A revision of the Malesian genus Blumeodendron (Euphorbiaceae)

M.A.D. Ottens-Treurniet¹, P.C. van Welzen¹,²

Abstract The genus Blumeodendron (Euphorbiaceae) comprises nine species and is distributed from the Andaman Islands and Myanmar in the west through Malesia to the Bismarck Archipelago in the east. Blumeodendron belongs to the subfamily Acalyphoideae, tribe Pycnocomeae, subtribe Blumeodendrinea (Webster 1994, 2014, Radcliffe-Smith 2001) and is part of clade A1 of the core acalyphoids in the molecular Euphorbiaceae skeleton phylogeny of Wurdack et al. (2005). Clade A1 is sister to a clade combining Macaranga Thouars and Mallotus Lour. (including Trevia L.). The species are common in rain forests and are small to large (up to 65 m high) trees. Other typical characters are the absence of stipules, the presence of very small lepidote hairs (termed minute stellate hairs by Radcliffe-Smith 2001), small, unisexual flowers lacking petals, the staminate ones with many stamens and disc glands forming a ruminate pattern on a convex receptacle, the fruits large, woody and probably indehiscent or late dehiscent (partly after Merrill 1920, Airy Shaw 1975).

During the last 150 years the genus was studied by various researchers, but most revisions are already quite dated, the only 21st century revision was for Thailand (Chayamarit 2005, 2007). The genus Blumeodendron was established by Müller in 1866 as a subgenus of Mallotus Blume (Blume) Kurz. The description of this species was followed by several others (e.g., Merrill 1920). In 1975 Airy Shaw reduced the then known twelve species to six species after a revision of the Bornean Euphorbiaceae. After Airy Shaw's revision most species appeared to be present on Borneo and only two were widespread outside Borneo, B. kurzii (Hook.f.) J.J.Sm. and B. tokbrai. A revision of Blumeodendron, covering its complete distribution, has not yet been made. Since the last revisions much more material has been accumulated, which will allow for new insights into the variability of the various species and which will perhaps alter species boundaries.

INTRODUCTION

Blumeodendron (Müll.Arg.) Kurz is a tree genus in the Euphorbiaceae, which ranges from the Andaman Islands and Myanmar in the west through Malesia to the Bismarck Archipelago in the east. Blumeodendron belongs to the subfamily Acalyphoideae, tribe Pycnoomeae, subtribe Blumeodendrinea (Webster 1994, 2014, Radcliffe-Smith 2001) and is part of clade A1 of the core acalyphoids in the molecular Euphorbiaceae skeleton phylogeny of Wurdack et al. (2005). Clade A1 is sister to a clade combining Macaranga Thouars and Mallotus Lour. (including Trevia L.). The species are common in rain forests and are small to large (up to 65 m high) trees. Other typical characters are the absence of stipules, the presence of very small lepidote hairs (termed minute stellate hairs by Radcliffe-Smith 2001), small, unisexual flowers lacking petals, the staminate ones with many stamens and disc glands forming a ruminate pattern on a convex receptacle, the fruits large, woody and probably indehiscent or late dehiscent (partly after Merrill 1920, Airy Shaw 1975).

During the last 150 years the genus was studied by various researchers, but most revisions are already quite dated, the only 21st century revision was for Thailand (Chayamarit 2005, 2007). The genus Blumeodendron was established by Müller in 1866 as a subgenus of Mallotus Blume (Blume) Kurz. The description of this species was followed by several others (e.g., Merrill 1920). In 1975 Airy Shaw reduced the then known twelve species to six species after a revision of the Bornean Euphorbiaceae. After Airy Shaw’s revision most species appeared to be present on Borneo and only two were widespread outside Borneo, B. kurzii (Hook.f.) J.J.Sm. and B. tokbrai. A revision of Blumeodendron, covering its complete distribution, has not yet been made. Since the last revisions much more material has been accumulated, which will allow for new insights into the variability of the various species and which will perhaps alter species boundaries.

The variation within Blumeodendron is very high, especially in the former circumscription of the two widespread species. It is typically a genus where it takes time to become familiar with the species before a sensible delimitation can be made. As a result, the species circumscriptions have changed dramatically. The definition of the widespread B. kurzii and B. tokbrai is much more restricted as B. borneensis Pax & K.Hoffm. (with B. concolor Gage as synonym), B. novoguineense Ottens & Welzen and B. subrotundifolium (Elmer) Merr. (with the seemingly distinct B. calaphyllum Airy Shaw as synonym) are regarded as distinct species. Thailand now contains three instead of two species (www.nationalherbarium.nl/thaieuph). Also, two species were not recognized before, B. gesinus Ottens, with reddish leaves and fruits and distinct rims on the fruits, and B. endocarpum Ottens & Welzen, with a thick endocarp around each seed instead around all seeds. Characters used for species recognition are indumentum, leaf aestivation, thickness and colour of dried leaves, inflorescence length and fruit type. The revision will be part of the ongoing revision of the Euphorbiaceae for the international Flora Malesiana Project (www.nationalherbarium.nl/euphorbs).

The aims of this study are to revise the genus, to capture the species variability, show the distributions and to create an identification key.

MORPHOLOGICALLY AND ECOLOGICALLY IMPORTANT CHARACTERS

Nodes In a number of Blumeodendron species the leaves are on the nodes of several successive short internodes, which can be extremely short and individually indistinguishable in the species with ‘whorled’ leaves. The short nodes alternate with much longer, leafless internodes. The nodes of the species B. borneensis, B. bullatum Airy Shaw, B. endocarpum and B. kurzii are much thickened; those of the other species are less thickened. Leaves of B. bullatum and B. endocarpum are alternate to subopposite and the node is thickened at the side of the leaf attachment. The nodes of B. kurzii are very distinctly thickened, almost globular in shape, and carry whorls of more than three leaves. The leaves of B. borneensis are alternate...
The nectaries occur on both surfaces, but in different numbers. The basal ones are generally larger than those along the midrib and margin and are sometimes visible to the naked eye.

Inflorescences
All the inflorescences resemble racemes but are thryses (reduced cymes racemously distributed along the inflorescence rachis). They are variable in length, while the lengths are very typical for the species (pistillate inflorescences are always shorter than staminate ones). Almost fascicle-like inflorescences of less than 2 cm length, are found in B. borneense, B. bullatum, B. kurzii and B. philippinense. Longer inflorescences, staminate ones up to 4.5 cm, pistillate ones up to 2.5 cm, are present in B. endocarpum and B. subrotundifolium. The longest inflorescences are present in B. gesinus, B. novoguineense and B. tokbrai (staminate ones up to 20 cm, pistillate ones up to 10 cm). The basal internodes of the longer inflorescences are longer than the more terminal internodes as can be seen in B. tokbrai. Pistillate flowers are single per node, staminate flowers are generally in small groups, with one flower open and the others generally present as buds.

The number of inflorescences per node also varies. Pistillate inflorescences are single except B. kurzii with c. 4 inflorescences per node. Staminate inflorescences are single (B. bullatum), paired (B. endocarpum, B. gesinus and B. subrotundifolium) or vary between 3 and 4 (B. tokbrai and B. philippinense) to 8 inflorescences per node in B. kurzii. The latter probably as a result of having mostly four whorled leaves and multiple inflorescences per leaf. Bracts are generally absent or early caducous.

