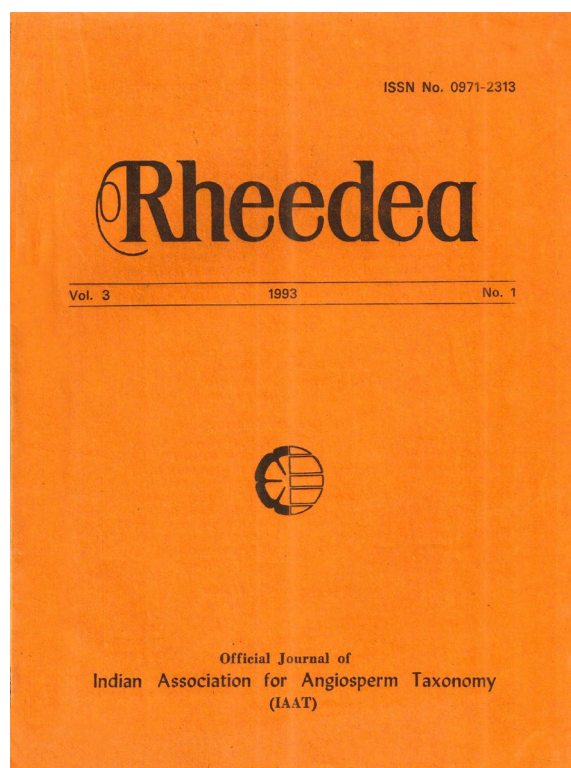




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## The Annonaceae of the Balikpapan - Samarinda area, East Kalimantan, Indonesia

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### Abstract

The Annonaceous flora of the Balikpapan-Samarinda area, East Kalimantan, Indonesia, is described, including one new species of *Monocarpia* Miq.

### INTRODUCTION

The Annonaceae are one of the most important families of the tropical lowland rain forest in the Malesian region and it seems that the highest diversity of this family is found in Borneo and New Guinea. As the trees are usually small to medium sized and the wood is very soft, most of the species are of no economic importance. However, as regards the abundance and/or frequency, the family stands at the third place after Euphorbiaceae and Myrtaceae and plays an important role in the understory layer. Especially *Polyalthia sumatrana* and *Polyalthia rumphii* are locally very abundant.

During my (P. K.) work for the Tropenbos project, "Tree Flora of the Balikpapan-Samarinda area, East Kalimantan, Indonesia", I got the opportunity to make collections of a large number of Annonaceae, which will not be included in the "Tree Flora" due to their habit (climbers) or their lack of economic importance. As this area is especially rich in genera as well as in species, we, nevertheless, decided to publish a paper on this family. We found 24 genera present from this area in the Wanariset Herbarium which represent about 50% of the total number of genera in Malesia. Additionally, we used also some older collections of this area, to get a better insight in the variation of the species. As our aim was not a revision of the genera but merely a floristic paper, we only checked material deposited at the Rijksherbarium, Leiden (L). As the number of species of each genus is generally not very high, we tried to construct keys as user friendly as possible, using mainly vegetative characters only, adding generative characters for the certainty of the identification.

#### Key to the genera (except the cultivated genus *Annona*)

- 1a Climbers.....2  
b Erect trees or shrubs.....7

- 2a Stellate hairs present, at least on young parts.....3  
 b Simple hairs present or plants glabrous.....4  
 3a Flowers small, c. 1.5 cm in diameter, sometimes sepals 2, petals 4, in two whorls..... **Cyathostemma**  
 b Flowers big, at least 2.5 cm in diameter, sepals 3, petals 6, in two whorls ..... **Uvaria**  
 4a Climbers with leaf-opposed, laterally compressed hooks.....**Artabotrys**  
 b Climbers without hooks.....5  
 5a Sepals persistent in fruit, separated from the carpels by a short interval of of the torus.....**Mitrella**  
 b Sepals not persistent in fruit.....6  
 6a Flowers leaf-opposed or extra-axillary, solitary .....**Friesodielsia**  
 b Inflorescences several-flowered, terminal, or axillary.....**Fissistigma**  
 7a Stellate hairs present.....8  
 b Simple hairs present or plants glabrous.....9  
 8a Leaves with long soft hairs, inner petals slightly clawed, monocarps few, ferruginous tomentose, with 1-2 seeds.....**Neo-uvaria**  
 b Leaves almost glabrous with some scattered small stellate hairs, intermixed with simple ones, inner petals concave at the base, monocarps several-seeded..... **Cyathocalyx**  
 9a Base of leaves usually heart-shaped or asymmetrical, flowers star-shaped, scented, fruitlets with articulation between monocarps and its stalk..... **Cananga**  
 b Base of leaves symmetrical, never truly heart-shaped, fruitlets never with articulation between monocarps and its stalk.....10  
 10a Anther cells transversely septate.....11  
 b Anther cells not transversely septate.....12  
 11a Leaves usually big (c. 30cm long, c. 15cm wide), inner petals mitriform, clawed, much smaller than outer ones.....**Goniothalamus**  
 b Leaves usually small (up to 15cm long, c. 8cm wide), inner petals spoon-shaped, more or less the same length of outer ones.....**Xylopia**  
 12a Flowers unisexual.....13  
 b Flowers bisexual.....14  
 13a Inner petals clawed, mitriform, valvate, female flowers often with staminodes.....**Pseuduvaria**  
 b Inner petals not clawed, ovate-orbicular, imbricate, female flowers without staminodes.....**Stelechocarpus**  
 14a Carpels 1-3.....15  
 b Carpels more than 5.....16  
 15a Carpel 1, globose, glaucous, seeds 2.....**Mezzettia**  
 b Carpels 1-3, ellipsoidal, not glaucous, seeds 10-12.....**Monocarpia**  
 16a Outer petals similar to sepals in size and form, small, inner petals much longer.....17  
 b Outer and inner petals similar in size and form.....18

- 17a Leaves usually not drying black, stamens miliusoid, i. e. without shield-like connective appendages..... **Miliusa**  
 b Leaves drying black, stamens uvarioid, i. e. with shield-like connective appendage..... **Pheanthus**
- 18a Inner petals mitriform..... **Mitrephora**  
 b Inner petals not mitriform..... 19
- 19a Stamens miliusoid, carpels 6..... **Alphonsea**  
 b Stamens uvarioid, carpels more than 6..... 20
- 20a Flowers very small, c. 3mm in diameter..... **Popowia**  
 b Flowers at least 1.5cm in diameter..... 21
- 21a Sepals and petals imbricate..... **Enicosanthum**  
 b Sepals and petals valvate..... 22
- 22a Inner petals grooved or warty at the base inside..... **Meiogyne**  
 b Inner petals neither grooved nor warty at the base inside..... **Polyalthia**

**Alphonsea** Hook. f. & Thomson

**Alphonsea javanica** Scheffer, Nat. Tijdschr. Ned. Ind. 31: 340. 1870; Backer, Schoolfl. Java 1:27. 1911.

Tree 10-30m tall. Young twigs glabrous. Leaves coriaceous, glabrous, upper surface shining, oblong or ovate-oblong, base rounded or cuneate, apex acutely acuminate, 8–25cm long, 4–8cm wide. Petiole 6–10mm long, c. 2mm in diameter. Lateral veins 9–11 pairs, anastomosing 5–6mm before the margin. Inflorescence 1-4-flowered, leaf-opposed or supra-axillary. Peduncle c. 5mm long, pedicel 10–20mm long. Sepals somewhat connate, c. 2mm long, c. 2mm wide. Outer petals c. 18mm long, 9mm wide, inner similar, but somewhat shorter and narrower. Stamens about 40–60 in 4 rows, miliusoid. Carpels 6 (not 4–12 as recorded by Backer, 1911), stigma oblong to capitate, slightly bilobed. Carpida 2–3(–6), cylindrical to ovoid, smooth, glabrous, 4–7cm long, 3–4cm in diameter. Stalk 4–5mm long, 4–6mm in diameter. Peduncle and pedicel c. 15mm long, 3–4mm in diameter.

*Distribution:* Thailand: Peninsula, Malay Peninsula, Sumatra, Java, Borneo, Philippines. Celebes, Moluccas.

*Ecology:* In the Balikpapan areas trees are usually found in Belukar forest near streams.

*Collector's notes:* Kessler observed that monocarps open at maturity in East Kalimantan specimens. The pulp is sweet and can be eaten.

*Specimens examined:* *Ambriansyah & Arifin* AA 398, AA 504; *Kostermans* 9907, 13977.

**Annona** L.

Treelet with simple hairs. Leaves with or without domatia. Flowers solitary or in few-flowered rhipidia. Flowers big or small, petals 6, or the inner

whorl very small or absent; valvate, ovaries free at first or united from the beginning into a fleshy syncarp, the surface covered with spines or almost smooth.

#### Key to the species

- 1a Young twigs glabrescent, petiole up to 5mm long, outer petals broadly ovate, fruits spiny.....**A. muricata**  
 2a Young twigs sericeous, petiole 6-12mm long, outer petals linear-oblong, fruits not spiny.....**A. squamosa**

*Annona muricata* L., Sp. Pl. 1:536.1753; Fries, Acta Horti Berg. 10:201. 1931.

*Vernacular name:* Sirsak (M).

Treelet up to 10m tall. Young twigs glabrescent. Petiole c. 5mm long. Leaves 8-12(-18)cm long, 3-5(-7)cm wide, membranous, base acute, apex acute, secondary veins 8-10 pairs, with minute domatia. Flowers solitary, terminal or opposite the leaves, big, c. 6cm in diameter. Outer petals broadly ovate, 2.5-3.5 cm long, base cordate, apex acuminate, inner petals somewhat shorter, shortly stipitate. Stamens many. Carpels many, hairy, ovule 1. Fruits ovoid to obovoid, 15-30cm long, 10-20cm in diameter, green, spines curved. Seeds black, c. 1.5 cm long, flesh white juicy.

*Note:* An edible fruit tree most probably indigenous from the Middle American Islands, now planted in all tropical countries.

*Specimens examined:* *Ambriansyah & Arifin W 322*

*Annona squamosa* L., Sp. Pl. 1:537.1753; Fries, Acta Horti Berg. 10:277.1931.

Treelet up to 5m tall. Young twigs sericeous. Petiole c. 6-12mm long. Leaves 5-11cm long, 2-5cm wide, membranous, base cuneate, apex shortly acute, secondary veins 8-11. Flowers solitary or on few-flowered rhipidia, opposite the leaves. Outer petals linear-oblong, base concave 1.5-3cm long, inner petals usually missing or at least rudimentary, ovate, c. 1 mm long. Stamens many. Carpels many, hairy, ovules many. Fruits globose-ovoid, 8-10cm in diameter, glaucous-green, glabrous, areoles prominent but not spiny.

*Note:* This fruit tree is less often planted than *A. muricata*, its origin are the west Indian Islands where it occurs abundantly.

*Specimen examined:* *Ambriansyah & Arifin AA 254*

#### *Artabotrys* R. Brown ex Ker-Gawler

Climbers. Indument of simple hairs. Inflorescences modified into hooks, several-flowered, leaf-opposed or supra-axillary. Sepals valvate. Petals valvate, equal-sized, spoon-shaped, base concave, enclosing the stamens and carpels, upper part terete or flattened. Stamens arranged in few whorls, apical prolongation shield-like, dilated. Carpels 1?-or 2-seeded.

## Key to the species

- 1 a Young twigs densely pubescent with long reddish brown hairs, leaves > 12cm long.....**A. macranth**  
 b Young twigs glabrous or with sparse short whitish hairs, leaves < 12 cm long  
 2 a Upper part of the petals in both whorls terete, 0.5—1 mm in diameter, fruits ellipsoid, 8—13 mm long, 4—7 mm in diameter.....**A. suaveolens**  
 b Upper part of the petals flattened or terete only in the inner whorl, c. 1.5 mm wide, fruits otherwise (not seen in *A. gracilis* and *A. sumatrana*).....3  
 3 a Pedicel 9—15 mm long, upper part of the petals flattened in both whorl, c.1.5 mm wide.....**A. gracilis**  
 b Pedicel 3--9 mm long, upper part of the petals wider or, if of the same width, then inner whorl terete .....4  
 4 a Pedicel 6—9mm long, upper part of the petals 3—4mm wide; fruits broadly to depressed obovoid.....**A. rosea**  
 b Pedicel 3—4 mm long, upper part of the petals c. 1.5mm wide in the outer whorl, terete in the inner whorl.....**A. sumatrana**

**Artabotrys gracilis** King, J. As. Soc. Beng. 61, 2:35. 1892.

Climber. Young twigs glabrous. Leaves membranous (to subcoriaceous), glabrous or with sparse hairs on the midrib beneath, ovate-oblong, 6.5—11.5 cm long, 2.5—4 cm wide, base cuneate, slightly attenuate, apex caudate, lateral veins faintly prominent, 7—10 pairs. Petiole 3—9mm long, 0.5—1mm in diameter. Pedicel 9—15mm long. Sepals connate, 2—3mm long, 3—3.5 mm wide. Petals 7--8 mm long, base 3 mm wide, upper part 1.5 mm wide, inner petals slightly narrower. Stamens and carpels not seen. Carpida not seen.

*Distribution:* Borneo.

*Ecology:* In Agathis/Dipterocarp forest, peat on sandy soil.

*Collector's notes:* Flowers white, or calyx green, petals lilac.

*Notes:* Leaves and flowers in dry state are sometimes covered with a yellow mouldiness as in *polyalthia rumphii*

*Specimens Examined:* van Balgooy 5837; Kostermans 10562

**Artabotrys macrantha** Holth., Blumea 5:180. 1942.

Climber up to 15 m high. Young twigs densely pubescent with long reddish brown hairs. Leaves membranous, glabrous above, pubescent beneath, obovate, 16—22 cm long, 7.5—10.5cm wide, base cuneate, apex shortly acuminate, lateral veins 10—11 pairs. Petiole 5—8mm long, 2.5—4 mm in diameter. Flowers not seen. Carpida c. 15, slightly rhomboid, smooth, pubescent, 3.5—4cm long, 2—3.5 cm in diameter, almost sessile. Peduncle c. 15mm long, 6mm in diameter. Seeds 2.

