairs*; *intramarginal vein 1*, *2–3 mm within margin*, *looped*; petioles fairly stout, *c.* 5 mm long, *c.* 2 mm thick. **Inflorescences** *racemose*, *terminal or subterminal-axillary*, *c. 10 cm long*; *rachis rigid*, *erect*, somewhat ribbed, shortly singly branched, *the branchlets bearing 3-clustered white flowers*. **Flowers:** *buds shortly club-shaped*, *c. 7 mm long*, *c. 4 mm diameter*, with cup-shaped hypanthium and *slightly shorter slender tapering pseudostalk*, shortly pedicellate; *calyx lobes 4*, *ovate-acute*, *c. 2 × 2 mm*, *thick*, *cupped round corolla* exposing it only at apex; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** unknown.

**Distribution.** Known with certainly only from Bt. Tawai FR, Kinabatangan district, Sabah (e.g., the type, *Cheksum CST 287*, *Zainudin A. 5014*, *Zainudin A. 5032*).

**Ecology.** In mixed dipterocarp forest on ultramafic substrate.

**Notes.** When not in flower or fruit, *Syzygium soepadmoi* is difficult to distinguish from immature *S. oligomyrum.* Further flowering collections may prove the species more widespread, and the following Sarawak collections, all from lower montane pole forest, could belong here: *S 34821* from Ulu Chipidi and *S 35909* from G. Apo Dari at *c.* 1460 m in Marudi district, and *S 46745* from Ulu Kayan, Dulit Range at *c.* 820 m in Lundu district.

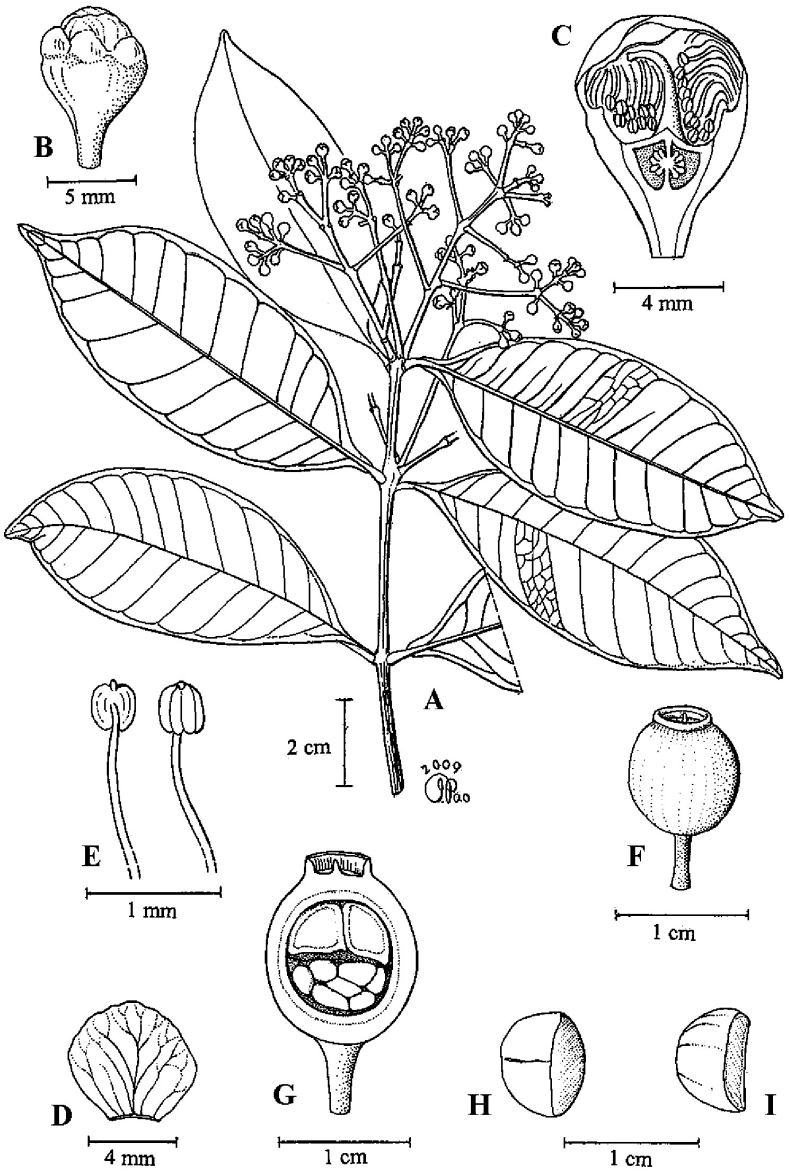


**Fig. 21.** *Syzygium soepadmoi*. A, flowering leafy twig; B, flower bud; C, longitudinal section of flower bud; D, petal; E, adaxial and abaxial view of stamens; F, fruit; G, longitudinal section of fruit; H, adaxial view of seed; I, side view of seed. (A from *Cheksum CST 287*, B–E from *A. Zainudin 5032*, F–I from *S 34821*.)

## 149. **Syzygium steenisii** Merr. & L.M.Perry

(C.G.G.J. van Steenis, 1901–1986, doyen of Far Eastern botany and founder of the Flora Malesiana programme)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 180; Beaman & C. Anderson *op. cit.* 226. **Type:** *Clemens 32683*, Borneo, Sabah, G. Nunkok, Kinabalu NP (holotype A; isotypes BO, BM, K, L Barcode L 0009472, NY). **Homotypic synonym:** *Eugenia steenisii* (Merr. & L.M.Perry) Burgess *op. cit.* 414.

Small tree, to 15 m tall, *c.* 25 cm diameter. **Bark** smooth, brown; inner bark red. *Parts glabrous*. **Twigs** stout, young extending shoots drying ribbed but *becoming round in cross-section*, smooth, *grey-brown*. **Leaves** *thickly leathery*, *drying dull dark purplish brown throughout*, *pits invisible above*, *dots beneath more or less evident*, *minute*, *dense*, *blackish*; *blades elliptic-obovate*, *c. 8 × 3*(*3.5–11 × 2–5*) *cm*, *base wedge-shaped tapering into petiole*, *margin entire*, *narrowly recurved*, *apex acuminate*, *acumen c. 5 mm long*; *lateral veins subequal*, *visible but slender*, overall dense, *main ones c. 20 pairs*, *slightly equally raised on both surfaces*, *not furrowed along crests above*, ascending; *intercostal venation visible but hardly raised*, *more so above than beneath*; *intramarginal veins 2*, *the main one 1–3 mm within margin*, *looped*; petioles *c.* 8 mm long. **Inflorescences** *paniculate*, *to 13 cm long*, *terminal*; rachis stout, 3x-branched, striated but round in cross-section. **Flowers:** *buds pear-shaped*, *to 8 mm long*, *c. 8 mm diameter*, becoming vase-shaped after anthesis, tapering from the wavy margin of calyx rim to base, *without distinct pseudostalk*, drying slightly wrinkled; *calyx lobes 4*, *unequally rounded*, *c. 0.5 × 3 mm*, *thick-margined*, spreading; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical to obovoid* or bilobed, *to 10 mm long*, *c. 16 mm diameter*, smooth, *with c. 3 mm diameter prominent raised reflexed apical calyx rim with thick wavy margin*.

**Distribution.** Endemic to Borneo. Known in Sabah from Keningau, Lahad Datu, Ranau, Sandakan, Sipitang, Tawau and Tenom districts (e.g., the type, *RSNB 4781*, *RSNB 7103*, *SAN 29140*, *SAN 46572*, *SAN 46763*, *SAN 60568* and *SAN 87413*) and in Sarawak from Belaga, Kapit, Kuching, Lawas, Limbang, Lundu and Marudi districts (e.g., *Nooteboom & Chai 01984*, *Beaman 11462*, *S 34840* and *Haviland s.n.*). Also recorded from C and E Kalimantan (e.g., *Risdale PBU 167*, *Endert 3664* and *Kostermans 7546*).

**Ecology.** Rare except on Mt. Kinabalu, in lowland and more often lower montane *kerangas* and rocky summits into the lower zone of upper montane forest, sometimes on ultramafic substrate, at 600–2400 m altitudes.

**Notes.** The following collections from Mt. Kinabalu, at 1500–3100 m in upper montane forest on ultramafic substrates, differ from the type in their more robust and larger parts. We do not regard these differences as being sufficiently consistent to merit formal status for this form: *Carr SFN 27654*, Pakka Pakka; *RSNB 4748* (Chew & Corner), Mesilau Cave; *RSNB 7129* (Chew & Corner), Mesilau R.; *RSNB 4421* (Chew & Corner), Bambangan R.; *RSNB 757* (Chew, Corner & Stainton), Eastern Shoulder.

## 150. **Syzygium stipitatum** P.S.Ashton

(Latin, *stipitatus* = stalked; referring to the elongated pseudostalk of flower bud)

Kew Bull. 61, 1 (2006) 138. **Type:** *D. Sundaling SAN 97280*, Borneo, Sabah, Sg. Binalik, Kinabatangan district, in flower (holotype K; isotypes KEP, L, SAN, SING).

Small tree *c.* 10 m tall, *c.* 10 cm diameter. **Bark** smooth, brown; inner bark pink. *Young parts glabrous*. **Twigs** 2–3 mm diameter apically, *elliptic in cross-section*, furrowed, *smooth*, *pale brown*. **Leaves** *papery*, *drying dull pale yellow-brown beneath*, *darker pink-brown above*, *dots and pits obscure*; *blades elliptic*, *13–18 × 7–10 cm*, *base wedge-shaped shortly tapering into petiole*, apex acuminate, acumen *c.* 15 mm long, tapering; *lateral veins unequal*, *main ones c. 16 pairs*, *slender but distinctly raised more so beneath*, spreading hardly arched, *each with a finer shorter intermediate vein*; *intercostal venation laxly reticulate*, *evident throughout but hardly raised*; *intramarginal veins 1*(*or 2*), *3–6 mm within margin*, *looped*; petioles slender, *c.* 12 mm long. **Inflorescences** *paniculate*, terminal or subterminal-axillary, *c.* 12 cm long; rachis *c.* 3 mm diameter at base, 3x-branched, spreading, many-flowered; bracts and bracteoles hemispherical, *c.* 1 × 2 mm, cupped. **Flowers:** *buds clove-shaped*, *c. 12 mm long*, *c. 5 mm diameter*, with the globose hypanthium set on *a 7 × 3 mm tapering pseudostalk*; *calyx lobes 4*(*–5*), *broadly ovate*, *c. 6 × 4 mm*, *blunt*, thin to papery, *surrounding a prominent domed corolla*, *spreading but not becoming reflexed at anthesis*; stamens many, exserted to *c.* 8 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 10 mm long at anthesis, slender. **Fruits** (young) obturbinate-globose, smooth, with prominent crown of calyx lobes.

**Distribution.** Endemic to Borneo. Recorded in Sabah from Kinabatangan and Sandakan districts (e.g., the type and *SAN 43848*) and in Sarawak from Belaga district (e.g., *Goh GSY 404* and *S 77361*).

**Ecology.** On river banks.

## 151. **Syzygium subcrenatum** Merr. & L.M.Perry

(Latin, *sub* = almost, *crenatus* = notched; referring to the leaf margin)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 190. **Type:** *Beccari 3390*, Borneo, W Kalimantan, Danau Lamajan (holotype FI; fragment A). **Heterotypic synonyms:** *Eugenia crenulata* Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 490, King *op. cit.* 91, Ridley *op. cit.* (1922) 751, *nom. illeg.*, *non* Willd. (1799); *E. pseudocrenulata* M.R.Hend., Gard. Bull. Sing. 12 (1949) 216, Kochummen *op. cit.* 211, *Syzygium pseudocrenulatum* (M.R.Hend.) I.M.Turner *op. cit.* (1996) 381, *op. cit.* (1997) 23, ***syn. nov.***, **type:** *Maingay KD 739*, Peninsular Malaysia, Malacca, *sin. loc.* (holotype K; isotype SING); *E. nemestrina* M.R.Hend., Gard. Bull. Sing. 11 (1947) 324, J.A.R. Anderson, Gard. Bull. Sing. 20 (1963) 176, *S. nemestrinum* (M.R.Hend.) I.M.Turner *op. cit.* (1996) 378, *op. cit.* (1997) 21, ***syn. nov.***, **type:** *Corner SFN 33590*, Singapore, McRitchie Reservoir (holotype SING; isotype K).

Canopy tree to 25 m tall, *c.* 1 m diameter; bole fluted, with stilt roots and buttresses to 1 m tall. **Bark** smooth to cracked, hoop-marked, pink- to grey-brown. *Young parts glabrous*. **Twigs** 3–4 mm diameter apically, *round or elliptic and often ribbed in cross-section*, *smooth to flaky*, *greyish brown*. **Leaves** thickly leathery, drying dark leaden greyish purple, glistening and with scattered more or less obscure pits above, *darker dull and densely minutely dark dotted beneath*; *blades broadly elliptic to oblong*, *c. 13 × 7*(*6–16 × 3.5–8*) *cm*, base broadly wedge-shaped tapering into petiole, *margin usually distinctly sparingly toothed towards apex*, *recurved*, apex acute, *rounded* or shortly broadly acuminate and twisted over; *lateral veins* dense, slender, *subequal*, *main ones c. 14 pairs*, *distinctly bluntly raised or hardly raised on both surfaces*; intercostal venation forming a prominent raised lattice; *intramarginal vein 1*(*or 2*), *c. 1 mm within margin*, *not or hardly looped*; *petioles stout*, *c. 14 mm long*. **Inflorescences** paniculate, terminal, *c.* 8 cm long; rachis stout, angular on drying, 3x-branched, with the flowers clustered on the short branchlets; bracts and bracteoles short, triangular, subpersistent. **Flowers:** *buds obconical*, *c. 6 mm long*, *c. 3 mm*

*diameter*, tapering from apex to base; *pseudostalk indistinct*; *calyx lobes 4*, *vestigial*, *free with thick margin*, broad, subacute, forming a wavy rim; stamens many, exserted to *c.* 5 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style short. **Fruits** *pumpkin-shaped*, *c. 17 mm long*, *c. 10 mm diameter*, smooth, *with obscure small calyx rim*.

**Distribution.** Sumatra, Peninsular Malaysia, Singapore and Borneo. In Borneo known in Sabah from Beaufort, Keningau, Kinabatangan, Lahad Datu, Ranau, Sipitang and Tawau districts (e.g., *SAN 19453*, *SAN 26262*, *SAN 73286*, *SAN 81935* and *SAN 102883*) and in Sarawak from Betong, Bintulu, Kapit, Kuching, Lawas, Limbang, Lundu, Marudi, Miri, Sibu and Simunjan districts (e.g., *S 9705*, *S 10475*, *S 12860*, *S 15098*, *S 16053*, *S 25680*, *S 32807*, *S 38560*, *S 53678* and *S 59488*). Also known in Brunei (e.g., *BRUN 975*) and Kalimantan (e.g., the type, *Tukirin 661*, *Endert 7822*, *Kostermans 9876* and *bb 14401*).

**Ecology.** Local, in mixed dipterocarp forest on yellow sandy soils, *kerangas*, mixed peat swamp forest, and occasionally in upper montane ridge forest.

## 152. **Syzygium subisense** P.S.Ashton
(from Ulu Subis, Niah NP, Sarawak)

Kew Bull. 61, 1 (2006) 138. **Type:** *P.C. Yii S 40164*, Borneo, Sarawak, G. Berangin, Ulu Subis (holotype K; isotypes KEP, L, SAR).

Small tree to 6 m tall, *c.* 5 cm diameter. *Parts glabrous*. **Twigs** *c. 3 mm diameter apically*, *round in cross-section*, *smooth*, *yellowish brown*. **Leaves** thinly leathery, *slightly satiny throughout*, *drying yellowish brown beneath*, *grey-green above*, obscurely pitted above, *not dotted beneath*; *blades lanceolate*, *15–22 × 6.5–8 cm*, *base broadly heart-shaped*, apex acuminate, acumen *c.* 6 mm long, tapering; *lateral veins unequal*, *main ones c. 22 pairs*, slender, with few intermediate veins, *elevated beneath*, *furrowed above*; *intercostal venation evident*, *slightly elevated beneath*, *obscure above*; *intramarginal vein 3–5 mm within margin*, *somewhat looped*; *petioles c. 2 mm long and thick*, *drying black*. **Inflorescences** paniculate, terminal, *c.* 7 cm long; rachis slender, round in cross-section, 2x-branched, flowers clustered at endings. **Flowers:** *buds jambu-shaped*, *c. 5 mm long*, *c. 6 mm diameter* (*including 4 reflexed or spreading hemispherical calyx lobes*), *waisted below hypanthium above the slightly expanded pseudostalk*; pedicels *c.* 1 mm long; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to *c.* 3 mm long, slender. **Fruits** unknown.

**Distribution and ecology.** Known only from the type collection from a limestone ridge at altitude *c.* 400 m.

## 153. **Syzygium subsessilifolium** (Merr.) Merr. & L.M.Perry
(Latin, *sub* = somewhat, *sessilis* = seated, *i.e.* without stalk, *folius* = leaved; referring to the sessile leaf blade)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 180; Masamune *op. cit.* 539. **Basionym:** *Eugenia subsessilifolia* Merr., J. Str. Br. Roy. As. Soc. 79 (1918) 24, *op. cit.* (1921) 434, J.A.R. Anderson *op. cit.* (1980) 280. **Type:** *Haviland 2923*, Borneo, Sarawak, Kuching (holotype SING; isotypes BO, K, L Barcode L 0009681).

Small tree. *Young parts glabrous*. **Twigs** *c. 1 mm diameter apically*, *slender*, *round in cross-section*, *pale brown*, pimpled. **Leaves** leathery, without pits or dots, drying dull greyish tawny above, dull pale chocolate-brown beneath; *blades subsessile*, *narrowly ovate to oblong*, *c. 13 × 6*(*6–14 × 2.5–6.5*) *cm*, *base heart- or wedge-shaped*, *unequal*, apex acuminate, acumen *c.* 1 cm long, tapering; *lateral veins unequal*, *main ones c. 13 pairs*, the basal 3 pairs arising together, *slender but more or less raised sometimes with median furrow above*, *more raised beneath*, spreading; intercostal venation obscure; *intramarginal vein 1–3 mm within margin*, *looped*; petioles very short, *c.* 2 mm long. **Inflorescences** *paniculate*, *in compact axillary clusters*, *c.* 1 cm long, 3-flowered. **Flowers:** *buds torch-shaped or spherical*, *c. 12 mm long*, *c. 8 mm diameter*, *tapering into c. 8 mm long slender pseudostalk*; *calyx lobes 4*, *ovate-acute*, *c. 3 × 3 mm*, *with broadly hyaline margins*, *spreading but not becoming reflexed at anthesis*; stamens many, exserted to 8 mm long at anthesis, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 10 mm long. **Fruits** ellipsoid, *c.* 18 mm long, *c.* 15 mm diameter, faintly ribbed, green, with *c.* 4 × 5 mm splayed calyx lobes on an *c.* 3 mm tall, *c.* 7 mm diameter collar.

**Vernacular name.** Sarawak—*ubah tangkai pendek* (Malay).

**Distribution.** Endemic to Borneo. Rare, recorded in Sabah from Lahad Datu district (e.g., *SAN 107369*) and in Sarawak from Kuching and Sibu districts (e.g., the type and *Haviland 1870*).

**Ecology.** On the banks of sluggish lowland rivers.

## 154. **Syzygium syzygioides** (Miq.) Merr. & L.M.Perry

(Greek, *-oides* = resembling, *Syzygium*; originally considered as a species of *Jambosa* that resembles *Syzygium*)

J. Arn. Arb. 19, 2 (1938) 109, *op. cit.* (1939) 171; Backer & Bakhuizen *f. op. cit.* 341; Chantaranothai & Parnell *op. cit.* (1994) 111; Turner *op. cit.* (1996) 383, *op. cit.* (1997) 26; Coode *et al.* (eds.) *op. cit.* 239; Parnell & Chantaranothai *op. cit.* (2002) 9001. **Basionym:** *Jambosa syzygioides* Miq., Fl. Ned. Ind. 1, 1 (1855) 431. **Homotypic synonyms:** *Calyptranthus caryophyllifolia* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1089, *non* Willd. (1796), *Syzygium caryophyllifolium* DC., Prodr. 3 (1828) 260; *E. syzygioides* (Miq.) M.R.Hend. *op. cit.* (1949) 154, Kochummen 3 (1978) 219. **Type:** *Blume s.n.*, Java (?L, *n.v.*). **Heterotypic synonyms:** *Eugenia cymosa* Wight, Ill. Ind. Bot. 2 (1841) 17, *non* Lam. (1789), Duthie *in* Hooker *f. op. cit.* 482, King *op. cit.* 100, Merrill, J. Str. Br. Roy. As. Soc. 77 (1917) 225, *op. cit.* (1921) 427, Ridley *op. cit.* (1922) 737, Craib, Fl. Siam Enum. 1 (1931) 637, *Syzygium cymosum* (Wight) Masam. *op. cit.* 527; *S. nelitricarpum* Teysm. & Binn., Tijdschr. Nederl. Ind. 27 (1864) 53; *E. pseudosyzygioides* M.R.Hend. *op. cit.* (1947) 315.

Small or canopy tree to 30 m tall, *c.* 80 cm diameter; bole fluted or with buttresses to 1.5 m tall. **Bark** warm brown, becoming flaky; inner bark pink- to purplish brown. *Young parts glabrous*. **Twigs** *c. 0.5 mm diameter apically*, *very slender*, *round in cross-section*, *warm pale brown*, *flaky*. **Leaves** *drying rust- to pink-brown*, *dull not shagreened throughout*, *with obscure scattered pits above* and *minute more or less obscure scattered dots beneath*; *blades elliptic-lanceolate*, *c. 7.5 × 2.5*(*4–8 × 1–4*) *cm*, base wedge-shaped tapering into petiole, *margin entire*, *narrowly recurved*, *apex caudate*, *acumen c. 12 mm long*; *lateral veins subequal*, slender, *main ones c. 28 pairs*, *c.* 2 mm apart, *somewhat obscure and hardly raised though slightly more so above and sometimes narrowly furrowed along crests*; *intercostal venation distinct* or *obscure*, *not furrowed above*; *intramarginal vein 1*, *close to margin*, *not looped*; *petioles slender*, *c. 6 mm long*. **Inflorescences** paniculate, terminal or

axillary, *c.* 2 cm long; rachis 0.5 mm diameter, slender, 2x-branched, many-flowered. **Flowers:** buds *club-shaped*, *c. 4 mm long*, *c. 3 mm diameter*, with globose hypanthium *tapering abruptly to c. 2 mm short slender pseudostalk*; *calyx lobes 4*, ovate-triangular, *c. 1.5 × 1.5 mm*, acute, thick-margined, *not ribbed*, appressed to domed corolla; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical* or depressed spherical, *c.* 7 mm long, *c.* 6 mm diameter, smooth, with *c.* 2 mm diameter and 1 mm high calyx rim.

**Distribution.** Widespread in Indo-Burma including the Andaman Isl., and in Malesia east to Buru Is. (Maluku). In Borneo, recorded in Sabah from Kudat, Lahad Datu and Tawau districts (e.g., *SAN A3193*, *SAN 11196*, *SAN 52771* and *SAN 69265*) and in Sarawak from Bau, Kapit, Kuching and Serian districts (e.g., *Native Collector 2602*, *S 20253*, *S 27759* and *S 45592*). Also known in C, E and S Kalimantan (e.g., *Kartawinata 1034*, *Kessler PK 1573*, *Kostermans 9152* and *bb 27174*).

**Ecology.** In lowland mixed dipterocarp forest especially near the coast; apparently uncommon; also on the Bau limestones in Sarawak.

## 155. **Syzygium tawahense** (Korth.) Merr. & L.M.Perry
(from Tawah, near Martapura, SE Kalimantan)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 174; Masamune *op. cit.* 540; Coode *et al.* (eds.) *op. cit.* 239. **Basionym:** *Jambosa tawahensis* Korth., Ned. Kruidk. Arch. 1 (1847) 202, Blume *op. cit.* (1850) 106, Miquel *op. cit.* (1855) 418, Merrill *op. cit.* (1921) 434. **Type:** *Korthals s.n.*, Borneo, SW Kalimantan, Tawah, near Martapura (holotype L, *n.v.*). **Homotypic synonym:** *Eugenia tawahensis* (Korth.) Burgess *op. cit.* 414, 415.