Flowers
The pedicel has a distinct abscission zone and flowerless inflorescences are often the result. In B. novoguineense and B. tokbrai the abscission zone can be halfway the pedicel giving an almost ladder-like appearance after flower drop. The buds are globose. The staminate flowers have 3–4 sepals, the pistillate flowers (3–)4–5 sepals; they lack petals.

Very typical for the staminate flowers are the disc glands which provide a ruminate appearance on the dome-shaped receptacle. The many stamens arise among the glands. The amount of stamens varies per species. The anthers are basifixed, 2-loculate, and open latrorse via lengthwise slits. A pistilode is absent.

The pistillate flowers have a circular, somewhat lobed, broad disc. The ovary is 2–3-locular with a single ovule per locule and on top 2–3 non-divided, recurved stigmata that are papillate above.

Fruits and seeds
The fruits show some key characters for identification. They are woody and globular to ovoid. Young fruits are often covered with the small lepidote hairs; on older fruits lepidote hairs are sometimes still visible. The upper part of the pedicle is thickened. Differences between the species can be found in the thickness of the wall, the thickness of the endocarp and the presence of ridges.

The wall of B. endocarpum is ovoid and dented in the middle of the upper margin (Fig. 3f), while the other species have very globular to ovoid fruits. Blumeodendron endocarpum differs in various ways from the other species; it has a thick endocarp surrounding every individual seed, while the endocarp encloses all seeds together in the other species (Fig. 3f). Another difference is that the exocarp of B. endocarpum separates from the meso- and endocarp during drying (Fig. 3f), while the layers remain stuck together in all the other species. Finally, there is
a difference in the manner of dehiscing. The fruits of all species dehisce tardily loculicidally, while the fruits of Blumeodendron do not seem to open and probably the seed will germinate after the woody endocarp decayed.

The margin of the fruits differs from possessing a much thickened rim (B. gesinus; Fig. 4b), to pitted (B. tokbrai; Fig. 9f) or slightly ridged (B. novoguineense; Fig. 6a).

The fruits of B. borneense (Fig. 1c) and B. endocarpum (Fig. 3c) show 3 and 6 vein ridges, respectively.

The seeds are typical, or more or less bean-shaped, though the shape varies somewhat per species, and are attached in the middle (in a dent) to (less typical) more subapical. It is unknown how the diaspores are dispersed. The fruits are woody and large, thus bird dispersal is ruled out. The seeds are covered by a thin, mainly yellow sarcotesta, which could imply that larger animals, like monkeys, might consume the seeds and disperse them. Considering the broad distributions of some of the species, then dispersal by means of water/sea is also a possibility, as the fruits generally dehisce very late, are buoyant, and relatively thick-walled.

**TAXONOMY**

**Blumeodendron**


Trees, dioecious; branchlets generally round in section, nodes thickened. Indumentum consisting of small, orange, lepidote hairs, glabrescent, few species locally with additional simple hairs. Stipules absent. Leaves alternate, subopposite or pseudo-whorled, simple; petiole apically but more so basally pulvinate, in section round but grooved transversely when dry; blade elliptic to obovate, margin entire, revolute, extrafloral nectaries 2–4, adaxially near base and additional smaller ones (up to 20(−40)) along midrib and margin; venation pinnae, marginal vein indistinct, primary and secondary nerves slightly raised above, secondary nerves looped and close near the margin, tertiary nerves scalariform, higher order nerves reticulate or partly scalariform. Inflorescences axillary or terminal thyrses, one or more together, erect. Flowers: pedicel with abscission zone; flowers actinomorphic, 5-merous, buds globose; sepal elliptic, valvate, margin entire; petals absent; disc present. Staminate flowers: sepals 3–4; disc glands on convex receptacle, providing a ruminate surface with the stamens in between the glands; stamens 31–40, anthers basified, 2-thecate, opening laterosie via lengthwise slits; pistilode absent. Pistillate flowers: sepals (3−)4−5; disc annular, broad; ovary 2–3-locular, placenta basal, ovulum single per locule, hemitropous; styles very short; stigmas 2−3, entire, often recurved, above papillate. Fruits capsular, gloular or ovoid, tardily completely septicidally and partly loculicidally dehiscent into bivalved cocci; pedicels thickened; wall woody, surface somewhat knobby. Seeds ovoid to subglobose, with sometimes flattened sides, more or less bean-shaped; sarcotesta present.

**Distribution** — Nine species ranging from Burma and the Andamans via Thailand through Malesia to New Guinea and the Bismark Archipelago.

**KEY TO THE SPECIES**

1. Leaves bullate, lower surface densely hairy on venation ........................................ 2. Blumeodendron borneense

2. Leaves smooth, lower surface glabrous ........................................ 2

3. All leaves in whorls of 3 or more, or leaf blades drying light green and leaves in (pseudo-)whorls or alternate. Flowers more or less fasciculate, inflorescences less than 2 cm long ........................................ 3

4. Leaves drying brownish green (kind of dark green) to brown, alternate to opposite to in (pseudo-)whorls of 3. Flowers not fasciculate, inflorescences generally more than 2 cm long ........................................ 4

5. Leaves alternate to in (pseudo-)whorls; blades drying light green, pergamentaceous to subcoriaceous. Terminal branches often triangular or flattened in section ........................................ 1. B. borneense

6. Leaves from Sulawesi and the Moluccas .............. 3

7. Leaf blades 6.2−46 by 3−22 cm, coriaceous (slightly bendable) to very coriaceous (breaking) when dry; petiole 2.4−18.5 cm long, diam of thinnest part 1−15 mm. Staminate inflorescences to 4.5 cm long, pistillate ones to 2.3 cm long. Fruit wall 2−4 mm thick 8. B. subrotundifolium

8. Plants from Sulawesi and the Moluccas .............. 9

9. Endocarp of fruit thickened around every seed. Inflorescences up to 2 cm long .............. 3. B. endocarpum

10. Endocarp of fruit around all seeds. Inflorescences up to 20 cm long ........................................ 3

11. Blumeodendron borneense Pax & K.Hoffm. — Fig. 1; Map 1

Blumeodendron borneense Pax & K.Hoffm. (1919) 14; Airy Shaw (1975) 58. — Blumeodendron tokbrai (Blume) Kurz var. borneense (Pax & K.Hoffm.) J.J.Sm. ex Airy Shaw (1981) 269. — Type: Beccari PB 2976 (Fl not seen; iso K), Borneo. Blumeodendron concilior Gage (1922) 244; Rdl. (1924) 281; Airy Shaw (1975) 59. — Type: Curtis KD 1368 (K), Malay Peninsula, Pangkor. Blumeodendron sp.: Merr. (1929) 157. — pro Elmer 21129 (L), British North Borneo (Sabah), Tawau.
Blumeodendron tokbrai auct. non (Blume) Kurz: Airy Shaw (1975) 60, p.p.,
‘form with oblong leaves’.