*Distribution:* Borneo, Talaud Islands.

*Ecology:* In Dipterocarp forest.

*Collector's notes:* Mesocarp red brown, flacy, pulp white.

*Note:* *A. macrantha* thus far is only known from Karakelong. Most likely *A. macrantha* is a synonym of *A. lanuginosa* Boerl. from Borneo, as the figure given by Boerlage (lc. Bogor. 1899) show the same dense indument as *A. macrantha*. Unfortunately herbarium material of *A. lanuginosa* is not available in the Leiden herbarium.

*Specimens examined:* Kade Sidiyasa 668

*Artabotrys rosea* Boerl., lc. Bogor. :166, t.53.1899.

Climber up to 20 m high. Young twigs glabrous or with sparse hairs. Leaves (sub) coriaceous, glabrous or with sparse hairs on the midrib beneath, oblong or ovate-oblong, base cuneate, slightly attenuate, apex acuminate, 5—11 cm long, 2.5—4.5 cm wide, lateral veins faint. c. 10—12 pairs. Petiole 3—5 mm long, c. 1 mm thick. Pedicel 4—7 mm long. Sepals slightly connate, 3—4 mm long, 3 mm wide. Petals 14—21 mm long, base 3 mm wide, upper part 3—4 mm wide, inner petals slightly narrower. Carpida 2—3, broadly to depressed obovoid, smooth, glabrous, c. 3 cm long, 3—3.5 cm in diameter, stalks 3—5 mm long, 6(—9) mm in diameter. Peduncle and pedicel 6—9 mm long, 3—4 mm in diameter. Seeds 2, basally attached.

*Distribution:* Borneo.

*Ecology:* In Mixed Dipterocarp Forest or secondary forest, on low ridges, on sandy loam soil.

*Collector's notes:* Flowers greenish white, greenish yellow, yellow, or pale violet when young. Fruits green or yellow.

*Specimens examined:* Ambriansyah & Arifin AA 279; AA 349; Endert 3430, 4793; Kessler 548, 598; Kostermans 4266, 4354, 4375, 9577, 13732; Leighton 214.

*Artabotrys suaveolens* (Blume) Blume, Fl. Java Anon. :62.1830; Boerl., lc. Bogor. :t.39.1899.

Climber up to 20 m high. Young twigs pubescent. Leaves (sub) coriaceous, glabrous except for the midrib beneath, elliptic to oblong, base cuneate, attenuate, apex acuminate to caudate, 4—9.5 cm long, 2—4 cm wide, lateral veins faint, 7—8 pairs. Petiole 3—5 mm long, 0.5—1 mm in diameter. Pedicel 2—6 mm long. Sepals more or less fused, 1.5—2 mm long, 1.5—2 mm wide. Petals 7—15 mm long, base 2—3 mm wide, upper part 0.5—1 mm wide. Carpels 3, glabrous. Carpida 1—3, ellipsoid, glabrous, 8—13 mm long, 4—7 mm wide, sessile, fruiting pedicel 4—8 mm long, 1—1.5 mm in diameter.

*Distribution:* Thailand, Malay Peninsula, Sumatra, Java, Borneo.

*Ecology:* In (Dipterocarp) Forest.

*Collector's notes:* Flowers yellowish or yellow white. Fruits green.

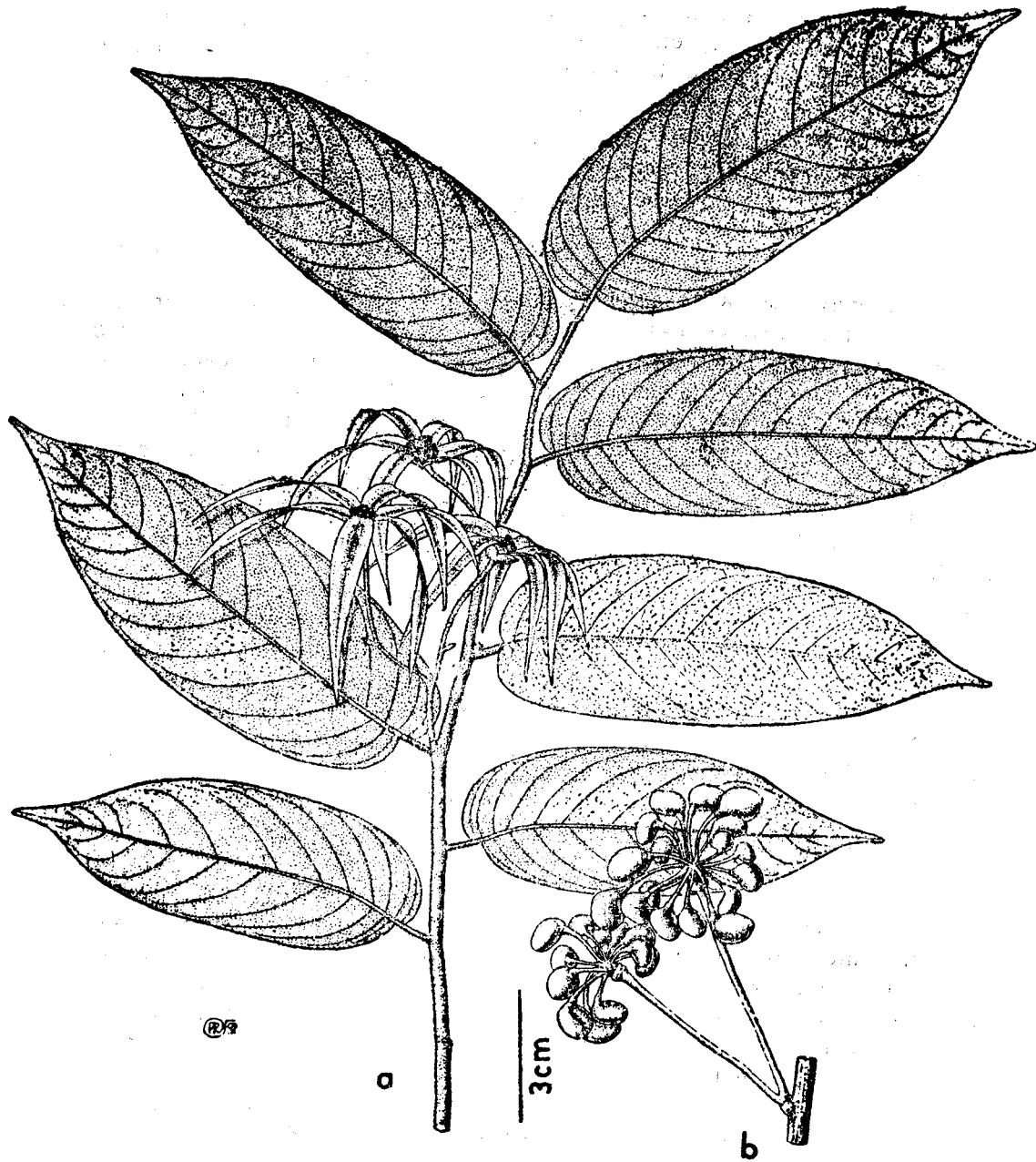


Fig. 1. *Cananga odorata*. a. Habit; b. Infructescence (AA 136)



enclosing the stamens and carpels, upper part flat or terete. Stamens numerous, apical prolongation shield-like, dilated. Ovules several. Carpida 1 to several, ovoid or cylindrical.

#### Key to the species

- 1a Leaves pubescent beneath; upper part of the petals 1.5–2.5mm wide; carpida 10–14.....**C. carinatus**  
 b Leaves glabrous beneath; upper part of the petals c.1 mm wide; carpida 1 (–2).....**C. havilandii**

**Cyathocalyx carinatus** (Ridley) J. Sinclair, Gard. Bull. Singapore 14:239.1955.  
 (Fig. 2)

Tree up to 25m tall. Young twigs densely pubescent with reddish brown stellate hairs, older twigs glabrous. Leaves subcoriaceous, glabrous above, pubescent beneath, dull on both sides, broadly elliptic to slightly obovate, 8–20 cm long, 5.5–10 cm wide, base cuneate to nearly rounded, often asymmetrical, apex acuminate or retuse, midrib glabrous or pubescent above, pubescent beneath, lateral veins prominent beneath, 8–15 pairs. Petiole 12–16mm long, 1.5–3mm in diameter. Inflorescence a few-flowered rhipidium, with 1 or 2 flowers maturing at a time, supra-axillary. Peduncle 0–9 mm long, pedicel 2–5 mm long. Sepals slightly connate, 4–5mm long, 3–5mm wide, apex sometimes reflexed. Petals 10–45mm long, concave base, c. 3–3.5 mm wide, upper part 1.5–2.5 mm wide. Stamens arranged in c.5 whorls. Carpels up to c. 14, stigma more or less ellipsoid. Carpida 10–14, ovoid to cylindrical, c. 15mm long, c. 15 mm in diameter, greyish puberulent, sessile, peduncle, c. 10mm long. Seeds 6–8.

*Distribution:* Malay Peninsula, Borneo.

*Ecology:* In Mixed Dipterocarp Lowland Forests, in swampy area, on tuff-plateau, on low ridges, on sandy loam soil.

*Collector's notes:* Flowers greenish or pale or dark yellow. Fruits green.

*Specimens examined:* *Ambriansyah & Arifin* W 123, W 931; *Endert* 5019; *Kessler* 621 = W 931; *Kostermans* 6367, 8734, 10215; *Van Balgooy* 6057

**Cyathocalyx havilandii** Boerl.: Ic. Bogor.: 169, t. 57.1899.

Tree up to 21m tall. Young twigs densely pubescent with simple reddish brown hairs, older twigs glabrous. Leaves coriaceous, glabrous except for the midrib beneath, broadly elliptic to obovate, 7.5–22mm long, 4–10cm wide, base acute to rounded, sometimes asymmetrical, apex acuminate, lateral veins slightly prominent, 7–9 pairs. Petiole 10–15mm long, 1.5–2.5mm in diameter. Inflorescence a cauliflorous cluster. Pedicel 6–9mm long. Sepals free, 2–5mm long, c. 3 mm wide, apex not reflexed. Petals 23–55mm long, base 3–4mm wide, upper part terete, c. 1mm in diameter. Stamens and carpels not seen. Carpida 1 or 2, subglobose-ovoid, 11–40 mm long, 8–32 mm wide, brownish puberulent, sessile, peduncle 15–20 mm long.

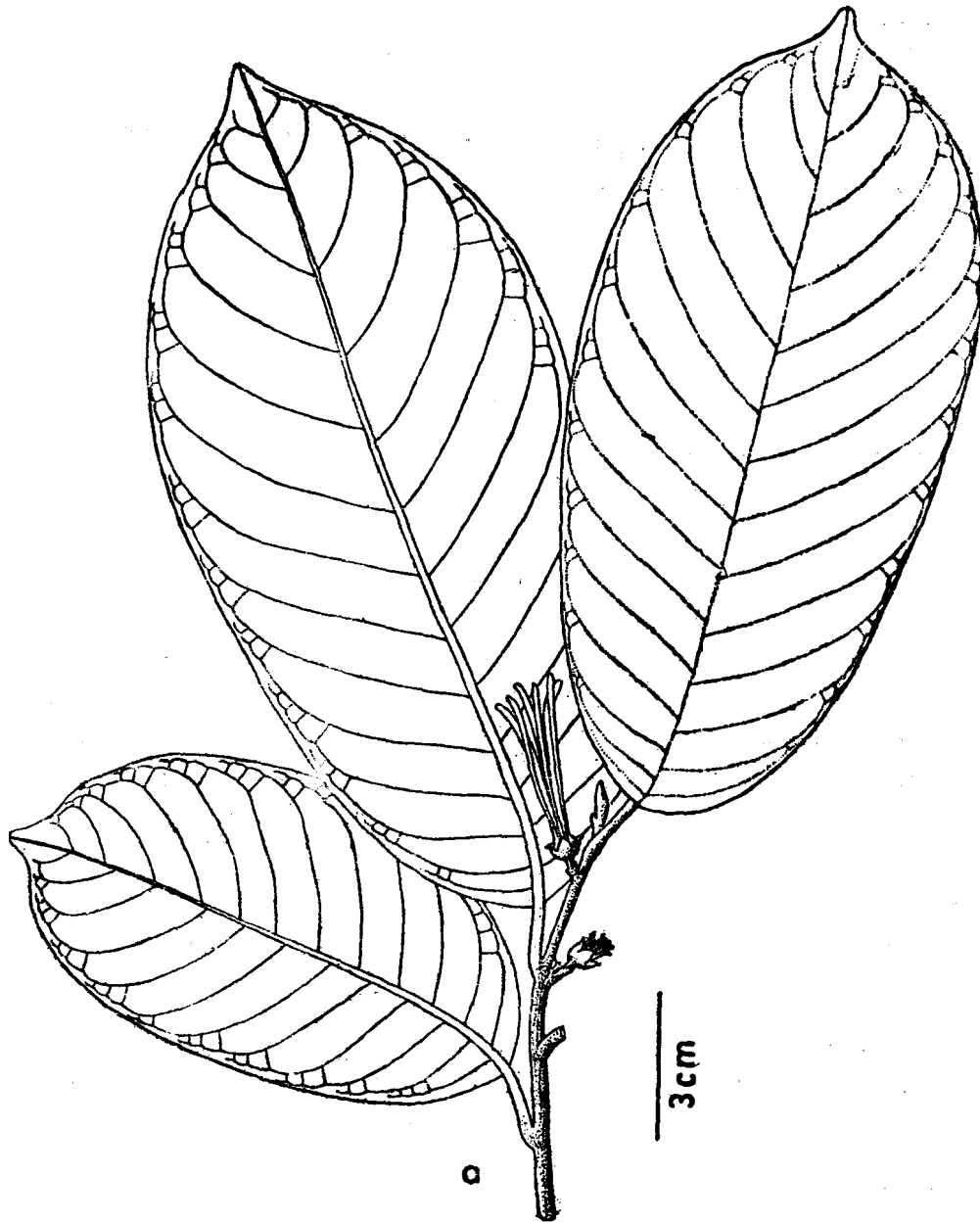


Fig. 2. *Cyathocalyx carinatus*. a. Habit (V. B. 6057)

*Distribution:* Borneo.