Medium-sized canopy tree to 30 m tall, *c.* 1 m diameter; buttresses short, stout. **Bark** mauve-brown, *becoming cracked and flaky*. *Parts glabrous*. **Twigs** *c. 4 mm diameter apically*, *stout*, *elliptic in cross-section*, *smooth*, *grey-brown*. **Leaves** thickly leathery, *drying warm purplish brown*, *slightly shiny above* (more so in juveniles), *slightly milky beneath*, *faintly pimpled on both surfaces*; *blades elliptic-oblong*, *c. 17 × 8*(*10–23 × 4–10*) *cm*, *base wedge-shaped tapering into petiole*, apex acuminate, acumen *c.* 1 cm long, tapering; *lateral veins unequal*, *main ones c. 12 pairs*, *with prominent intermediate veins*, *prominent on both surfaces though more so below*, spreading, *not furrowed above*; *intercostal venation distinct on both surfaces*; *intramarginal veins 2*, *main one well within margin*, *looped*; petioles stout, *c.* 1 cm long. **Inflorescences** *paniculate*, *c. 10 cm long*, *terminal or axillary*; rachis 3x-branched, elliptic in cross-section, stout, *spreading with the flowers bunched at the branch endings*; *bracts and bracteoles triangular*, *c. 2 × 2 mm*, *fugaceous* or *sometimes acicular*, *keeled*, *c. 12 × 3 mm*, *subpersistent*. **Flowers:** *buds clove-shaped*, *c. 10 mm long*, *c. 5 mm diameter*, *tapering to base without distinct pseudostalk*, ribbed; *calyx lobe 4*, *ovate*, *c. 1.5 × 1.5 mm*, subequal, *small but distinct*, *not hyaline at margin*, strongly cupped, erect, breaking off at anthesis leaving a vase-shaped ribbed hypanthium; stamens many, exserting to *c.* 8 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 6 mm long. **Fruits** *spherical*, to 3 cm diameter, *with small apical calyx rim*, *prominently ribbed and more or less warty*, *drying green*.

**Distribution.** Endemic to Borneo. In Sabah widespread, recorded from Beaufort, Kinabatangan, Kota Kinabalu, Kudat, Labuk Sugut, Lahad Datu, Papar, Sandakan, Sipitang and Tawau districts (e.g., *SAN A4796*, *SAN 27982*, *SAN 30852*, *SAN 39483*, *SAN 57820*,

*SAN 86450*, *SAN 107785* and *SAN 124394*) and in Sarawak from Kapit, Marudi, Miri and Simunjan districts (e.g., *S 3897* and *S 75386*). Also known in Brunei (e.g., *BRUN 175*, *BRUN 204* and *S 5885*) and E Kalimantan (e.g., *Meijer 2241* and *van Balgooy 5957*).

**Ecology.** Common at altitudes below 400 m, in mixed dipterocarp forest on yellow sandy soil, and mixed and *alan* peat swamp in Brunei.

## 156. **Syzygium taytayense** (Merr.) Merr.

(of Taytay, Palawan Isl., the Philippines)

Philip. J. Sc. 79 (1950) 417. **Basionym:** *Eugenia taytayensis* Merr., Philip. J. Sci. C, Botany 10 (1915) 223. **Type:** *Merrill 9201*, the Philippines, Taytay, Palawan Isl. (holotype PNH, ?destroyed; isotype K).

Subcanopy tree, *c.* 15 m tall, *c.* 30 cm diameter. **Bark** whitish; inner bark brown. Parts glabrous. **Twigs** 3–4 mm diameter apically, *distinctly narrowly winged in cross-section*, otherwise smooth, *warm dark brown*. **Leaves** *papery*, *drying wrinkled*, *warm chocolate-brown throughout*, more or less indistinctly pitted above, *densely pimpled beneath*; *blades ovates-lanceolate*, *4–9 × 2.5–5.5 cm*, *base shallowly heart-shaped or abruptly rounded*, apex acuminate, acumen tapering, *c.* 1 cm long; *lateral veins unequal*, *main ones c. 9 pairs*, somewhat ascending, *slender but prominent beneath*, *more or less prominently furrowed above*, *intermediate veins shorter*; intercostal venation lax, more or less evident though hardly raised beneath, obscure above; intramarginal veins 1(or 2), 4–7 mm within margin, prominently looped; *petioles very short*, *c. 2 mm long*. **Inflorescences** *paniculate*, *terminal* or *subterminal-axillary*, *c. 7 cm long*; rachis narrowly ribbed otherwise smooth, 2x-branched, many-flowered, spreading; bracts and bracteoles narrowly triangular, *c.* 3 × 2 mm, keeled. **Flowers:** *buds clove-shaped*, *c. 8 mm long*, *c. 3 mm diameter*, with globose hypanthium with domed corolla on a *c. 4 mm slender slightly tapering pseudostalk*; *calyx lobes 4*, *free*, *broadly triangular-ovate*, *c. 2 × 3 mm*, acute, clasping the base of corolla dome; *stamens many*, exserting to 6 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 8 mm long. **Fruits** *broadly pear-shaped to obovoid*, *c. 17 mm long*, *c. 7 mm diameter*, *ripening red*, drying black, minutely wrinkled, subsessile, *with c. 3 mm diameter slightly raised calyx rim*.

**Distribution.** The Philippines (Palawan Isl.) and Borneo. In Sabah recorded from Kinabatangan and Ranau districts (e.g., *SAN 95595* and *SAN 116208*). Also known in E Kalimantan (*Ambriansyah 567* and *Ambriansyah 1279*).

**Ecology.** Rare, in lowland forests.

## 157. **Syzygium tenuicaudatum** Merr. & L.M.Perry

(Latin, *tenue-* = slender, *caudatus* = tailed; referring to the long slender acumen of leaf apex)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 175; Coode *et al.* (eds.) *op. cit.* 240. **Type:** *Clemens 21634*, Borneo, Sarawak, Sg. Gaat, Kapit district (holotype NY; isotype K). **Homotypic synonym:** *Eugenia tenuicaudata* (Merr. & L.M.Perry) J.A.R.Anderson *op. cit.* (1980) 280.

Small understorey tree. **Bark** smooth, pale cream-brown. *Parts glabrous*. **Twigs** slender, *round or elliptic in cross-section*, *strikingly cream-white*, *smooth*. **Leaves** leathery, *drying*

*shiny throughout*, *purplish brown above*, *dark chocolate-brown beneath*, *pits and dots obscure*, *minute*; *blades oblanceolate*, *c. 20 × 3.5*(*6–25 × 3–5*) *cm*, *base wedge-shaped abruptly joining petiole*, *apex caudate*, *acumen slender to 3 cm long*; *lateral veins unequal*, *main ones 20–25 pairs*, *with many shorter intermediate veins*, *sharply prominent especially beneath*, spreading, *furrowed above*; *intercostal venation not distinctly net-like*; *intramarginal veins 2*, *main ones c. 2 mm within margin*, *somewhat looped*, prominent; *petioles c. 10 mm long*, drying black. **Inflorescences** *paniculate*, *terminal or subterminal-axillary*, *to 10 cm long*; rachis slender, sparsely branched. **Flowers** white; *buds clove-shaped*, *to 8 mm long*, *c. 3 mm diameter*, *tapering gradually into pseudostalk*, becoming urn-shaped at anthesis; *calyx lobes 4*, *free*, *c. 2 × 3 mm*, short, broad, rounded, *thick with pale margin*, reflexed at anthesis and falling thereafter; *stamens many*, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *round or irregularly ellipsoid*, *to 18 mm long*, *to 20 mm diameter*, smooth.

**Distribution.** Endemic to Borneo. Rare in Sabah, known by a single collection from Beaufort district (*Cuadra SAN A 1409*) and in Sarawak recorded from Kapit, Miri, Sri Aman and Tatau districts (the type, *S 17772*, *Clemens 21204a*, *S 41299*, *S 41717*, *S 44868*, *S 48354* and *S 61742*).

**Ecology.** On sandy soils in mixed dipterocarp forest, and on stream banks.

## 158. **Syzygium tenuilimbum** P.S.Ashton

(Latin, *tenue* = slender, *limbum* = leaved; referring to the shape of leaf blades)

Kew Bull. 61, 1 (2006) 140. **Type:** *Bernard Lee S 52465*, Borneo, Sarawak, Bt. Tebunan, Ulu Trusan, Lawas district (holotype K; isotypes KEP, SAR).

Tree. *Parts glabrous*. **Twigs** *slender*, *1–2 mm diameter apically*, *round in cross-section*, *red-brown*, smooth. **Leaves** *thinly leathery*, *drying wrinkled*, *dull mauve-brown throughout*, *pitted above*, *more or less distinctly black dotted beneath*; *blades narrowly lanceolate*, *7–19 × 1.5–4.5 cm*, *base wedge-shaped tapering somewhat abruptly at petiole*, *margin shallowly wavy and slightly recurved*, apex acuminate, acumen *c.* 2 cm long, tapering; midrib ridged on each side above; *venation obscure throughout*; *lateral veins unequal*, *main ones c. 15 pairs*, *hardly and equally raised throughout*, *furrowed above*, ascending; *intercostal venation lax*; *intramarginal vein 1*, *c. 1 mm within margin*, *looped*; *petioles 3–7 mm long*, drying black. **Inflorescences** *paniculate*, *terminal*, *lax*, *c.* 2 cm long; rachis round in cross-section, 2–3x-branched. **Flowers:** *buds goblet-shaped*, *c. 4 mm long*, *c. 3 mm diameter*, smooth, *with wide hypanthium tapering into c. 2 mm slender pseudostalk*; *calyx lobes distinct*, hemispherical, subacute, *c. 1.5 × 2 mm*, *thick*, *hyaline only along margin*; stamens many, white, exserted to *c.* 5 mm at anthesis, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** *spherical*, *c. 14 mm diameter*, smooth, *ripening green*, drying dull pink-brown, with prominent *c.* 3 mm diameter, *c.* 2 mm high calyx rim.

**Distribution.** Endemic to Borneo: on the coastal sandstone hills and mountains of NE Sarawak, including Lawas (the type), Lambir Hills NP (ecological vouchers 0925-150(02978), 1521-37D(03898) and 4414-010(02689 deposited at the Lambir Field Herbarium) and from Nanga Pelagus in C Sarawak (*Daud & Tachun SFN 35648*). Also known in Brunei (e.g., *Coode MC 7570*).

**Ecology.** In mixed dipterocarp forest on deep yellow sandy humic soils, and the Lawas type and from lower montane mossy pole forest at 1200–1480 m altitudes.

## 159. **Syzygium treubii** Merr. & L.M.Perry

(Melchior Treub, 1851–1910, Dutch plant physiologist, 1880–1909 Director of the Bogor Botanical Gardens, Indonesia)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 192. **Type:** *Endert 2458*, Borneo, E Kalimantan, W Kutei, near Long Puhus (holotype BO; isotypes K, L Barcode L 0329881).

Tree to 20 m tall. *Parts glabrous*. **Twigs** *c.* 3 mm diameter apically, rather stout, *round in cross-section*, *grey-brown*, *smooth*. **Leaves** leathery, *drying dull brownish green*, *sparsely pitted above*, *sparsely dotted beneath*; *blades elliptic-oblong*, *c. 12 × 4.5*(*9–15 × 3–7*) *cm*, *base wedge-shaped tapering into petiole*, *apex acuminate*, *acumen slender*, *c. 8 mm long*; *lateral veins unequal*, *main ones c. 12 pairs*, *faint and not furrowed above*, slender but *distinctly raised beneath*, spreading; *intercostal venation indistinct*; *intramarginal vein 2*, *main one 2–4 mm within margin*, *looped*; petioles 8–12 mm long. **Inflorescences** paniculate, terminal, *c. 10 cm long*; rachis slender, weakly quadrangular in cross-section, 3x-branched; *bracts and bracteoles early caducous*. **Flowers** white; *buds* (young) *ellipsoid*, *c.* 3 mm long, *c.* 2 mm diameter, *smooth*, *not milky*, urn-shaped at anthesis, *without distinct pseudostalk*; *calyx lobes 4*, *obscure on a hardly lobed rim*; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** (unripe) depressed spherical, *c.* 6 mm diameter, with minute apical calyx rim.

**Distribution.** Endemic to Borneo, rare. Known in Sabah from Kinabatangan, Sandakan and Tawau districts (e.g., *SAN 18636*, *SAN 56884* and *SAN 66400*) and in E Kalimantan (e.g., the type, *Kessler Berau 1566* and *Endert 4864*).

**Ecology.** In lowland forests.

## 160. **Syzygium tubiflorum** P.S.Ashton

(Latin, *tubi-* = tubular, *flos* = flower; referring to the tubular flower bud)

Gard. Bull. Sing. 61, 1 (2009) 13. **Type:** *Ming, Sidken & Jeprin MB 904*, Borneo, Sabah, Meliau Basin Conservation Area (holotype SING).

Treelet 5 m tall. Parts glabrous. **Twigs** very slender, 0.5–1 mm diameter apically, *narrowly but distinctly 4-winged*, drying dark brown to blackish, smooth. **Leaves** leathery, drying pale grey-brown, faintly densely pitted above, densely prominently black dotted beneath; *blades lanceolate*, *1.5–4 × 0.3–1.5 cm*, base wedge-shaped tapering into petiole, apex acuminate, acumen slender, *c.* 1.2 cm long; *venation obscure above except for the furrowed midrib*; *lateral veins unequal*, *main ones c. 6 pairs*, irregularly disposed and *evident beneath only*, *slender and hardly raised above*; *intermediate veins few*; petioles very slender, *c.* 4 mm long, *c.* 0.5 mm diameter. **Inflorescences** racemose, terminal or axillary, erect, *c.* 15 mm long; rachis *c.* 1 mm diameter, round in cross-section, singly branched; *bracts lorate-lanceolate*, *c. 7 × 1 mm*, *falling early*. **Flowers:** *buds tubular*, *smooth*, *not milky*; *calyx lobes 4 usually erect*, *triangular*; *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** (young) *torch-shaped*, *c. 5 mm long*, *c. 2 mm diameter*, *subsessile*, *without distinct stalk*, *smooth*, *drying black*.

**Distribution and ecology.** Known only in Sabah from the type collection from the Meliau summit ridge at *c.* 1220 m altitude.

**Notes.** A distinct entity in the *Syzygium zeylanicum* group, but at once can be distinguished by its leaf venation, smooth round young fruit, and early falling bracts and bracteoles.

## 161. **Syzygium ultramaficum** P.S.Ashton Plate 8B.

(Latin, *ultramaficus* = rocks exceedingly rich in bases including magnesium and iron; referring to the substrate of its natural habitat)

Kew Bull. 61, 1 (2006) 140. **Type:** *B. Perumal & D. Sundaling SAN 134998*, Borneo, Sabah, Lahad Datu district, Bt. Silam, at *c.* 850 m (holotype K; isotype SAN).

Small tree, *c.* 6 m tall, *c.* 15 cm diameter. **Bark** reddish. *Parts glabrous*. **Twigs** *stout*, *c. 3 mm diameter apically*, *round in cross-section*, *smooth*, *grey-brown*. **Leaves** thinly leathery, *drying dull*, *grey-brown above*, *yellow-brown beneath*, *densely pitted above*, *pimpled beneath*; *blades lanceolate*, *12–16 × 3–4 cm*, *base broadly heart-shaped*, apex acuminate, acumen *c.* 6 mm long; *lateral veins unequal*, *main ones c. 17 pairs*, slender, *furrowed above*, elevated beneath, *with a few shorter intermediate veins*; *intercostal venation obscure beneath*, *elevated above*; *intramarginal vein 1–2 mm within margin*, *hardly looped*; *petioles c. 2 mm long*, *c.* 2 mm diameter, *corky*, *whitish*. **Flowers** few on terminal *c.* 5 mm short rachises; *buds jambu-shaped*, *c. 40 mm long*, *c. 30 mm diameter*, on *c.* 2 mm pedicel, tapering throughout; *calyx lobes 4*, *subhemispherical*, *c. 10 × 15 mm*, subacute, *reflexed at anthesis*; stamens many, exserted to *c.* 2 cm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 3 cm long. **Fruits** unknown.

**Distribution.** Endemic to Borneo; recorded in Sabah from Kudat and Lahad Datu districts (e.g., the type, *SAN 21642*, *SAN 26659*, *SAN 52607*, *SAN 94299*, *SAN 95593* and *SAN 96679*).

**Ecology.** On ultramafic and limestone substrates in lowland mixed dipterocarp forest, coastal islands, and lower montane forest. On exposed cliffs and screes.

## 162. **Syzygium urceolatum** (Korth.) Merr. & L.M.Perry

(Latin, *urceolatus* = urn-shaped; referring to the flower bud)

Mem. Amer. Acad. Arts. & Sci. 18, 3 (1939) 174; Masamune *op. cit.* 540. **Basionym:** *Jambosa urceolata* Korth., Ned. Kruidk. Arch. 1 (1847) 202. **Type:** *Korthals s.n.*, Borneo, SE Kalimantan, near Martapura (holotype L, Barcode L 0009687). **Heterotypic synonyms:** *Eugenia lepidocarpa* Wall., Cat. (1831) No. 3618, *p.p.*, *nom. nud.*, *ex* Kurz, J. As. Soc. Beng. 46, 2 (1877) 68, Duthie *in* Hooker *f. op. cit.* 476, Ridley *op. cit.* (1922) 730, *E. grandis* var. *lepidocarpa* (Wall. *ex* Kurz) Kurz, For. Fl. Brit. Burma 1 (1877) 490, **type:** *Wallich s.n.*, Singapore (?CAL, ?K); *Syzygium palembanicum* Miq., Fl. Ind. Bat., Suppl. 1 (1861) 313, Merrill & L.M. Perry *op. cit.* (1939) 175, Masamune *op. cit.* 536, Turner *op. cit.* (1996) 379, *op. cit.* (1997) 22, Beaman & C. Anderson *op. cit.* 222, *E. palembanica* (Miq.) Merr. *op. cit.* (1917) 225, *op. cit.* (1921) 432, M.R. Henderson *op. cit.* (1949) 85, Kochummen *op. cit.* 206, J.A.R. Anderson *op. cit.* (1980) 278; ***syn. nov.***, **type:** *Teijsmann* [*Teysmann*] *HB 3823*, Sumatra, Palembang, Muara Enim (holotype U, Barcode U 0005222); *E. selangorensis* Ridl., J. Fed. Mal. States Mus. 5 (1914) 32, *op. cit.* (1922) 730, M.R. Henderson *op. cit.* (1949) 84, ***syn. nov.***, **type:** *Robinson s.n.*, Peninsular Malaysia, Selangor, G. Mengkuang (*n.v.*); *E. kuchingensis* Merr. *op. cit.* (1917) 213, *op. cit.* (1921) 429, J.A.R. Anderson *op. cit.* (1980) 276, *p.p.*, *S. kuchingense* (Merr.)

Merr. & L.M.Perry *op. cit.* (1939) 175, Masamune *op. cit.* 531, Coode *et al.* (eds.) *op. cit.* 237, ***syn. nov.***, **type:** *Native Collector 258*, Borneo, Sarawak, near Kuching (holotype A).

Large canopy tree, to 35 m tall, to 80 cm diameter; buttresses stout, short. **Bark** pinkish brown, *smooth or becoming finely cracked into oblong plates*. *Parts glabrous*. **Twigs** *3–4 mm diameter apically*, *stout*, *round in cross-section*, *smooth*, *grey-brown*. **Leaves** leathery, *drying glistening dark purple-brown above*, *somewahat glistening to dull rich chocolate-brown or milky beneath*, *pits above and dots beneath obscure and scattered or absent*; *blades elliptic-oblong*, *c. 13 × 6*(*6–20 × 3–9*) *cm*, *base broadly wedge-shaped to rounded shortly tapering into petiole*, *apex abruptly acuminate*, *acumen c. 5 mm long*, rounded or notched, bent down; midrib raised with prominent median furrow above; *lateral veins unequal*, *main ones 8–14 pairs*, *hardly raised on either surface though more so beneath*, or *furrowed or obscure above*, *well-spaced*, *somewhat ascending or spreading*; *intercostal venation obscure*; *intramarginal veins 2*, *main ones 3–6 mm within margin*, *looped*; petioles stout, *c.* 1.5 cm long, drying black. **Inflorescences** *paniculate*, *terminal*, *to 10 cm long*; rachis stout, round in cross-section, 3x-branched with the basal branches as long as the rachis, *flowers clustered at the endings*. **Flowers:** *buds urn-shaped*, *to 6 mm long*, *to 4 mm diameter*, ribbed, *without distinct pseudostalk*; *calyx lobes 4*, *distinct*, *unequal*, *broadly ovate*, acute, *c. 2 × 3 mm*, *thickly leathery*, appressed, cupped, reflexed at anthesis; stamens many, exserting to *c*. 8 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to *c.* 8 mm long. **Fruits** *spherical*, *to 12 mm diameter*, *distinctly ribbed, with c. 5 mm diameter prominent calyx rim*.

**Vernacular name.** Sabah and Sarawak—*ubah samak* (Malay, Iban, Brunei).

**Distribution.** Peninsular Myanmar, Sumatra, Peninsular Malaysia and Borneo.

**Ecology.** In mixed dipterocarp forest in the lowlands and upper dipterocarp forest at altitudes to *c.* 1000 m, mostly on clay soils.

**Uses.** The bark has formerly been used for tanning fishing nets, and for caulking boats.

**Notes.** In Borneo, three subspecies are recognised.

**Key to subspecies**

1. Lateral veins furrowed above…….. subsp. **urceolatum**
   Endemic to Borneo, widespread. In Sabah known by a single collection from G. Silam, Lahad Datu district (*SAN 75190*) and in Sarawak recorded from Bintulu, Kuching, Lawas, Lundu and Serian districts (e.g., *S 4690*, *S 12714*, *S 26595*, *S 27204*, *S 45908* and *S 59467*). Also known in Brunei (e.g., *S 7819*) and Kalimantan (e.g., the type, *Sidiyasa 506*, *Kessler PK 530* and *Kessler PK 1579*).
   Locally abundant, especially in Sarawak, in *kerangas* and its ecotone with mixed dipterocarp forest; in Sabah known from mixed dipterocarp forest on ultramafic substrate, at *c.* 800 m altitude.
   Lateral veins more or less raised above……2

2. Leaf blades drying dark, not milky beneath; lateral veins somewhat ascending…… subsp. **palembanicum** (Miq.) P.S.Ashton, ***stat. nov.***

Basionym: *Syzygium palembanicum* Miq., Fl. Ind. Bat., Suppl. 1 (1861) 313, Merrill & L.M. Perry *op. cit* (1939) 175, Masamune *op. cit.* 536, Turner *op. cit.* (1996) 379, *op. cit.* (1997) 22, Beaman & C. Anderson *op. cit.* 222. Homotypic synonym: *Eugenia palembanica* (Miq.) Merr. *op. cit.* (1917) 225, *op. cit.* (1921) 432, M.R. Henderson *op. cit.* (1949) 85, Kochummen *op. cit.* 206, J.A.R. Anderson *op. cit.* (1980) 278, type: *Teijsmann HB 3823*, Sumatra, Palembang, Muara Enim (holotype U). Heterotypic synonyms: *Eugenia lepidocarpa* Wall., Cat. (1831) No. 3618, *nom. nud.*, *ex* Kurz, J. As. Soc. Beng. 46, 2 (1877) 68, Duthie *in* Hooker *f. op. cit.* 476, Ridley *op. cit.* (1922) 730, *E. grandis* var. *lepidocarpa* (Wall. *ex* Kurz) Kurz, For. Fl. Brit. Burma 1 (1877) 490, type: *Wallich s.n.*, Singapore (?CAL, ?K); *E. selangorensis* Ridl. *op. cit.* (1914) 32, M.R. Henderson *op. cit.* (1949) 84.

Distribution as the species. In Borneo widespread; known in Sabah from Beaufort, Keningau, Kota Marudu, Kudat, Labuk Sugut, Lahad Datu, Papar, Tambunan and Tawau districts (e.g., *SAN A 1392*, *SAN 19883*, *SAN 21755*, *SAN 35141*, *SAN 58454*, *SAN 73589*, *SAN 82264*, *SAN 113519* and *SAN 124014*), and in Sarawak from Bau, Belaga, Bintulu, Kapit, Kuching, Lubok Antu, Lundu, Miri, Mukah, Samarahan and Sibu districts (e.g., *S 19891*, *S 23223*, *S 42232*, *S 48178*, *S 59068* and *S 67236*). Also known in Brunei (e.g., *Wong WKM 335*, *Simpson 2023* and *Simpson 2629*) and in C and E Kalimantan (e.g., *Ridsdale PBU 68*, *Goverse Berau 505* and *Kostermans 13003*).

Leaf blades greyish, more or less milky beneath; lateral veins spreading…….. subsp. **kuchingense** (Merr.) P.S.Ashton, ***stat. nov.***

Basionym: *Eugenia kuchingensis* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 213, *op. cit.* (1921) 429, J.A.R. Anderson *op. cit.* (1980) 276, *p.p.* Type: *Native Collector 258*, Borneo, Sarawak, near Kuching (holotype PNH, destroyed; isotype A). Homotypic synonym: *Syzygium kuchingense* (Merr.) Merr. & L.M.Perry *op. cit.* (1939) 175, Masamune *op. cit.* 531, Coode *et al.* (eds.) *op. cit.* 237.