Trees, up to 35 m high, bole to 15 m high, dbh to 30 cm (–2 m);
buttresses sometimes present, few, c. 1 m high, c. 0.3 m out,
c. 20 cm thick; stem generally round, nodes notably thickened;
lepticels indistinct, round; flowering branches 5–28 mm thick,
terminal ones often triangular of flattened in section; distance
between internodes c. 18 cm; sympodial growth via axillary
buds obvious. Outer bark tan to reddish brown, to dark brown,
whitish grey, (pale) grey to grey-brown dappled, smooth to
rough to fissured and peeling off, brittle, c. 1 mm thick; inner
bark white to pale yellow, orange, pale greenish, pale brown
outside to yellow inside, c. 4 mm thick; sapwood white to pale
yellow; heartwood reddish. Indumentum: simple hairs absent.
Leaves in (pseudo-)whorls of 3 to alternate (see Notes 1, 2);
petiole 0.7–10 cm long, diam of thinnest part 0.9–3 mm, shiny,
basal pulvinus 1.1–3.4 mm diam; lepidote hairs present, older
parts glabrous; blade ovate to elliptic (see Note 3), c. 6–40 by
2–21 cm, length/width ratio 1.7–3.2, pargamentaceous to
subcoriaceous, symmetric, glabrous, smooth dark green, dry-
ishing light green, base rounded to obtuse, margin recurved, apex
acuminate to cuspidate, tip to 1 cm long, extrafloral nectaries
c. 6–18 along midrib, c. 6–26 along margin, both sides smooth;
venation slightly and partly raised above, secondary nerves 4–7
pairs, at c. 46° angle with midrib, tertiary nerves perpendicular
to midrib and secondary nerves, not raised above, higher order
nerves reticulate, not raised above. Inflorescences ramifor-
ous to axillary and terminal, flowers almost fasciculate when
staminate buds young, pistillate inflorescences single, length
unknown. Staminate flowers only known from one specimen,
either as bud or withered: pedicel c. 19 mm long, round; sepals
3, ovate, c. 4 by 3 mm, completely reflexed; stamens many,
anthers c. 0.9 by 0.9 mm. Pistillate flowers unknown. Fruits c. 3
per inflorescence, subglobose, basally slightly sulcate, cap.
3.5–4.1 by 3.1–4.3 cm, yellow to brown, 2–3-locular, ripening
from green to yellow, dry brown, surface somewhat knobby,
vein ridges c. 3; pedicels c. 2 cm long, up to c. 0.4 cm diam,
abscission zone indistinct; margin slightly thickened; wall 1–2
mm thick; endocarp enclosing two or more seeds; stigmas usu-
ally persistent. Seeds bean-shaped, 2.1–2.3 by 1.4–2 by 1–1.1
cm, attached in middle of bean, covered by a thin sarcotesta,
dirty white to yellowish, sweet, edible.

Distribution — Malay Peninsula (very rare, only type of B. con-
color) and Borneo.

Habitat & Ecology — In mixed dipterocarp lowland forest,
secondary forest, alluvial forest, mossy forest, primary upper
montane forest, often along water and on very wet (but not
inundated) soil; soil on (sandy) clay, igneous derived sandy
clay. Altitude: 25–700 m. Flowering: January; fruiting: Febru-
ary–May; July, September, October, December.

Vernacular names — Kalimantan: Kapol utan; Simpul (Bassap
Dayak); Sabah: Indalus (Dusun Kinabatangan), Tampoi (Malay).

Notes — 1. Quite typical for B. borneense are the light co-
oured twigs, of which the upper ones are flattened or triangular,
the leaves that dry light green, especially the lower surface,
the almost fascicled flowers (one specimen in bud seen), and
the thin-walled fruits (wall 2 mm at most). Blumeodendron
borneense is mainly known from Borneo. In Borneo a group of
specimens, B. tokbrai, dries dark green and resemble B. bor-
neeense, but the leaves are alternate to (sub)opposite and
seldom in whorls of 3 (end of branches), the flowers are along
rachises and the fruits are very thick-walled (c. 5 mm).

2. The type of B. concolor, Curtis KD 1368 (K) from the Malay
Peninsula, strongly resembles B. borneense, as the leaves are
of the same size, elliptic and also dry green, the flowers are in
fascicles. However, the leaves are alternate. Another example
of a specimen with leaves alternate (but close together) or in
pseudo-whorls is a cultivated specimen from Borneo in the
Bogor Botanical Garden, Gravendeel, de Wilde & Hovenkamp
527 (Kebun Raya IX.C.144). As the leaves in Bornean B. born-
eeense can also be in pseudo-whorls B. concolor is regarded as
a synonym of B. borneense.

3. Specimens from Sarawak, including the type, and Brunei
have a tendency to show ovate leaves, those of Sabah and
Kalimantan are elliptic.

2. Blumeodendron bullatum Airy Shaw — Fig. 2, Map 1

Blumeodendron (?) bullatum Airy Shaw (1965) 310; (1972a) 86; (1975) 58. —
Type: Haviland & Hose 3658 (holo K; iso BM, L), Sarawak, near Kuching.

Probably trees; branchlets generally round, nodes notably thick-
ened to side of leaf; lepticels absent or indistinct; flowering
branches c. 5 mm diam. Indumentum of simple, white hairs and
occasionally lepidote hairs on nodes. Leaves alternate to subop-
posite; petiole 0.5–1.6 cm long, diam of thinnest part 0.2–0.5
cm, round, dull, basal pulvinus 0.4–0.8 cm diam, simple hairs
present; blade elliptic, 6.1–22.3 by 3.8–10.3 cm, length/width
ratio 1.6–2.2, coriaceous, symmetric, strongly bullate, drying
brown, base rounded, margin strongly revolute, apex rounded,
extrafloral nectaries along margin c. 12, basal ones usually not
obvious; venation distinct, sunken above, strongly raised below,
covered with simple hairs underneath and basal part of midrib
above, marginal vein distinct, nerves 5–8 pairs, at 34°–41°
angle with midrib, tertiary nerves perpendicular to midrib and

Map 1 Distribution of Blumeodendron borneense Pax & K.Hoffm. (▲) and B. bullatum Airy Shaw (■).
Fig. 1  Blumeodendron borneense Pax & K.Hoffm. a. Habit; b. extrafloral nectaries on upper surface of leaf blade; c. fruit; d. seed in lateral and ventral view (a, b: Laman, Rachman & Mirmanto TL 713; c, d: McDonald 3613; all L). — Drawing by Esmée Winkel, 2016.
secondary nerves, distance between tertiary nerves 0.3–0.6 cm; higher order nerves scalariform to reticulate. Inflorescences axillary, very short thyrses, single, c. 0.8 cm long, flowers seemingly fasciculate, but peduncle c. 0.2 cm long, erect; bracts not well visible, c. 0.5 cm long. Staminiate flowers c. 8.7 mm diam; pedicel 3.5–5.5 mm long; buds c. 3.5 mm diam, covered with simple and lepidote hairs, sepals 2–3, elliptic, margin entire, c. 3.9–4.4 by 2.9–3.2 mm, valvate, free; stamens c. 33, filaments c. 4.7 mm long, anthers c. 0.6 mm long. Pistillate flowers, fruits and seeds unknown.

Distribution — Borneo (Sarawak; only known from the type).

Habitat & Ecology — Flowering: November.

Note — Airy Shaw (1965) was not certain if this species belonged to *Blumeodendron*, but the absence of stipules, the ruminate staminate disc glands and the presence of orange lepidote hairs on the buds are all indicative of only *Blumeodendron*.

**Fig. 2** *Blumeodendron bullatum* Airy Shaw. a. Habit; b. revolute leaf margin with extrafloral nectary on upper surface and hairs on lower surface; c. staminate flower with sepals, disc glands and stamens (all: Haviland & Hose 3658, L). — Drawing by Anita Walsmit Sachs, 2015.
3. **Blumeodendron endocarpum** Ottens & Welzen, sp. nov. —

Fig. 3; Map 2

Resembling *B. subrotundifolium* in short inflorescences and alternate to subopposite leaves, differing in leaves chartaceous (to coriaceous), drying greenish brown, very short pistillate pedicels and most of all, a thick endocarp around every seed, not around the seeds together. — Type: *BW* (Kalkman) 6282 (holo L), [Indonesia, Papua] Div. W. New Guinea, Beriat, c. 12 km S of Teminaboean.