*Ecology:* In Lowland Dipterocarp Forest, on sandy loam soil.

*Collector's notes:* Flowers yellowish-white. Fruits green, young fruits glaucous.

*Specimens examined:* *Ambriansyah & Arifin* AA 47 = W 497; *Kostermans* 10169, 13594; *Kade Sidiyasa & Kochummen* 575.

### Cyathostemma Griffith

Climbers with stellate hairs. Flowers globose in pendulous cymes or spikes. Sepals valvate. Petals imbricate, 4 or 6, not expanding. Stamens numerous. Ovaries numerous, stigma U-shaped, ovules many.

*Note:* A genus very close to *Uvaria* but differing in the globose flowers and the petals which do not expand.

### Key to the species

- 1a Leaves glabrous on lower surface, ripe fruitlets glabrous.....*C. viridiflorum*  
 b Leaves stellate pubescent on the lower surface, sometimes glabrescent, ripe fruitlets tawny-stellate-tomentose .....*C. excelsum*

*Cyathostemma excelsum* (Hook. f. & Thomson) J. Sinclair, Gard. Bull. Singapore 14:226.1955.

*Tetrapetalum volubile* Miq., Ann. Mus. Bot. Lugd. Bat. 2:1.1865; syn. nov.

(Fig. 3.)

Climber up to 30m tall. Young twigs rusty tomentose, later often glabrous. Leaves oblong-elliptic, 10–27cm long, 4–10cm wide, base slightly or deeply heart-shaped, apex acuminate, sparsely stellately hairy beneath, almost glabrous above, secondary veins 10–13 pairs. Flowers c. 15–20, on a dense c. 4cm long, supra-axillary spike. Sepals 2 or 3, imbricate, broadly rotund. Petals 4 or 6, in two rows, imbricate, yellowish-green, broadly rotund, deeply concave. Stamens numerous. Carpels numerous, hirsute, stigmas bilobed. Carpidia sub-globose, densely stellate-tawny-tomentose, tuberculate, 2–3cm in diameter, stalk c. 3cm long. Seeds 10–14, biseriate.

*Distribution:* Peninsula Malaya, Sumatra and Borneo.

*Notes:* *Tetrapetalum volubile* Miq., formerly only known from Borneo, closely resembles *Cyathostemma excelsum* (Hook. f. & Thomson) J. Sinclair. The type of the former and a few sheets from other localities (*Kade Sidiyasa & Kochummen* 565) differ in having only 2 sepals and 4 petals (thus the genus name). We are convinced that this is no constant character and all other characters suggest that this species is a *Cyathostemma*, if that genus is to be maintained distinct from *Uvaria*.

*Specimens examined:* *Enderf* 1551; *Kade Sidiyasa & Kochummen* 565; *Kostermans* 4733.

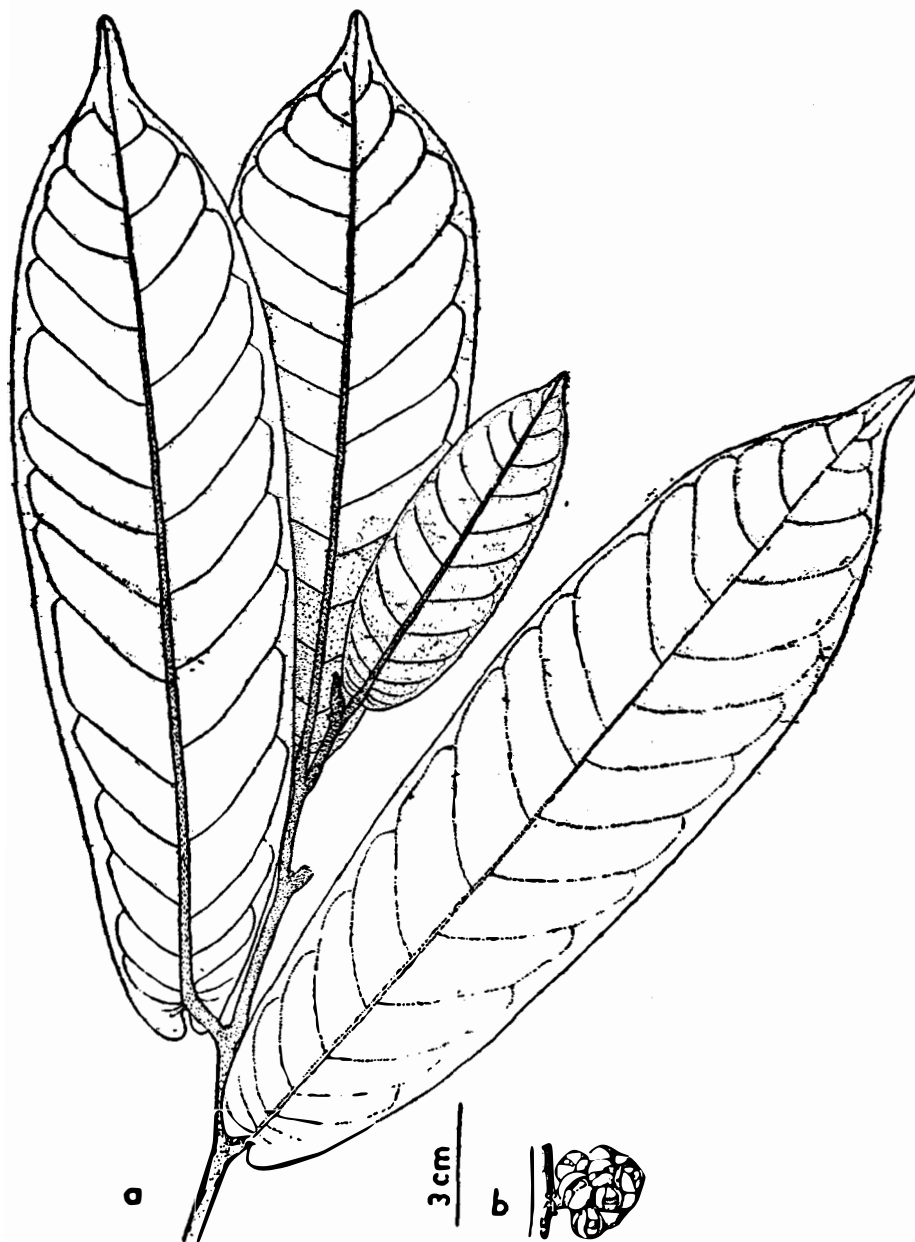


Fig. 3. *Cyathostemma excelsum*. a. Habit; b. Inflorescence (S 565)

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*viridiflorum* Griffith, Notulae 4:707.1854; Sinclair, Gard. Bull 1.1955.

up to 25m long. Young twigs slightly pubescent, older cons-. Leaves oblong-elliptic or obovate, 12–20cm long, 5–8cm broad, drying greenish, base emarginate, apex acute to acuminate, 10–13 pairs, more or less glabrous beneath, midrib with stellate glands, glabrous. Petiole c. 5mm long. Inflorescences on leafless stems: shoots, cymes arising on c. 5–10cm long, slender rusty-tomentose. Flowers c. 1cm in diameter, green. Sepals broadly ovate, c. 3mm long. Petals of the two whorls subequal in shape and size, c. 5mm long, base incurved. Stamens numerous. Carpels numerous, stigmas 1. Fruitlets oblong-ovoid, 2.5–4cm long, glabrous; stalks stout. Seeds 5–6, in two rows.

Common in swampy forest along rivers.  
Malay Peninsula and Borneo.  
Cited: *Van Balgooy* 6127.

#### *Enicosanthum* Becc.

*paradoxum* Becc., Nuovo Giorn. Bot. Ital. 3:183, t. 5.1871.

Tree to 20m tall. Young twigs densely pubescent with brown simple glands, usually densely pubescent. Leaves membranous, glabrous above, the midrib and lateral veins pubescent beneath, (narrowly) elliptic, 5–11.5cm long, 5.5–11.5cm wide, base rounded to acute, apex acuminate, prominent beneath, 15–17 pairs. Petiole 5–12mm long, 2–3mm wide. Inflorescence cauliflorous, several-flowered. Peduncle or branch 1–2cm long; pedicel 2–20mm long. Sepals imbricate, free, some 5–8mm long, 9–11mm wide. Petals imbricate, more or less 5–60mm long, 12–15mm wide, inner petals somewhat narrower. Anthers 2–3mm long, apical prolongation shield-like, hairy. Carpels crowded to one fleshy or sticky mass, ovule 1, basal. Carpoid mid-fusiform, densely puberulent, brown, 25–45mm long, 10–20mm wide, piculate. Stalks 5–10mm long. Peduncle and pedicel 45–50mm long.

Borneo.

pterocarp Forests or Secondary Forest; on sandy low ridges.  
Flowers (pale) yellow, ivory, or greenish yellow; covered with green.

Cited: *Ambriansyah & Arifin* AA 206, AA 270, AA 484; *Van Balgooy & Hermans* 5391; 9845; *Souveau* K-8; *Kade Sidiyasa* 545,

**Cyathostemma viridiflorum** Griffith, Notulae 4:707.1854; Sinclair, Gard. Bull Singapore 14:221.1955.

Climbers up to 25m long. Young twigs slightly pubescent, older conspicuously striate. Leaves oblong-elliptic or obovate, 12–20cm long, 5–8cm wide, subcoriaceous, drying greenish, base emarginate, apex acute to acuminate, secondary veins 10–13 pairs, more or less glabrous beneath, midrib with stellate hairs, otherwise glabrous. Petiole c. 5mm long. Inflorescences on leafless stems or on knobby short shoots, cymes arising on c. 5–10cm long, slender rusty-tomentose peduncles. Flowers c. 1cm in diameter, green. Sepals broadly ovate, c. 3mm long, c. 5mm wide. Petals of the two whorls subequal in shape and size, c. 5mm long, c. 5mm wide, base incurved. Stamens numerous. Carpels numerous, stigmas U-shaped, brown. Fruitlets oblong-ovoid, 2.5–4cm long, glabrous; stalks stout, c. 2cm long. Seeds 5–6, in two rows.

*Ecology:* Usually in swampy forest along rivers.

*Distribution:* Malay Peninsula and Borneo.

*Specimen examined:* Van Balgooy 6127.

#### **Enicosanthum** Becc.

**Enicosanthum paradoxum** Becc., Nuovo Giorn. Bot. Ital. 3:183, t. 5.1871.

Tree up to 20m tall. Young twigs densely pubescent with brown simple hairs, older twigs usually densely pubescent. Leaves membranous, glabrous above except for the midrib and lateral veins, pubescent beneath, (narrowly) obovate, 12–34cm long, 5.5–11.5cm wide, base rounded to acute, apex acuminate, lateral veins prominent beneath, 15–17 pairs. Petiole 5–12mm long, 2–3mm in diameter. Inflorescence cauliflorous, several-flowered. Peduncle or rhipidia up to 13cm long; pedicel 2–20mm long. Sepals imbricate, free, sometimes caducous, 5–8mm long, 9–11mm wide. Petals imbricate, more or less obovate, 25–35(–60)mm long, 12–15mm wide, inner petals somewhat narrower. Stamens numerous; 2–3mm long, apical prolongation shield-like, hairy. Carpels numerous, stigmas crowded to one fleshy or sticky mass, ovule 1, basal. Carpella at least 5, ellipsoid-fusiform, densely puberulent, brown, 25–45mm long, 10–20mm wide, apex apiculate. Stalks 5–10mm long. Peduncle and pedicel 45–50mm long. Seed 1.

*Distribution:* Borneo.

*Ecology:* In Dipterocarp Forests or Secondary Forest; on sandy low ridges.

*Collector's notes:* Flowers (pale) yellow, ivory, or greenish yellow; covered with ants. Fruits green.

*Specimens examined:* Ambriansyah & Arifin AA 206, AA 270, AA 484; Van Balgooy 5819; Kostermans 5391; 9845; Souveur K-8; Kade Sidiyasa 545.

**Fissistigma Griffith**

Climbers. Indument of simple hairs. Inflorescences usually several-flowered, terminal, leaf-opposed, or axillary. Buds usually conical. Sepals valvate. Petals valvate, inner whorl slightly smaller than the outer whorl. Stamens numerous, apical prolongation shield-like, dilated. Carpels several to numerous, placed on a cylindrical torus. Carpodia stipitate, subglobose or ovoid. Seeds several, in 2 series.

**Key to the species**

- 1a Leaves velutinous beneath **F. manubriatum**  
 b Leaves covered with whitish or reddish brown indument.....2  
 2a Leaves covered with whitish hairs beneath.....**F. latifolia**  
 b Leaves covered with reddish brown indument beneath.....3  
 3a Outer petals c. 5mm wide; carpels numerous.....**F. borneensis**  
 b Outer petals c. 3.5mm wide; carpels or carpodia up to c. 7.....**F. kingii**

**Fissistigma borneense** (Miq.) Merr., Philipp. J. Sc. 15:130.1919.

Climber up to 10 m tall. Young twigs densely covered with reddish brown hairs, older twigs rather densely hairy. Leaves subcoriaceous, pubescent above, rather densely pubescent beneath, elliptic-oblong, 10.5–15.5 cm long, 4.5–6.5 cm wide, base rounded to slightly cordate, apex retuse. Petiole 5–10 mm long, 2–3 mm in diameter. Lateral veins prominent beneath, 17–18 pairs. Inflorescence several-flowered, terminal, 6–8 cm long. Pedicel 5–15 mm long. Sepals fused, 2 mm long, c. 3 mm wide. Outer petals 10–13 mm long, c. 5 mm wide, densely pubescent; inner petals 8–9 mm long, c. 4 mm wide. Stamens c. 1.3 mm long, apical prolongation triangular. Carpels numerous. Carpodia not seen.

*Distribution:* Borneo.

*Ecology:* Dipterocarp Forests.

*Collectors' notes:* Flowers yellow.