Endemic to Borneo; recorded in Sabah from Beaufort, Kota Marudu, Lahad Datu, Sandakan and Sipitang districts (e.g., *Lugas LL 974*, *SAN 20851*, *SAN 37998*, *FD FMS 44559*, *SAN 79354*, *SAN 126515*, *SAN 129503* and *SAN 131973*) and in Sarawak from Bintulu, Kapit, Kuching, Lawas, Lundu, Marudi and Miri districts (e.g., *S 16257*, *S 25696*, *S 27128*, *S 30069*, *SFN 35671*, *S 59471* and *S 91205*). Also known in Brunei (e.g., *Wong WKM 209*, *BRUN 7653*, *S 7877*, *BRUN 16565* and *FD FMS 32622*) and in E Kalimantan (e.g., *Kostermans 13613*).

Locally common in mixed dipterocarp forest on yellow sandy soils; recorded also from upper montane forest at G. Mulu (Sarawak) on summit ridge at altitudes to 2500 m. The bark was formerly a major source of tanning dye.

## 163. **Syzygium valdecoriaceum** P.S.Ashton

(Latin, *valde-* = strongly, *coriaceus* = leathery; referring to the texture of leaf blades)

Kew Bull. 61, 1 (2006) 142. **Type:** *Ashton S 19623*, Borneo, Sarawak, Belaga district, Carapa Pila, Pila-Mujong watershed, 900 m (holotype K; isotypes KEP, L, SAR, SING). **Synonym:** *Eugenia megalophylla* J.A.R.Anderson *op. cit.* (1980) 277, *non S. megalophyllum* Merr. & L.M.Perry (1939).

Canopy tree to 25 m tall, *c.* 60 cm diameter; buttresses low. **Bark** becoming flaky then dippled ochreous and red-brown mottled. *Parts glabrous*. **Twigs** *c. 3 mm diameter apically*, *stout*, *round in cross-section*, *smooth*, *pale brown*. **Leaves** *thickly leathery*, *drying* rigid, *dull or satiny pale yellowish- to pink-brown*, *sparsely shallowly pitted above*, *hardly or not dotted beneath*; *blades oblong-elliptic*, *c. 18 × 9*(*8–15 × 3–6*) *cm*, *base wedge-shaped tapering into petiole*, *apex abruptly acuminate to subcaudate*, acumen to 10 mm long, tapering; *midrib not sharply angled*; *lateral veins unequal*, *main ones c. 15 pairs*, *basal pairs shorter than adjacent ones*, *slender but distinctly raised beneath*, *visible but hardly*

*raised or minutely furrowed above*, *with less prominent intermediate veins that reach intramarginal vein*; *intercostal venation obscure*; *intramarginal vein 1*, *2–4 mm within margin*, *hardly looped*; *petioles stout*, *to 10 mm long*. **Inflorescences** *racemose*, *c. 5 cm long*, *terminal*; rachis 2x-branched, stout, round in cross-section, *flowers in dense clusters at branchlet endings*. **Flowers** white, *buds narrowly obconical*, *c. 3 mm long*, *c. 1.5 mm diameter*, *hardly contracted above the stout*, *tapering pseudostalk*; *calyx lobes 5*, *distinct*, *c. 1 × 1.5 mm*, hardly raised or overlapping, obtuse, *thick*; stamens many, exserted to *c.* 2 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 3 mm long. **Fruits** *spherical*, *to 15 mm diameter*, smooth, *with c. 2 mm diameter small calyx rim*.

**Distribution.** Endemic to Borneo. In Sabah known by a single collection from Sg. Pingas Pingas, Kinabatangan district (*SAN 113958*), and in Sarawak from Belaga, Lawas and Miri districts (e.g., the type; species code EUGEEV, *vouchers 3112-167*(*521038* in Lambir Field Herb.), *1722-358*(*521037*), *4510-14*(*521042*), Tree Demography Plot, Lambir Hills NP, and *S 27910*). Also recorded in Brunei (e.g., *S.J. Davies ecol. voucher L 443*, Ladan Hills FR, *S.J. Davies ecol. voucher A272* Andulau FR) and S Kalimantan (e.g., *Kostermans 8058*).

**Ecology.** Locally frequent in mixed dipterocarp forest on yellow sandy soils, especially on ridges; the type was collected from organic soils over basalt at 800 m altitude.

## 164. **Syzygium valdevenosum** (Duthie) Merr. & L.M.Perry

(Latin, *valde-* = strongly, *venosus* = veined; referring to the prominent leaf venation)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 182; Turner *op. cit.* (1996) 384, *op. cit.* (1997) 27; Beaman & C. Anderson *op. cit.* 227. **Basionym:** *Syzygium* (*Eugenia*) *ellipticum* Wall., Cat. (1831) No. 3587, *nom. nud. et nom. illig. non* Lam. (1789), *nec* Sm. (1797); *Eugenia valdevenosa* Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 489, King *op. cit.* 111, Ridley *op. cit.* (1922) 743, M.R. Henderson *op. cit.* (1949) 180, Burgess *op. cit.* 414, Kochummen *op. cit.* 221, Corner *op. cit.* (1997) 593. **Type:** *Wallich s.n.* (*Cat. No. 3587*), Penang (holotype K). **Heterotypic synonym:** *Eugenia alata* Ridl., J. Str. Br. Roy. As. Soc. 86 (1922) 293. **Type:** *Ridley s.n.*, Peninsular Malaysia, Selangor, Semangkok Pass, track to Bt. Tegala (?K).

Small tree to 9 m tall. **Bark** smooth, grey-brown. *Parts glabrous*. **Twigs** *c. 3 mm diameter apically*, *initially round then becoming 4-ridged in cross-section when older*, *dark red-brown*, smooth. **Leaves** somewhat papery, *drying dull mauve-brown and obscurely pitted above*, *greenish to rich rust-brown* often with darker veins and *obscurely or prominently densely dotted beneath*; *blades elliptic-oblong*, *c. 17 × 8*(*10–24 × 4–10*) *cm*, *base wedge-shaped tapering into petiole*, apex acuminate, acumen *c.* 6 mm long, blunt; *midrib rounded beneath*; *lateral veins unequal or subequal*, *prominent beneath*, *less so and not furrowed above*, spreading, *main ones c. 11 pairs*; intercostal venation visible, more so beneath than above; intramarginal vein 1(–3) pairs, the main ones 4–7 mm within margin but arising from above the midrib base and prominently diverging like a pair of opposite basal veins, looped; *petioles c. 9 mm long*. **Inflorescences** paniculate, to 15 cm long but variable, terminal or subterminal-axillary; rachis 3x-branched, spreading, stout with slender branches, round in cross-section, with many small flowers. **Flowers:** *buds at first goblet-shaped becoming torch-shaped* with small swollen apical hypanthium, *c. 6 mm long*, *c. 3 mm diameter*, *tapering to c. 3 mm slender pseudostalk*; *calyx lobes* (*4 or*)*5*, *free*, *more or less vestigial*, broadly rounded; stamens white, many, exserting to *c.* 5 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, *style exserting to c. 5 mm long*. **Fruits** *spherical* or weakly bilobed but often apically depressed, to 18 mm across, smooth; *calyx rim inconspicuous or shortly raised*.

**Distribution.** Sumatra, Peninsular Malaysia and Borneo. In Sabah recorded from Keningau, Kota Belud, Lahad Datu, Pensiangan, Ranau, Sandakan, Tawau and Tenom districts (e.g., *SAN A 2422*, *SAN 24055*, *SAN 26751*, *Clemens 28368*, *Clemens 28524*, *Clemens 28592*, *SAN 43068* and *SAN 111482*) and in Sarawak from Bintulu, Kapit, Lubok Antu and Tatau districts (e.g., *Haegens et al. 419*, *S 28429* and *S 40727*). Also known from E Kalimantan (e.g., *Endert 4037* and *Kostermans 13456*).

**Ecology.** In mixed and upper dipterocarp forest, at altitudes to 1700 m on Mt. Kinabalu where occasionally on ultramafic substrate. Apparently uncommon in Sabah and Sarawak, not yet recorded from Brunei.

## 165. **Syzygium valentissimum** P.S.Ashton

(Latin, *valentissimus* = very robust; referring to the thick-leathery leaf blade)

Gard. Bull. Sing. 61, 1 (2009) 14. **Type:** *Julaihi et al. S 83369*, Borneo, Sarawak, Sabal-Balai Ringin FR, Kelingkang Range, Sri Aman district, in flower bud (holotype KEP Barcode 49674).

Canopy tree, *c.* 30 m tall. **Bark** brown. Parts glabrous. **Twigs** *stout*, *c. 4 mm diameter apically*, *quadrangular in cross-section*, *smooth*, dark chocolate-brown. **Leaves** *thickly leathery*, drying dark chocolate-brown, dull below, somewhat glistening above; *blades ovate to lanceolate*, *7–15 × 5–6 cm*, base broadly wedge-shaped tapering into petiole, margin hardly recurved, *apex acuminate*, *acumen c. 8 mm long* down-turned; *venation overall finely but distinctly more or less equally raised on both surfaces*; *lateral veins subequal*, *main ones c. 18 pairs* with many intermediate veins; intercostal venation reticulate; *petioles stout*, *c. 15 mm long*, *c. 3 mm diameter*, drying black. **Inflorescences** paniculate terminal or subterminal-axillary, *c.* 11 mm long (immature); rachis ascending, stout, quadrangular in cross-section, 2x-branched. **Flowers:** buds (young) obconical, *c.* 5 mm long, *c.* 4 mm diameter, without distinct pseudostalk; calyx lobes 4, broadly hemispherical, obtuse, *c.* 3 × 4 mm, cupped, broadly imbricate and tightly clasping corolla; stamens many, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** unknown.

**Distribution.** Endemic to Borneo. Known only in Sarawak from the lower sandstone slopes in mixed dipterocarp forest of the Kelingkang Range, Sri Aman district (the type) and from G. Buri (*S 43414*), Samarahan district.

## 166. **Syzygium velutinum** A.P.Davis

(Latin, *velutinus* = velvety; referring to the indumentum)

Kew Bull. 52, 3 (1997) 720; *Coode et al.* (eds.) *op. cit.* 240. **Type:** *A.P. Davis 496*, Borneo, Brunei, Belait, Sg. Liang Arboretum (holotype BRUN; isotypes K, L).

Small understorey tree, *c.* 6 m tall with descending branches bearing spaced leaves. **Bark** smooth, cream-grey; inner bark thin, brown. **Twigs** *c. 3 mm diameter apically*, *stout*, *rounded in cross-section*, *densely velvety hairy*, *glabrescent*, *drying rich golden brown*. **Leaves** leathery and crumpled on drying, dull dark tawny above, *rich golden rufous velvety hairy or glabrous*, *smooth and dull beneath*, *obscurely pitted above*; *blades ovate-elliptic* or *broadly lanceolate*, *c. 35 × 22*(*20–50 × 13–25*) *cm*, *base heart-shaped to auriculate*, *or rounded*, apex shortly broadly acuminate; *lateral veins strongly unequal*, *main ones c. 20 pairs*, spreading, *very prominent beneath*, *furrowed above*; intercostal venation evident

beneath, obscure above; *intramarginal veins 2*, *hardly looped*; petioles stout, *c.* 5 mm long, densely velvety hairy. **Inflorescence** terminal or axillary, short, few-flowered. **Flowers:** *buds jambu-shaped*, *to 5 cm long*, *c. 1.5 cm diameter*, hardly waisted and tapering to base of pseudostalk; *calyx lobes 4*, *deltoid*, subacuminate, *c. 5 × 7 mm*, *spreading at anthesis*; stamens many, to 2 cm long, white, *anther locules parallel*; *ovary at the distal end of flower bud*. **Fruits** urn-shaped, to 4 cm across, glabrous, smooth, with trumpet-shaped calyx rim.

**Distribution.** Endemic to Borneo. In Sabah known by a single collection from Mansod Hill, Beaufort district (*Goklin 2251*) and similarly in Sarawak recorded only from G. Mulu NP, Marudi district (*S 38073*). Most collections are from Brunei (e.g., the type, *Arifin ARK 46*, *Kirkup 445*, *Wong WKM 581*, *Wong WKM 948*, *Simpson 2125*, *S 5784*, *BRUN 15510*, *BRUN 16960* and *BRUN 17546*).

**Ecology.** Locally common on deep sandy soils in mixed dipterocarp forest and its *kerangas* ecotone, at altitudes below 500 m.

## 167. **Syzygium villamilii** (Merr.) Merr. & L.M.Perry

(A. Vilamill, Philippino plant collector in Sabah *c.* 1915–1917)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 187; Masamune *op. cit.* 541; Coode *et al.* (eds.) *op. cit.* 240; Beaman & C. Anderson *op. cit.* 227. **Basionym:** *Eugenia villamilii* Merr., Philip. J. Sci. Bot. 13 (1918) 98, *op. cit.* (1921) 434, *op. cit.* (1929) 216. **Type:** *Villamil 229*, Borneo, Sabah, Pinajos R., Kinabatangan district (holotype PNH, ?destroyed; isotypes A, BO, K). **Heterotypic synonym:** *Syzygium richardsii* Airy Shaw, Kew Bull. 4 (1949) 122, ***syn. nov.***, **type:** *Native Collector* (for P.W. Richards) *1431*, Borneo, Sarawak, G. Dulit, Marudi district (holotype K).

Small subcanopy, streamside tree to 30 cm diameter; buttresses thin. **Bark** pale cream-brown, smooth, eventually patchily scaly; inner bark thin, cream-brown. *Young parts glabrous*. **Twigs** *slender*, *c. 3 mm diameter apically*, with long internodes, *round in cross-section*, *thinly flaky*, *distinctly cream-white*. **Leaves** thinly leathery, *drying wrinkled*, *shagreened or dull pale tawny* and *indistinctly pitted above*, *dull pale yellowish grey-brown* and *indistinctly dotted beneath*; *blades narrowly elliptic-oblong or lanceolate*, *c. 18 × 5.5*(*16–28 × 4–10*) *cm*, *base obtuse or wedge-shaped terminating abruptly at petiole*, *margin entire and not wavy*, apex slender-subcaudate, acumen *c.* 2 cm; *lateral veins subequal*, *slender*, *visible but hardly raised more so beneath*, *furrowed above*, *main ones c. 20 pairs*, *c.* 8 mm apart, *with many shorter intermediate veins*, spreading; *intercostal venation lax*, *not forming a dense lattice*, *obscure above*, *visible beneath*; *intramarginal veins 2–3 mm within margin*, *slightly to distinctly looped*; petioles *c.* 12 mm long. **Inflorescence** *to 4 cm long*, slender, congested, *terminal or axillary*. **Flowers:** *buds shortly clove-shaped*, *to 5 mm long*, *c. 3 mm diameter*, *tapering to base but slightly waisted*, *becoming goblet-shaped at anthesis*; *calyx truncate with 5 vestigial thick-margined subacute lobes forming an undulating rim*; stamens many, exserting to 5 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style exserting to 5 mm long. **Fruits** *spherical*, *to 18 mm diameter*, *with c. 2 mm diameter prominent calyx rim*.

**Distribution.** Endemic to Borneo, widespread. In Sabah recorded from Beluran, Lahad Datu, Ranau, Sandakan, Semporna, Sipitang, Tawau and Tenom districts (e.g., *SAN 4135*, *FD BNB 9409*, *Elmer 20929*, *SAN 35134*, *SAN 47706*, *SAN 52619*, *SAN 96012* and *SAN 123265*) and in Sarawak from Bintulu, Limbang, Marudi and Miri districts (e.g., *S 18301*, *S 22018* and *SFN 35647*). Also known from Brunei (e.g., *Forman 1120*, *BRUN 15179* and *BRUN 18045*).

**Ecology.** Common along the banks of sluggish inland waterways and in floodplains in primary and old secondary forest, frequent also on moist slopes in mixed dipterocarp forest on sandy clay soils; in upper dipterocarp forest sometimes over ultramafic substrate on Mt. Kinabalu.

## 168. **Syzygium villiferum** (Ridl.) Masam.

(Latin, *villius* = long soft hairs, *ferus* = bearing; referring to the fine downy hairs on the young twig, leaf lower surface, petiole and inflorescence)

EPB (1942) 541. **Basionym:** *Eugenia villifera* Ridl., J. Bot. 68 (1930) 13. **Type:** *Beccari 1253*, Borneo, Sarawak, near Kuching (holotype K). **Homotypic synonym:** *Syzygium hirtum* (Korth.) Merr. & L.M.Perry var. *villiferum* (Ridl.) Merr. & L.M.Perry *op. cit.* (1939) 158.

Treelet *c.* 5 m tall. *Young twigs*, *leaf beneath*, *petiole*, *inflorescence*, *flower bud*, *and fruit densely rust-brown downy hairy*. **Twigs** *stout*, *c. 5 mm diameter apically*, *sometimes at first 4-ribbed*, *later becoming round in cross-section*. **Leaves** drying papery, dark rust-brown and minutely pitted above; *blades oblong to lanceolate*, *24–38 × 6.5–14 cm*, *base heart-shaped*, apex tapering acuminate; *lateral veins unequal*, *main ones c. 26 pairs*, *with infrequent shorter intermediate veins*, *slender but prominent beneath*, drying darker than the blade as also the intercostal veins, spreading, arched, *narrowly furrowed above*; *intercostal veins* perpendicular to midrib, sinuous, *distinct and elevated beneath*, *obscure above*; intramarginal veins 1(–3), 4–6 mm within margin, somewhat looped; petioles stout, *c.* 4 mm long, *c.* 3 mm diameter. **Inflorescences** paniculate, terminal, *c.* 9 cm long; rachis round in cross-section. **Flowers:** *buds torch-shaped*, *c. 12 mm long*, *c. 7 mm diameter*, without distinct pseudostalk; *calyx lobes 4*, *ovate-acute*, *c. 4 × 4 mm*, *not hyaline at margin*, *not reflexed at anthesis*; stamens many, exserting to *c.* 2 cm, *anther locules parallel*; *ovary at the distal end of flower bud*, style slender. **Fruits** spherical, *c.* 10 mm diameter, with prominent crown of persistent calyx lobes.

**Distribution.** Endemic to Borneo; known in Sarawak from Belaga, Kapit, Kuching, Miri and Samarahan districts (e.g., *Beccari 1253*, *Beccari 2521*, *Haviland 3380*, *Clemens 21628*, *S 24412*, *S 34260*, *S 38517*, *S 45571*, *S 51635* and *S 51638*). Also recorded from E Kalimantan (e.g., *Jaheri 1692* and *Endert 2585*).

**Ecology.** Mixed dipterocarp forest on yellow sandy soils, and the ecotone to *kerangas* at low altitudes, and the lower facies of upper montane forest at altitudes to 1500 m.

**Notes.** Differing from *Syzygium hirtum* notably in its tomentum, and also in its generally broader leaf. The two species have separate ecological distributions.

## 169. **Syzygium viridifolium** (Elmer) Merr. & L.M.Perry

(Latin, *viride-* = greenish, *-folius* = leaved; referring to the colour of the dry leaf)

Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 183; Beaman & C. Anderson *op. cit.* 227. **Basionym:** *Eugenia viridifolia* Elmer, Leafl. Philip. Bot. 4 (1912) 1420, Burgess *op. cit.* 414, J.A.R. Anderson *op. cit.* (1980) 280. **Type:** *Elmer 12975*, the Philippines, Palawan Is., Mt. Pulger, April 1911 (holotype A). **Heterotypic synonyms:** *Eugenia fraseri* Ridl., J. Bot. 68 (1930) 33, *Syzygium fraseri* (Ridl.) Masam. *op. cit.* 528.

Tree *c.* 15 m tall. **Bark** greyish brown, becoming flaky; inner bark pink to red. *Young parts glabrous*. **Twigs** *c.* 1 mm diameter apically, *round in cross-section*, slender, *smooth*, *grey-brown*. **Leaves** *drying dull pale greenish yellow*, *obscurely pimpled above and dark dotted beneath*; *blades elliptic*, *c. 6.5 × 2.5*(*3.5–8 × 1.5–3*) *cm*, base wedge-shaped tapering into petiole, *margin entire*, *apex acuminate*, *acumen c. 6 mm long*; *lateral veins* dense, slender, *subequal*, *main ones c. 16 pairs*, *barely visible though more so beneath*, *narrowly furrowed above*, spreading; intercostal venation obscure; *intramarginal vein close to margin*, *hardly looped*; *petioles c. 4 mm long*. **Inflorescences** *paniculate*, *terminal or axillary*, *c. 15 mm long*; *rachis* slender, quadrangular in cross-section, *singly branched with clustered flowers*. **Flowers** yellowish-green; *buds* slender, *torch- to clove-shaped*, *c. 10 mm long*, *c. 3 mm diameter*, *slightly swollen at hypanthium thereby distinguishing a pseudostalk*; *calyx lobes 4*, *vestigial*, acute; *stamens many*, exserting to 3 mm long, *anther locules parallel*; *ovary at the distal end of flower bud*, style *c.* 5 mm long. **Fruits** *narrowly obconical*, *c. 8 mm long*, *c. 4 mm diameter*, *ripening reddish purple*, *drying pale honey-brown*, subsessile, hardly tapering at the rimmed apex.

**Distribution.** Borneo and the Philippines (Palawan Isl.). In Borneo known in Sabah from Beaufort, Keningau, Kudat, Kuala Penyu, Lahad Datu, Ranau, Sipitang and Tambunan districts (e.g., *Sugau 70*, *Chew et al. 106*, *Fraser 139*, *Tandom 4231*, *Beaman 6843*, *SAN 76408*, *SAN 102841* and *SAN 129616*) and in Sarawak from Kapit, Lawas and Marudi districts (e.g., *S 4561*, *S 12351* and *S 12373*).

**Ecology.** Lowland and upper mixed dipterocarp forest, at altitudes to 1500 m.

## 170. **Syzygium zeylanicum** (L.) DC. Plate 8C.

(from Ceylon = Sri Lanka)

Prodr. 3 (1828) 260; Merrill & L.M. Perry *op. cit.* (1938) 101 & 224, *op. cit.* (1939) 159; Masamune *op. cit.* 541; Amshoff *op. cit.* 497; Backer & Bakhuizen *f. op. cit.* 339; Ashton *op. cit.* (1981) 431; Chantaranothai & Parnell *op. cit.* (1994) 118; Turner *op. cit.* (1996) 385, *op. cit.* (1997) 27; Coode *et al.* (eds.) *op. cit.* 240; Parnell & Chantaranothai *op. cit.* (2002) 908; Beaman & C. Anderson *op. cit.* 228; Chen & Craven *op. cit.* 357. **Basionym:** *Myrtus zeylanica* L., Sp. Pl. 1 (1753) 472. **Lectotype** (here designated)**:** *Herb. Herman 4*, *21*, *No. 182* (BM). **Homotypic synonyms:** *Eugenia zeylanica* (L.) Wight, Ill. Ind. Bot. 2 (1841/1850) 15, Duthie *in* Hooker *f. op. cit.* 485, King *op. cit.* 108, Merrill *op. cit.* (1921) 434, Ridley *op. cit.* (1922) 738, J.A.R. Anderson *op. cit.* (1980) 280, *nom. illeg.*, *non* Willd. (1799), *nec.* Roxb. (1814 & 1832), *Acmena zeylanica* (L.) Thwaites, Enum. Pl. Zeyl. (1859) 118. **Heterotypic synonyms:** *Eugenia spicata* Lam., Encycl. 3, 1 (1789) 201, M.R. Henderson *op. cit.* (1949) 231, J.A.R. Anderson *op. cit.* (1963) 176, Burgess *op. cit.* 414, Kochummen *op. cit.* 217, Corner *op. cit.* (1997) 591, *Syzygium spicatum* (Lam.) DC. *op. cit.* 260; *Myrtus bracteata* Willd., Sp. Pl. edit. 4, 2, 2 (1799) 969, *E. bracteata* (Willd.) Raeusch. *ex* DC. *op. cit.* 264, *nom. illeg.*, *non* Rich. (1792), *S. bracteatum* (Willd.) Korth., Ned. Kruidk. Arch. 1 (1847) 205, *Jambosa bracteata* (Willd.) Miq. *op. cit.* (1855) 437; *Acmena parviflora* DC. *op. cit.* 262; *E. koenigii* Blume *op. cit.* (1850) 100; *E. longicauda* Ridl., J. Str. Br. Roy. As. Soc. 61 (1912) 7; *E. antiseptica auct. non* Kuntze (1891): Ridley *op. cit.* (1930) 17. (For other synonyms *cf.* Merrill & L.M. Perry *op. cit.* (1939) 159; Chantaranothai & Parnell *op. cit.* (1994) 118 and http://apps.kew.org/wcsp/Myrtaceae).