*Blumeodendron kurzii* auct. non (Hook.f.) J.J.Sm.: Airy Shaw (1980) 37.

(Shrubs to) trees, to 40 m high, bole to 18 m high, dbh to 40 cm diam; buttresses sometimes present, to 1.5 m high, to 1.5 m wide, 4–10 cm thick; flowering branches 2–3 mm diam, lenticellate, generally round, flat near petioles, distance between internodes usually c. 6 cm. **Indumentum**: simple hairs absent. **Outer bark** (light) (greyish) brown to dark brown to dark grey, smooth to shallowly fissured, strongly peeling with large scales, 0.25–0.5 mm thick; inner bark white, creamy, yellowish brown, orange to (light) brown, 4–5 mm thick; exudate sometimes present, light brown; sapwood white, pink or light brown; heartwood

---

**Fig. 3** *Blumeodendron endocarpum* Ottens & Welzen. a. Habit; b. upper surface of leaf with extrafloral nectaries; c. fruit; d, e. seed; f. section through fruit showing detached endocarp around seeds (a, b: *BW* (Versteegh) 3971; c–f: *BW* (Kalkman) 6282; all L). — Drawing by Esmée Winkel, 2016.
orange-brown to (light) brown, 5–12 cm diam. Leaves alternate to subopposite; petiole 2.3–9 cm long, diam of thinnest part 1–2 mm, basal pulvinus 1.5–4.1 mm diam; blade elliptic, 11.2–31 cm long by 4.6–13.9 cm, length/width ratio 1.8–3, blade length/petiole length ratio 4.4–4.8, pergammentaceous (to coriaceous), often basally slightly asymmetric, glabrous, base broadly cuneate to attenuate, margin entire, revolute, apex acuminate (to cuspitate), tip round, both surfaces smooth, glabrous, green above, glossy light green to greyish green underneath; above drying greenish brown and brownish green underneath (greener than abaxially), extrafloral nectaries 2 adaxially near base, along midrib 6–15, along margin 8–36; venation: marginal nerve indistinct, secondary nerves (5–)6–8(–9) pairs, at c. 51.1° angle with midrib, tertiary nerves perpendicular to midrib and secondary nerves, not raised on both sides, c. 0.8 cm apart, higher order nerves reticulate, not raised on both sides. Inflorescences axillary and terminal, staminate ones mostly 2 per axil, thyroid, erect, to 2 cm long, with lepidoz hairs. Staminiate flowers 8–9 mm diam, white to (pale) yellow(-green); buds 14–30 per inflorescence; pedicel 8.5–17 mm long; sepals 3, ovate, c. 6 by 3 mm; stamens 35–43, filaments 4–5.5 mm long, anthers 0.5–1.1 mm long. Pistillate flowers only seen as young fruits; almost sessile, to 3.5 cm long, up to 11.5 cm long, flowers 4.3–6.4 mm diam, yellow-green to yellow; buds 1.6–2.8 mm diam, often sticky with secretion; pedicel above abscission zone 3.1–3.3 mm long, c. 0.4 mm diam; sepals 3(–4), round, 4.5–5.3 by 2.5–3.8 mm long, completely recurved; stamens c. 27, filaments 2–4.5 mm long, anthers 0.4–0.7 mm long. Pistillate flowers 2.3–3 mm diam, pale green to yellow; sepals 5, ovate to triangular, very small, c. 0.5 by 0.5 mm, margin with few hairs; disc c. 0.4 mm thick ring; ovary obovoid, c. 1.5–3.3 mm high by 2–3 mm wide, sutures thickened; 2(–3)-locular, style 0.3–1 mm long, stigmas 1–2.8 mm long. Fruits ellipsoid to obovoid, c. 2.5–3.8 by 3–3.5 cm, probably indehiscent because loculicidal sutures with a rounded thickened rim, green when...
immature, orangish brown when dry; pedicel c. 4 mm long, c. 4.5 mm diam, abscission zone in the middle, upwards strongly widening; sepal remnants sometimes persistent; disc distinct, drying brownish; wall c. 2 mm thick, surface somewhat knobbly; endocarp enclosing all seeds; stigma usually persistent. Seeds ovoid but flattened on one side, not symmetric, attached subapically, 1.9–2.5 by 1.3–2.3 by 1–1.2 cm, sarcotesta thin, veins visible.

Distribution — Borneo.

Habitat & Ecology — Lowland mixed dipterocarp forest to sub-montane, mossy forest, sometimes along roads in primary forest, seldom in logged over forest. Soil: yellow sandy, clay rich to ultrabasic; bedrock often sandstone. Altitude: 25–1375 m. Flowering: February—April, June, August, September; fruiting: February, May—August, October—December.

Vernacular names — Borneo: Sabah: Tampoi (Melayu); Sarawak: Bantas (Iban), Bantas ketupong, Empungan (Iban).

Notes — 1. Gesinus is the first name of the first author’s husband. The name is a personal name and not a latinisation, therefore ICN art. 60C.4 applies (http://www.iapt-taxon.org/nomen/main.php?page=art60), the name should not be changed into gesinum.

Fig. 4 *Blumeodendron gesinus* Ottens. a. Habit; b. fruit; c. seeds on columnella in top view; d. columnella; e. extrafloral nectaries on upper leaf surface (a, e: SAN (Ignasius B. & Clement M.) 140150; b–d: Pereira et al. 158; all L). — Drawing by Esmée Winkel, 2016.
2. This new species was generally confused with B. tokbrai, because of the long inflorescences. Very typical are the rims on the fruits and their orangish colour when dry. The same colour can be found on the lower surface of the dried leaves.

3. The variation in inflorescence lengths seems to be large, varying between short (bud) to long (flowers), but inflorescences with buds are not yet fully grown and will largely extend during maturation of the flowers.

5. **Blumeodendron kurzii** (Hook.f.) J.J.Sm. — Fig. 5; Map 4

*Blumeodendron kurzii* (Hook.f.) J.J.Sm. (1910) 463; Koord. (1912) 493; Backer & Bakh.f. (1913) 480; Airy Shaw (1963) 348; (1972b) 224; Whitmore (1947) 70, f. 2; Airy Shaw (1975) 59; (1981) 269, f. 38; (1983) 10; Chayam. (2005) 130; (2007) 611, f. 2. — *Malolatus kurzii* Hook.f. (1887) 427. — Lectotype (designated here): King’s collector 7114 (K), [Malaysia,] Perak, Larut. (Other syntypes: Helfer KD 5010 (K), Andaman Islands; Anonymous s.n., s.d. (K), [Malaysia], Perak.)

*Blumeodendron verticillatum* Merr. (1920) 557; (1923) 429; (1929) 157. — Type: *FB (Meyer) 2603 (PNH lost; iso L), Philippines, Luzon, Bataan Prov., Mt Mariveles. (NY noted Elmer 20815 as type, but this is incorrect, the specimen is not cited by Merrill 1920).*

*Blumeodendron sumatranum* S.Moore (1925) 102. — Synotypes: *Forbes 1522 (BM, GH 2 sheets, L 3 sheets), Sumatra, Lampongs, Goenoeng Trang; Forbes 1563 (BM?, GH, L 2 sheets), Sumatra, Lampongs, hills NE of Goenoeng Trang; Forbes 1650a (BM, GH, L), Sumatra, Lampongs, Penang-goengan.*

*Blumeodendron cuneatum* S.Moore (1925) 103. — Type: *Forbes 2874 (holo BM; iso A, GH, L 4 sheets), Sumatra, Palembang, Ayer Angat, foot of Kabo volcano.