*Specimens examined:* Ambriansyah & Arifin AA 223

**Fissistigma kingii** (Boerl.) Burkill, Kew Bull.: 317.1935.

Climber, up to 10 m tall. Young twigs densely covered with reddish brown indument, older twigs glabrescent, often numerous, lenticels present. Leaves subcoriaceous, usually glabrous above except for the primary vein, rather densely covered with reddish brown hairs beneath, elliptic-oblong, 6.5–21 cm long, 3–10 cm wide, base more or less rounded, apex faintly acuminate to rounded to slightly retuse. Petiole 7–15 mm long, 1.5–3 mm in diameter. Lateral veins prominent beneath, 7–16 pairs. Inflorescence several-flowered, axillary, 3–10 cm long. Pedicel 3–10 mm long. Sepals slightly fused, 1.5–2 mm long, c. 2 mm wide. Outer petals 8–14 mm long, c. 3.5 mm wide, densely pubescent; inner petals 7–9 mm

long, c. 2mm wide. Stamens c. 0.8mm long. Carpida up to 7, subglobose, smooth, brown puberulent, 15—20mm in diameter; stalks 7—17mm long. Peduncle 10—20mm long. Seeds 5, in 2 series.

*Distribution:* Thailand, Malay Peninsula, Sumatra, Borneo, Celebes.

*Ecology:* In Mixed Dipterocarp Lowland Forests, sandy loam soil.

*Collector's notes:* Flowers brown, rusty, or dark yellow, inside (dirty) white.

*Specimens examined:* *Ambriansyah & Arifin* W 898; *Endert* 2423, 3299; *Kostermans* 8788, 10594; *Leighton* 601; *Meijer* 2235.

*Fissistigma latifolia* (Dun.) Merr., Philipp. J. Sc. 15:130.1919.

Climber up to 10m tall. Young twigs densely pubescent, older twigs pubescent or glabrescent, sometimes lenticels present. Leaves subcoriaceous, glabrous or minutely pubescent above, white pubescent beneath, 8—15cm long, 4—7.5cm wide, base cuneate to nearly rounded, apex deeply to slightly retuse, lateral veins prominent beneath, 13—21 pairs. Petiole 7—10mm long, 1—2.5mm in diameter. Inflorescence terminal, several-flowered, 2—10mm long. Pedicel 6—10mm long. Sepals slightly fused, 2.5mm long, 2—3mm wide. Petals (11-)20—35mm long, 4—5mm wide; inner petals slightly smaller. Stamens not seen. Carpels c. 10? Carpida not seen.

*Distribution:* Indochina, Malay Peninsula, Sumatra, Java, Borneo.

*Ecology:* In Primary Lowland Mixed Dipterocarp Forest, on sand and limestone.

*Collector's notes:* Flowers yellow or dirty white, (very sweetly) fragrant. Leaves glaucous below.

*Specimens examined:* *Kostermans* 13905; *Kade Sidiyasa* 722.

*Fissistigma manubriatum* (Hook. f. & Thomson) Merr., Philipp. J. Sc. 15:130.1919. (Fig. 4)

Climber up to 20m tall. Young twigs densely covered with reddish brown indument, older twigs more or less glabrescent, sometimes lenticels present. Leaves subcoriaceous, glabrous above except for the midrib, velutinous beneath, (narrowly) oblong, 4—18cm long, 1.5—5cm wide, base cuneate to rounded, apex acute or sometimes slightly retuse. Petiole 5—10mm long, 1—2mm in diameter. Lateral veins prominent beneath, 10—14 pairs. Inflorescence 1- or few-flowered, terminal, 1—8.5cm long. Pedicel 5—12mm long. Sepals slightly fused, 6—7mm long, 5—6mm wide. Petals 15—18mm long, 7—8mm wide, velutinous. Stamens 1.5—2mm long. Carpels numerous. Carpida 8—24, subglobose to ovoid, 15—30mm long, 13—23mm in diameter, slightly warty, densely hairy, glabrescent with age; stalks 15—30mm long; peduncle 10—20mm long. Seeds c. 8, in 2 series.

*Distribution:* Malay Peninsula, Sumatra, Borneo.

*Ecology:* In Mixed Dipterocarp Lowland Forests, on sandy (loam) soil, near man-grove or on dry slope or ridge top.



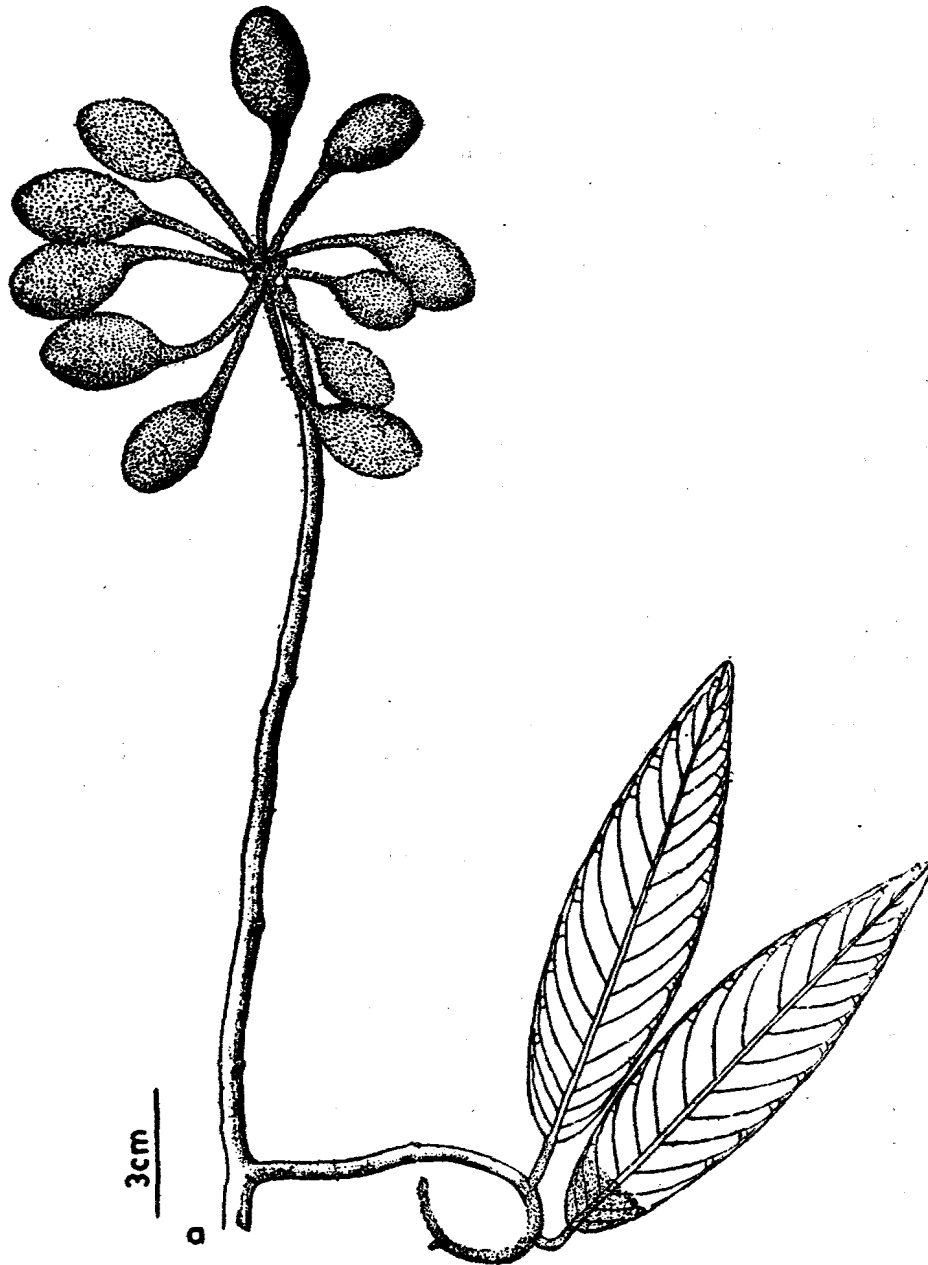


Fig. 4. *Fissistigma manubriatum* s. Habit (W 876)

*Collector's notes:* Flowers brown or gold brown. Fruits brown.

*Specimens examined:* *Ambriansyah & Arifin* W 705, W 871, W 876; *Kostermans* 7107, 7965; *Leighton* 636, 886; *Reksodihardjo* 90; *Winkler* 330.

#### Friesodielsia Steenis

Climbers. Indument of simple hairs. Flowers leaf-opposed or extra-axillary, solitary. Sepals 3, valvate. Petals 6, in 2 whorls, inner whorl smaller, valvate. Stamens numerous, apical prolongation shield-like. Carpels numerous with 1–3 ovules. Carpida stipitate.

#### Key to the species

- 1a Young twigs and lower side of the leaves densely covered with brownish indument; pedicel 2–4mm long; sepals 8–11mm long; stalks of the carpida 2–4mm long.....*F. borneensis*  
 b Young twigs and lower side of the leaves covered with minute (whitish) hairs; pedicel 6–8mm long; sepals 6mm long; stalks of the carpida 12–15 mm long.....*F. biglandulosa*

*Friesodielsia biglandulosa* (Blume) Steenis, *Blumea* 12:358.1964.

Climber up to 25m tall. Young twigs minutely pubescent, older twigs glabrous, sometimes lenticels present. Leaves subcoriaceous, glabrous or with minute pubescence on both sides, 8.5–23cm long, 4.5–9cm wide, base acute to nearly rounded, apex acuminate, lateral veins prominent beneath, 8–11 pairs. Petiole 5–12mm long, 1.5–2.5mm in diameter. Inflorescence, supra-axillary or terminal, few-flowered. Pedicel 6–8mm long. Sepals free, 6mm long, 2.5–3mm wide. Outer petals 13–17mm long, c. 4mm wide. Stamens and carpels not seen. Carpida 5–10, ellipsoid, 12–15mm long, 7–8mm in diameter, sparsely to more or less densely minutely pubescent; stalks 12–15mm long; peduncle 10–15mm long. Seed 1, basal.

*Distribution:* Malay Peninsula, Sumatra, Java, Borneo.

*Ecology:* In Swamp Forest or Mixed Dipterocarp Lowland Forest.

*Collector's notes:* Flowers greenish grey. Fruits yellow, greenish yellow, or pinkish purple. Leaves glaucous beneath.

*Specimens examined:* *Ambriansyah & Arifin* AA 337; *Ambriansyah & Arifin* W 344; *Kessler* 617; *Korthals* s. n.; *Leighton* 242; *Kade Sidiyasa* 775; *Soegeng Reksodihardjo* 731.

*Friesodielsia borneensis* (Miq.) Steenis, *Blumea* 12:358.1964.

Climber up to 15m tall. Young twigs densely covered with brown indument, older twigs less densely hairy. Leaves membranous, glabrous or sparsely to densely hairy above, brown hairy beneath, 4–27cm long, 2–10cm wide, base rounded to cuneate, apex acuminate to acute, lateral veins prominent beneath, 7–14 pairs. Petiole 2–10mm long, 0.5–4mm in diameter. Sepals free, 8–11mm

## Annonaceae of Balikpapan

long, 6—8mm wide, veins prominent. Petals 10—12mm long. Stamens and carpels not seen. Carpida c. 11?, ellipsoid-ovoid (when young?), 8—10mm long, c. 7mm in diameter, glabrous, minutely warty, stalks 2—4mm long, peduncle not seen. Seeds 1—2.

*Distribution:* Malay Peninsula, Sumatra, Borneo.

*Ecology:* In Mixed Dipterocarp Lowland Forests, on dry ridges.

*Collector's notes:* Flowers pale brown. Fruits red, pink purple, purple blue, or yellow; oily. Leaves glaucous beneath.

*Specimens examined:* Van Balgooy 6083; Kessler 625; Kostermans 5497; Leighton 159, 259, 353

**Goniothalamus (Blume) Hook. f. & Thomson**

Small trees or shrubs. Indument of simple hairs. Flowers fasciculate or solitary, axillary or extra-axillary. Sepals 3, valvate. Petals 6, in 2 whorls, inner whorl smaller than outer whorl, valvate, inner whorl broadly clawed, cohering. Stamens numerous, septate or not, apical prolongation shield-like. Carpels numerous. Ovules 1, basal, or 2—4, lateral. Carpida 1—2-seeded.

**Key to the species**

- 1a Leaves membranous; sepals fused; inner petals 6—8mm long.....**G. ridleyi**
- b Leaves subcoriaceous; sepals free; inner petals 10—35mm long .. .....2
- 2a Leaves 7—15cm long; petiole 4—8mm long; flowers in many-flowered clusters; pedicel 35—50 mm long .....**G. fasciculatus**
- b Leaves 20—60cm long; petiole 8—30mm long; flowers solitary; pedicel c. 8 mm long.....**G. macrophyllus**

**Goniothalamus fasciculatus** Boerl., Icon. Bogor. : t. 59.1899.

Tree up to 20m tall. Young twigs rather densely pubescent, older twigs sparser pubescent. Leaves subcoriaceous, glabrous except for the veins, (narrowly) elliptic to obovate, 7—15cm long, 2.5—4.5mm wide, base acute, slightly asymmetrical, apex caudate to acuminate, lateral veins prominent beneath, 8 pairs. Petiole 4—8mm long, c. 1mm in diameter. Flowers in a cauliflorous, many-flowered cluster. Pedicel 35—50mm long. Sepals free, 6—10mm long, 5—6mm wide. Outer petals 17—40mm long, 6—9mm wide. Inner petals 11—32mm long, 4—5mm wide. Stamens 1.3—2mm long. Carpels numerous. Carpida not seen.

*Distribution:* Borneo.

*Ecology:* Unknown.

*Collector's notes:* Petals yellow, greenish at the base, sepals green. Flowers slightly fragrant, visited by beetles.