Small bushy tree, occasionally to 15 m tall, to 60 cm diameter. **Bark** becoming orange-brown, thinly papery flaky. Parts glabrous. **Twigs** slender, *prominently narrowly 4-winged or angled in cross-section*, *smooth*. **Leaves** *thinly leathery*, *drying dull pale yellowish- to chocolate-brown and pitted above*, *dull pale orange-brown and more or less sparsely black dotted beneath*; *blades lanceolate to elliptic*, *c. 7 × 3*(*2.5–8 × 1.5–4*) *cm*, *base narrowly wedge-shaped terminating abruptly at petiole*, *apex caudate*, *acumen c. 1 cm long*; *lateral*

*veins subequal*, *hardly raised though slightly more so beneath*, *more or less shallowly furrowed above*, *main ones c. 6 pairs*, well-spaced, *with few intermediate veins*; *intercostal venation obscure*; *intramarginal vein 1*, *close to margin*, *hardly looped*; *petioles slender*, *c. 5 mm long*. **Inflorescences** paniculate, to 3 cm long, terminal or axillary; rachis slender, 2x-branched, *with small triangular to acicular subpersistent bracts and bracteoles*. **Flowers:** *buds narrowly obovoid-cylindrical*, *c. 5 mm long*, *c. 2 mm diameter*, hypanthium slender, tapering to base or to *c.* 2 mm pseudostalk, *densely minutely warty and usually bluish milky*; *calyx lobes* (*4 or*)*5*, *small*, *triangular-ovate*, acute, *erect and clasping the corolla*; stamens many, white, exserting to *c.* 8 mm, *anther locules parallel*; *ovary at the distal end of flower bud*, styles *c*. 9 mm long. **Fruits** ripening white, oblong-spherical, *c.* 6 mm diameter, with small crown of recurved apical calyx lobes.

**Vernacular name.** Sarawak—*ubah gelam* (Malay, Iban).

**Distribution.** Widespread from India and Sri Lanka to Myanmar, Thailand, Sumatra, Peninsular Malaysia, Singapore, Java and Borneo. In Sabah recorded from most districts (e.g., *SAN A 655*, *SAN 30946*, *SAN 52781*, *SAN 84042*, *SAN 123320* and *SAN 125970*) and in Sarawak from Betong, Bintulu, Kapit, Kuching, Lawas, Miri, Mukah, Sibu and Sri Aman districts (e.g., *Beccari 3074*, *S 9115*, *S 9821*, *S 18577* and *KEP 80006*). Also known in Brunei (e.g., *Awong AK 17*, *Kirkup DK 203*, *BRUN 2574*, *BRUN 5048* and *Dransfield JD 6798*) and in W, C and E Kalimantan (e.g., *Enoh 402*, *Church 724*, *Endert 1520*, *Kessler PK 2153* and *Kostermans 13082*).

**Ecology.** Common on degraded land and old secondary forest including mixed peatswamp over sand near the coast, also on rocky hilltops and yellow sandy soils on inland ridges in mixed and upper dipterocarp forest, at altitudes to 1300 m.

**Notes.** There are 4 specimens named *Myrtus zeylanica* L. in the Hermann herbarium. Three, all in bud, are on one sheet (vol. 1, p. 47, no. 182); they appear to be from the same gathering. In these, the hypanthium is smooth and the twigs only faintly quadrangular towards their apices. The fourth, in flower, has sharply ribbed twigs and glaucous warty hypanthium. Because this conforms with the current understanding of this species, it is here designated as the lectotype.

# Apparent undescribed species, for which material is inadequate for description

## 171. **Syzygium sp. A.**

Tree, *c.* 12 m tall. *Parts glabrous*. **Twigs** stout, *round in cross-section*, *grey-brown*. **Leaves** thinly leathery, *glistening throughout*, densely pimpled above, *black dotted beneath*; *blades elliptic*, *c. 13 × 4.5 cm*, *base wedge-shaped tapering into petiole*, apex acuminate, acumen *c.* 1 cm long, tapering; *midrib not sharply angled*; *lateral veins unequal*, *more or less equally raised on both surfaces*, main ones *c.* 11 pairs; *intercostal venation distinct on both surfaces*; *intramarginal vein 5–8 mm within margin*, *looped*; *petioles c. 10 mm long*. **Inflorescences** and **flowers** unknown. **Fruits** (young) obovoid, *c.* 18 mm long, *c.* 15 mm diameter, with *c.* 8 mm diameter crown of *c.* 3 × 5 mm reflexed calyx lobes.

**Distribution & ecology.** One collection: *S 46814* from Ulu Kayan Dulit, Sarawak, at *c.* 900 m altitude.

**Notes.** The leaves resembling that of *Syzygium pycnanthum* but smaller.

## 172. **Syzygium sp. B.**

Tree, *c.* 7 m tall. *Parts glabrous*. **Twigs** *c*. 2 mm diameter apically, *pale rust-brown*, *smooth*, *round with 2 slight opposite ridges*. **Leaves** *thickly leathery*, drying mauve-brown and *not pitted above*, chocolate-brown and *densely obscurely pimpled beneath*; *blades elliptic-obovate*, *c. 17 × 9.5 cm*, *base broadly wedge-shaped ending abruptly at petiole*, *margin narrowly recurved*, apex shortly acuminate; *lateral veins unequal*, *main one c. 11 pairs*, *each pair with 1 main intermediate vein*, sharply raised beneath, *shallowly so or slightly furrowed above*; intercostal venation evident throughout; *intramarginal vein looped*; petiole stout, *c.* 3 mm long. **Inflorescences** (young) paniculate, terminal, *c.* 10 cm long; rachis stout, quadrangular in cross-section, 3x-branched; bracts and bracteoles triangular, keeled, *c.* 4 × 3 mm. **Flowers** densely clustered; young buds obconical, *c.* 3 mm long, *c.* 2 mm diameter, with obscure short pseudostalk, prominently ridged, with 4, *c.* 1.5 × 2 mm, unequal hemispherical thick calyx lobes conceiling the corolla.

**Distribution and ecology.** One collection: *S 72970* from Kg. Steringos, Bau district, Sarawak.

**Notes.** In the *Syzygium urceolatum* group.

## 173. **Syzygium sp. C.**

Tree. Vegetative parts as in *Syzygium longiflorum* but the leaf blade drying chocolate-brown, without dots or pits, lateral veins unequal, slightly raised on both surfaces; post-anthesis flower bugle-shaped with very distinct *c.* 4 mm long very slender pseudostalk; calyx lobes apparently vestigial; stamens many.

**Distribution and ecology.** One collection: *S 48552* from N Berkalap, Melatai, Balleh, Sarawak; in mixed lowland dipterocarp forest.

## 174. **Syzygium sp. D.**

Tree, *c.* 18 m tall. **Bark** red-brown, papery-scaly. *Parts glabrous*. **Twigs** *c. 2 mm diameter apically*, *pink-brown*, *smooth*, *round in cross-section*. **Leaves** papery, *drying somewhat wrinkled*, *chocolate-brown*, minutely pitted above, pale dotted beneath; *blades elliptic*, *c. 14 × 4.5 cm*, *base narrowly wedge-shaped tapering into petiole*, apex narrowly subcaudate acumen *c.* 15 mm long; *lateral veins unequal*, *main ones c. 10 pairs*, *slender but distinctly raised beneath*, *not furrowed above*; intercostal venation lax, hardly raised beneath, obscure above; *intramarginal vein looped*; *petioles slender*, *c. 12 mm long*. **Inflorescences** paniculate, terminal or axillary; rachis 2x-branched, round in cross-section, slender. **Flowers:** buds obconical, *c.* 3 mm long, *c.* 2 mm diameter; corolla distinct; calyx rim with 4 vestigial lobes at base.

**Distribution and ecology.** Only one collection: *S 49925* from G. Pueh, Lundu district, Sarawak; in lowland forest.

## 175. **Syzygium sp. E.**

Tree, to 25 m tall. Similar to *Syzygium palawanense* but the inflorescence with longer branches, apparently paniculate.

**Distribution and ecology.** One collection: *S 40953* from Ulu-Semurau-Melinau watershed, Kapit district, Sarawak, at altitude *c.* 1300 m, in lower facies of upper montane forest.

## 176. **Syzygium sp. F.**

Tree. Resembling *Syzygium palawanense* but the leaf blade with more prominent venation and the inflorescence is *c.* 3 cm long and terminal.

**Distribution and ecology.** One collection: *S 58575* from Mulu NP, Sarawak; in mixed dipterocarp forest at *c.* 50 m altitude.

## 177. **Syzygium sp. G.**

Small tree. Differing from *Syzygium grande* in its more slender twig, distinctly ovate 8–12 × 4–7 cm leaf blade with slender midrib and hardly raised lateral veins, and *c.* 11 cm long spreading paniculate inflorescence with many smaller flower buds *c.* 5 mm long, *c.* 3 mm diameter.

**Distribution and ecology.** One collection: *Tandom 2942* from Pulau Gaya, Kota Kinabalu district, Sabah; in coastal forest on a sandstone island.

**Notes.** The habitat and overall character recall *Syzygium grande*, but the leaves and flowers are distinct.

## 178. **Syzygium sp. H.**

Distinguished from *Syzygium multibracteolatum* by its distinctly raised lateral veins with the blade somewhat folded in between, and from *S. pterophorum* and other members of the *S. zeylanicum* group by its prominently winged twig and *c.* 8 × 3.5 cm leaf blade is somewhat larger than in *S. zeylanicum*.

**Distribution and ecology.** Known by two specimens *S 23681* from Bt. Iju Arip Balingian, Sarawak and *SAN 74888* from G. Silam Lahad Datu, Sabah. In lowland mixed dipterocarp forest, overlying respectively acid volcanic rhyolite, and ultramafic volcanic substrates.

**Notes.** Ecotypes on humic soils, apparently somewhat similar to *Syzygium pterophorum* but *S 23681* have a more leathery blade, stouter inflorescence and twig.

# *Syzygium* species recorded from Borneo but not yet confirmed from Sabah and Sarawak

Merrill and Perry (Mem. Amer. Acad. Arts & Sci. 18, 3 (1939) 135–202) recorded the following species from Borneo. In the present account, these have either their occurrence in Borneo is not confirmed, or they occur in Kalimantan but not yet recorded from Sabah and Sarawak, or they are of uncertain status owing to the inadequate type material.

**1. Syzygium aegiceroides** Korth., Ned. Kruidk. Arch. 1 (1847) 203; Merrill & Perry *op. cit.* (1939) 155; Masamune, EPB (1942) 522. **Type:** *Korthals s.n.*, Borneo, Kalimantan, Martapura (holotype L, Barcode L 0009578; fragm. A).
The leaves and ramiflorous inflorescences recall those of *Syzygium polyanthum*, but the inflorescences are unusually short. The material is insufficient to be certain.

**2. Syzygium blumei** (Steud.) Merr. & L.M.Perry *op. cit.* (1939) 164. **Basionym:** *Eugenia blumei* Steud., Nomencl. Bot. 2nd. edition, 1 (1840) 601 (as a new name for *E. angustifolia* Blume, Flora 7 (1824) 291, *nom. illeg.*, *non* Lam. 1789; *Myrtus hyperifolia* Blume, Bijdr. Fl. Ned. Ind. 17 (1827) 1082, *nom. illeg.*, *non* Salisb. 1796, *Jambosa hypericifolia* (Blume) DC., Prodr. 3 (1828) 287, *E. hypericifolia* (Blume) Koord. & Valeton, Bijdr. Booms. Java 6 (1900) 69, *nom. illeg.*, *non* Gardner 1843). **Type:** *Blume s.n.*, Java (L, *n.v.*; photo in A). **Heterotypic synonym:** *Eugenia lancifolia* Miq., Ann. Bot. Ind. 1, 1 (1850) 17. **Type:** *Korthals s.n.*, Borneo, Kalimantan, *loc. incert.* (L, *n.v.*).

Merrill and Perry claimed the occurrence of this Javanese species in Borneo on the basis of a fragment of specimen, *Korthals s.n.*, from Kalimantan, *loc. incert.* (in A). It clearly belongs to the *Jambu* group, and particularly resembles *Syzygium jambos*, though the relatively small leaves with heart-shaped bases are distinctive. I conclude that *S. blumei*, if indeed a future monographer regards it as a distinct species from *S. jambos*, does not occur in Borneo.

Closely allied to *Syzygium panzeri*, *S. formosum* and *S. scortechinii*, *S. blumei* is nevertheless distinguished by its sharply 4-angled twig and small leaf with prominent venation as in *S. panzeri*, but differs by its large *c.* 2 cm diameter spherical fruit on *c.* 3 cm peduncle. It may prove to be synonymous with *S. panzeri*, in which case *blumei* would be the correct specific epithet.

**3. Syzygium karimatense** Merr. & L.M.Perry *op. cit.* (1939) 198. **Type:** *Teijsmann s.n.*, Indonesia, G. Jungjung, Karimata Isl. (holotype BO; fragment at A).
The leaves are clustered, erect, small, obovate-elliptic, papery, retuse to acute. The flower buds are torch-shaped with vestigial calyx lobes, resembling those of *Syzygium claviflorum* but smaller. Not closely resembling any species known from Sabah or Sarawak.

**4. Syzygium korthalsianum** Miq., Fl. Ind. Bat. 1, 1 (1855) 454; Merrill & L.M. Perry *op. cit.* (1939) 191; Masamune *op. cit.* 531. **Basionym:** *Eugenia korthalsiana* Miq., Anal. Bot. Ind. 1 (1850) 25. **Type:** *Korthals s.n.*, Borneo, Kalimantan, *loc. incert.* (holotype L; isotype A).
This entity is close to *Syzygium kunstleri* but the leaves are very small and the gland dots are less distinct. Also occurring in Sumatra and Peninsular Malaysia.

**5. Syzygium lamii** Merr. & L.M.Perry *op. cit.* (1939) 173. **Type:** *Obi 10* (= *bb 2402*), Borneo, W Kalimantan, Sg. Malian, Kg. Baharu, Buntok (holotype BO; isotype L; photo & fragm at A)
The leaves are elliptic-ovate, thinly leathery, finely densely dotted beneath, dark pitted above; the petiole is *c*. 8 mm long. The inflorescence is *c.* 6 cm long, rachis 3x-branched; flower buds *c.* 7 mm long, *c.* 3 mm diameter, clove-shaped, calyx lobes *c.* 2 × 2 mm, ovate subacuminate, thick to the margins. The flowers recall those of *Syzygium chloranthum*, but the leaf venation is more distinctly raised beneath, as in *S. racemosum.*

**6. Syzygium lancifolium** (Miq.) Merr. & L.M.Perry *op. cit.* (1939) 196; Masamune *op. cit.* 532. **Basionym:** *Jambosa lancifolia* Miq., Fl. Ind. Bat. 1, 1 (1855) 427, *p.p.*, *non Eugenia lancifolia* Miq., Anal. Bot. Ind. 1 (1850) 17. **Heterotypic synonyms:** *Jambosa insignis* Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 100, *p.p.*; *E. munroii* Miq. *op. cit.* (1850) 18, *non E. monronii* Wight. **Cited specimen:** *Korthals s.n*., Borneo, Kalimantan, *loc. incert.* (L; photo and fragment in A)
This specimen was originally associated with the enigmatic Javanese entity *Jambosa lancifolia* Miq. It is fragmentary, and I accept the view of Merrill and Perry that this prevents its reliable assignment to *Syzygium jambos* or a related species.

**7. Syzygium leucophloium** Merr. & L.M.Perry *op. cit.* (1939) 174. **Type:** *Korthals s.n.*, Borneo, Kalimantan, *loc. incert.* (holotype L; photo A). **Homotypic synonyms:** *Jambosa cuneata* Blume, Mus. Bot. Lugd.- Bat. 1 (1850) 105, *Syzygium cuneatum* (Blume) Masam. *op. cit.* 527, *non. S. cuneatum* Wall.
A distinct species on account of its stout cream twig and narrowly oblong leaf with veins furrowed above recalling that of *Syzygium leptostemon*, but the abruptly heart-shaped base, shiny upper and glistening lower surface of the leaf blade are different. Further, the terminal and axillary stout-branched inflorescence bears open flowers measuring *c.* 10 mm long and *c.* 8 mm diameter with bugle-shaped hypanthium; *c.* 6 × 5 mm patent hemispherical hyaline calyx lobes; and abundant stamens and stamens and style exserted to *c.* 9 mm long, associating it with the *Syzygium jambos* group. Known only from S Kalimantan.

**8. Syzygium pallidilimbum** Merr. & L.M.Perry *op. cit.* (1939) 183. **Type:** *Dachlan 19* (= *bb 12891*), Borneo, S Kalimantan, Kintap, Pleihari (holotype BO; isotype A).
This species is easily distinguished by its pale greenish yellow 4-ribbed twigs; oblong greenish grey drying leaves that are sparsely black-dotted beneath, with obtuse base and *c.* 16 pairs of main lateral veins (with shorter intermediate veins) that are narrowly furrowed above, and very short stout petiole; and terminal or axillary slender spreading inflorescence bearing slender goblet-shaped flowers with ribbed pseudostalk. It appears to be endemic to S and SW Kalimantan.

**9. Syzygium papillosum** (Duthie) Merr. & L.M.Perry *op. cit.* (1939) 157; Masamune *op. cit.* 536. **Basionym:** *Eugenia papillosa* Duthie *in* Hooker *f.*, Fl. Br. Ind. 2 (1878) 495. **Type:** *Maingay 737*, Pen. Malaysia, *loc. incert.* (holotype CAL; isotype K).
This Peninsular Malaysian species occurs in Kalimantan, but has not been recorded from Sabah and Sarawak. It recalls *Syzygium oblanceolatum* but differs in its larger leaf with prominently auriculate base and *c.* 20 pairs of main lateral veins, its round twig, mainly terminal inflorescences, and larger fruit.

**10. Syzygium polycephalum** (Miq.) Merr. & L.M.Perry *op. cit.* (1939) 153; Masamune *op. cit.* 537. **Basionym:** *Eugenia polycephala* Miq., Anal. Bot. Ind. 1 (1850) 19. **Type:** *Korthals s.n.*, Borneo, Kalimantan, G. Pamatton (holotype L; photo in A).

Also recorded from W Java (*Horsfield s.n.*; L, photo in A). The leaves recall those of *Syzygium papillosum* (see above) in size, shape and number of lateral veins but taper to the base, while the spreading *c.* 10 cm long cauliflorous paniculate inflorescences at once distinguish it.

**11. Syzygium slootenii** Merr. & L.M.Perry, *op. cit.* (1939) 193. **Type:** *Yates 1612*, Sumatra, Bandar Pulu, Asahan (holotype A; isotype NY).
Merrill and Perry identify *Endert 3592* (near Kong Kemul, W Kutei, E Kalimantan) with the Sumatran type. They compare the species wih *Syzygium havilandii*, from which it differs in its stout inflorescence; we tentatively compare this specimen with *S. chloranthum* though the buds, which are young, are unusually short. The flower buds on the type are immature. We consider this a distinct species close to *S. oligomyrum*, differing in the furrowed veins on the blade above and the stout much branched inflorescence. We consider that Endert's specimen represents *S. incarnatum* and conclude that *S. slootenii* does not occur in Borneo.

**12. Syzygium splendens** (Blume) Merr. & L.M.Perry *op. cit.* (1939) 180. **Basionym:** *Jambosa (?) splendens* Blume *op. cit.* (1850) 119.
The synonymy is presented by Merrill and Perry. We consider that none of the collections from Borneo assigned here by Merrill & Perry belong to this Javanese species. Among them, *Beccari 1336*, near Kuching, represents *S. elliptilimbum.*

## Names rejected by Merrill & Perry owing to loss of types

The following names were rejected by Merrill & Perry, and also here, because the types, supposedly at Leiden or Utrecht, have not been found:

**13. Syzygium conicum** Korth., Ned. Kruidk. Arch. 1 (1847) 204; Merrill & L.M. Perry *op. cit.* (1939) 196; Masamune *op. cit.* 526. **Type:** *Korthals s.n.*, Borneo, Kalimantan, *loc. incert.*

**14. Syzygium ovale** Korth. *op. cit.* 205; Merrill & L.M. Perry *op. cit.* (1939) 197; Masamune *op. cit.* 535. **Type:** *Korthals s.n.*, Borneo, Kalimantan, *loc. incert.*

**15. Syzygium tenellum** Blume *ex* Miq., Anal. Bot. Ind. 1 (1850) 27; Merrill & L.M. Perry *op. cit.* (1939) 197; Masamune *op. cit.* 540. **Type:** *Korthals s.n.*, Borneo, Kalimantan, *loc. incert.* (L; one leaf in U).

**16. Syzygium tessellatum** Korth. *op. cit.* 203; Merrill & L.M. Perry *op. cit.* (1939) 197; Masamune *op. cit.* 540. **Type:** *Korthals s.n.*, Borneo, Kalimantan, *loc. incert.* Neither Miquel nor Merill could locate the type at L.

# 11. **TRISTANIOPSIS** Brongn. & Gris

(Greek, -*opsis* = -like; like the genus *Tristania*)

Co-authored by Stephen Teo, Forest Research Centre, Kuching, Sarawak

Bull. Soc. Bot. France 10 (1863) 371; Wilson & Waterhouse, Austral. J. Bot. 30 (1982) 433; Dawson, Bull. Natl. Hist. Nat., B, Adansonia Ser. 4, 7, 2 (1985) 177; Turner, Gard. Bull. Sing. 47, 2 (1996) 388; Coode *et al.* (eds.), CLBD (1996) 241; Argent *et al.* (eds.), MNDT-CK (1997) 474; Parnell & Chantaranothai, Fl. Thailand 7, 4 (2002) 912; Beaman & C. Anderson, PMK 4 (2004) 228. **Synonyms:** *Tristania auct. non* R. Br. (1812)**:** A. de Candolle, Prodr. 3 (1828) 210, Bentham & Hooker, Gen. Pl. 1, 2, (1862) 708, Duthie *in* Hooker *f.*, Fl. Brit. Ind. 2 (1878) 467, Niedenzu *in* Engler & Prantl, Nat. Pflanzenfam. 3, 7 (1898) 88, Koorders & Valeton, Bijdr. Booms. Java 6 (1900) 172, King, J. As. Soc. Beng. 70, 2 (1901) 71, Merrill, EB (1921) 433, Ridley, FMP 1 (1922) 714, Masamune, EPB (1942) 541, Backer & Bakhuizen *f.*, FJ 1 (1964) 347, Kochummen, TFM 3 (1978) 251, J.A.R. Anderson, CLTS (1980) 281, Burgess, TBS (1966) 411, Corner, WSTM 4th. edition 2 (1997) 597; *Tristania* sect. *Eutristania* Benth. *in* Bentham & Hooker *op. cit.* 709.

Trees, treelets or shrubs; bole of large trees broadly ribbed; buttresses short, broad. **Bark** *either smooth*, white to bluish grey to yellow to rust-red or mauve brown, *or flaking in large scroll-like* grey to red-brown *pieces*, or becoming *shaggily flaky and fissured*, dark grey- or chocolate-brown (upland and montane species); inner bark thin, pale yellow to greenish. **Sapwood** waxy yellow, more or less hard; heartwood dark brown. **Leaves** *laminar*, *pinnately veined*, *alternate* or *spirally* (*in juveniles*) *arranged*, sessile or subsessile to distinctly petioled; *blades* elliptic or most often oblanceolate, *symmetrical*, pitted above, glabrous or with persistent tomentum and finely gland-dotted beneath, base always tapering to a more or less narrow flange along the side of the petiole, auricules present or absent, margin entire, more or less recurved; *venation distinct*; midrib furrowed above, prominent and often sharp beneath; main lateral veins slender, more or less unequal, dense, more or less distinct; intercostal venation lax, indistinct; intramarginal vein close to margin. **Inflorescence** *cymose or corymbose*, axillary, short to long, longer than bract-like structure subtending it; bracts and bracteoles small, strap-shaped. **Flowers** bisexual; hypanthium cup- to urn-shaped; calyx 5-lobed, lobes deltoid, subacute, thick; petals 5, white or yellowish, suborbicular, stalked; stamens solitary or in clusters of 2–10, if in cluster the central ones longest and the outer ones shortest, opposite petals, anthers dorsifixed, globose; ovary semi-inferior, densely hairy, 3-loculed, each locule with many pendulous ovules, style hardly exceeding stamens, columnar, stigma small. **Fruit** a 3-loculed capsule, small to big. **Seeds** few and large to minute and numerous, in Bornean species narrowly elliptic, flat, winged; embryo straight, cotyledons convolute or obvolute, kidney-shaped.