Trees, to 35 m high, bole to 30 m high, dbh to 60 cm; sometimes slightly fluted at base, flutes c. 1.5 m high, out 50 cm to sometimes a short buttress; flowering branches 4–22 mm diam., round to sometimes triangular in section below the nodes, internodes up to 18 cm long; terminal bud surrounded by round or triangular axillary buds. *Outer bark* dark brown to brown-grey to greyish (black), smooth to cracked in irregular pieces to (powdery) scaly, soft to hard, 0.5–6 mm thick; inner bark beefy red outside to (pale) reddish to brown inside, 3–6 mm thick, sap absent to clear; sapwood white, yellow, reddish or brown; heartwood yellowish red to pinkish brown (to rays brown). Leaves always in whorls of 3–5 per node, young ones yellow-green to light green; petiole 1.3–12 cm long, diam of thinnest part 1–4 mm, sordid green to brown, (green-brown to) dark brown when dry, generally darker than stem, basal pulvinus c. 4 mm diam., upper pulvinus larger and mainly developed abaxially; blade (ovate to) elliptic to oblong to obovate, 8.8–42 (51), see Uses) by 4.4–23.7 (26.5) cm, length/width ratio 1.3–2.5, coriaceous, symmetric, glabrous, dried (dark green) to light brown on both sides, base obtuse to cuneate, margin usually light brown or yellow when dry, flat to revolute, apex acuminate (to cuspidate), extraraxillary nectaries often 2. adaxially near base, at both sides along midrib 0–19 and along margin 6–36; venation: marginal vein distinct, secondary nerves (5–) 6–12 pairs, well visible, 2/3 of length of nerves parallel with others, tertiary nerves perpendicular to midrib, hardly visible above, raised beneath, 0.3–0.4 cm apart, higher order nerves reticulate, indistinct. *Inflorescences* cauliflorous, ramiflorous, axillary and terminal, thyrsoid, almost fasciculate; staminate ones more than 8 together, up to 1.7 cm long, pistillate ones c. 4 together, up to 3 cm long; bracts absent. *Flowers* yellowish, yellow-green or light green; pedicel 0.4–1 cm long; staminate buds globose, c. 35 per inflorescence, c. 3.9 mm diam. *Staminate flowers* 7–7.5 mm diam; pedicel c. 10 mm long; sepals 3, 4–5 by 2.2–3.5 mm; disk lobes yellow; stamens 20–25, filaments 2–10 mm long, yellow, anthers 0.75–1 mm long, yellow to later fulvous. *Pistillate flowers* not seen. *Fruits* capsular, subglobose, 3.3–5.8 cm wide by 2.8–4.6 cm high, 2–3 locular, dry dark brown; pedicel thickened, c. 1 cm long, c. 6 mm diam, abscission zone in the middle to subapically; sepals usually persistent; disc distinct, drying dark brown; wall 2–4 mm thick, surface knobby; margin not or slightly thickened as very low ridges; endocarp enclosing two or more seeds; style very sturdy, at most 1 mm long; stigma usually persistent, up to 5 mm long, spreading. Seeds bean-shaped, but one end smaller than other, 2.1–2.2 by 1.3–1.6 by c. 1.2 cm, dark brown, attached in middle; sarcotesta yellow.

*Distribution* — Peninsular Thailand, Malay Peninsula, Sumatra, Java, Borneo, Philippines (Luzon, Samar).

*Habitat & Ecology* — Ranging from primary and evergreen forest to logged over and secondary forest (with bamboo); soil: often rich, varying from igneous derived sandy soil to sandy clay to loamy soil to limestone; bedrock once reported as basalt. Altitude: 5–600 (–1800) m. Flowering: March—August, November—January; fruiting: March—June, August—December.

*Uses* — *Clemens* 51511 is tentatively identified as *B. kurzii*. It is a single, enormous leaf, c. 51 by 26.5 cm, much larger than all other material of *B. kurzii*. The label indicates that large
leaves are used by the Dusun in N Borneo as rain shelter and to repair leaks in roofs. The seeds are eaten in the Philippines.

Vernacular names — Sumatra: Madanggadjah, Safanggeu bala, Tafanggeu, Tapanggeu delok, Tafanggeu toengo, Tam-pang. Java: Huru batu. Borneo: Kalimantan; Pelai, Tawiloeng; Sabah: Kulobon (Murut), Medang; Sarawak: Bantas (Iban); Ukut. Philippines: Kabarawang (Samar-Leyte Bisaya).

Note — Typical are the brown drying leaves present in pseudo-whorls: leaves in a whorl but originating at slightly different levels.

6. *Blumeodendron novoguineense* Ottens & Welzen, nom. nov. — Fig. 6a, b; Map 5


Trees, to 40 m high, bole to 33 m high, dbh to 53 cm; bole sometimes fluted or with low buttresses up to 1.5 m high, out 0.6–2 m, 3–10 cm thick; flowering branches 2–3 mm diam, generally round, with orange lepidote hairs, early glabrescent, long internodes up to 8.5 cm. Outer bark red-brown to grey-brown to dark brown to brownish black, smooth to pustular lenticellate, not fissured nor peeling to little peeling with small to large scales, 0.25–0.5 mm thick; under bark wine-red; inner bark yellow to yellowish brown to red to light to dark brown, 3–12 mm thick; sapwood white to orange-brown to reddish brown to light brown; heartwood light brown to black. Leaves on hardly
widened nodes at end of short nodes, alternate to subopposite to in pseudo-whorls of 3; petiole 1–4.1 cm long, diam of thinnest part 0.8–1.2 mm, round, basal pulvinus 1.3–2 mm diam, fast fading orange lepidote hairs; blade (ovate to) elliptic, 5.3–17.5 cm, length/width ratio 1.5–2.6, pergamnetaceous to coriaceous, symmetric, glabrous, base (broadly) cuneate, margin recurved, apex acuminate, tip rounded, extraloral nectaries on both surfaces along midrib, 2 to many, along margin several, both surfaces smooth, mid to dark green when fresh, dull and lighter beneath, drying brownish green, slightly darker brown underneath; venation slightly raised on both sides, marginal vein indistinct, secondary nerves pinnate, 5–8 pairs, sometimes very parallel, at c. 52° angle with midrib, tertiary nerves more or less scalariform, perpendicular to midrib, higher order nerves indistinct, reticulate. Inflorescences axillary, mostly single, staminate rachises up to 9.5 cm long, 1–1.3 mm diam, pistillate ones up to 3 cm long in flower, up to 9 cm when in fruit, 1–1.5 mm diam, thickening during fruit set to c. 2 mm; bracts vestigial; flowers single per node (young additional buds can be present when staminate). Staminate flowers c. 7.5 mm diam, white, sweet scented; pedicel 2–5 mm long, 0.8–1 mm diam; sepals 3–4, ovate, 3.8–5 by 2.5–3.5 mm, green to yellow; disc lobes yellow; stamens c. 40, filaments 3–8.3 mm long, white, anthers 0.4–0.6 mm long. Pistillate flowers 3.8–6 mm diam, green; pedicel c. 3.3 mm long; sepals 3–5, triangular, 1.6–3.1 by 1.4–2 mm, recurved; ovary 2(–3)-locular, ellipsoid, c. 3 by 3 mm; style c. 0.8 mm long, sturdy, stigmas 2–5 mm long, recurved. Fruits capsular, flattened obvoid, angular (perhaps not ripe yet) with often slightly raised suture, 2–2.9 cm wide by 2–2.9 cm high; pedicel c. 3 mm long, abscession zone subbasally; wall 1–1.8 mm thick, brown when dry, surface somewhat rugose; endocarp enclosing all seeds; stigma mostly persistent. Seeds bean-like to flattened at one side, c. 1.9 by 1.3 by 1 cm, attached in middle, black.