*Specimens examined:* Van Balgooy 5726

**Goniothalamus macrophyllus** (Blume) Hook. f. & Thomson, Fl. Ind. 74.1855.

Treelet or shrub up to 6m tall. Young and older twigs glabrous. Leaves subcoriaceous, glabrous on both sides, usually minutely pubescent on the veins beneath, narrowly obovate, 20–60cm long, 5.5–13cm wide, base nearly rounded, apex acuminate, lateral veins prominent beneath, 13–25 pairs, anastomosing to a marginal vein at 2–3mm from the margin. Petiole 8–30mm long, 3mm in diameter. Flower cauliflorous or axillary, solitary. Pedicel 8mm long. Sepals free, c. 4–7 mm long, 7mm wide. Outer petals 22–45mm long, 6–15mm wide. Inner petals 15–34mm long, c. 10mm wide. Stamens numerous, c. 4mm long. Carpels not seen. Carpidia 7–12, subglobose to obovoid, glabrous or sparsely pubescent, smooth, 14–20mm long, 9–17mm wide, stalks c. 6mm long, peduncle 15–20mm long. Seeds?

*Distribution:* Malay Peninsula, Sumatra, Java, Borneo.

*Ecology:* In Mixed Dipterocarp Lowland Forests, on deep clay soil or on sandstone ridge.

*Collector's notes:* Flowers cream, fragrant, or (dark or greenish) yellow, base of the petals purplish brown, calyx greyish green. Unripe fruit green.

*Specimens examined:* *Ambriansyah & Arifin* W 608, W 788; *Van Balgooy* 5799, 5847; *Van Balgooy & Kessler* 5881; *Kostermans* 5862, 13948; *Leighton* 672; *RHHC* TFB 1616.

**Goniothalamus ridleyi** King, J. As. Soc. Beng. 61, 2:72.1892.

Treelet up to 8m tall. Young twigs (sparsely) pubescent, older twigs glabrous. Leaves membranous, glabrous above, sparsely puberulent to glabrous beneath, obovate to oblong or to elliptic, 9–25cm long, 4–8.5cm wide, base acute to cuneate, apex acuminate to caudate, lateral veins prominent beneath, 8–21 pairs, anastomosing to a marginal vein at 2–5mm distance from the margin. Petiole 8–16mm long, 1.5–2.5mm in diameter. Inflorescence at the base of the trunk, in many-to few-flowered clusters. Pedicel 40–50mm long. Sepals fused, 6–7mm long, 4–6mm wide. Outer petals 18–30mm long, c. 6–7mm wide. Inner petals 6–8mm long, c. 5mm wide. Stamens numerous, apical prolongation shield-like, apiculate, hairy. Carpels numerous. Carpidia 7–11, obovoid, glabrous, stalks c. 1mm long, peduncle c. 70mm long. Seed 1.

*Distribution:* Malay Peninsula, Sumatra, Borneo.

*Ecology:* In Dipterocarp or Kerangas Forest, on sandstone ridge.

*Collector's notes:* Flowers red, purple-red, or (dull) maroon, erect. Fruits red, pendent. Plants have a strong smell.

*Specimens examined:* *Van Balgooy* 5855; *Dransfield* 4454; *Leighton* 271; *Wiria-dinata* 1213.

**Meiogyne** Miq.

**Meiogyne virgata** (Blume) Miq., Ann. Mus. Bot. Lugd. Bat. 2:12.1865.

Tree up to 19m tall. Young twigs more or less densely pubescent, hairs simple, older twigs glabrous or sometimes sparsely pubescent, sometimes numerous lenticels present. Leaves membranous to subcoriaceous, glabrous above, sometimes primary veins hairy above, with sparse hairs beneath, more densely hairy on the veins beneath, elliptic, elliptic-ovate, or oblong, 6–23cm long, 2.5–10cm wide, base acute to cuneate, apex acuminate, lateral veins prominent beneath, 6–8(–17) pairs. Petiole 5–12mm long, 0.5–2.5mm in diameter. Inflorescence axillary, 1–2-flowered. Pedicel 2–6mm long. Sepals valvate, free, 2–6mm long, 3–4mm wide. Outer petals valvate, sometimes imbricate, 11–18mm long, 5–9mm wide, densely velutinous. Inner petals 8–11mm long, 5–6mm wide, densely velutinous outside, glabrous or warty at the base inside. Stamens numerous. Carpels c. 3–10, ovules up to 16, biseriate. Crpidia 3–8, ellipsoid to ovoid, 30–40mm long, 20–26mm in diameter, densely puberulent, brown, sessile or shortly stalked, stalks 1–2mm long, peduncle 5–13mm long. Seeds several, in 2 series.

*Distribution:* Thailand, Indochina, Malay Peninsula, Sumatra, Java, Borneo.

*Ecology:* In Mixed Dipterocarp Lowland Forest or Primary Forest, on loam or sandy soils or limestone rocks.

*Collector's notes:* Flowers dirty pale red, pink, or white with a pink hue, warts red. Sepals greenish or brown. Fruits brown, green with brown hairs, or yellow green.

*Specimens examined:* *Ambriansyah & Arifin* AA 332, AA 366, AA 552; *Endert* 4751; *Kostermans* 5302, 6903, 9720, 13298; *Wiradinata* 270

**Mezzettia** Becc.

**Mezzettia parviflora** Becc., Nuovo Giorn. Bot. Ital. 3:188.1871; Heijden & Kessler, Blumea 35:217.1990. (Fig. 5)

Trees up to 40m, 20–80cm in diameter. Buttresses developed or not. Bark rough with irregular cracks, sometimes dipped, shedding in irregular pieces, dark grey with lighter patches. Inner bark orange brown, thick, fibrous, with a dark line between outer and inner bark. Sapwood pale brown to whitish. Twigs glabrous. Leaves coriaceous, glabrous on both sides, oblong to elliptic or lanceolate, (3.5–) 4–11 (–16)cm long, 2–4.5 (–5.5)cm wide, base acute, apex acuminate, sometimes acute, blunt, midrib flat or slightly prominent above, lateral veins 8–20 pairs. Petiole glabrous, (5–) 6–8 (–12)mm long, 1–1.5 (–2)mm in diameter. Inflorescence a 2–4-flowered rhipidium, on short shoots. Flowers greenish, small, sepals 3.5mm long, pubescent inside, tips often reflexed. Outer petals lanceolate to linear-lanceolate up to 17mm long. Inner petals ovate-oblong, up to 9mm long. Stamens 9–17, thecae 2-locular, opening latero-introrse with

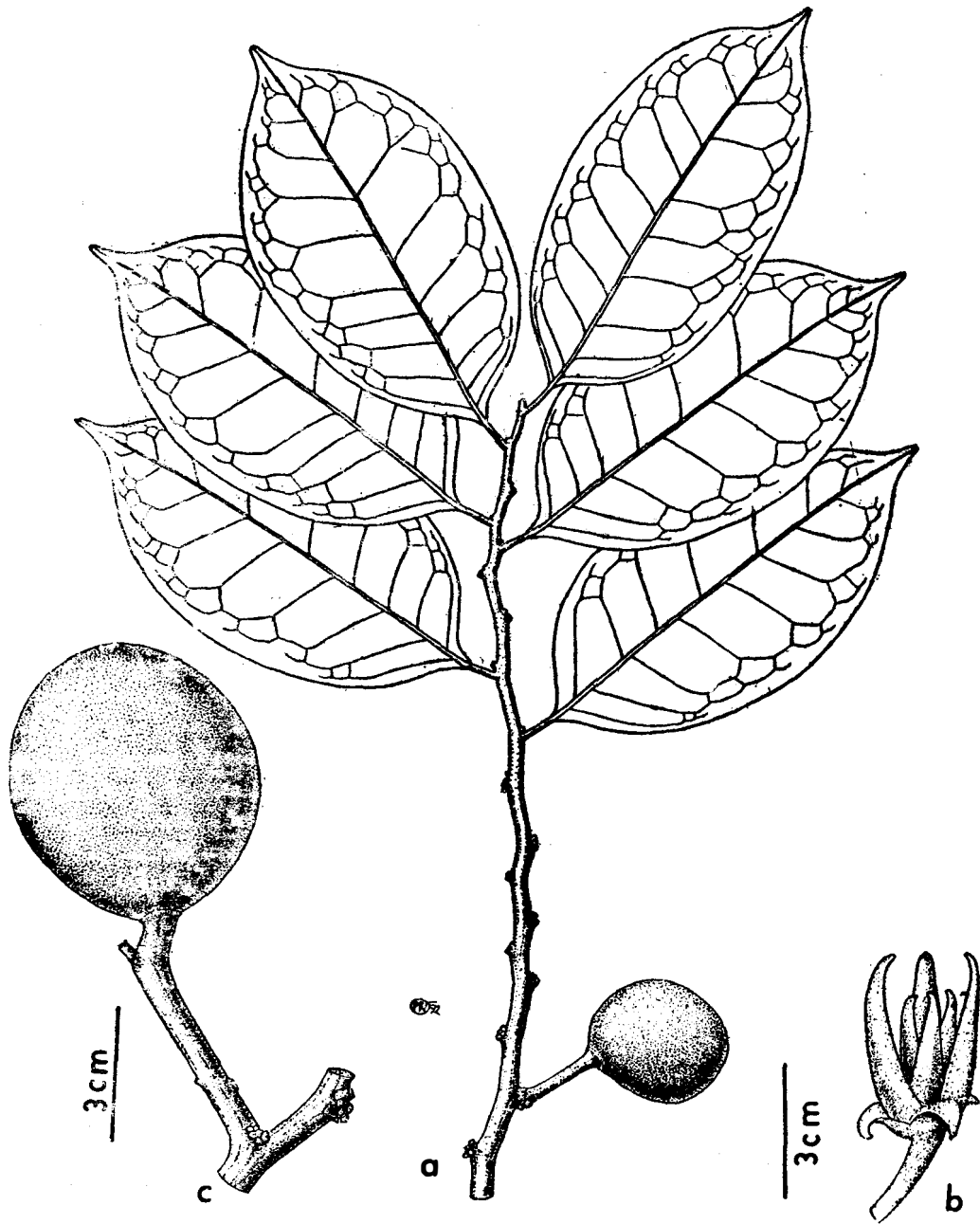


Fig. 5. *Mezzettia parviflora*. a. Habit (W 313); b. flower; c. fruitlet (W 828)

## Annonaceae of Balikpapan

two valves, staminodes sometimes present. Carpel glabrous. Fruitlet globose to sub-globose, 4–7cm in diameter, smooth, shrunk when dry, glaucous. Seeds 2, 3–4 by c. 2.5 by c. 2cm.

*Note:* Fallen leaves yellow.

*Uses:* One of the tallest Annonaceous trees, sometimes used for its timber.

*Specimens examined:* *Ambriansyah & Arifin* W 313, W 827, W 828

**Miliusa** Leschenault

**Miliusa macropoda** Miq., Ann. Mus. Bot. Lugd. Bat. 2:40.1865.

Tree up to 27m tall, up to 45cm in diameter. Young twigs tomentose. Leaves elliptical or oblong-elliptical, 10–21cm long, 3.5–9.5cm wide, membranous, drying greenish-brownish, base rounded to acute, slightly asymmetrical, apex acuminate, c. 1cm long, secondary veins 6–8 pairs, interarching 5mm from margin. Petiole short, 2–3mm long. Inflorescences axillary on up to 2cm long short shoots, usually only one flower developed, pedicel up to 25cm long, filiform, hanging downwards. Sepals 3, very small, up to 1mm long, outer petals very small, up to 1mm long, similar to sepals, inner petals triangular-ovate, up to 1.5 cm long, c. 0.5cm wide, saccate at base, glabrous except the margins. Stamens many, miliusoid, i.e. connective not concealing the anthercells, carpels many, ovaries 5–6. Fruitlets on up to 4cm long stalks, cylindrical, glabrous, 1–4-seeded.

*Habitat:* In Lowland Dipterocarp Forests up to 400m altitude.

*Distribution:* Endemic in Borneo.

*Note:* The genus *Miliusa* resembles *Phaeanthus* in having the outer petals similar to the sepals. The stamens of the latter, however, are uvarioid and leaves usually dry black.

*Collector note:* Mature flowers dark purplish brown, fruitlets green.

*Specimens examined:* *Ambriansyah & Arifin* AA 272; *Endert* 5168, 5189; *Kostermans* 13973

**Mitrella** Miq.

**Mitrella kentii** Miq., Ann. Mus. Bot. Lugd. Bat. 2:39.1865.

Climber up to 30m tall. Young twigs pubescent, hairs simple, older twigs sparsely pubescent. Leaves subcoriaceous, glabrous above, pubescent beneath, elliptic-oblong or broadly elliptic, 4.5–10cm long, 1.5–4.5cm wide, base more or less rounded, apex acute, lateral veins rather faint. Petiole 6–14mm long, 0.5–1.5mm in diameter. Inflorescences axillary, 1- or 2-flowered. Pedicel 5–7mm long. Sepals valvate, fused, 2mm long, 2–3mm wide. Outer petals valvate, 9–11mm long, 6–7mm wide. Inner petals cohering, 5–6mm long, c. 3mm wide. Stamens numerous, arranged in c. 4 rows. Carpels numerous, glabrous, ovules few. Carpoidia 1–11, subglobose, 5–8mm long, 6–7mm in diameter, sparsely puberulent to glabrous, more or less rugulose, stalks 4–6mm long, peduncle 5–9mm long, sepals persistent. Seeds 1 or 2?

*Distribution:* Ma'ay Peninsula, Sumatra, Java, Borneo, Philippines, Aru Islands (Moluccas).

*Ecology:* In Primary Mixed Dipterocarp Forests or in Secondary Forest, on sandy loam soil.

*Collector's notes:* Flowers (pale) brown, yellow, or outer petals orange, inner petals cream. Fruits grey, greenish yellow, yellow, green, brown green, or red. Flowers visited by small beetles.

*Specimens examined:* *Ambriansyah & Arifin* AA 145, AA 338; *Van Balgooy & Kessler* 5923; *Ambriansyah & Arifin* W 160; *Ender* 1935, 2244, 3131, 3312; *Forman* 479; *Kostermans* 4452, 5176, 21657, 21683, 10172; *Kramadibrata* 142; *Leighton* 365; *Kade Sidiyasa* 600; *Soegeng Reksodihardjo* 103; *Wiria-dinata* 256

#### Mitrephora Hook. f. & Thomson

*Mitrephora korthalsiana* Miq., Ann. Mus. Bot. Lugd. Bat. 2:28.1865.