**Vernacular names.** Sabah—*selunsur* (Malay), *pelawan-pelawan* (Kadazan, Malay). Sarawak—*melaban* (Iban, for scroll-barked species), *kawi* (Iban, for shaggily flaky-barked species), *selan(g)* (Malay and Brunei).

**Distribution.** About 50 species distributed from northeast parts of India to Myanmar, Thailand, Cambodia, Sumatra, Peninsular Malaysia, Java, Borneo, the Philippines, Sulawesi, New Guinea, New Caledonia and Eastern Australia. There are two centres of diversity for *Tristaniopsis*: Borneo (*c*. 12 species of which 11 are recorded in Sabah and Sarawak) and New Caledonia (15 species).

**Ecology.** *Tristaniopsis* is a genus of open forest, including late succession on landslips, rocky and sandy river banks, and narrow summit ridges. It occurs in all vegetation types in Malesia, mixed and upper dipterocarp forest on the full range of soils, *kerangas*, swamp, riparian, lowland, upper montane forest, limestone, mangrove, and on ultramafic substrates. *T. rubiginosa* and *T. whiteana* subsp. *monostemon* are Bornean endemics confined to *kerangas*; *T. corymbosa*, *T. kinabaluensis* subsp. *silamensis* and *T. merguensis* subsp. *tavaiensis* are Sabah endemics confined to ultramafic substrates. In Borneo, the steep young landslip-prone topography with rocky or sandy river banks and the poor soils with open-

canopy forests have promoted speciation. The *kerangas* forests and forests over ultramafic soil are the richest in species diversity.

**Uses.** The wood is hard but brittle and not durable in contact with the ground. It is frequently used as carrying-sticks, rice-pounders and the handles of hoes. It was sometime used as house-posts, poles and fences in Brunei. In Peninsular Malaysia, wood is used as keel for boats and house posts as well as parang sheath. Among the Ibans, there is a superstition following the 'doctrine of signatures', that felling the tree can cause the skin to peel off in very much the same way the peely bark peels off.

**Notes.** A difficult genus in a difficult family for species identification. Several species cannot be reliably identified without examination of the number of stamens and, in some cases, the fruit. Morphological variation implies hybridization between lowland *Tristaniopsis beccarii* and *T. pentandra*, between montane *T. elliptica* and *T. bilocularis*, and between *T. pentandra* and *T. elliptica.* The presence and length of the petiole is used to identify species in the field key. In this genus, the leaf blade continues down the petiole as a narrow flange. The petiole, if present, is therefore recognised here as that part at the leaf base where further tapering of the blade has ceased. The descriptions of the leaf refer solely to those of mature trees.

In the present account, we have taken a comparative approach, awaiting the monographer to determine whether the subspecies as defined here may eventually be justified and recognised as distinct species.

## Key to *Tristaniopsis* species

1. Leaf base (at least in juveniles) distinctly auriculate. Stamens at least 6 per cluster. Fruits (capsules) to 10 mm long, to 8 mm diameter……...**6. T. merguensis**
   Leaf base (even in juveniles) more or less attenuate or wedge-shaped. Stamens 1–3(–5) per cluster. Fruits (capsules) to 6 (rarely to 9) mm long, *c.* 5 mm diameter…….……2

2. Leaves subsessile or with very short petioles (occasionally with *c.* 15 mm long petioles)…….3
   Leaves distinctly petiolate…….4

3. Leaf blades generally obovate, at most *c.* 12 × 4.5 cm, thickly leathery……
   ……**5. T. kinabaluensis**
   Leaf blades generally oblanceolate, 13–35 × 5–12 cm, thinly or thickly leathery…….
   ……**7. T. microcarpa**

4. Leaf blades at most 3.5 cm wide……...5
   Leaf blades mostly more than 4 cm wide…….8

5. Leaf blades obovate or occasionally oblanceolate. Stamens generally at least 4 per cluster. Lowland species……...……**8. T. obovata**
   Leaf blades elliptic, lanceolate or obovate-oblanceolate. Stamens at most 3 per cluster.....6

6. Leaf blades elliptic; petiole at most 5 mm long. Stamens 3 per cluster. Fruits 3-locular……...**4. T. elliptica**

Leaf blades lanceolate, oblanceolate or oblong; petiole at least 5 mm long. Stamens 1–2 per cluster. Fruits 2- or 3-locular……..7

7. Leaf blades thinly leathery; petiole *c.* 5 mm long. Stamens 1 opposite each petal. Fruits 3-locular……...**1. T. anomala**
Leaf blades thickly leathery; petiole *c.* 8 mm long. Stamens generally 2 opposite each petal. Fruits 2-locular……...**3. T. bilocularis**

8. Leaf blades glistening beneath; lateral veins dense, subequal, (54–)68(–92) pairs……...**11. T. whiteana**
Leaf blades dull beneath; lateral veins unequal, not dense, 22–28 pairs……..9

9. Twigs *c.* 3 mm diameter apically. Leaf blades, initially greyish puberulent beneath, soon becoming glabrous. Stamens 1 opposite each petal…….**9. T. pentandra**
Twigs 5–8 mm diameter apically. Leaf blades persistently densely or sparsely brownish pubescent beneath. Stamens 3(–5) per cluster……10

10. Leaf blades distinctly persistently chocolate-brown puberulent beneath. Stamens 3–4 per cluster……...**10. T. rubiginosa**
Leaf blades sparsely grey-brown pubescent beneath. Stamens 5 per cluster……..
……..**2. T. beccarii**

## 1. **Tristaniopsis anomala** (Merr.) P.G.Wilson & P.T.Waterh. Fig. 22.

(Latin, *anomalus* = abnormal; referring to the unusually small flowers, each with only 5 stamens)

Austral. J. Bot. 30 (1982) 439; Coode *et al*. (eds.) *op. cit.* 241. **Basionym:** *Tristania anomala* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 227, *op. cit.* (1921) 435, Masamune *op. cit.* 541, Burgess *op. cit.* 416, Airy Shaw, Kew Bull. 4 (1949) 117, J.A.R. Anderson *op. cit.* (1980) 281. **Type:** *Native Collector* (*Bur. Sci.*) *2868*, Borneo, Sarawak, G. Murud summit (holotype PNH, destroyed; isotype K).

Gnarled shrub or small tree to 24 m tall, *c*. 50 cm diameter. **Bark** brittle, fissured, becoming shaggily flaky, greyish brown to dark red-brown; inner bark yellowish brown. **Sapwood** white, hard. Young parts grey-brown puberulent, early caducous except on inflorescence, calyx and sometimes midrib beneath. **Twigs** *c.* 2–3 mm diameter apically, grey-brown, rough and very finely fissured, rounded in cross-section. **Leaves** *thinly leathery*, drying dark olive-brown, densely pitted above, faintly minutely dotted beneath; *blades lanceolate to oblong*, *c. 4.5 × 1.1*(*3–6.7*) *× 1–1.5 cm*, *base narrowly wedge-shaped tapering into petiole*, apex acute to rounded; main lateral veins (13–)17(–20) pairs, slightly raised or flat above and below, faint, 1–2 mm apart, ascending; intramarginal vein close to margin; *petioles* slender, *c. 5 mm long*. **Inflorescences** *cymose*, *c.* 10 cm long; rachis 4x-branched. **Flowers:** *buds c. 2 mm long*, *c. 2 mm diameter*; pedicel *c.* 2 mm long; calyx lobes *c*. 0.15 × 0.3 mm; petals yellow-green, *c.* 0.8 mm long; *stamens one opposite each petal*, filament *c.* 0.1 mm long, anther ellipsoid, 0.05 mm long. **Fruits** ellipsoid, *3-locular*, *c. 5 mm long*, *c. 3 mm diameter*, *3-loculed*. **Seeds** minute, many.

**Distribution.** Endemic to Borneo; recorded in Sabah from Kinabatangan and Lahad Datu districts (e.g., *SAN 91180*) and in Sarawak from Bau, Kapit, Kuching, Lundu, Marudi and Miri districts (e.g., *Stevens 311*, *Fuchs 21001*, *S 30427*, *S 34880*, *S 39414*, *S 48482* and *S*

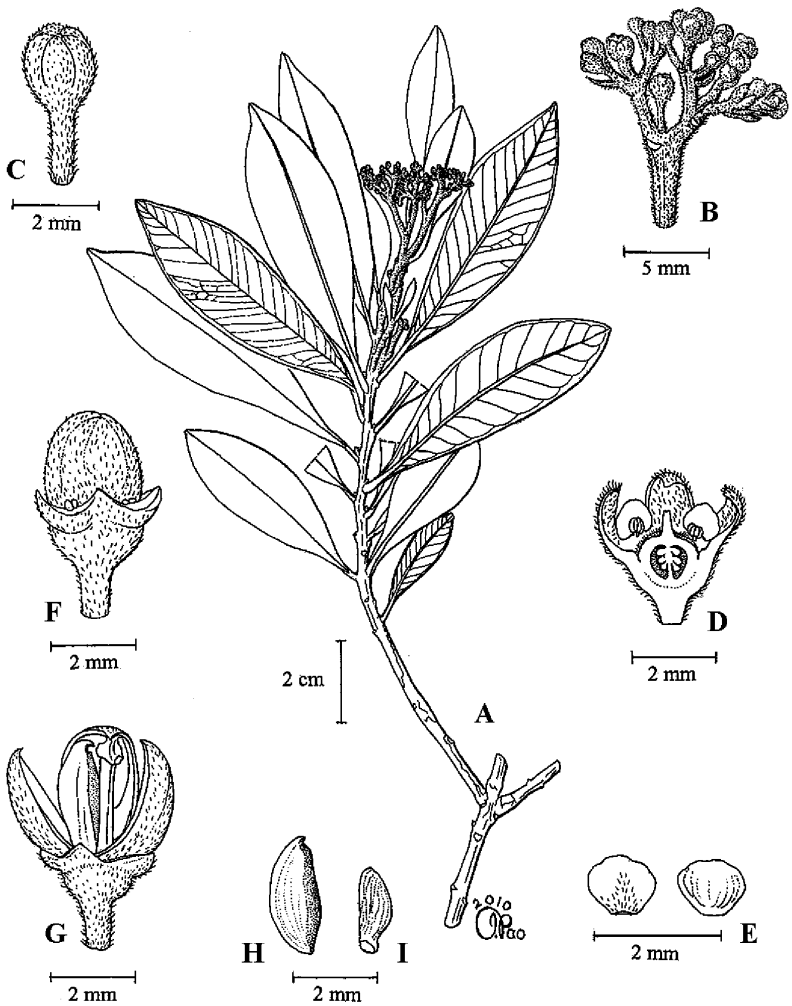


**Fig. 22.** *Tristaniopsis anomala*. A, flowering (young) leafy twig; B, distal end of inflorescence; C, flower bud; D, longitudinal section of open flower; E, adaxial and abaxial views of petals; F, young fruit; G, dehiscing mature fruit; H & I, seeds. (A–E from *S 73519*, F–I from *P.F. Stevens 311*.)

*73519*). Also known in Brunei (e.g., *BRUN 417*, *BRUN 420*, *Sands 5253* and *BRUN 5606*) and W Kalimantan (e.g., *Ismail 12/97*).

**Ecology.** Locally abundant on acid organic soils on narrow spurs, ridges and summits in upper dipterocarp forest and lower montane *kerangas* pole forest, at 120–1600 m altitudes. In Sarawak (G. Api), also occur in forest on limestone.

## 2. **Tristaniopsis beccarii** (Ridl.) P.G.Wilson & J.T.Waterh.

(Eduardo Beccari, 1843–1920, first botanical explorer of Sarawak)

Austral. J. Bot. 30 (1982) 439. **Basionym:** *Tristania beccarii* Ridl., J. Bot. 68 (1930) 37, Masamune *op. cit.* 542, J.A.R. Anderson *op. cit.* (1980) 281. **Type:** *Beccari 2244*, Borneo, Sarawak, *loc. incert.* (holotype K).

Tree to c. 15 m tall, *c.* 30 cm diameter. **Bark** at first smooth, greyish brown, later peeling off in scroll-like reddish brown strips. **Sapwood** brown. *Young parts densely coarsely pubescent*, *persistent on inflorescence and usually on blade below*. **Twigs** *c. 8 mm diameter* apically, round in cross-section, smooth, grey-brown, soon thinly peeling. **Leaves** leathery, drying mauve-brown, densely pitted above, faintly dotted and *dull beneath*; blades oblong to ovate or obovate, *c. 13 × 5.5*(*7.5–22 × 3.3–10.5*) *cm*, *base narrowly wedge-shaped tapering into petiole*, apex shortly *c.* 6 mm acuminate; *lateral veins unequal*, *not dense*, *main ones c.* 28 pairs, *with variably less prominent intermediate veins*, shallowly furrowed or occasionally raised above, distinctly raised below, *3–6 mm apart*, ascending; intramarginal vein 1–5 mm within margin; *petioles c. 12*(*6–20*) *mm long*, stout. **Inflorescences** *cymose*, *c.* 17 cm long; rachis 4x-branched. **Flowers:** buds *c.* 4 mm long, *c.* 3 mm diameter; pedicel 1–2 mm long; hypanthium drying wrinkled, obscurely warty; calyx lobes *c.* 2 × 2 mm; petals *c.* 2 mm wide; *stamens 5 per cluster opposite each petal*, filament *c.* 10.2 mm long, anthers *c.* 0.1 mm. **Fruits** ellipsoid, *c. 7 mm long*, *c. 5 mm diameter*; pedicel *c.* 3 mm long, stout. **Seeds** many, kidney-shaped, *c.* 0.4 × 0.1 cm.

**Vernacular names.** Sabah and Sarawak—*selunsur merah* or *selunsur paya* (Malay).

**Distibution.** Endemic to Borneo; known in Sarawak from Kapit, Kuching, Limbang, Lundu, Marudi, Miri, Mukah and Sibu districts (e.g., *S 99*, *S 373*, *S 1037*, *S 9658*, *S 9880*, *S 9967*, *S 10271*, *S 19596*, *S 23704*, *SFN 35704*, *S 44298*). Also recorded from Brunei (e.g., *S 1186*).

**Ecology.** Local, on sandy podsols and ultramafic substrates in *kerangas*, often poorly drained, and the extreme *padang* vegetation at the centre of the larger peat swamps, at altitudes to 1300 m.

## 3. **Tristaniopsis bilocularis** (Stapf) P.G.Wilson & J.T.Waterh.

(Latin, *bis* = two, *loculus = a little place*; referring to the 2-locular ovary)

Austral. J. Bot. 30 (1982) 439; Beaman & C. Anderson *op. cit.* 229. **Basionym:** *Tristania bilocularis* Stapf, FMK (1894) 152, Masamune *op. cit.* 542, Burgess *op. cit.* 417, J.A.R. Anderson *op. cit.* (1980) 281. **Type:** *Haviland 1199*, Borneo, Sabah, Mt. Kinabalu (holotype K).

Trees to 21 m tall, to 40 cm diameter. **Bark** *early becoming finely fissured and coarsely flaky*, *reddish brown*; inner bark fibrous, reddish. **Sapwood** pale reddish. Parts more or less glabrous. **Twigs** 2–4 mm diameter apically, round in cross-section, finely fissured, grey-brown. **Leaves** *thickly leathery*, drying grey-brown, densely pitted above, faintly dotted beneath; *blades lanceolate to oblong*, *c. 6.5 × 2*(*4.5–9.5 × 1.5–2.7*) *cm*, *base narrowly wedge-shaped tapering to petiole*, margin prominently revolute, apex broadly acute; main lateral veins *c.* 24 pairs, with unequal intermediate veins, raised or flat above, raised below, 2–4 mm apart, ascending; intramarginal vein close to margin; *petioles c. 8*(*–12*) *mm long*. **Inflorescences** *cymose*, grey-brown puberulent, *c.* 9.5 cm long; rachis 5x-branched; bracts oblanceolate, *c.* 13 × 5 mm. **Flowers:** buds *c.* 2.5 mm across; pedicel *c.* 1 mm long; calyx lobes *c.* 0.3 × 0.4 mm; petals *c.* 0.5 mm wide; *stamens* (*1–*)*2 per cluster*, *opposite each petal*, filament *c.* 1 mm long, anther *c.* 0.4 mm long; ovary 2(–3)-loculed. **Fruits** *2*(*–3*)*-locular*, ellipsoid, *c.* 5 mm long, *c.* 4 mm diameter, red, green at the apex; calyx lobes densely to sparsely minutely hairy; pedicel *c.* 2 mm long. **Seeds** many, kidney-shaped, *c.* 0.4 × 0.1 mm.

**Distribution.** Endemic to Borneo. In Sabah recorded from Keningau, Ranau, Sipitang and Tambunan districts (e.g., *RSNB 1842*, *RSNB 4181*, *SAN 20338*, *SAN 24201*, *SAN 28598*, *Clemens 28958*, *SAN 44391*, *SAN 46764*, *SAN 57880*, *SAN 76692* and *SAN 79603*) and in Sarawak from Lawas, Limbang and Miri districts (e.g., *BRUN 1049*, *BRUN 1665*, *BRUN 2236* and *S 76983*). Also recorded from NE Kalimantan (e.g., *Kostermans 13826* and *Kostermans 14032*).

**Ecology.** Common on Mt. Kinabalu, local elsewhere, in the lower facies of upper montane forest, at 700–2000 m altitudes.

## 4. **Tristaniopsis elliptica** (Stapf) P.G.Wilson & J.T.Waterh.

(Latin, *ellipticus* = elliptic; referring to the shape of leaf blades)

Austral. J. Bot. 30 (1982) 439; Beaman & C. Anderson *op. cit.* 229. **Basionym:** *Tristania elliptica* Stapf, *op. cit.* 151, Masamune *op. cit.* 542, Burgess *op. cit.* 417, J.A.R. Anderson *op. cit.* (1980) 281. **Type:** *Haviland 1257*, Borneo, Sabah, Marai Parai, Mt. Kinabalu, at *c.* 1800 m (holotype K).

Treelet or tree often crooked, to 21 m tall, to 30 cm diameter. **Bark** fissured and thickly flaky, dark brown; inner bark brown. **Sapwood** light brown. Inflorescence and flower bud at first densely grey-brown puberulent, becoming sparse on inflorescence, glabrescent on fruit. **Twigs** *c.* 3 mm diameter apically, round in cross-section, at first smooth, early become flaky. **Leaves** *thickly leathery*, drying dull olive-grey; *blades elliptic*, *c. 5 × 2.5*(*3–10 × 1.5–3.5*) *cm*, *base broadly wedge-shaped tapering into petiole*, apex broadly acute to obtuse; main lateral veins *c.* 24 pairs, with variably shorter intermediate veins, prominently raised above and below, 2–5 mm apart, ascending; intramarginal vein *c.* 1 mm within margin; *petioles c. 2*(*–5*) *mm long*. **Inflorescences** *cymose*, *c.* 5 cm long; rachis 4x-branched. **Flowers:** buds *c.* 3 mm long, *c.* 2.5 mm diameter; pedicel *c*. 1.5 mm long; calyx lobes *c.* 0.5 × 1 mm; petals *c.* 0.5 mm wide; *stamens 3 per cluster opposite each petal*, filament *c.* 0.05 mm long, anther minute. **Fruits** ellipsoid to globose, *c. 6 mm long*, *c. 5 mm diameter*, *3-locular*; pedicel *c.* 1 mm long. **Seeds** ellipsoid, *c.* 0.5 × 0.1 mm.

**Distribution.** Endemic to Borneo. Recorded in Sabah from Kota Belud, Ranau, Sandakan and Tambunan districts (e.g., *RSNB 937*, *Wong WKM 2400*, *SNP 5154*, *SAN 17254*, *SAN 31793*, *SAN 38338*, *KEP 80374* and *SAN 133206*) and in Sarawak from Lawas and Marudi

districts (e.g., *Nooteboom & Chai 1966*, *S 20176*, *S 26507*, *S 32938*, *S 33034*, *S 38225* and *S 58442*).

**Ecology.** Locally common in upper montane forest of Mt. Kinabalu at 1500–3300 m altitude, sometimes on ultramafic substrates; also common in forest on raw humus overlying limestone at altitudes above 900 m at G. Mulu in Sarawak.

## 5. **Tristaniopsis kinabaluensis** P.S.Ashton
(of Mt. Kinabalu, Sabah)

Gard. Bull. Sing. 57 (2005) 269. **Type:** *A. Gibot SAN 60705*, Borneo, Sabah, Ranau district, Bt. Hampuan (holotype K; isotype SAN).

Tree *c.* 20(–35) m tall, *c.* 30 cm diameter. **Bark** rust-brown, cracked and falling in small flakes; inner bark red-brown. *Young parts densely yellowish-silvery to pale brown downy*, glabrescent. **Twigs** *c.* 3 mm diameter apically, stout, eventually dark brown. **Leaves** subsessile, *thickly leathery*, dull, drying mauve- to dark yellowish-brown, generally pale mauve glaucous beneath, more or less distinctly pitted above, faintly to obscurely dotted beneath; *blades obovate-oblanceolate*, *4–12 × 1.5–4.5 cm*, *base tapering or abruptly terminating into petiole*, apex rounded or shortly broadly acuminate; venation hardly or not raised on either surface; main lateral veins *c.* 15 pairs, ascending; *petioles stout*, *very short*, *c. 1 mm long*. **Inflorescences** *cymose*, *c.* 8 cm long, terminal or axillary; rachis doubly branched, flowers clustered towards the end of the branches. **Flowers:** buds obconical, *c.* 4 mm long, *c.* 3 mm diameter, subsessile; calyx lobes ovate-acute, *c.* 1 × 1 mm; *stamens 3*(*–5*) *per cluster*. **Fruits** ellipsoid or spherical, *c. 4 mm long*, *c. 3 mm diameter*.

**Distribution.** Endemic to Borneo; so far known with certainly only from Kinabalu NP and G. Silam in Sabah (but see notes under subsp. *kinabaluensis* below).

**Ecology.** Locally common in lower montane oak-laurel forest and in lower montane *kerangas* on ultramafic substrate, at 800–1500 m altitudes.

**Notes.** Two subspecies are recognised.

**Key to subspecies**

Indumentum dull rufous-brown. Leaf venation obscure throughout. Fruit ellipsoid, *c.* 5 mm long, *c.* 4 mm diameter; fruit calyx lobes *c.* 1 × 1 mm, clasping the base of dehisced capsule valves……..

subsp. **kinabaluensis**

Known with certainly only in and near Kinabalu NP, Sabah. Locally common in lower montane oak-laurel forest at altitudes to 1500 m (e.g., the type, *Chew et al. 1862*, *RSNB 4148*, *RSNB 4458*, *RSNB 4859*, *J.H. Beaman 9381*, *J.H. Beaman 10699*, *Clemens 30242*, *SAN 33924*, *SAN 33945*, *SAN 36776* and *SAN 37990*). Several collection from G. Mulu NP in Sarawak (e.g., *S 4289*, *S 30818*, *S 41131* and *S 49609*), in fruit or young flower bud, differ in their thinly leathery, dull but not glaucous leaf blade. They were collected from forest vegetation on organic soil overlying limestone (at altitudes to 1500 m) and sandstone (at altitudes to 1800 m). Good flowering material is awaited before their identity can be confirmed.

Indumentum yellow-silvery. Leaf venation visible, with the main lateral veins slender and slightly raised beneath. Fruit spherical, *c.* 4 mm diameter; valves broadly elliptic, to 4 × 3 mm; fruit calyx shallowly cup-shaped, to 8 mm diameter, the lobes spreading, to 3 × 4 mm……..

subsp. **silamensis** P.S.Ashton
(of G. Silam, Sabah)
Gard. Bull. Sing. 57 (2005) 271. **Type:** *G. Shea SAN 75187*, Borneo, Sabah, G. Silam, Lahad Datu district (holotype K; isotypes SAN, SING).
Known only from G. Silam in lower montane *kerangas* on ultramafic substrate, at 400–900 m altitudes (e.g., the type, *J.H. Beaman 6991*, *SAN 37845* and *SAN 75180*).