Distribution — New Guinea.

Habitat & Ecology — Lowland rain forest to Araucaria-Anisoptera forest at higher altitudes; soil: clayey, sandy clay, loam, broken lava, can be inundated in the wet season. Altitude: 8–800 m. Flowering: March–June, August, September, November; fruiting: January, March, July–September, November, December.

Vernacular names — New Guinea: Papua: New Guinea: Arom (Hattam); Kem (Mooi); Lowkwa (Manikiong); Manaper/Manapper/Manapir (Biak); Moe-e (Tor); Moentawiempi, Moentawinakpopi (Roberbai, Japen dialect); Moëre (Wain); Mwer (Berik); Sohol/Sohei (Manikiong); Tabet (Moejoe); Tajapmoetop (Mandobo); Wobbrijka (Manikiong); Winsoka (Arfak, Sidai dialect); Papua New Guinea: Akop; He-arahai (Mangalese, Bariji dialect).

Wood — Sapwood not defined from heartwood, white to straw-coloured, close grained, medium hard to hard, medium heavy to heavy. Pores few, small, visible to naked eye, short radial chains. Rays few, barely visible to the naked eye. Parenchyma in numerous fine bands. (NGF (Mair) 547; NGF (Havel & Kairo) 17205).
Notes — 1. The epithet *papuana* by Gilg is the oldest one on species level, however, within *Blumeodendron* the combination already existed (*B. papuanum* Pax & K.Hoffm.; Pax & Hoffmann 1919). Therefore, Gilg’s name has to receive a new name within *Blumeodendron* even in spite of the fact that *B. papuanum* Pax & K.Hoffm. is the same species.

2. This species closely resembles *B. tokbrai*, but differs in the size and form of the fruits, smaller (2–2.9 by 2–2.9 cm vs 2.3–4.8 by 2.3–4.1 cm) and often angular and with slightly thickened sutures (vs round, without thickened sutures), the thickness of the fruit wall is thinner (1–1.8 mm vs 4–7 mm) and the presence of broader sepals in the pistillate (1.4–2 mm vs 0.5–1.1 mm) and staminate flowers (2.5–3.5 by 1–2 mm). Moreover, the leaves of *B. novoguineense* usually dry brownish green, which also occurs in *B. tokbrai*, but most dry leaves of *B. tokbrai* are dark brown.

7. *Blumeodendron philippinense* Merr. & Rolfe — Fig. 7; Map 6

*Blumeodendron philippinense* Merr. & Rolfe (in Merr. 1920) 555; Merr. (1923) 429. — Type: FB (Topacio) 20054 (holo PNH lost; iso L), Philippines, Luzon, Bataan Prov., Mount Mariveles.

Trees, to 15 m high, dbh to 45 cm; flowering branches c. 5 mm diam, generally round, with fast fading orange lepidote hairs, internodes c. 4 cm long. Leaves alternate; petiole 3.9–8.9 cm long, diam of thinnest part 1.5–2 mm, round with groove above, basal pulvinus c. 3 mm diam, with lepidote hairs, orange, early caducous; blade ovate, 7.8–21 by 3.7–10.2 cm, length/width ratio 2–2.3, coriaceous, symmetric, glabrous, base broadly cuneate to attenuate, margin recurved, apex acuminate, both surfaces smooth, glossy, upper dark green, lower pale green, adaxial surface browner than abaxial surface when dry, extra-

![Image](attachment:image.png)

**Fig. 7 Blumeodendron philippinense** Merr. & Rolfe. Habit (FB (Topacio) 20054, L). — Drawing by Esmée Winkel, 2016.
floral nectaries along margin 6–7; venation: marginal vein indistinct, secondary nerves 5–6 pairs, usually parallel, at c. 33° angle with midrib, tertiary nerves perpendicular to midrib and/or only to secondary nerves, higher order nerves indistinct. Inflorescences terminal and axillary, only consisting of an up to 1.3 cm long rachis, staminate ones 3–4 together, pistillate ones single or 2 per node; latter inflorescences thickening after fertilization, to 2.5 mm diam; lepidote hairs present, orange. Staminate flowers seen in bud; pedicel c. 3 mm long; buds c. 4 mm diam, c. 6 per inflorescence; rest unknown. Pistillate flowers seen in fruiting stage; upper part of pedicel above abscission zone c. 3 mm long; sepals 5, ovate, c. 2 by 2 mm; disc very c. 1 mm high; ovary 2–3-locular, style c. 0.8 mm long, stigmas c. 3 mm long. Fruits subglobular, c. 2 per inflorescence, up to 3 cm in width when immature, green (probably unripe), surface knobby; pedicel c. 6 mm long, to c. 3.5 mm diam, abscission zone basally; wall c. 1 mm thick, drying brown; endocarp enclosing two or more seeds; stigma mostly persistent. Seeds not seen mature.


Note — Distinctive for this species are the alternate, coriaceous leaves and the very short inflorescences. The short inflorescences are reminiscent of B. kurzii (leaves in whorls) and alternate leaves are found in various species, but all with longer inflorescences except for B. borneense from the Malay Peninsula, but the latter form has light green dried leaves instead of brown dry leaves.

8. Blumeodendron subrotundifolium (Elmer) Merr. — Fig. 8; Map 6


Trees, to 50 m high, bole to 25 m high, dbh to 91 cm; bole sometimes fluted or with low buttresses up to 1.5 m, out c. 1.5 m, c. 2.5 cm thick; flowering branches 3 (staminate)—28 (pistillate) mm diam, generally round, with orange lepidote hairs, early glabrescent, internodes up to c. 5 cm. Outer bark brown to yellow-brown to grey-brown to yellow-grey to grey (to greyish green), fissured to scaly to flaky, soft, lenticellate, 1–3 mm thick; inner bark red, light or reddish brown or dark brown with yellow and light brown spots (laminated), hard; 8–10 mm thick; sometimes exudate reported, red, watery; sapwood cream to white (with pinkish tinge radially), yellow or light reddish brown, very hard; heartwood brown. Leaves alternate to subopposite to in pseudo-whorls; petiole 2.4–18.5 cm long, diam of thinnest part 1–15 mm, round, basal pulvisc 2–20 mm diam, fast fading orange lepidote hairs; blade elliptic, 6.2–46 by 3–22 cm, length/width ratio 1.2–3.1, coriaceous (slightly bendable) to very coriaceous (breaking), symmetric, glabrous, base emarginate to rounded to cuneate, margin recurved, apex acuminate to cuspidate, both surfaces smooth, extrafloral nectaries on both surfaces along midrib c. 2–26, along margin c. 8–20, adaxial surface usually drying shiny brown, abaxial surface lighter dull brown; venation: marginal vein indistinct, secondary nerves pinnate, 3–4(–11) pairs, sometimes very parallel, at c. 52° angle with midrib, tertiary nerves raised below, perpendicular to midrib and/or only to secondary nerves, higher order nerves indistinct. Inflorescences caulis, ramiflorous to axillary, c. 0.1 cm diam, staminate ones often paired, up to 4.5 cm long, pistillate ones single, up to 2.3 cm long, rachis thickening during fruit set to c. 4 mm, peduncle c. 1.3 cm long, brown; bracteoles triangular, c. 0.5 by 0.2 cm, margin undulate; lepidote hairs orange. Flowers pale yellow to yellow-green to yellowish tinged pink to (greenish) red. Staminate flowers 5–6 mm diam; pedicel 3–25 mm long, brown; buds 1.5–5 mm diam; sepals 2–3, ovate, 4–5.5 by 3–5 mm; disc lobes yellow; stamens 25–40, yellow, filaments 1.5–3 mm long, anthers 0.4–0.5 mm long. Pistillate flowers not seen; sepals 4–5, c. 1.5 by 2.2 mm; ovary 2–3-locular, dull sordidly purple; style c. 1 mm long, sturdy, stigmas c. 2.5 mm long, recurved, greenish. Fruits capsular, subglobular (smaller) to ovoid (larger), 3.5–6 cm wide by 2.9–4.5 cm high, green (unripe) to yellow to orange-yellow (or red); pedicel c. 1.5 cm long, to c. 0.8 mm diam, abscission zone in the middle; wall 2–4 mm thick, dark brown when dry, margin slightly thickened, but without ridges, surface knobby; endocarp enclosing two or more seeds; stigma mostly persistent. Seeds bean-like to flattened at one side, 2.3–3.4 by 1.6–2.4 by 1.1–1.3 cm, attached in middle; sarcotesta cream to purple.