Tree up to 18m tall, c. 20cm in diameter. Bark smooth. Young twigs rusty tomentose. Leaves ovate to oblong-elliptical, 4–10cm long, 2–4.5cm wide, base acute, apex acute to acuminate, secondary veins 8–10, pocket domatia present, petiole c. 5mm long. Inflorescence leaf-opposed, few-flowered. Sepals broadly ovate, c. 5mm long, outer petals ovate, c. 1.5cm long, spreading, inner petals c. 1cm long, cohering by their edges above, free below, clawed. Stamens numerous. Carpels numerous, hairy. Carpodia cylindrical, c. 2cm long, c. 1.5cm in diameter, tomentose with whitish short hairs and brownish long ones, stalk c. 2cm long, c. 4mm in diameter. Seeds few.

*Distribution:* Up to date known only from South and East Kalimantan.

*Note:* One of the few species of Annonaceae with domatia.

*Specimens examined:* *Kade Sidiyasa* 709; *Kostermans* 5048, 5162, 7418.

#### Monocarpia Miq.

Trees up to 35m tall, up to 60cm in diameter. Bole cylindrical, bark smooth, grey to black, often hooped. Inner bark orange-brown. Sapwood yellowish. Young twigs velvety or glabrous. Leaves membranous or thinly coriaceous, secondary veins 9–20, sunken or not above, interarching near the margin or not. Flowers solitary, or 2–3 together on short stalks, opposite the leaves, bract relatively big, c. 4mm long. Sepals valvate, connate at base only or up to the middle. Petals 6, valvate, inner whorl slightly shorter, shortly clawed. Stamens numerous, connective with a truncate dilated apex. Carpel(s) 1 or 3, style short, stigma pilose. Carpodia 1–3, roundish or cylindrical, fruitwall hard, stony, or fleshy.



## Key to the species

- 1a Young twigs velvety, secondary veins 13–20 pairs, sunken above, clearly interarching c. 3–4mm before the margin, sepals connate at base only, carpel 1, carpidium 1, cylindrical, red when ripe, fruitwall fleshy.....**M. euneura**
- b Young twigs glabrous, secondary veins 9–10 pairs, not sunken above, only slightly interarching, sepals connate up to the middle, carpels 3, carpidia 1–3; globose to cylindrical, yellowish-green when ripe, fruitwall leathery to stony.....**M. kalimantanensis**

**Monocarpia euneura** Miq., Ann. Mus. Bot. Lugd. Bat. 2:12.1865.

Trees up to 20m tall, up to 30cm in diameter. Young twigs velvety. Leaves elliptical, 10–20cm long, 4–6cm wide, membranous, base rounded to wedge-shaped, apex acuminate, c. 1cm long, secondary veins 13–20 pairs, sunken above, clearly interarching 3–4mm before the margin. Sepals connate at base only. Carpel 1, densely velvety. Carpidium 1, cylindrical, c. 8cm long, 5cm in diameter, glabrous, red when ripe, fruitwalls fleshy.

*Ecology:* Rare in logged over Lowland Dipterocarp Forests.

*Specimens examined:* Kade Sidiyasa 737, 837

**Monocarpia kalimantanensis** Kessler, spec. nov.

(Fig. 6)

Arbor ca. 35m alta, ca. 60cm diametro. Ramuli juniores glabri. Folia subcoriacea, oblonga usque elliptica, 10–20cm longa, 3.5–5.5cm lata, basi cuneata, apice 0.5–1cm acuminata, costa subtus prominenti, sparse pubescente, nervis lateralibus, 9–10-pairibus, omnibus curvato-ascendentibus, ca. 2–3mm ante marginem conjunctis; petioli 4–6mm longi, 2–3mm crassi. Inflorescentiae foliis oppositae, 1(–3)-floribus. Sepala ad medium connata. Petala sparse pubescente. Carpella 3. Carpidia 1–2(–3), ca. 3 cm stipitata, cylindrica, ca. 8cm longa, ca. 5.5cm diametro, pericarpo 4–6mm crasso (in sicco!), laeve, semina ca. 12, biseriata.

*Typus:* *Ambriansyah & Arifin* W 670, Indonesia, Kalimantan Timur, Wanariset research area, Road Samboja-Semai, km 5 (holo L, iso Wanariset Herbarium),

Trees up to 35m tall, up to 60cm in diameter. Young twigs glabrous. Leaves thinly coriaceous, secondary veins 9–10, not sunken above, only slightly interarching before the margin. Sepals connate up to the middle. Carpels 3. Fruitlets 1–2(–3), cylindrical, c. 8cm long, c. 5.5cm in diameter, yellowish-green when ripe, fruitwalls hard, stony. Seeds c. 12, biseriate.

*Distribution:* East Kalimantan

*Ecology:* Frequent in Lowland Dipterocarp Forest.

*Specimens examined:* *Ambriansyah & Arifin* W 179, W 511, W 670: *Van Balgooy* 5798; *Kade Sidiyasa* 453, 570, 571

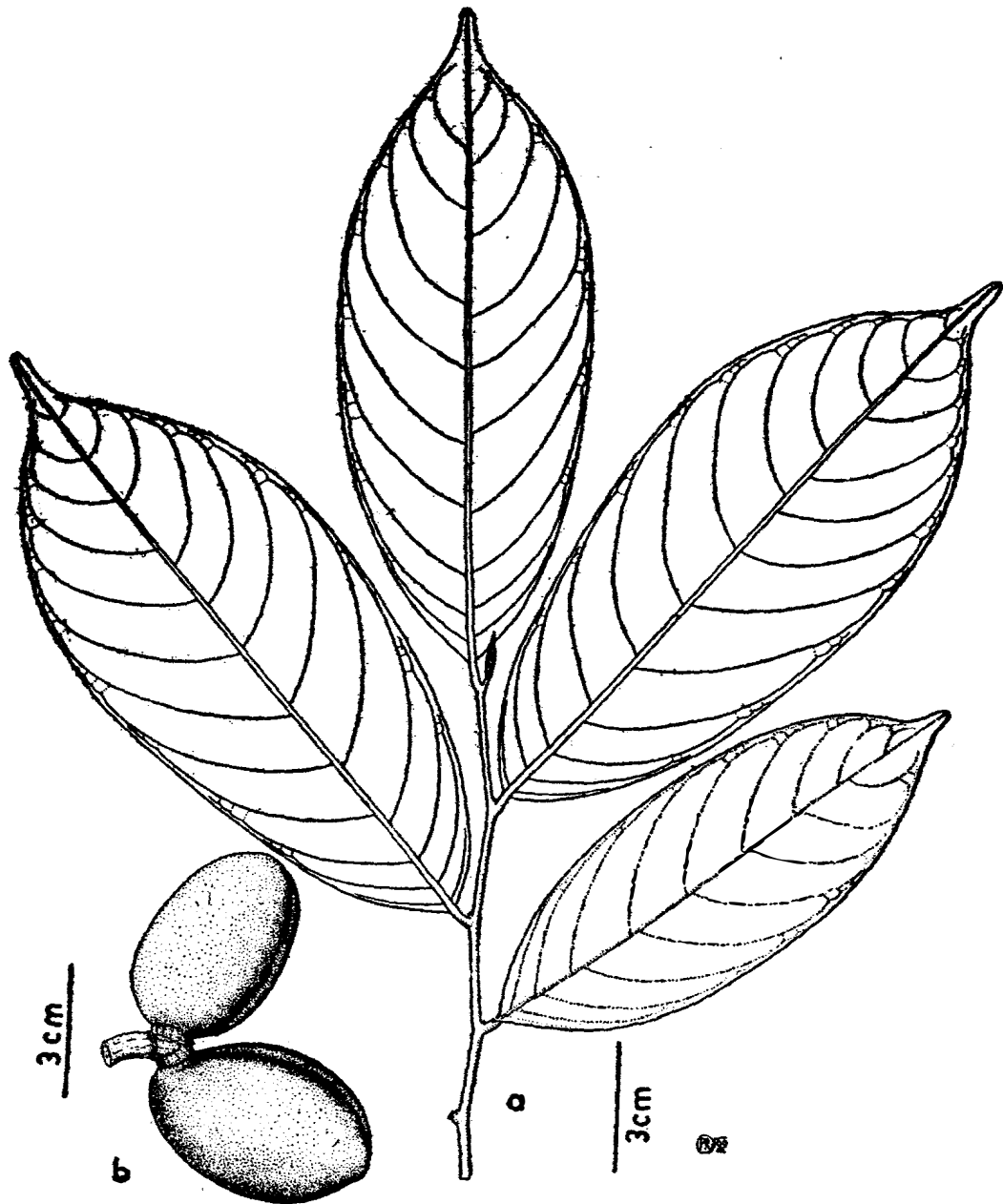


Fig. 6. *Monocarpia kalimantanensis*. a. Habit(S 570); b. fruitlets (W 670)

## Annonaceae of Balikpapan

## Neo-uvaria Airy Shaw

**Neo-uvaria acuminatissima** (Miq.) Airy Shaw, Kew Bull. : 279.1939. (Fig. 7)

Trees c. 15m tall, c. 10cm in diameter. Young twigs tomentose. Leaves elliptic-lanceolate, 15–22cm long, 4–10cm wide, base cuneate, apex acuminate, stellately tomentose beneath, secondary veins 11–18 pairs. Flowers solitary or 2–3, axillary. Sepals broadly ovate-triangular, c. 3mm long. Outer petals narrow-oblong, 1–1.5cm long, inner ones slightly smaller, arched in bud. Stamens c. 25. Carpels 8–12, pubescent. Carpodia 4–6, yellowish tomentose, oblong, c. 3–4cm long, 2–2.5cm in diameter. Seed 1.

*Distribution:* Malay Peninsula, Sumatra, Borneo, Philippines.

*Specimens examined:* Ambriansyah & Arifin W 58, W 165; Van Balgooy 5928

## Phaeanthus Hook. f. &amp; Thomson

**Phaeanthus splendens** Miq., Ann. Mus. Bot. Lugd. Bat. 2:40. 1865. (Fig. 8)

Tree up to 20m tall, c. 20cm in diameter. Bole sometimes fluted at base, bark black, smooth, hooped. Young twigs rusty-pubescent, soon glabrous. Leaves papery, tending to dry brownish-black, oblong - elliptic to lanceolate, 10–20cm long, 3–6cm wide, base acute, apex acuminate, more or less glabrous beneath except midrib, secondary veins 8–11 pairs, petioles c. 5mm long. Flowers solitary, occasionally in pairs or three, supra-axillary, pedicels 2–4cm long, minutely pubescent. Sepals and outer petals similar, small, c. 2mm long, pubescent, inner petals large, oblong-ovate, c. 1.2cm long, c. 8mm wide. Stamens many, connective prolongation truncate. Carpels several, pubescent, stigma club-shaped. Carpodia several, cylindrical, apiculate, 2–2.5cm long, c. 1cm in diameter, stalks c. 2cm long. Seed single.

*Distribution:* Up to date only known only from Kalimantan.

*Note:* The type of *Phaeanthus crassipetalus* Beccari is very similar to this species.

After a revision of this genus it will become most probably a synonym of *P. splendens*.

*Specimens examined:* Ambriansyah & Arifin W 727, W 997; Kade Sidiyasa 485, Kostermans 4146, 5656; Leighton 134, 821

## Polyalthia Blume

Trees or shrubs. Indument of simple hairs. Inflorescence axillary or leaf-opposed. Petals valvate in very young buds, equal-sized or sometimes unequal. Stamens numerous, apical prolongation shield-like. Carpels numerous. Ovules 1, basal, or few, lateral. Carpodia stipitate, globose to oblong, 1- or few-seeded.