## 6. **Tristaniopsis merguensis** (Griff.) P.G.Wilson & J.T.Waterh.
(of Mergui, Peninsular Myanmar)

Austral. J. Bot. 30 (1982) 439; Turner *op. cit.* (1996) 388; Coode *et al.* (eds.) *op. cit.* 241; Argent *et al.* (eds.) *op. cit.* 474; Parnell & Chantaranothai *op. cit.* (2002) 413; Beaman & C. Anderson *op. cit.* 230. **Basionym:** *Tristania merguensis* Griff., Cantor Pl. (1837) 18, Duthie *in* Hooker *f. op. cit.* 466, King *op. cit.* 72, Merrill *op. cit.* (1921) 435, Ridley *op. cit.* (1922) 715, *op. cit.* (1930) 37, Masamune *op. cit.* 542, Kochummen *op. cit.* 252, J.A.R. Anderson *op. cit.* (1980) 282. **Type:** *Griffith s.n.*, Peninsular Myanmar, Mergui, Tennaserin (holotype CAL, *n.v.*; isotype K). **Heterotypic synonyms:** *Tristania maingayi* Duthie *in* Hooker *f. op. cit.* 467, King *op. cit.* 72, Ridley *op. cit.* (1922) 715; *Tristania subauriculata* King *op. cit.* 72, Ridley *op. cit.* (1922) 714; *Tristania grandifolia* Ridl. *op. cit.* (1930) 38, Masamune *op. cit.* 542, Burgess *op. cit.* 417, J.A.R. Anderson *op. cit.* (1980) 281, *Tristaniopsis grandifolia* (Ridl.) P.G.Wilson & J.T.Waterh. *op. cit.* 439; *Tristania stellata* Ridl. *op. cit.* (1930) 38, Masamune *op. cit.* 542, J.A.R. Anderson *op. cit.* (1980) 282, *Tristaniopsis stellata* (Ridl.) P.G.Wilson & J.T.Waterh. *op. cit.* 439.

Canopy tree to *c.* 30 m tall, to *c.* 40 cm diameter. **Bark** red-brown, becoming irregularly cracked and coarsely flaky in scroll-like pieces, fibrous; inner bark pale red-brown, rather crumbly. **Sapwood** rich red-brown, hard. Inflorescence rachis persistently minutely yellow-brown pubescent, flower buds caducously so, parts otherwise glabrous. **Twigs** 3–5 mm diameter apically, round in cross-section, glabrous, smooth but soon becoming thinly flaky. **Leaves** subsessile, leathery, glabrous; blade elliptic to obovate, *c.* 10 × 4(6–17 × 2–7) cm, *base distinctly auriculate in juvenile leaves but less distinctly so in mature leaves*, *apex obtuse*, *sharply acute to broadly acuminate*; main lateral veins shallowly furrowed to slightly raised above, raised below, (17–)28(–34) pairs, 2–8 mm apart, ascending; intramarginal vein *c.* 1 mm within margin; petioles very short or 8–10 mm long. **Inflorescences** *cymose*, 8–12 cm long; rachis 5x-branched. **Flowers:** buds *c.* 3 mm long, *c.* 2 mm diameter; pedicel *c.* 2.5 mm long; calyx lobes *c.* 1 × 1 mm; petals *c.* 1.5 mm; *stamens* (*3–*)*5–10 per cluster*, filament 1–2 mm long, anther *c.* 0.1 mm. **Fruits** large, ellipsoid-globose, *to 10 mm long*, *c. 8 mm diameter*; pedicel 0.5–1 mm long. **Seeds** elliptic, *c.* 8 × 3 mm.

**Vernacular name.** Sarawak—*terkoyong-terkoyong* (Malay).

**Distribution.** Peninsular Myanmar, Thailand, Sumatra, Peninsular Malaysia, Singapore and Borneo.

**Ecology.** Lowland mixed peat swamp forest over sandy alluvium especially in the Lawas, NE Sarawk swamp, *kerangas* forest over ultramafic rock and rarely on limestone hill and organic soil on high ridge tops at altitudes to 1000 m.

**Notes.** In Borneo, two subspecies are recognised.

**Key to subspecies**

Leaf blades generally larger, base auriculate, apex obtuse or sharply to broadly acute; petiole very short, to *c.* 2 mm long. Inflorescences to 12 cm long……

subsp. **merguensis**

Distribution and ecology as the species. In Borneo recorded in Sabah from Beaufort, Lahad Datu and Sipitang districts (e.g., *SAN 12085*, *SAN 66926*, *SAN 68396* and *SAN 73354*) and in Sarawak from Bintulu, Kuching, Lawas, Marudi and Serian districts (e.g., *BRUN 808*, *BRUN 819*, *Beccari 3676*, *S 13356*, *S 15947*, *S 30830* and *S 42956*). Also known from Brunei (e.g., *S 5898*) and E Kalimantan (e.g., *Kostermans 13137*).

Leaf blade smaller, base not auriculate, apex broadly acuminate, acumen to 5 mm long; petiole 8–10 mm long. Inflorescences shorter, to *c.* 8 cm long……..

subsp. **tavaiensis** P.S.Ashton Plate 8D.

Gard. Bull. Sing. 57 (2005) 273. **Type:** *L. Madani SAN 81723*, Borneo, Sabah, Bt. Tawai FR, Kinabatangan district (holotype K; isotypes KEP Barcode 101639, SAN, SING).

Known only from Bt. Tawai FR, Sg. Meliau, Kinabatangan district in Sabah (e.g., the type, *Zainudin 5029*, *Cheksum Tawan CST 285*, *FRI 41350* and *SAN 135176*).

Local, in forest overlying ultramafic rock.

## 7. **Tristaniopsis microcarpa** P.S.Ashton

(Greek, *micros* = minute, *karpos* = a fruit; referring to the tiny capsule)

Gard. Bull. Sing. 57 (2005) 273, *ibid.* 61, 1 (2009) 14. **Type:** *H.S. Martyn SAN 21623*, Borneo, Sabah, Look Mengulang, P. Sakar, Lahad Datu district (holotype K; isotypes BO, KEP Barcode 101587, L, SAN, SAR, SING).

Canopy tree to 30 m tall, to 40 cm diameter. **Bark** at first smooth greenish to yellow- or rust-brown, later exfoliating in large grey-brown scroll-like strips, eventually becoming shaggy towards base. Living parts shortly greyish puberulent, more or less persistent but becoming sparse on inflorescence and exposed parts of flower and fruit, elsewhere early glabrescent. **Twigs** *c.* 5 mm diameter apically, round in cross-section, stout, drying blackish at endings, becoming grey-brown and thinly peeling. **Leaves** *thinly to thickly leathery*, drying dull olive-brown, darker and pitted above, *glabrous or persistently buff-cinereous and densely minute- or sparsely large-dotted beneath*; *blades oblanceolate*, (*8–*)*13–35* × (*3–*)*5–12 cm*, *base more or less attenuate*, apex shortly broadly acuminate or blunt; main lateral veins 25–30 pairs, with variably distinct intermediate veins, dense, spreading, raised throughout more so beneath; intercostal venation lax, distinct; intramarginal vein 2–4 mm within margin; *petioles usually very short* (*leaves subsessile*) or occasionally to 15 mm long. **Inflorescences** *cymose or corymbose*, subterminal-axillary, *c.* 20 cm long; rachis *c.* 15 cm long, stout, erect, *c.* 3 mm diameter at base, elliptic in cross-section, 4x-branched, many-flowered. **Flowers** yellowish; buds subglobose, *c.* 3 mm across; pedicel *c.* 1 mm long; calyx lobes ovate, *c.* 0.3 × 0.3 mm, acute; petals 0.8 mm long; stamens 3(–4) opposite each petal, central filament *c.* 1.5 mm long, lateral ones *c.* 0.8 mm long, anthers minute, spherical; style *c.* 1 mm long. **Fruits** *c.* 6 mm long, *c.* 4 mm diameter, *c.* 6 mm wide when open. **Seeds** many, small.

**Distribution.** Endemic to Borneo.

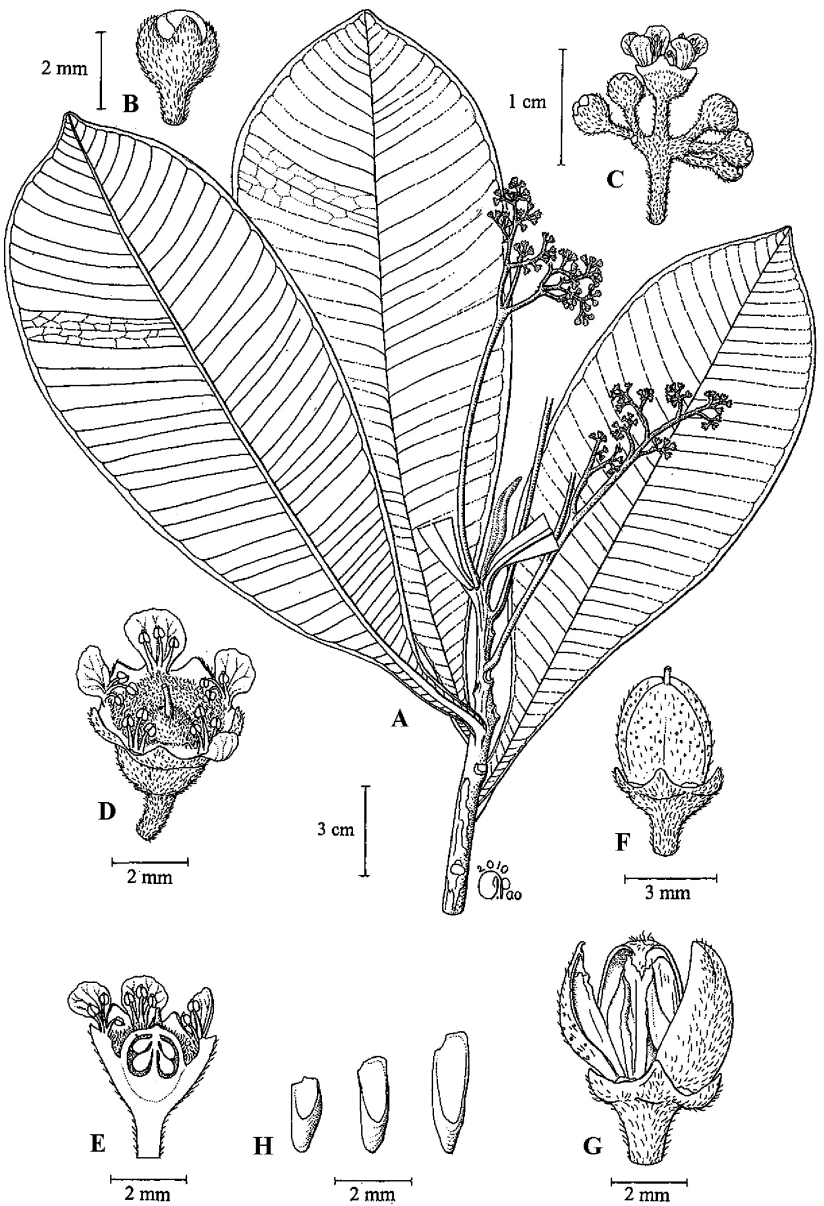


**Fig. 23.** *Tristaniopsis microcarpa* subsp. *microcarpa*. A, flowering leafy twig; B, flower bud; C, distal end of inflorescence; D, open flower; E, longitudinal section of open flower; F, fruit; G, dehiscing fruit; H, seeds. (A–B from *SAN 83534*, C–E from *SAN 21623*; F–H from *S 32801*.)

**Ecology.** Locally frequent in mixed dipterocarp forest at altitudes to 1000 m, on clay and sandy clay soils over both sedimentary and also ultramafic rocks where it is sometimes common on bank of rocky rivers.

**Note.** Two subspecies are recognised.

**Key to subspecies**

Mature trees to 30 m tall, to 40 cm diameter. Living parts shortly greyish puberulent, glabrescent. Leaves thinly leathery. Inflorescence cymose……..

subsp. **microcarpa** Fig. 23.

Locally frequent in mixed dipterocarp forest at altitudes to 1000 m, on sandy clay soils over both sedimentary and ultramafic rocks. In Sabah widespread, recorded from Kinabatangan, Lahad Datu and Sandakan districts (e.g., *SAN 21623*, *SAN 26655*, *SAN 26995*, *SAN 52602*, *SAN 83534*, *SAN 93896* and *SAN 134716*), and in Sarawak from Kapit, Lawas and Marudi districts (e.g., *S 32801*, *S 38913*, *S 41468* and *S 62110*). Also known in C Kalimantan (e.g., *Argent & Wilkie 943*, *Jarvis & Ruskandi 6212*).

Mature trees to 15 m tall, to 20 cm diameter. Living parts persistently densely buff-cinereous. Leaves thickly leathery. Inflorescence corymbose……..

subsp. **corymbosa** P.S.Ashton

(Latin, *corymbosus* = a flat-topped or convex open flower-cluster; referring to the inflorescence)

Gard. Bull. Sing. 61, 1 (2009) 15. Type: *Kodoh & Tarmiji SAN 83666* [erroneously stated as *SAN* "*8366*" in the original publication], Borneo, Sabah, mile 87.5, Hap Seng logging area, Telupid, Kinabatangan district (holotype K; isotypes KEP Barcode 100819, L, SAN, SING).

Endemic to Sabah (Kinabatangan and Lahad Datu districts); apparently restricted to forest on ultramafic substrate (Bt. Tawai and G. Silam) and lower montane *kerangas* (G. Lotung), at 850–1000 m altitude (e.g., the type, *FRI 36238*, *FRI 41309*, *SAN 13451*, *SAN 63945* and *SAN 70315*).

## 8. **Tristaniopsis obovata** (Benn.) P.G.Wilson & P.T.Waterh.

(Latin, *obovatus* = obovate; referring to the shape of leaf blades)

Austral. J. Bot. 30 (1982) 439; Turner *op. cit.* (1996) 388; Coode *et al.* (eds.) *op. cit.* 241; Argent *et al.* (eds.) *op. cit.* 474. **Basionym:** *Tristania obovata* Benn., Pl. Jav. Rar. (1838) 127, *t.* 27, Miquel, Fl. Ind. Bat. 1, 1 (1855) 397, Kochummen *op. cit.* 253, J.A.R. Anderson *op. cit.* (1980) 282. **Type:** *Horsfield s.n.*, Sumatra, Bangka Isl. (holotype BM, *n.v.*). **Heterotypic synonyms:** *Tristania clementis* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 239, Masamune *op. cit.* 542, J.A.R. Anderson *op. cit.* (1980) 281, Burgess *op. cit.* 417, *Tristaniopsis clementis* (Merr.) P.G.Wilson & J.T.Waterh. *op. cit.* 439, ***syn. nov.***, **type:** *M.S. Clemens 9570*, Borneo, Sabah, Jesselton (Kota Kinabalu), 23 Oct. 1915 (holotype not traced; fragment NY); *Tristania spathulata* Ridl., J. Str. Br. Roy. As. Soc. 82 (1920) 184, *op. cit.* (1922) 715.

Treelet or canopy tree to 20 m tall, to 20 cm diameter. **Bark** at first smooth, then peeling off in scroll-like strips, new unpeeled bark dark brown, old unpeeled bark light greyish brown; inner bark reddish yellow. Twig, leaf beneath, inflorescence and young flower bud rusty puberulous, glabrescent on twig and bud, more or less caducous on inflorescence, early glabrescent to sparsely persistent on leaf blade beneath. **Twigs** *c.* 2 mm thick apically, reddish brown, round in cross-section, smooth soon peeling. **Leaves** leathery, glabrous, pink-brown and densely pitted above, warm brown to coppery and finely dotted beneath;

*blades obovate*, *lanceolate to occasionally oblanceolate*, *c. 7 × 2.5*(*4.5–10.5 × 2–3*) *cm*, *base wedge-shaped tapering into petiole*, apex notched to 4 mm shortly acuminate; main lateral veins *c*. 17 pairs with shorter intermediate veins, slightly raised or flat above and below, obscure, 3–5 mm apart, ascending; intramarginal vein *c*. 1 mm within margin; *petioles 10–18 mm long*. **Inflorescences** *cymose*, *c.* 6.5 cm long; rachis 3x-branched. **Flowers:** buds *c.* 3.5 mm long, *c.* 4 mm diameter; pedicel *c.* 2 mm long; calyx lobes *c.* 2 × 3 mm; petals *c.* 1 mm wide; *stamens c. 4*(*–5*) *per cluster*, 1–2.5 mm long, filament 0.8–2 mm long, anther *c.* 0.2 mm. **Fruits** ellipsoid, *c. 9 mm long*, *c. 5 mm diameter*; pedicel *c*. 2 mm long. **Seeds** many, flat-ellipsoid, *c.* 0.5 × 0.2 mm.

**Distribution.** Sumatra (Bangka Isl.), Peninsular Malaysia, Java and Borneo. In Sabah widespread, recorded from Beaufort, Kinabatangan, Kuala Penyu, Sandakan and Sipitang districts (e.g., *SAN A 3035*, *SAN 36658*, *SAN 55774*, *SAN 72527*, *SAN 78163*, *SAN 80597*, *SAN 108806*, *SAN 132103*, *SAN 132124* and *SAN 140717*) and in Sarawak from Bintulu, Kapit, Kuching, Limbang, Miri and Serian districts (e.g., *S 1100*, *S 1211*, *S 8635*, *S 18006* and *S 32159*). Also known in Brunei (e.g., *BRUN 399*, *S 1171*, *Dransfield J.D. 6522*, *Coode 6863* and *S 7801*) and Kalimantan.

**Ecology.** Coastal islands, rocky and sandy shores, and open *kerangas* on raised beaches, limestone karst summits and ridges including ultramafic substrate at altitudes to 1300 m; locally common.

## 9. **Tristaniopsis pentandra** (Merr.) P.G.Wilson & J.T.Waterh.

(Greek, *penta* = five, *andros* = a man; referring to the five stamens in each flower)

Austral. J. Bot. 30 (1982) 439; Coode *et al.* (eds.) *op. cit.* 241. **Basionym:** *Tristania pentandra* Merr., J. Str. Br. Roy. As. Soc. 77 (1917) 228, *op. cit.* (1921) 435, Masamune *op. cit.* 542, J.A.R. Anderson *op. cit.* (1980) 282. **Type:** *Foxworthy 378*, Borneo, Sarawak, G. Pueh, Kuching district (holotype PNH, *n.v.*; isotype ? SING).

Tree to 25 m tall, to 40 cm diameter. **Bark** at first smooth, glaucous greyish or rust-brown with purplish or coppery stripes, peeling in scroll-like strips. *Young parts greyish puberulent*, *glabrescent on twigs*, *caducous on petiole and leaf*, persistent on flower and fruit calyx, persistent but becoming sparse on inflorescence. **Twigs** *c. 3 mm diameter apically*, round in cross-section, grey-brown, at first smooth, later peeling. **Leaves** leathery, drying mauve-grey, paler and densely pitted above, *dull and obscurely dotted beneath*; *blades lanceolate or oblanceolate c. 13 × 5*(*9–16 × 2–7*) *cm*, *base wedge-shaped tapering into petiole*, apex acute to broadly acute; *main lateral veins c. 22 pairs*, *with shorter less prominent intermediates veins*, furrowed above, raised below, ascending; intramarginal vein *c.* 1 mm within margin; *petioles c. 8*(*–15*) *mm long*. **Inflorescences** *c.* 8 cm long; rachis 4x-branched. **Flowers:** buds *c.* 2.5 mm long, *c.* 1 mm diameter; pedicel *c.* 1 mm long; calyx drying finely wrinkled, obscurely warty, lobes *c.* 0.2 × 0.2 mm; petals *c*. 0.8 mm wide; *stamens 1 opposite each petal*, filament *c.* 1 mm long, anther *c.* 0.2 mm. **Fruits** ellipsoid, *c. 3 mm long*, *c. 2 mm diameter*; pedicel *c.* 2 mm long. **Seeds** many, oblong, *c.* 3 × 1 mm, flat.

**Distribution.** Endemic to Borneo. In Sabah recorded from Kinabatangan and Sipitang districts (e.g., *Wong WKM 2142*, *Wong WKM 2204* and *SAN 141804*) and in Sarawak from Bau, Kapit, Kuching, Lawas, Limbang, Lundu, Song and Sri Aman districts (e.g., *S 13156*, *S 13276*, *S 15096*, *Clemens 20071*, *Clemens 20092*, *S 32862*, *S 34929*, *S 36126*, *S 36311*, *S*

*40916*, *S 47361*, *S 50460*, *S 80189* and *S 80190*). Also known in Brunei (e.g., *Dransfield 7152*, *Coode 7885* and *SAN 17464*).

**Ecology.** Lowland mixed peat swamp forest and lowland and lower montane *kerangas* including pole forest on shale and basalt, at altitudes to 1800 m.

## 10. **Tristaniopsis rubiginosa** S.Teo *ex* P.S.Ashton

(Latin, *rubiginosus* = red-brown; referring to the indumentum)

Gard. Bull. Sing. 57 (2005) 274. **Type:** *Purseglove 5053*, Borneo, Sarawak, Telok Asam, Bako NP, Kuching district (holotype K; isotypes SAR, SING).

Small tree to 7 m tall, to 15 cm diameter. **Bark** pale grey and mauve, peeling and scroll-marked; inner bark whitish. **Sapwood** dark yellow-brown. *Young parts densely dark warm brown pubescent*; indumentum caducous successively on petiole, twig, inflorescence and hypanthium, *more or less persisting on lower leaf surface* and fruit. **Twigs** *c. 5 mm diameter apically*, somewhat flattened at first, becoming round in cross-section, smooth, blackish when dry, eventually thinly flaking. **Leaves** thickly leathery, *distinctly persistently dark chocolate-brown pubescent beneath*, fading to mauve in fallen leaves, *drying dull*, mauve-brown and densely pitted above, obscurely dotted beneath; *blades broadly elliptic to obovate*, *10–17*(*–28*) × *5–9 cm*, *base wedge-shaped narrowly tapering down sides of petiole*, margin prominently recurved, apex *c.* 1 cm long broadly acuminate or bluntly rounded; *main lateral veins c. 26 pairs*, *with unequally dispersed more or less equal intermediate veins*, spreading, slender but distinctly raised beneath, visible but hardly raised above; intercostal venation obscure, lax; *petioles* stout, *10–17 mm long*. **Inflorescences** *cymose*, *c.* 12 cm long, terminal or subterminal-axillary; rachis 3x-branched, drying flattened and ribbed. **Flowers:** buds ellipsoid, *c.* 5 mm long, *c.* 3 mm diameter; hypanthium obconical; *stamens 3–4 per cluster*. **Fruits** *c. 5 mm long*, *c. 4 mm diameter*, (dehisced fruits *c.* 7 mm diameter). **Seeds** many, small.

**Distribution.** Endemic to Borneo. Known with certainty in Sarawak from Bako NP and Sampadi FR, Kuching district (e.g., the type, *S 10315*, *S 10408*, *S 10495*, *S 12341*, *S 17868*, *S 66799* and *S 81530*). Also known in Brunei (e.g., *BRUN 647*).

**Ecology.** Locally common at the Bako NP, Sarawak in *kerangas* on sandstone plateaux and raised beaches.

## 11. **Tristaniopsis whiteana** (Griff.) P.G.Wilson & J.T.Waterh.

(Rev. White, Christian chaplain in Singapore, *c.* 1841)

Austral. J. Bot. 30 (1982) 440; Kessler & Sidiyasa, TBSA-EK (1994) 186; Turner *op. cit.* (1996) 389; Coode *et al.* (eds.) *op. cit.* 241; Argent *et al.* (eds.) *op. cit.* 475. **Basionym:** *Tristania whiteana* Griff., Pl. Cantor. (1837) 18, J. As. Soc. Beng. 23 (1854) 637, King *op. cit.* 73, Merrill *op. cit.* (1921) 436, Ridley *op. cit.* (1922) 716, Masamune *op. cit.* 542, Airy Shaw, Kew Bull. 4 (1949) 118, Burgess *op. cit.* 417, Kochummen *op. cit.* 253, J.A.R. Anderson *op. cit.* (1980) 282. **Type:** *Rev. White s.n.*, Singapore (CAL, *n.v.*). **Synonyms:** *Tristania sumatrana* Miq., Fl. Ind. Bat., Suppl. (1860) 308; *Tristania wightiana* Griff. *ex* Duthie *in* Hooker *f. op. cit.* 466.

Canopy or emergent tree, 20–45 m high, 30–150 cm diameter; buttresses concave-rounded. **Bark** whitish to light greenish grey or brilliant coppery brown, at first smooth, later peeling

in scroll-like strips; inner bark whitish. **Sapwood** yellowish. Leaf beneath, rachis, flower bud and fruit sparsely or densely more or less persistently grey-brown puberulent, or sometimes glabrous. **Twigs** *c.* 2 mm thick apically, slender, round in cross-section, glabrous, smooth eventually thinly peeling. **Leaves** thinly leathery, shiny fresh green when alive, *drying rich dark olive-brown*, *glistening beneath*; *blades* oblong to lanceolate, *c. 13 × 4*(*7–17 × 2.5–4.5*) *cm*, *base narrowly wedge-shaped or gradually tapering towards short petiole*, apex sharply acute; *main lateral veins subequal*, (*54–*)*68*(*–92*) *pairs*, *dense*, slender, slightly but distinctly raised on both surfaces; intramarginal vein *c.* 1 mm within margin; *petioles slender*, (*5–*) *8*(*–12*) *mm long or very short*. **Inflorescences** *cymose*, *c.* 10 cm long; rachis 5x-branched. **Flowers** cream with yellow stamens; buds *c.* 1.5 mm long, *c.* 1 mm diameter; pedicel *c.* 1 mm; calyx minutely warty, not ribbed, lobes *c.* 0.5 × 1 mm; petals *c.* 1.5 mm wide; *stamens 1 or 3 per cluster opposite each petal*, filament *c.* 1.5 mm long, anther *c.* 0.2 mm. **Fruits** ellipsoid, *c. 4 mm long*, *c. 3.5 mm diameter*. **Seeds** many, *c*. 0.4 × 0.2, elliptic.