Distribution — Peninsular Thailand, Malay Peninsula, Sumatra, Borneo, Philippines.

Habitat & Ecology — Mixed lowland dipterocarp forest, evergreen forest, gallery (Emperan) forest, peat swamp forest, to mossy submontane forest, along logging roads; soil sandy loam, sandy clay, clayey loam, alluvial soil, bedrock: sandstone. Altitude: sea level to 1200 m. Flowering: March–November; fruiting: January, April–November. Fallen seeds/fruits are eaten by birds and animals (e.g., pigs).

 Vernacular names — Malay Peninsula: Gaham badak; Kaum Bada. Sumatra: Babak; Basi; Madang soeting; Makoera; Mamboeloe; Medang koekien; Eondal; S IKEE0E3; Tendid (Malay); Toetoeo siujeureh; Toetoeo siujeureh 0em; Toetoeo siujeureh pajo. Borneo: Anambas & Natuna Islands: Medang keladi; Kalimantan: Duhat (Malay); Kahingai; Sibawak; Sarawak; Bantas; Bantas belulang (Iban); Belulang; Berti-an (Kenyah); Empungan (Malay Sarikie); Marabulian; Ngisigi (Land Dayak); Teku (Malay). Philippines: Hallimokon (Samar); Mangamit.

Notes — 1. Blumeodendron subrotundifolium resembles B. kurzii in leaf-shape, colour of dried leaves and leaf texture. However, the leaves do not arise in whorls from thickened nodes. Also, the inflorescences are generally longer than the almost fasciculate ones of B. kurzii.
2. *Blumeodendron calophyllum* is added here as a synonym of *B. subrotundifolium*. Most specimens can easily be divided over both species as they look spectacularly different. Small, coriaceous leaves with slender petioles and more axillary smaller fruits are present in typical *B. subrotundifolium*, while much larger, very coriaceous (not bendable) leaves with thick petioles and cauliflorous large fruits are found in *B. calophyllum*. However, quite a number of specimens bridge the gap between both typical forms (see Table 1). Both forms are generally high trees with (very) coriaceous leaves on relatively long petioles, which are dry dark shiny brown above and dull brown underneath. Leaf sizes also vary strongly in *B. kurzii*, a species with which *B. subrotundifolium* was often confused.

9. *Blumeodendron tokbrai* (Blume) Kurz — Fig. 6c, 9; Map 7


*Mallotus ?vernicosus* Hook.f. (1887) 443. — *Blumeodendron vernicosum* (Hook.f.) Gage (1922) 244; Ridl. (1924) 282. — Type: Cantley 9 (K), Singapore, Botanical Garden.

![Fig. 8 Blumeodendron subrotundifolium (Elmer) Merr. a. Habit; b. fruit in lateral view; c. fruit in top view; d. base of upper leaf surface with extrafloral nectaries (a, b: Kessler et al. Berau 763; c, d: Nooteboom & Chai 2317; all L). — Drawing by Esmée Winkel, 2016.](image-url)
Table 1  Division of B. subrotundifolium forms over the smaller B. subrotundifolium form and the much larger B. calophyllum with all intermediates. Intermediate specimens are assigned to three columns to stress the gradualness in character changes.

<table>
<thead>
<tr>
<th>Area</th>
<th>Typical B. subrotundifolium</th>
<th>Intermediates</th>
<th>Typical B. calophyllum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sumatra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bb 3045</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bb 5215</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bb 5369</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bb 27645</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Béguin 491</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Béguin 501</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Achmad 1270</td>
<td>bb 2823</td>
<td>bb 2431</td>
</tr>
<tr>
<td></td>
<td>Achmad 1325</td>
<td>bb 3137</td>
<td>bb 9078</td>
</tr>
<tr>
<td></td>
<td>Achmad 1448</td>
<td>bb 29523</td>
<td>bb 19621</td>
</tr>
<tr>
<td></td>
<td>bb 5791</td>
<td>bb 30093</td>
<td>bb 25204</td>
</tr>
<tr>
<td></td>
<td>Béguin 288</td>
<td></td>
<td>De Wilde &amp; De Wilde-Duyfjes 19486</td>
</tr>
<tr>
<td></td>
<td>Béguin 328</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>bb 5215 Achmad 1325</td>
<td>bb 18259</td>
<td>bb 18324</td>
</tr>
<tr>
<td>Borneo</td>
<td>bb 13778</td>
<td>bb 28140</td>
<td>Kostermans 7652</td>
</tr>
<tr>
<td></td>
<td>BBUN 15</td>
<td>bb 34369</td>
<td>S 15684</td>
</tr>
<tr>
<td></td>
<td>Kostermans 13629</td>
<td>Fuchs 31372</td>
<td>SAN 85404</td>
</tr>
<tr>
<td></td>
<td>S 9568</td>
<td>Jacobs 5367</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S 36664</td>
<td>Kostermans 7629</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S 39134</td>
<td>S 5228</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S 41635</td>
<td>S 34695</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S 41880</td>
<td>S 38587</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAN 16283</td>
<td>S 44010</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAN 24987</td>
<td>SAN 30133</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAN 84144</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAN 100029</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sidiyasa et al. 3387</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suzuki 5354</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suzuki 10048</td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>BS 16549</td>
<td>PNH 42439</td>
<td>FB 18906</td>
</tr>
<tr>
<td></td>
<td>FB 10598</td>
<td>PNH 117385</td>
<td>PPI 4276</td>
</tr>
<tr>
<td></td>
<td>PNH 14450</td>
<td></td>
<td>Santos 4541</td>
</tr>
<tr>
<td></td>
<td>PNH 117735</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

?Elateriospermum paucinervia Elmer (1908) 484. — Blumeodendron paucinervium (Elmer) Merr. (1920) 555; (1923) 426. — Type: Elmer 7416 (holo PNH lost; iso L), Philippines, Luzon, Tayabas Prov., Lucban.