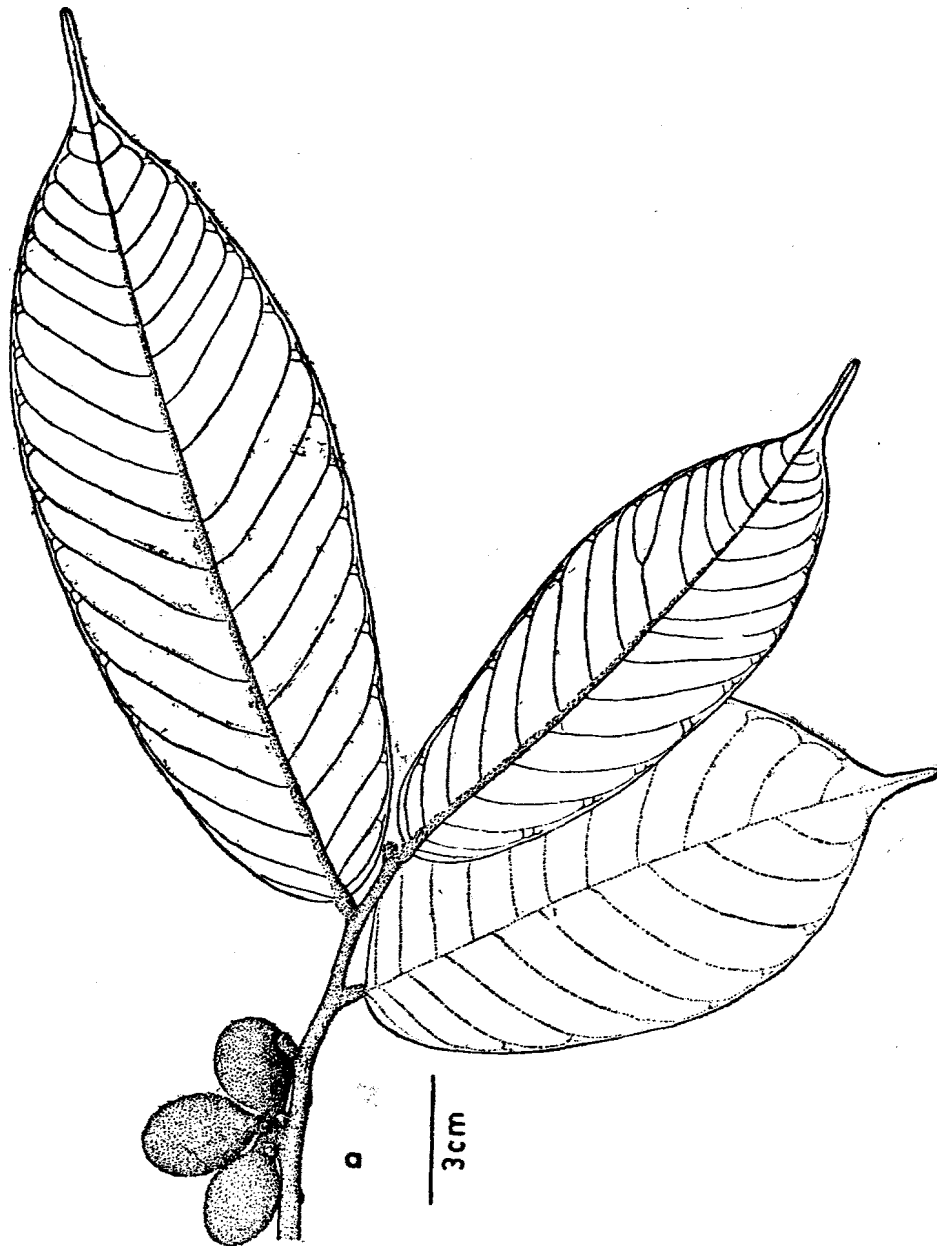


Fig. 7. *Neo-uvaria acuminatissima*. a. Habit

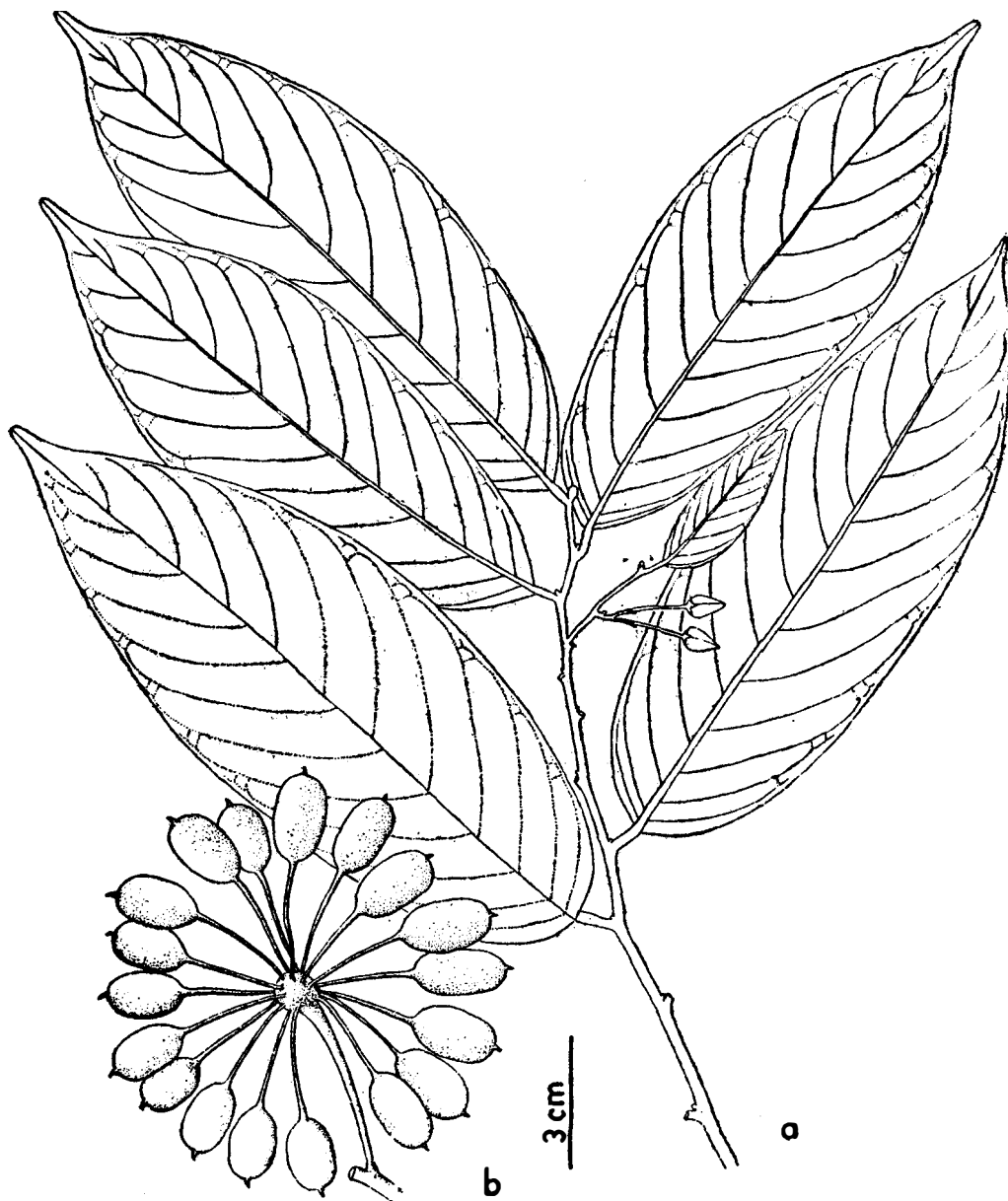


Fig. 8. *Phaeanthus splendens*. a. Habit; b. Infructescence (W 727).

## Key to the species

*Note:* Not all species from East Borneo can be identified because of the large number of species and the lack of any revision of the genus.

- 1a Leaves glaucous beneath.....2
- b Leaves not glaucous beneath.....3
- 2a Fruitlets globose.....**P. glauca**
- b Fruitlets ovoid, tapering to each end.....**P. sumatrana**
- 3a Stalks of the carpidia 30—60mm long.....4
- b Stalks of the carpidia up to 13mm long.....5
- 4a Young twigs glabrous, leaves coriaceous.....**P. lateriflora**
- b Young twigs hairy, leaves membranous.....**P. rumphii**
- 5a Lateral veins anastomosing to a marginal vein at 2—6mm from the margin; carpidia wrinkled.....**P. flagellaris**
- b Lateral veins not anastomosing to a marginal vein; carpidia tuberculate or warty.....6
- 6a Lateral veins 7—9 pairs; leaves mottled greyish in dry state.....**P. cauliflora**
- b Lateral veins 11—15 pairs; leaves not mottled greyish in dry state...**P. microtus**

***Polyalthia cauliflora*** Hook. f. & Thomson, Fl. Ind. :138.1855. (Fig.9)

Small tree up to 8m tall. Young twigs pubescent, soon becoming glabrous. Leaves membranous to chartaceous, mottled greyish in dry state, glabrous above, pubescent beneath, (narrowly) elliptic (to obovate), 5.5—10.5cm long, 1.5—4.5cm wide, base acute, apex acuminate to caudate, lateral veins more or less prominent beneath, 7—9 pairs. Petiole 2—4mm long, 0.5—1.5mm in diameter. Flowers not seen. Carpidia numerous, subglobose to shortly cylindrical, 5—8mm long, c. 6mm wide, sparsely pubescent, warty, apex apiculate, stalks 8—13mm long, peduncle 25—30mm long. Seed 1 or 2.

*Distribution:* Thailand, Malay Peninsula, Sumatra, Borneo.

*Ecology:* Lowland Mixed Dipterocarp Primary Forest and? Kerangas Forest.

*Collector's notes:* Fruits dark green or red, rami- or cauliflorous.

*Note:* The specimen *Ambriansyah & Arifin* AA 151 could not be identified with certainty to the species level.

*Specimens examined:* *Ambriansyah & Arifin* AA 151? *Van Balgooy* 5767. 5809; *Kade Sidiyasa* 714

***Polyalthia flagellaris*** (Becc.) Airy Shaw, Kew Bull. :283.1939.

Tree up to 17m tall. Young twigs densely pubescent, older twigs glabrous. Leaves membranous, glabrous above, sparsely pubescent beneath, more or less elliptic, 8—17cm long, 3—7cm wide, base cuneate, apex caudate, lateral veins prominent beneath, 8—11 pairs, anastomosing to a marginal vein at 2—6mm distance from the margin. Petiole 3—5mm long, c. 1.5mm in diameter.



Fig. 9. *Polyalthia cauliflora* a. Habitus b. Inflorescence (AA 151)

Flowers not seen. Carpodia numerous, more or less obovoid or berries truncate on both sides, 15–25mm long, 10–18mm in diameter, glabrous, wrinkled or slightly warty; stalks 3–5mm long, laterally attached; peduncle c. 40mm long. Seeds 1–3?

**Distribution:** Borneo.

**Ecology:** Primary Lowland Dipterocarp Forest.

**Collector's notes:** Fruits dark red (brown), cauliflorous, at the base of the trunk.

**Note:** The material could not be identified with certainty to *P. flagellaris*. The fruits are somewhat different. Flowers of this species are placed on long flagels.

**Specimens examined:** Kade Sidiyasa 526, 695, 1015.

*Polyalthia glauca* (Hassk.) F. Muell., Descr. Notes Papuan Pl. App. 95.1877., non Boerl. (1899); Rogstad, J. Arnold Arbor. 70:209.1989. (Fig. 10)

Medium-sized tree up to 35m high, up to 30cm in diameter. Bark surface greyish white, smooth, hooped. Twigs glabrous, pale. Leaves 10–18cm long, 4.5–6cm wide, oblong-lanceolate, base rounded to acute, apex acuminate, 0.5–2 cm long, glabrous and shining above, glaucous beneath, secondary veins fine, not clearly visible. Flowers in clusters of 3–10, on tubercle-like shoots, in the axils of fallen leaves. Petals linear or oblong, spreading. c. 2cm long. Fruitlets globose, red, becoming black, c. 2cm in diameter; stalk c. 1.5cm long. Seed 1.

*Specimens examined:* *Ambriansyah & Arifin* W 151, W 319, W 865; *Van Balgooy* 5907.

*Polyalthia lateriflora* (Blume) Kurz, J. As. Soc. Beng. 43, 2:52.1874.

*Polyalthia lateriflora* (Blume) King, J. As. Soc. Beng. 61, 2:65.1892., nom. illeg.

Tree up to 21m tall. Twigs glabrous. Leaves coriaceous, glabrous on both sides, oblong, 15–29cm long, 5–9.5cm wide, base rounded to acute, apex acuminate, lateral veins slightly prominent beneath, 9–15 pairs. Petiole 5–9mm long, 1.5–2.5mm in diameter. Flowers not seen. Carpida ramiflorous, numerous, ellipsoid, 23–38mm long, 13–16mm in diameter, sparsely minutely puberulent to glabrous, more or less smooth; stalks 33–55mm long; peduncle 50mm long; torus thickened. Seed 1?

*Distribution:* Thailand, Malay Peninsula, Sumatra, Java, Borneo, Celebes, Moluccas, New Guinea.

*Ecology:* Mixed Lowland Dipterocarp Forest.

*Collector's notes:* Fruits reddish-orange or brown.

*Specimens examined:* *Ambriansyah & Arifin* W 343, 676; *Kade Sidiyasa* 662.

*Polyalthia microtus* Miq., Ann. Mus. Bot. Lugd. Bat. 2:13.1865.

Small tree up to 5m tall. Young twigs densely pubescent to hirsute, older twigs more or less glabrescent, sometimes lenticels present. Leaves membranous, glabrous above (when adult), sparsely pubescent beneath, more or less obovate, 9–23cm long, 3–8.5cm wide, base cuneate to subcordate, apex acuminate, lateral veins prominent beneath, 11–15 pairs. Petiole c. 2mm long, 1.5–3mm in diameter. Flowers supra-axillary or ramiflorous, solitary? Pedicel 8–11mm long. Sepals free, 4–7mm long, 3.5–4.5mm wide. Petals 9–16mm long, outer ones 3–4mm wide, inner ones 2–3mm wide. Stamens and carpels not seen. Carpida 2–13, shortly cylindrical to ellipsoid, 7–9mm long, 4–5mm in diameter, pubescent, tuberculate, apex apiculate; stalks 3–13mm long; peduncle 13–15mm long. Seeds 1–3?



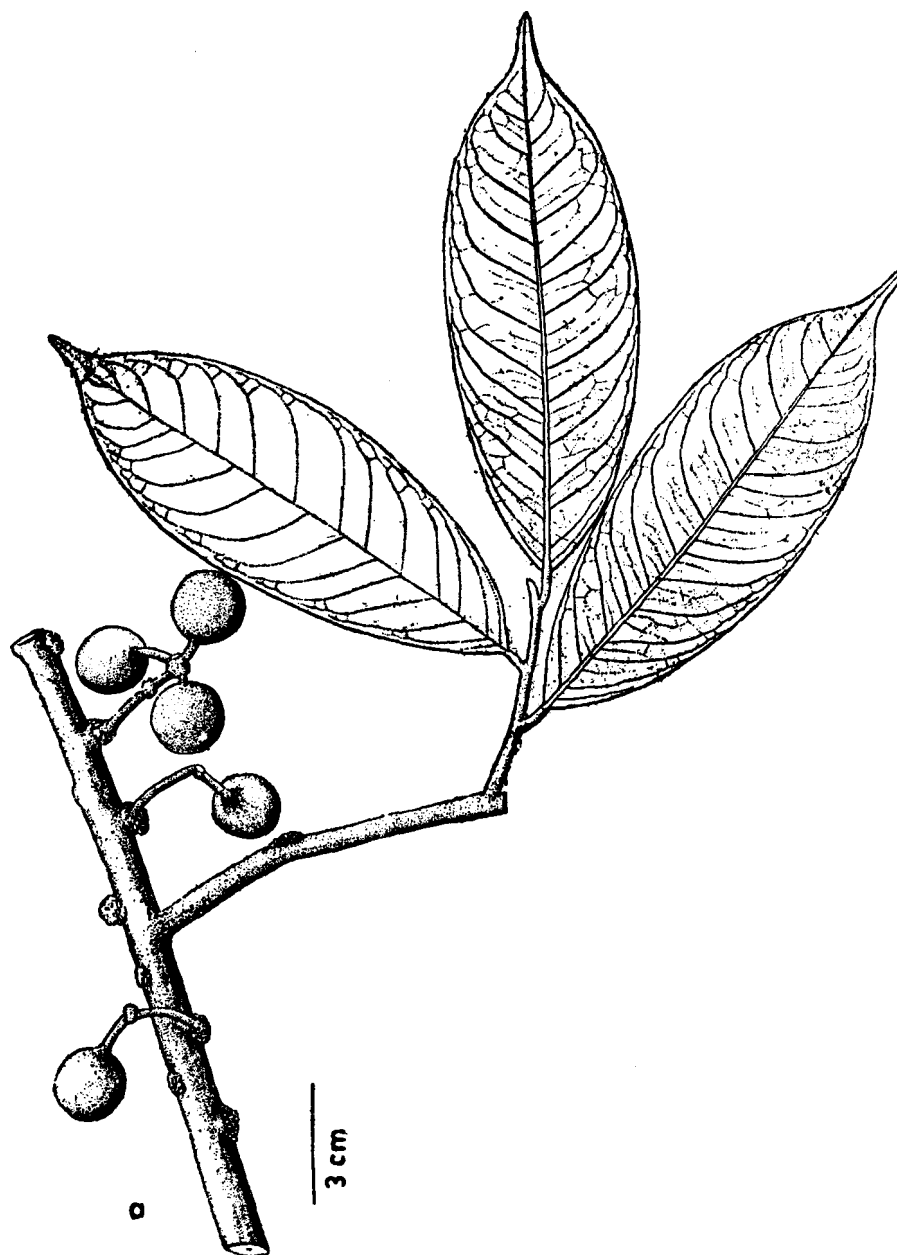


Fig. 10. *Polyalthia glauca*. a. Habit (W 319)

*Distribution:* Borneo.