**Vernacular name.** Sarawak—*selunsor putih* (Malay).

**Distribution.** Sumatra, Peninsular Malaysia, Singapore and Borneo.

**Ecology.** Locally abundant in primary and secondary forest on river banks from the lowland to upper dipterocarp forest on clay and *kerangas* on sandy soils at altitudes to 1500 m.

**Notes.** In Borneo, two subspecies are recognised.

**Key to subspecies**

Larger tree to 45 m tall, 150 cm diameter. Bark whitish to light greenish grey. Leaves distinctly petiolate, base wedge-shaped. Stamens 3 per cluster opposite each petal…….

subsp. **whiteana** Plate 8E.

Distribution and ecology as the species. In Borneo widespread; known in Sabah from Beaufort, Kinabatangan, Kudat, Lahad Datu, Ranau, Sandakan, Tambunan, Tawau, Tenom and Tuaran districts (e.g., *SAN 30876*, *SAN 51084*, *SAN 77725*, *SAN 79604* and *SAN 83584*) and in Sarawak from Belaga, Bintulu, Kapit, Kuching, Lundu, Miri and Serian districts (e.g., *S 4219*, *S 5399*, *SFN 10394*, *S 15224*, *S 25783*, *SFN 35672*, *S 39731*, *S 40049*, *S 47100* and *S 57385*). Also known in Brunei (e.g., *BRUN 485* and *BRUN 881*) and W, C and E Kalimantan (e.g., *Mogea 3555* and *van Balgooy 5340*).

Tree of smaller stature, to 25 m tall, 30 cm diameter. Bark brilliant coppery brown. Leaves subsessile or sometimes with a very short petiole, base gradually attenuating toward petiole. Stamens 1 opposite each petal……

subsp. **monostemon** P.S.Ashton

(*mono* = one, *stemon* = stamen; referring to the solitary stamen opposite each petal)

Gard. Bull. Sing. 57 (2005) 277. Type: *Dan S 3033*, Borneo, Sarawak, Lambir Hills NP, Miri district (holotype K; isotypes L, SAN, SAR).

Locally gregarious in forest on the banks of white or black water rivers and in *kerangas* on sandstone rocks. Known with certainly in Sarawak from Bintulu, Kuching, Lundu and Miri districts (e.g., *S 15452*, *S 16457*, *S 46502*, *S 75411* and *S 75432*), Brunei (e.g., *BRUN 3303*, *Coode MC 7102* and *BRUN 15109*) and W Kalimantan (e.g., *Church et al. 1745*).

# 12. **UROMYRTUS** Burret

(Latin, *uro* = tailed, *myrtus* = the myrtle tree; referring to the prominent tail-like anther connective)

Notizbl. Bot. Gart. Belin-Dahlem 15 (1941) 490; Scott, Kew Bull. 33 (1979) 511; Snow & Guymer, Syst. Bot. 26, 4 (2001) 733.

Small trees or shrubs. Living parts minutely hairy. **Twigs** *round* or elliptic *in cross-section*. **Leaves** *laminar*, *decussate*, *opposite*, more or less leathery, dull below, variable above, margin flat; *venation obscure*, *pinnate*, with intramarginal vein close to margin; pits and gland-dots various or *absent*; with 1 or more pairs of rust-brown hairs in the stipule position; distinctly petioled. **Inflorescences** *1*(*–3*)*-flowered*, terminal or axillary; peduncles recurved. **Flowers** 4–5-merous; hypanthium urn-shaped, not exceeding ovary; calyx lobes small, erect persistent; petals present, *c.* 7 mm long; *stamens many*, multiseriate, not clustered, *anther with appendage exceeding apex with one prominent and several lesser glands*; *ovary inferior*, (*2–*)*3-locular*, each locule usually with many ovules in 2 vertical rows, placentation axile, style columnar, stigma small. **Fruit** *a berry*. **Seeds** *1–many*, hard, flat; embryo more or less curved, cotyledons shorter than the thick hypocotyls.

**Distribution.** About 14–16 species; one in Borneo, 3 in New Guinea, 6–9 in New Caledonia and 4 in eastern Australia. In rain forest climates, including forest but also open areas, at altitudes to 1500 m.

**Ecology.** In Borneo, very local in open forest on sandstone tableland and in lower facies of upper montane forest on rocky summits of isolated mountains, at altitudes to 800 m.

**Notes.** *Myrtus* and *Xanthomyrtus* share a staminal appendage terminating in a gland, but in *Uromyrtus* the staminal connectival appendage extends prominently beyond the anther and is multiglandular; ovules are in 2 rows within each locule as in *Xanthomyrtus* but not *Myrtus*.

## **Uromyrtus sarawakensis** A.J.Scott

Fig. 24.

(of Sarawak)

Kew Bulletin 33 (1979) 513. **Type:** *Brunig S 10403*, Borneo, Sarawak, Bako NP, Kuching district (holotype K; isotype L).

Treelet or shrub, with diffuse crown. **Bark** smooth. Young leaves and flowers villous, parts otherwise glabrous. **Twigs** *c.* 1 mm diameter apically, round in cross-section, grey-brown, finely cracked and flaking. **Leaves** thinly leathery, drying dull or shagreened pink-brown, darker beneath, dots and pits obscure; blades ovate-lanceolate, 2.5–6 × 1–2.5 cm, base broadly wedge-shaped terminating abruptly at petiole, apex *c.* 1 cm acuminate; venation obscure but for slightly raised main lateral and intramarginal veins beneath; lateral veins unequal, main ones *c.* 4 pairs; intramarginal veins 2–4 mm within margin more so towards base, hardly looped; petioles slender, *c.* 4 mm long. **Flowers** solitary, axillary; peduncles slender, *c.* 15 mm long, *c.* 0.5 mm diameter, subtended by *c.* 2 mm long linear bracteoles; buds urn-shaped, *c.* 5 mm across; calyx lobes ovate-deltoid subacute, *c.* 2 × 1 mm; petals white, *c.* 7 mm long; stamens 15–20, 2–3-seriate, with *c.* 1 mm short stout pale yellow filaments and oblong anthers with *c.* 0.2 mm conical appendages; ovary 3-loculed, each locule with 1–few ovules, style *c.* 3 mm long. **Fruits** ripening red to black, spherical, *c.* 5

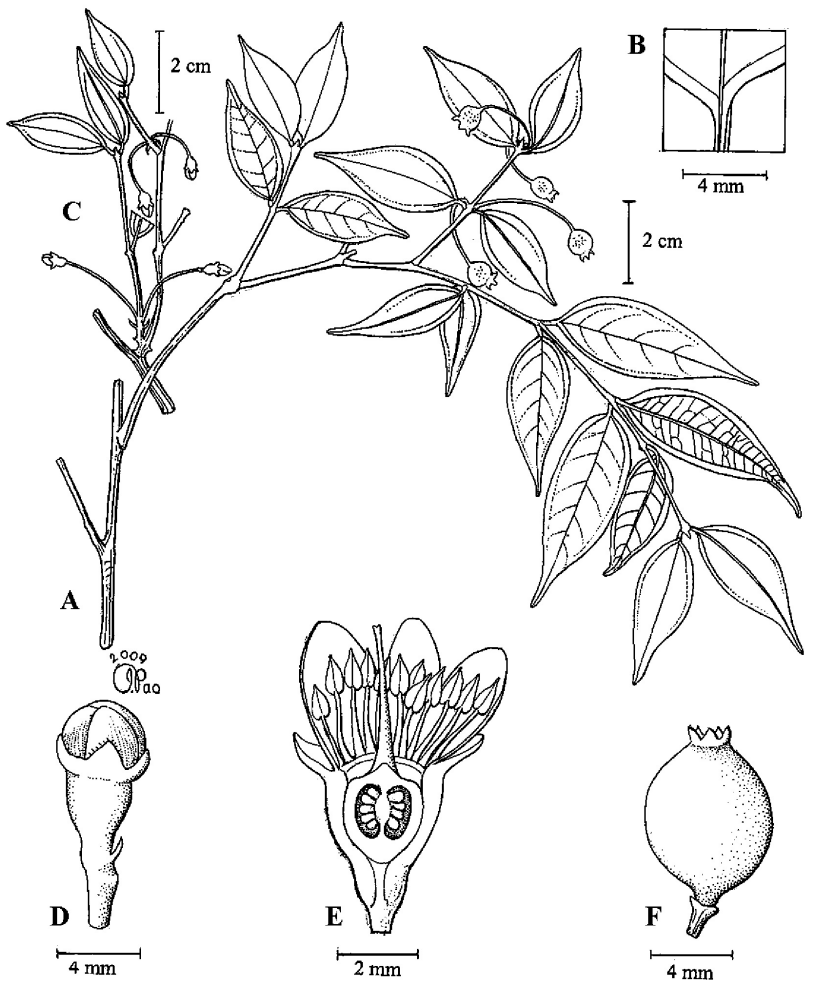


**Fig. 24.** *Uromyrtus sarawakensis*. A, fruiting leafy twig; B, 3-veined base of upper leaf surface; C, flowering leafy twig; D, flower bud; E, longitudinal section of open flower; F, fruit. (A–B from *Chew CWL 1409*, C–D from *S 29916*, E from *S 8378*; F from *S 10403*.)

mm diameter, with persistent *c.* 2 mm erect calyx lobes. **Seeds** 1–3, kidney-shaped; testa bony.

**Distribution.** Endemic to Borneo; so far recorded only in Sarawak from Bako NP (the type, *Purseglove 5608*, *Purseglove 5633*, *S 9921*, *S 17933*, *S 29916* and *S 42605*), the summits of G. Matang (e.g., *Beccari 2933*) and G. Santubong (e.g., *Chew CWL 1409*) all in Kuching district.

# 13. **WHITEODENDRON** Steenis

(Cyril Tenison White, 1890–1950, Australian botanist, *dendron* = tree)

Act. Bot. Neerl. 1 (1952) 436; J.A.R. Anderson, CLTS (1980) 282; Coode *et al.* (eds.), CLBD (1996) 241.

Large glabrous tree. **Leaves** *laminar*, *spirally arranged pinnately veined*; terminal leaf bud falcate; *blade prominently unequal-sided*; lateral veins slender, unequal, densely parallel. **Inflorescences** *divaricate-paniculate*. **Flowers** large, pedicellate; perianth 5-merous; hypanthium saucer-shaped, calyx lobes prominent; petals large, elliptic; *stamens many*, *united at base into 5 bundles opposite petals*, free filaments slender, long; ovary semi-inferior, 3-loculed, each locute with many ovules, style short, slender, stigma minute. **Fruit** *a one-seeded*, *3-valved almost superior capsule*. **Seeds** basifixed, oblique, ellipsoid; testa hard; cotyledons unequal, the outer one thick, the inner thin and folded; plumule stout, terminal.

**Distribution.** Monotypic genus endemic to Borneo.

## **Whiteodendron moultonianum** (W.W. Sm.) Steenis Fig. 25.

(John Coney Moulton, 1886–1926, former Curator of the Sarawak Museum and founder of its journal)

Act. Bot. Neerl. 1 (1952) 439; Browne, FTSB (1955) 279; J.A.R. Anderson *op. cit.* (1980) 282; Coode *et al.* (eds.) *op. cit.* 241. **Basionym:** *Tristania moultoniana* W.W.Sm., Not. Roy. Bot. Gard. Edinb. 8 (1915) 328, Merrill *op. cit.* (1921) 435, Masamune *op. cit.* 542. **Type:** *Native Collector 172*, Borneo, Sarawak, Kuching (holotype E; isotype K).

Large canopy tree, *c.* 40 m tall, *c.* 70 cm diameter; bole stoutly ribbed extending as low sinuous buttresses. **Bark** rusty brown, flaky; inner bark thin, rust-brown. **Sapwood** yellow-brown, hard; heartwood rust-brown. Parts glabrous. **Twigs** 2–3 mm diameter apically, round in cross-section, rust-brown, smooth, with prominently raised circular leaf scars. **Leaves** spirally arranged, leathery, pits and dots obscure, drying dull rich rust-brown; blades obovate-oblanceolate, *c.* 8 × 4(5–20 × 2–6) cm, prominently unequal-sided, base tapering to petiole, apex subacute to rounded; midrib stout, round, prominent beneath, furrowed with lateral ridges above; lateral veins *c.* 25 pairs, with many more or less unequal intermediate veins, all reaching the intramarginal veins, very slender, straight, elevated beneath somewhat obscure above; intercostal venation almost parallel but branched, evident beneath; intramarginal veins 2 pairs, the main ones *c.* 6 mm within margin at the widest part of blade, closer elsewhere, hardly looped; petioles stout, *c.* 2 mm long. **Inflorescences** terminal or subterminal-axillary panicles, *c.* 10 cm long; rachis 2x-branched, *c.* 2 mm

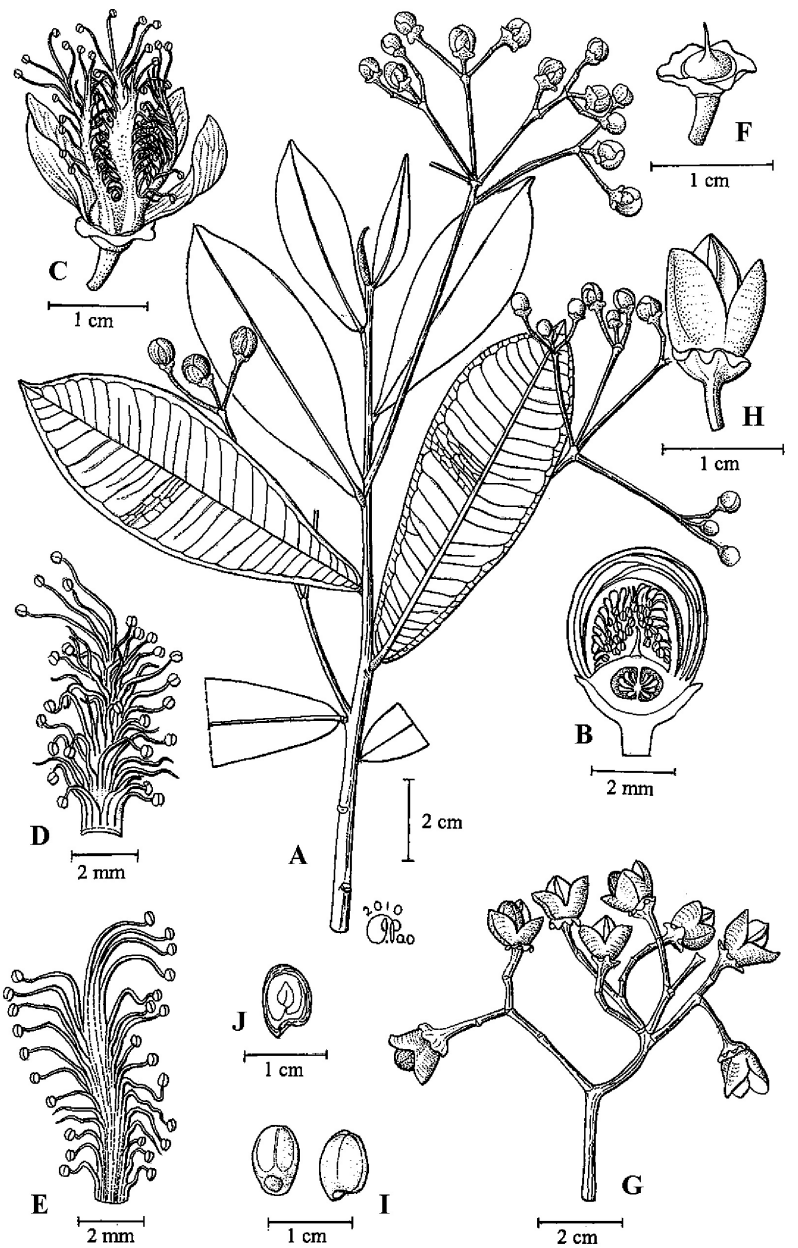


**Fig. 25.** *Whiteodendron moultonianum*. A, flowering leafy twig; B, longitudinal section of flower bud; C, open flower; D, adaxial view of stamen bundle; E, abaxial view of stamen bundle; F, young fruit; G, infructescence with mature dehisced fruits; H, dehiscing fruit; I, adaxial and abaxial side views of seeds; J, longitudinal section of seed. (A–B from *BRUN 53*, C–F from *S 1253*, G–J from *S 1280*.)

diameter at base, round or somewhat flattened in cross-section; bracts and bracteoles small, triangular, caducous. **Flowers:** buds spherical, *c.* 7 mm diameter; pseudostalk *c.* 5 mm long; hypanthium a shallow, *c.* 4 mm deep, faintly warty saucer; calyx lobes 5, hemispherical, *c.* 2 × 2 mm, hyaline, caducous; corolla cream; stamens pale green, many, in 5 fascicles adnate at base opposite petals, exserted to *c.* 4 mm, filaments short, anthers yellow; style short. **Fruits** broadly ellipsoid, *c.* 8 mm long, *c.* 7 mm diameter, 3(–4)-valved, subtended by the *c.* 5 × 6 mm obconical hypanthium with calyx rim.

**Vernacular names.** Sarawak—*melaban* (Malay), *kawi* (Iban).

**Distribution.** Endemic to Borneo; known in Sarawak from Kuching, Lundu, Marudi, Miri and Tatau districts (e.g., the type, *S 18005*, *S 38259*, *S 42994*, *S 44703*, *S 62281*, *S 66794*, *S 75422* and *S 76338*). Also recorded from Brunei (e.g., *BRUN 53*, *Wong WKM 333*, *S 7866* and *BRUN 5502*), and W Kalimantan (e.g., *bb 17145* and *bb 35256*).

**Ecology.** Locally common in mixed dipterocarp forest on deep leached yellow sands and sandy clay soils on low hills not far from Holocene coast lines, at altitudes to 450 m.

# 14. **XANTHOMYRTUS** Diels

(Greek, *xanthos* = yellow, *myrtus* = the myrtle tree; referring to the colour of the flowers)

*In* Engler, Bot. Jahrb. 57 (1922) 366; Scott, Kew Bull. 33 (1979) 461; J.A.R. Anderson, CLTS (1980) 282; Coode *et al.* (eds.), CLBD (1996) 242; Beaman & C. Anderson, PMK 5 (2004) 230.

Gnarled trees to 35 m tall or shrubs. **Twigs** *mostly pubescent or minutely warty*, *round in cross-section*. **Leaves** *minute*, *laminar*, *generally opposite*, leathery, small, *pinnately veined*, with minute fugaceous stipules, shortly petioled. **Flowers** solitary or *in terminal or axillary dichasia*; peduncles and pedicels short; bracts and bracteoles minute; hypanthium spherical or bell-shaped; *perianth 4*(*–5*)*-merous*; calyx lobes thick, distinct; *petals yellow or gold*, clawed at base; *stamens* (*10–*)*20*(*–40*) *in one series*, filaments slender tapering, yellow, anthers spherical, dorsifixed with an apical oil gland, dehiscing longitudinally; *ovary* (*2–*)*3*(*–4*)*-locular*, ovules 10–20 in each locule, arranged biserially, placentation axile or horizontal and biseriate, style filiform, caducous leaving a pit, stigma minute. **Fruit** *a fleshy berry*, reddish, generally ripening black, crowned with persistent calyx lobes that more or less adnate at base. **Seeds** many, kidney-shaped, hard; testa crustaceous; embryo horseshoe-shaped, with tiny cotyledons at the end of the curved embryo and elongated radicle.

**Distribution.** About 20 species, occurring in Borneo, the Philippines, Sulawesi, Maluku, New Guinea, the Bismarck Archipelago and New Caledonia. In Borneo one species.

**Ecology.** In shrublands on rocky submits, ultramafic and sandstone rocks, in upper montane forest including its lower facies at 600–2600 m altitude.

**Notes.** In the present account based largely on the readily observable morphological characters of the vegetative and reproductive structures, the three species (*X. flavida*, *X. moultonii* and *X. taxifolia*) previously recognised as distinct in Borneo are combined into a single species, *X. flavida*, with three subspecies.

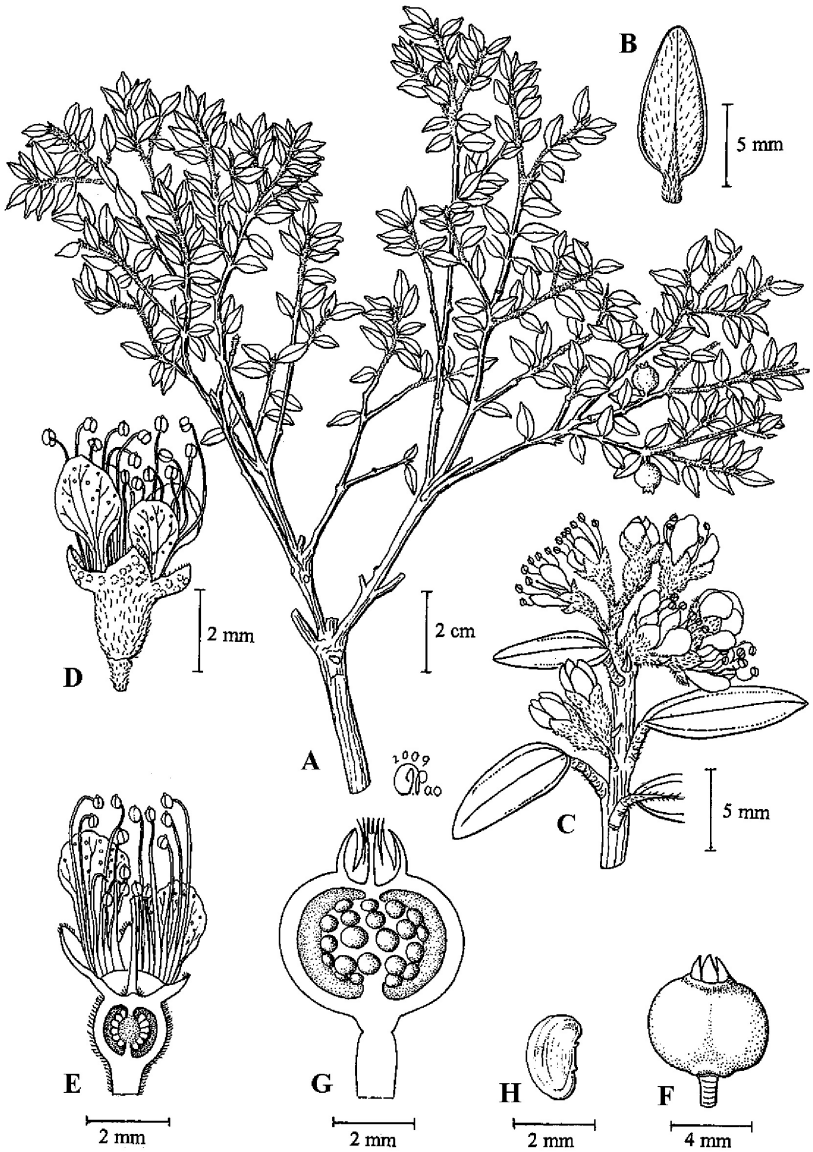


**Fig. 26.** *Xanthomyrtus flavida* subsp. *moultonii*. A, leafy twig; B, leaf lower surface; C, distal end of flowering leafy twig; D, open flower; E, longitudinal section of open flower; F, fruit; G, longitudinal section of fruit; H, seed. (A–B from *S 70900*, C–E from *S 50861*, F–H from *S 70900*.)