Trees, to 40 m high, bole to 25 m high, dbh to 100 cm; stilt roots or buttresses up to 3 m high, out to 3 m; flowering branches 2–5.5 mm diam, often somewhat angular, with internodes 3–7 cm long; nodes hardly thickened. Outer bark red-, greenish- or light brown to (dark) grey to red to orange-(brown), smooth, pustular or fissured, lenticels round, c. 0.5 mm thick; inner bark wine- or orange red to yellow-brown, brown, (ochre-)orange, white, purple, yellow-pink and sometimes mottled, 5–10 mm thick; exudate indistinct, but plants becoming sticky; sapwood straw to pale yellow to cream to greyish white; heartwood straw. Leaves usually always a few alternate, but also subopposite to 3 leaves whorled; petiole 1.2–9.4 cm long, diam of thinnest part 1–2 mm, basal pulvinus 1–3.6 mm diam, hairs present (see Note 2); blade (ovate to elliptic to obovate), 5.3–31 by 3.1–17.3 cm, length/width ratio 1.4–2.4 (3.3), ratio leaf length/petiole length 4.4–4.8, pergamnaceous to coriaceous, asymmetric, with simple and lepidote hairs when young, base attenuate to cuneate, margin slightly recurved, apex acuminate to cuspidate, tip rounded to mucronulate, extrafloral nectaries sometimes adaxially along midrib, c. 10, young leaves resinous, covered with orange lepidote hairs, surfaces drying brown to brown-green to dark green, smooth, abaxial surface browner than adaxial surface when dry; venation slightly raised above, marginal vein indistinct, secondary nerves 5–9 pairs, at c. 45.6° angle with midrib, tertiary nerves perpendicular to midrib, c. 2 mm apart, distinct, raised beneath, higher order nerves reticulate, indistinct. Inflorescences axillary and terminal, staminate ones 1–3 together, to 20 cm long, c. 1.4 mm diam, pistillate ones single, to 10 cm long, c. 1 mm diam; lepidote hairs orange, simple hairs white. Buds c. 3 mm diam. Staminate flowers 4–7.7 mm diam, white to pale green, sweet scented; pedicel 5.8–8.4 mm long, 0.3–0.7 mm diam; sepals 3–4, ovate to elliptic, 2.5–4 by 1–2 mm, inside red; stamens 31–36, filaments c. 4 mm long, white, anthers c. 0.5 mm long, yellow. Pistillate flowers 0.9–2.3 mm diam, light green; pedicel c. 2.5 mm long, c. 0.8 mm diam; sepals 5, triangular to ovate, 1.5–3 by 0.5–1.1 mm, inside red; ovary 2–3(–4)-locular, ellipsoid, 1.7–2.3 mm high, 1.4–2.3 mm diam; style indistinct, 0.3–0.5 mm long, stigma 1.3–4 mm long, recurved. Fruits ellipsoid to flattened-globular,
Fig. 9  *Blumeodendron tokbrai* (Blume) Kurz.  

a. Habit with alternate leaves and long inflorescences; b. base of leaf blade; c. staminate flower; d. idem with disc glands in detail; e. pistillate flower; f. fruit; g. seed (a, b: KEP (Ismail) 104883; c, d: Niyomdham et al. 1009; e: KEP FRI (Cockburn) 7696; f. KEP FRI (Ng) 1966; g. SF (Sinclair) 39693; all L). — Drawing by Anita Walsmit Sachs, 2006.
3.3–4.8 cm broad by 2.3–4.1 cm high, green to red-brown when dry; pedicel to 1 cm long, up to 3 mm diam, abscission zone basally; sepal not persistent; disc distinct; wall 4–7 mm thick, meso- and endocarp thickened, mesocarp sometimes with cavities when dry (see Note 3), surface knobly; margin mostly pitted when dry; endocarp enclosing 2 or more seeds; stigma usually long persistent. Seeds bean-shaped, 2–3.8 by 1.1–2.2 by 0.9–1.3 cm; sarcotesta yellow.

Distribution — Thailand, Malay Peninsula, Sumatra, Java, Borneo, Philippines, Sulawesi, Moluccas.

Habitat & Ecology — Primary dipterocarp lowland forest, peat swamp forest, mangrove, kerangas forest, riverine forest, secondary forest; soil: white sand, sandy clay, clay, sandstone. Altitude: sea level to 1400 m. Flowering and fruiting throughout the year.

Uses — Sarawak (Borneo): Wood used for canoes and planks; fruits edible.

Vernacular names — Malay Peninsula: Gaham badak; Kaum bada; Marahabulan. Sumatra: Awa siujeure; Batin-batin oeding; Belanti; Berowoa babi; Kalek kasih; Kemili oetan (Malay-Palembang); Keteroeng; Lala lalar oeding; Matakoeroeng; Niho (Enggano); Lala lalar oeding; Matakoeroeng; Oekih danan; Pananipai; Siujeure etum; Siujeure-pajo; Siujeure-silai; Sioerohe alalai; Tekoeroeng; Tipeueroeng keteroeng; Tipeueroeng silai; Toe-teen ramboetan dotan. Java: Boeroal; Kendoeng leuweung; Ki tokbraay; Tokbray. Sangi and Talada Isles: Aluwatu. Borneo: Brunei; Antangon (Iban); Kalimantan; Sibar; Sabah; Gangu-lang; Gulang gulang; Tombuakat; Sarawak: Bantas (Iban); Buan (Kayan); Empungan (Millanau); Marahabulan; Merbulan; Melahabulan; Oendal; Pelapi (Kayan); Selunsor merah; Takok (Melanau); Teku. Sulawesi: Talade; Aluwatu.

Notes — 1. Blumeodendron novoguineense and B. tokbrai resemble each other closely, see Note 2 under former.

2. Simple hairs are usually visible in Sumatran collections.

3. Some specimens in Borneo dry with green leaves and the fruits are very thick, not only the endocarp is thick also the meso- and endocarp thickened, mesocarp sometimes with cavities of which is unclear if these were formed during drying of the fruits. Examples are: A (Wood) 4815, S (Pae) 16992, S (Au) 23937, SAN (Gansau) 47750. Probably S (Anderson & Paie) 28338, with staminate buds, and Ambrianyah & Arifin W 807, with young fruits, also belong to this form. Endert 4029, from SE Kalimantan, dried brownish green and also has fruits — still young — with a thickened mesoderm, but without cavities (see also Note 1 under B. borneense).

4. Formerly, no distinction was made between B. tokbrai and B. novoguineense. The geographical border between both species is between the Moluccas (B. tokbrai; fruits larger and thick-walled) and New Guinea (B. novoguineense; fruits smaller and thin-walled). This may be due to clinal variation in the fruits of B. tokbrai, which show a geocline, they are larger in the west (Malay Peninsula and Sumatra) and smaller towards the east (Philippines, Moluccas). Thus it seems that the small fruits of B. novoguineense are a continuation of this trend, but this is actually not the case.

EXCLUDED TAXA

Blumeodendron muelleri Kurz (1874) 245, nom. superfl. (presented as new name for Paracaroton pendulus) = Paracaroton pendulus (Hassk.) Miq.

Acknowledgements We like to thank the directors of A, BISH, BM, G, GH, HBG, K, L, NY, SAN, U and US for photos or loans of their material. An anonymous reviewer, editor and desktop editor are thanked for improving the manuscript. The beautiful drawings were made by Anita Walsmit Sachs and Esmée Winkel.

REFERENCES