## **Xanthomyrtus flavida** (Stapf) Diels

(Latin, *flavidus* = yellowish; referring to the colour of the petals/flowers)

*In* Engler, Bot. Jahrb. 57 (1922) 366; Merrill, Sar. Mus. J. 3 (1928) 533; Masamune, EPB (1942) 543; J.A.R. Anderson *op. cit.* (1980) 282; Coode *et al.* (eds.) *op. cit.* 234 ("*flava*"); Beaman & C. Anderson *op. cit.* 230. **Basionym:** *Myrtus flavida* Stapf *in* Hooker, Ic. Pl. (1894) pl. 23, *t.* 2290, FMK (1894) 151, Merrill, EB (1921) 424. **Type:** *Haviland 1155*, Borneo, Sabah, Mt. Kinabalu (holotype K; isotypes BM, L Barcode L 0009720). **Heterotypic synonyms:** *Myrtus taxifolia* Ridl., Bull. Misc. Inform. Kew (1914) 209, Merrill *op. cit.* (1921) 424, *Xanthomyrtus taxifolia* (Ridl.) Merr. *op. cit.* (1928) 532, Masamune *op. cit.* 543, Scott *op. cit.* 466, J.A.R. Anderson *op. cit.* (1980) 282, ***syn. nov.***, **type:** *J. Anderson 188*, Borneo, Sarawak, G. Berumput, Lundu district (holotype K); *M. moultonii* Merr., J. Str. Br. Roy. As. Soc. 86 (1922) 337, *X. moultonii* (Merr.) Merr. *op. cit.* (1928) 533, Masamune *op. cit.* 543, Scott *op. cit.* 467, ***syn. nov.***, **type:** *Moulton 6747*, Borneo, Sarawak, G. Temasek, Ulu Baram, *c.* 2100 m, Nov. 2, 1920 (holotype PNH, ? destroyed; isotypes BM, K); *X. flavida* (Stapf) Diels var. *latifolia* Airy Shaw, Kew Bull. 4 (1949) 117, Scott *op. cit.* 466; **type:** *Richards 2508*, Borneo, Sarawak, Dulit Ridge, Belaga district (holotype K).

Treelet or much-branched shrub to 9 m tall, to 16 cm diameter. **Bark** dark grey-brown, flaky. Young parts pale cream-brown pubescent, the hairs ascending. **Twigs** 1–2 mm diameter apically. **Leaves** small, coriaceous, drying olive-brown, dull or glistening above, persistently villose at least on midrib beneath, distinctly or obscurely pitted above, gland-dotted beneath; blades ovate, ovate-lanceolate, elliptic-lanceolate to linear-lanceolate, sometimes obovate, (4–)8–20(–33) × 2–4(–11) mm, base obtuse or slightly cuneate, margin strongly recurved, apex obtuse, acute with blunt tip, acuminate, or sometimes broadly obtuse; midrib furrowed above, slightly raised beneath; lateral veins inconspicuous on both surfaces; petioles slender, 1–2.5 mm long. **Flowers** in 1–3-flowered axillary peduncle; hypanthium campanulate to turbinate, 1–2 mm long, densely villose; petals ovate, obovate to narrowly obovate, 2.5–5 × 2 mm; stamens free, 15–30; ovary 2–3-locular, ovules 10–20 per locule. **Fruits** 4–6 mm diameter, ripening purple or black. **Seeds** many, *c.* 1 mm diameter; embryo with broad cotyledons lying face to face.

**Distribution.** Borneo and Sulawesi.

**Ecology.** As the genus.

### Key to subspecies

1. Leaves linear-lanceolate, 10–18 × 2–4 mm; pits above and gland-dots beneath more or less obscure……
   subsp. **taxifolia** (Ridl.) P.S.Ashton, ***stat. nov.***
   (Latin, *Taxus* = the yew tree, *folius* = leaved; with leaves resembling that of yew tree, *i.e.* narrow but soft leaves)
   Basionym: *Myrtus taxifolia* Ridl. *op. cit.* (1914) 209, Merrill *op. cit.* (1921) 424. Type: *J. Anderson 188*, Borneo, Sarawak, G. Berumput, Lundu district (holotype K). Synonym: *Xanthomyrtus taxifolia* (Ridl.) Merr. *op. cit.* (1928) 532, Masamune *op. cit.* 543, Scott *op. cit.* 466, J.A.R. Anderson *op. cit.* (1980) 282.
   Treelet or shrub, 5–9 m tall, 8–16 cm diameter. Leaf base obtuse to slightly cuneate, apex acute with blunt tip. Flowers in 1-flowered axillary peduncle; hypanthium turbinate; ovary 2-locular, ovules 15–20 per locule.
   Endemic to Borneo; known with certainly only in Sarawak from G. Santubong in Kuching district (e.g., *S 21459*), G. Berumput and G. Pueh in Lundu district (e.g., the type, *Mjöberg 179*, *S 1410*, *Clemens 20294*, *S 47360* and *S 73528*) and G.

Silantek in Sri Aman district (e.g., *S 42614*). Local and uncommon in open shrubby lower facies of upper montane forest on rocky summits, at 600–1800 m altitude.

Leaves ovate, obovate, ovate-elliptic, ovate-lanceolate or elliptic-lanceolate; pits above and gland-dots beneath distinct……2

2. Living parts cream-brown villose, indumentum not at first caducous. Leaf blade ovate-lanceolate, ovate-elliptic to elliptic-lanceolate, 8–33 × 2–9(–11) mm, apex obtuse or acute with blunt tip……..

subsp. **flavida**

Synonym: *Xanthomyrtus flavida* (Stapf) Diels var. *latifolia* Airy Shaw *op. cit.* 117.

Much branched shrub to 2 m tall. Leaf base obtuse. Flowers in 1–3-flowered axillary peduncle; hypanthium turbinate; ovary 2–3-locular, ovules 10–12 per locule.

Distribution as the species. In Borneo, recorded in Sabah from Kota Belud, Lahad Datu and Ranau districts (e.g., *SPN 6821*, *Clemens 2781*, *Clemens 30252* and *SAN 95215*) and in Sarawak from Belaga, Miri and Sri Aman districts (e.g., *Hansen 1089*, *Richards 2508*, *S 3043* and *S 40415*). Also known in Brunei (e.g., *Wong WKM 1853*) and W Kalimantan (e.g., *Hallier 3432*).

Indumentum of living parts, that of flower excepted, soon caducous. Leaf blades ovate, obovate, or ovate-lanceolate or elliptic-lanceolate, 4–11 × 2–4 mm, apex broadly obtuse, acute or acuminate with blunt tip……..

subsp. **moultonii** (Merr.) P.S.Ashton, ***stat. nov.*** Fig. 26.

(John Coley Moulton, 1886–1926, Curator of the Sarawak Museum 1905–1915 and founder of its journal)

Basionym: *Myrtus moultonii* Merr. *op. cit*. (1922) 337. Type: *Moulton 6747*, Borneo, Sarawak, G. Temasek, Ulu Baram, *c.* 2100 m, Nov. 2, 1920 (holotype PNH, ? destroyed; isotypes BM, K). Synonym: *Xanthomyrtus moultonii* (Merr.) Merr. *op. cit.* (1928) 533, Masamune *op. cit.* 543, Scott *op. cit.* 467.

Much-branched shrub to 3 m tall. Leaf base obtuse. Flowers in 1-flowered axillary peduncle; hypanthium campanulate; ovary 2–3-locular, ovules 10–15 per locule.

Endemic to Borneo; known in Sabah from G. Tambuyukon, Kinabalu NP (e.g., *SPN 4822* and *SPN 5574*) and G. Trus Madi, Tambunan district (e.g., *SAN 133194*) and in Sarawak from G. Mulu, Marudi district (e.g., *S 35829* and *S 38751*) and G. Murud, Limbang district (e.g., *Nooteboom & Chai 2000* and *S 44462*). Also recorded from C Kalimantan (e.g., *Mogea 3972*). Local, on rocky sandstone summits in upper montane forest, at 1800–2600 m altitude.

# PLATES

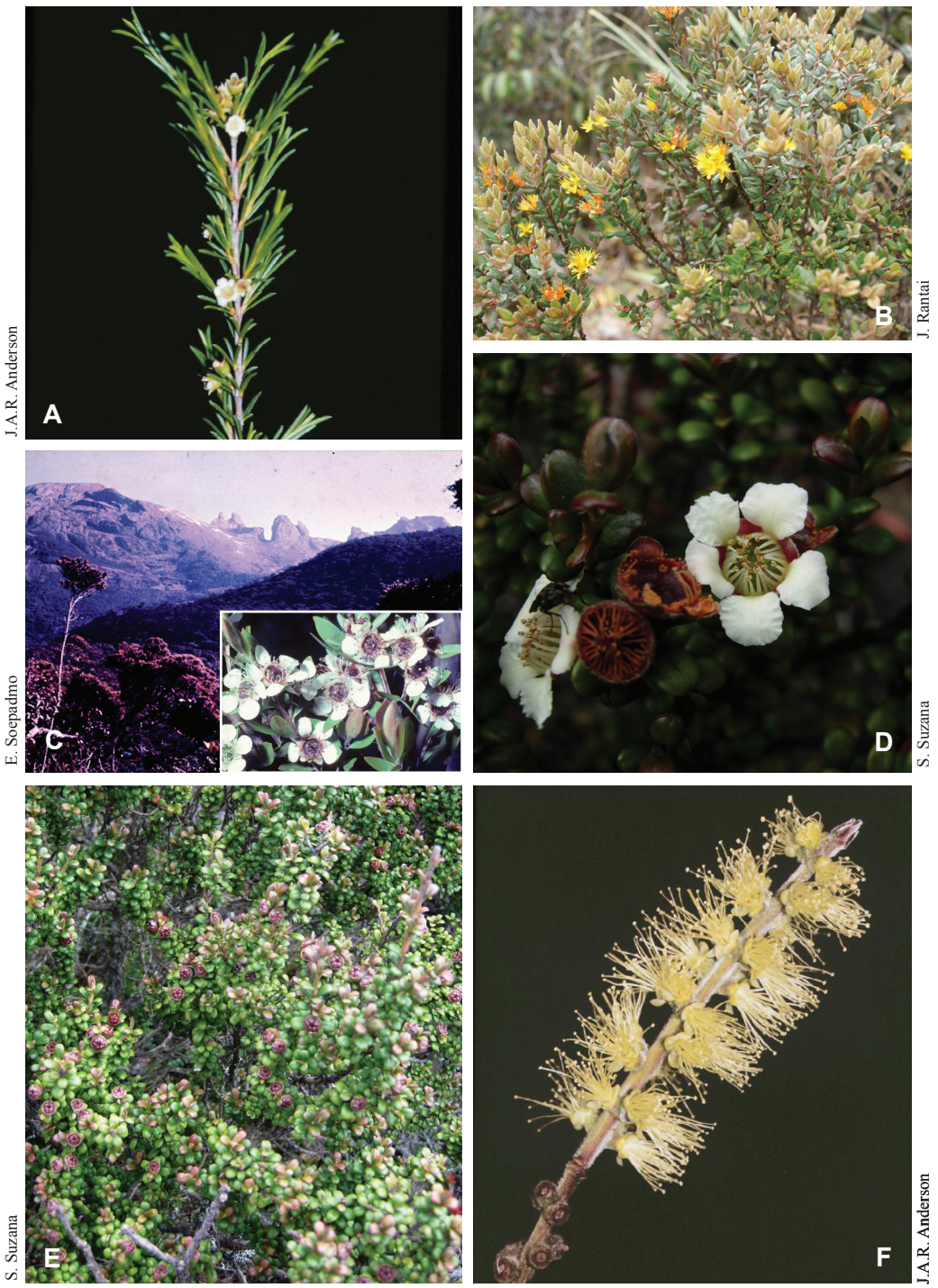


**Plate 4. Myrtaceae.** A, *Baeckea frutescens*: flowering leafy twig; B, *Decaspermum vitis-idaea*: habit; C, *Leptospermum javanicum*: natural habitat and fully open flowers (inset); D–E, *Leptospermum recurvum*: D open flower, E habit; F, *Melaleuca cajuputi* subsp. *cumingiana*: inflorescence with fully open flowers**.**

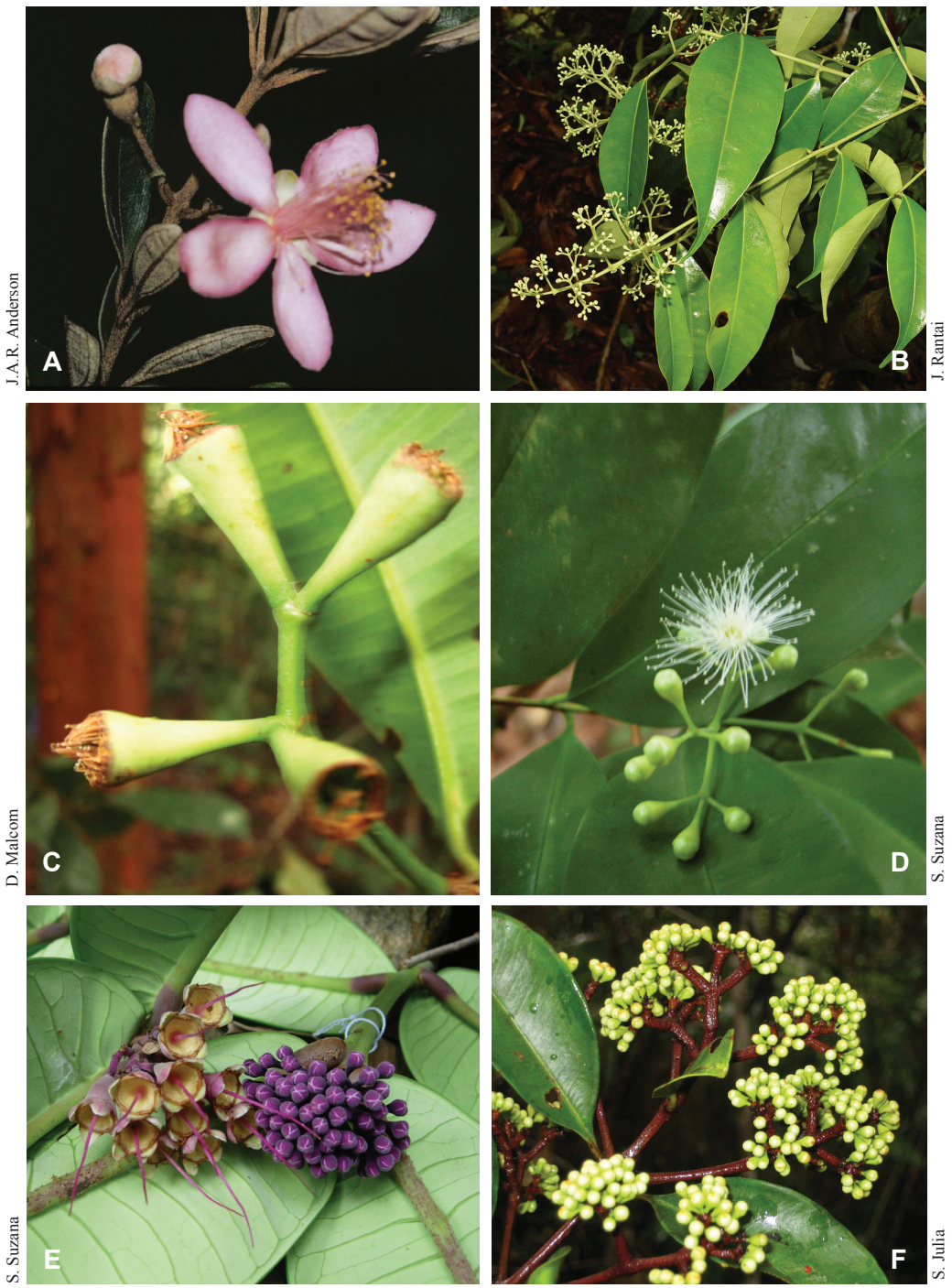


**Plate 5. Myrtaceae.** A, *Rhodomyrtus tomentosa*: leafy twig with flower bud and open flower; B, *Syzygium acuminatissimum*: flowering leafy twigs; C, *Syzygium biniflorum*: distal part of inflorescence bearing paired post-anthesis flowers (developing young fruits); D, *Syzygium castaneum*: inflorescence with flower buds and a fully open flower; E, *Syzygium creaghii*: densely flowered inflorescence with flower buds and post-anthesis flowers; F, *Syzygium curtisii*: densely flowered inflorescences with almost open flower buds.

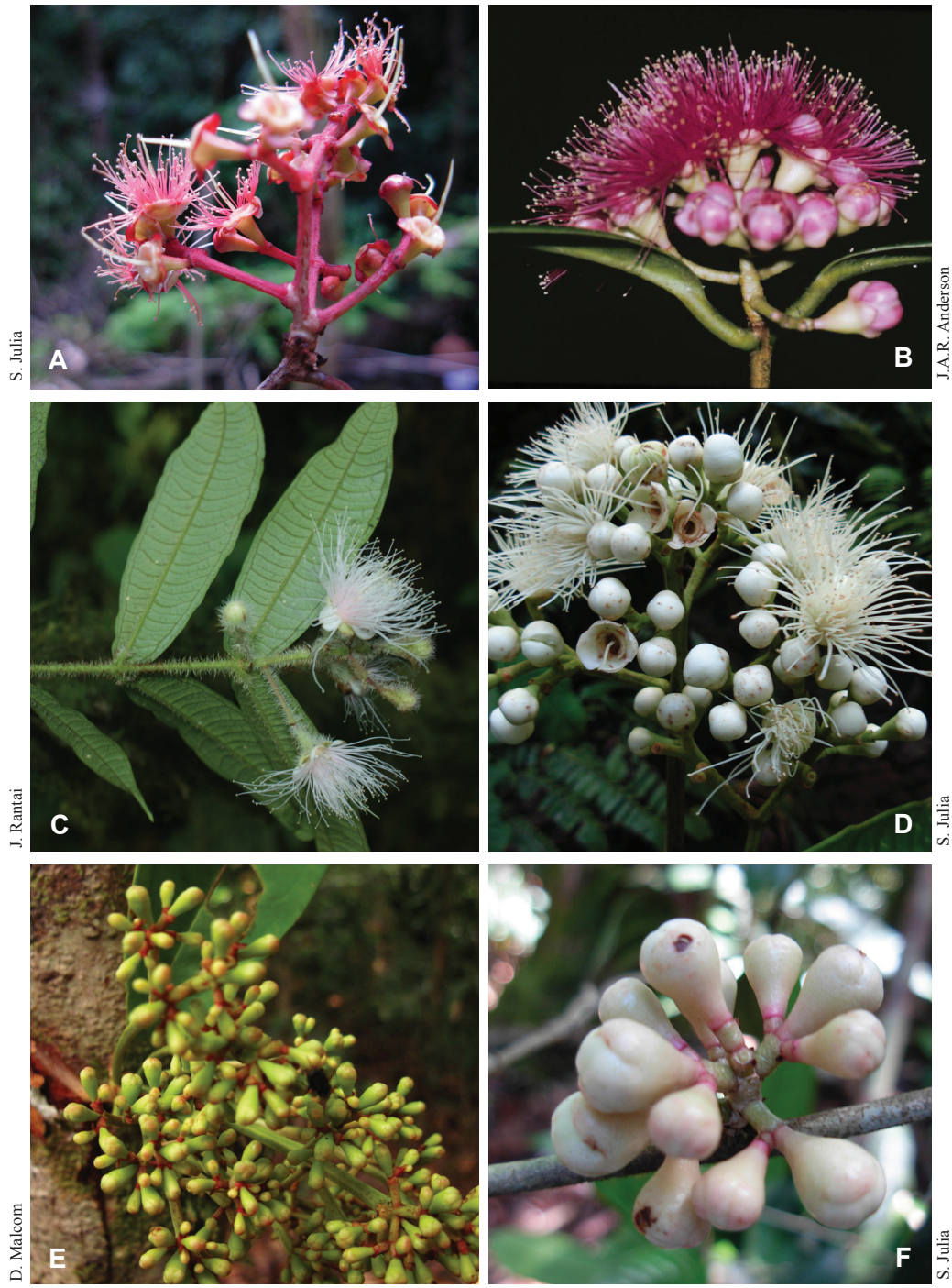


**Plate 6. Myrtaceae.** A, *Syzygium filiforme*: terminal inflorescence bearing post-anthesis flowers; B, *Syzygium glanduligerum*: terminal inflorescence with almost and fully open flowers; C, *Syzygium hirtum*: flowering leafy twig with mature flower buds and fully open flowers; D, *Syzygium kiauense*: terminal inflorescence with mature flower buds and fully open flowers; E–F, *Syzygium peregrinum*: E densely flowered ramiflorous inflorescences, F almost open flower buds.

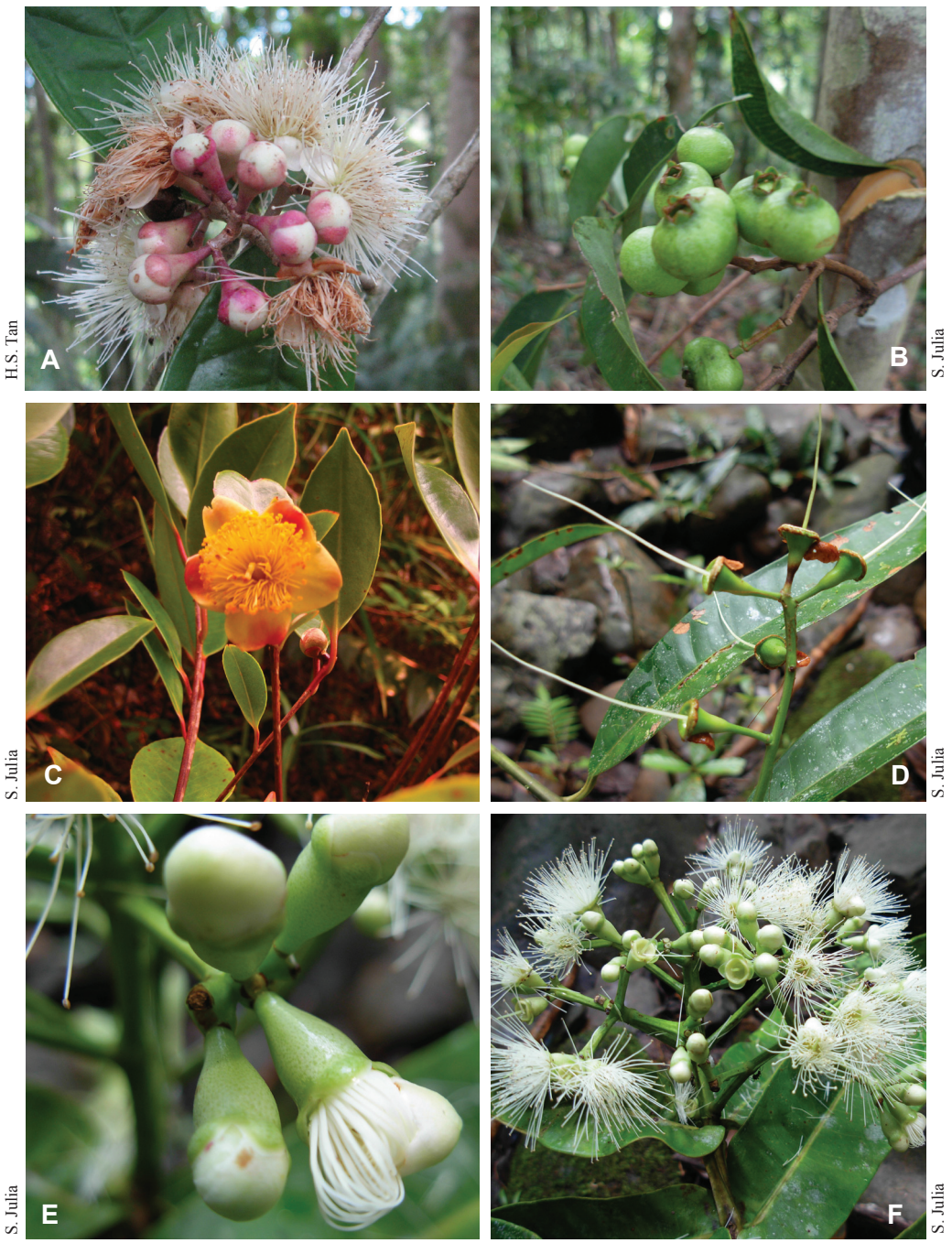


**Plate 7. Myrtaceae.** A–B, *Syzygium punctilimbum*: A terminal inflorescence with mature flower buds and fully open flowers, B fruits; C–D, *Syzygium ramiflorum*: C fully open flower, D post-anthesis flowers (developing young fruits); E–F, *Syzygium rejangense*: E mature and opening flower buds, F inflorescences with mature flower buds and fully open flowers.


**Plate 8. Myrtaceae.** A, *Syzygium scortechinii*: leafy twig bearing young and almost mature fruits; B, *Syzygium ultramaficum*: leafy twig with mature and almost open flower buds; C, *Syzygium zeylanicum*: leafy twig with post-anthesis flowers and developing young fruits; D, *Tristaniopsis merguensis* subsp. *tavaiensis*: tree trunk with peeling off outer bark; E, *Tristaniopsis whiteana* subsp. *whiteana*: tree trunk with peeling off outer bark.

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

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