*Ecology:* (Lowland) Dipterocarp Forest, on loam soil with limestone or near swampy area.

*Collectors notes:* Flowers yellow, orange or orange-brown. Fruits greyish green. (not ripe) or bright green.

*Specimens examined:* *Ambriansyah & Arifin* AA 240, AA 276; *Kessler* 586; *Kostermans* 4909; *Kade Sidiyasa* 660; *Kade Sidiyasa et al.* 832.

***Polyalthia rumphii*** (Blume) Merr., Enum. Philipp. Fl. Pl. 2:162.1923.

Treelet 5–15m tall, 3–10cm in diameter. Young twigs with short simple hairs. Leaves elliptical, c. 8–15cm long, 4.5–5.5cm wide, glabrous on both sides except midrib, base unequal, more or less cuneate, apex acuminate, lateral veins, 8–10 pairs, anastomosing c. 2–3(–4)mm before the margin, pocket domatia present. Pedicel and peduncle in fruit c. 2.2cm long, 1mm in diameter, usually with 1 small leafy bract, c. 1cm long, 3mm wide. Fruitlets many (c. 40–50), c. 1cm long, 5mm in diameter, shortly apiculate, glabrescent; stalk c. 1.7cm long, 2mm in diameter; sepals persistent in fruit. Seed 1.

*Distribution:* Malay Peninsula, Java, Sumatra, Borneo, Philippines.

*Ecology:* Frequent as understory treelet, often in more open places.

*Notes:* A very variable species, especially in leaf- and flower characters. The flowers and fruitlets in dry state are often covered with a yellow mouldiness of unknown origin.

*Specimens examined:* *Ambriansyah & Arifin* W 61, W 126, W 264, W 297, W 577, *Ambriansyah & Arifin* AA 297, AA 329, AA 470; *Nicolaus* B 02; *Kessler* 640.

***Polyalthia sumatrana*** (Miq.) Kurz, J. As. Soc. Beng. 43, 2:53.1874; Rogstad, J. Arnold Arbor. 70:220.1989.

*Vernacular names:* Banitan putih (M), Ampunyt (M), Balal (D).

Medium-sized tree up to 35m high, up to 30cm in diameter. Bark surface greyish-white, smooth, often hooped. Twigs glabrous, pale. Leaves 9–16cm long, 2.5–4.5cm wide, oblong-lanceolate, base rounded to acute, apex acuminate, 0.5–1cm long, glabrous and shining above, glaucous beneath, secondary veins fine, not clearly visible. Flowers 1–3, in the axils of fallen leaves. Petals linear-oblong, spreading, c. 4cm long. Fruitlets ovoid, tapering to each end, red, c. 2cm in diameter; stalk c. 2cm long. Seed 1.

*Distribution:* Very common species.

*Specimens examined:* *Ambriansyah & Arifin* W 12, W 82, W 440, W 509; *Van Balgooy* 5758; *Kessler* 612; *Kade sidiyasa* 262, 449.

#### **Popowia** Endl.

Shrubs to trees. Leaves granular or subgranular in texture, glabrous, pubescent or tomentose. Flowers small, up to 5mm in diameter, leaf-opposed.

## Annonaceae of Balikpapan

Sepals free. Petals of the two rows free or united at the base, apex often incurved. Stamens few, connective prolongation truncate. Carpels few; stigma subcapitate. Carpida globose or ovoid, sessile or stalked. Seed single.

## Key to the species

- 1a Leaves glabrous on upper surface.....**P. pisocarpa**  
 b Leaves rusty tomentose on upper surface.....**P. hirta**

**Popowia hirta** Miq., Ann. Mus. Bot. Lugd. Bat. 2:21.1865.

Trees 8—30m tall, 10—50cm in diameter. Bark black, smooth. Young twigs rusty-tomentose. Leaves oblong, elliptic to elliptic, 11—18cm long, 4—7(—9)cm wide, base rounded, unequal, apex acute or shortly acuminate, softly and densely tomentose on both sides, secondary veins 10—13 pairs. Pedicel up to 8mm long. Sepals broadly ovate, c. 3mm long, spreading, tomentose outside, glabrous inside. Petals united at the base. Carpels 7—9. Carpida globose, purple or red turning black, 1.2—1.8cm in diameter; stalks 1—1.4cm long.

*Distribution:* Borneo.

*Specimens examined:* *Ambriansyah & Arifin* W 297, W 326; *Van Balgooy* 5841; *Kade Sidiyasa* 608; *Kostermans* 6090, 6097, 7181; *Leighton* 136; *Maskuri* 163; *Soegeng Reksodihardjo* 105.

**Popowia pisocarpa** (Blume) Endl. in Walp., Repert. 1:64.1842.

Shrubs or treelets up to 8m tall. Bark hooped. Young twigs pubescent. Leaves elliptic to lanceolate, sometimes slightly obovate, 5—14cm long, 2.5—7 cm wide, base slightly rounded, unequal, apex acuminate, upper side glabrous, pubescent beneath, secondary veins 6—10 pairs, tertiary veins usually not visible in mature leaves. Pedicel 4—6mm long. Sepals triangular-ovate, c. 2mm long, spreading, glabrous inside. Petals free, inner ones shortly clawed. Carpels 5—6. Carpida globose, c. 1cm in diameter.

*Distribution:* Wide spread and common species in Thailand, Indochina, Malay Peninsula, Java, Sumatra, Philippines, New Guinea, Borneo.

*Specimens examined:* *Ambriansyah & Arifin* W 632, W 823; *Ambriansyah & Arifin* AA 535; *Ender* 1540, 3677; *Kostermans* 4029, 4579, 5328, 6792, 7628, 9696, 10537, 21148; *Kuswata Kartawinata* 1306; *Leighton* 63, 320, 523; *Maskuri* 820; *Wiriadinata* 254.

**Pseuduvaria** Miq.,

**Pseuduvaria spec. A**

Trees c. 25m tall, c. 30cm in diameter. Bark smooth, blackish, hooped. Leaves elliptic-oblong, c. 6—13cm long, 3—5cm wide, base broadly cuneate to

rounded, apex acuminate, c. 1cm long, almost glabrous beneath except midrib, secondary veins 9–10 pairs, looping. Petioles c. 5mm long, c. 1.5mm in diameter. Inflorescences on small knob-like short-shoots. Flowers small, c. 3mm in diameter, unisexual. Male flowers: sepals subovate, c. 1.5mm long, outer petals similar to sepals, slightly longer, inner petals clawed, tips cohering, hairy outside, glabrous within, stamens many. Female flowers: sepals and petals as in male ones staminodes 3, carpels c. 15, tomentose. Carpida unknown.

*Note:* Our material cannot be matched with any of the species of *Pseuduvaria* in our Herbarium. It seems to be related to *P. monticola* Sinclair, a mountain species from Thailand and Malay Peninsula.

*Specimens examined:* Ambriansyah & Arifin AA 158 (female), Kade Sidiyasa 460 (male)

#### **Stelechocarpus** (Blume) Hook. f. & Thomson

**Stelechocarpus cauliflorus** (Scheffer) R. E. Fries, Ark. f. Bot. 3:42.1953.

Tree up to 20m tall, c. 40cm in diameter. Bark hooped, black, smooth. Sapwood white. Leaves oblong-lanceolate, 15–40cm long, 10–20cm wide, glabrous, base and apex acute, secondary veins 10–12 pairs. Petiole 5–10mm long. Flowers dioecious. Males usually on the thicker twigs, female on knob-like tubercles on c. 2cm thick twigs. Sepals connate at base, glabrous, orbicular, c. 5mm long, outer petals obovate-orbicular, 1–1.3cm long, imbricate, stamens many, carpels many, obscurely 3-angled, hairy, stigmas lobed. Fruitlets broadly ovoid, 4–5cm in diameter, sessile. Seeds 4–6, in two rows.

*Distribution:* Malay Peninsula, Borneo.

*Specimens examined:* Kessler 616 = W 925 (female)

#### **Uvaria** L.

Climbers. Indument of stellate hairs. Inflorescence terminal, leaf-opposed, supra-axillary or axillary, 1 or few-flowered. Sepals valvate. Petals imbricate, free or fused. Stamens numerous, apical prolongation shield-like or tongue-shaped. Carpels numerous. Ovules 1–30, usually in 2 series. Carpida subglobose, ovoid, or oblong, several-seeded. Seeds arillate or not.

#### **key to the species**

- 1a Inflorescence many- to few-flowered clusters; cauliflorous, sepals entirely connate in bud, completely enclosing the petals; carpida c. 7–10, banana-shaped ..... **U. elmeri**
- b Inflorescence terminal or extra-axillary; sepals not enclosing the petals completely in bud; carpida numerous..... 2

- 2a Carpidia (almost) glabrous, faintly constricted between the seeds.....  
 .....**Uvaria ovalifolia** var. **borneensis**  
 b Carpidia (densely) covered with stellate hairs .....3  
 3a Leaves glabrous above, except for the primary vein..... **Uvaria lobbiana**  
 b Leaves covered with stellate hairs above, parsely pubescent with minute  
 stellate hairs or glabrous beneath.....**Uvaria grandiflora**

**Uvaria elmeri** Merr., Univ. Calif. Publ. Bot. 15:61.1929.

Climber up to 20m tall. Young twigs usually densely covered with brown stellate hairs, older twigs glabrous. Leaves (sub)coriaceous, covered with stellate hairs or (almost) glabrous on both sides, (broadly) obovate to elliptic-oblong, 10–33cm long, 3.5–12cm wide, base rounded, acute or cordate, apex caudate, acuminate acute; or retuse, lateral veins prominent beneath, 10–18 pairs. Petiole 2–12mm long, 1.5–3mm in diameter, densely hairy. Inflorescence cauliflorous, in many-flowered clusters to solitary. Pedicel 13–20 mm long. Sepals in bud entirely connate and enclosing completely the petals, 10–20mm long. Petals 12–18mm long, 7–12mm wide. Stamens numerous, arranged in c. 12 whorls, apical prolongation shield-like. Carpels numerous, stigmas united into one sticky mass. Carpidia (at least) 7–10, banana-shaped, 25–18mm long, 10–28mm in diameter, brown puberulent, stalks 15–20mm long, peduncle c. 35–40mm long. Seeds many, in 2 series.

*Distribution:* Borneo.

*Ecology:* In (Agathis) Dipterocarp Forest or Secondary Forest.

*Collector's notes:* Flowers yellowish green, greenish or pale yellow, inside yellow, or sepals green, petals dark red. Ripe fruit yellow.

*Note:* This species may be conspecific with *Uvaria cauliflora* Ridley.

*Specimens examined:* *Ambriansyah & Arifin* AA 474; *Ambriansyah & Arifin* W 995; *Van Balgooy* 5827; *Kostermans* 4115, 6963, 21245; *Kade Sidiyasa* 490; *Soegeng Reksodihardjo* 721.

**Uvaria grandiflora** Roxb., Hort. Beng. : 43.1814.

Climber up to 10m tall. Young twigs densely covered with brown stellate hairs, older twigs glabrous. Leaves subcoriaceous, covered with stellate hairs on both sides, obovate or elliptic to ovate, 6–17.5cm long, 3–7.5cm wide, base rounded to slightly cordate, apex acuminate to caudate or acute, lateral veins prominent beneath, 10–14 pairs. Petiole 2–9mm long, 1–2.5mm in diameter. Flowers not seen. Carpidia numerous, ovoid to obovoid, 15–35mm long, 13–23mm in diameter, densely covered with brown stellate hairs, verruculose; stalks 10–15mm long; peduncle 10–90mm long. Seeds up to c. 10, in 2 series.

**Distribution:** Hainan, Thailand, Malay Peninsula, Sumatra, Java, Borneo, Celebes, Moluccas, New Guinea.

**Ecology:** Unknown

**Note:** Due to scarce fruiting material available of *U. grandiflora* in the Leiden Herbarium, the specimen could not be identified with certainty. The flowers of this species are very large and red or purplish in vivo.

**Specimens examined:** *Ambriyansyah & Arifin* AA 406, AA 486.

***Uvaria lobbiana*** Hook. f. & Thomson, Fl. Ind. 100.1855.

**Vernacular name:** Akar hitam (M).

Climber up to c. 20m tall. Young twigs pubescent, older twigs pubescent or glabrous. Leaves subcoriaceous, glabrous above except on the primary vein, sparsely pubescent with minute stellate hairs or glabrous beneath, obovate-oblong, 6–18cm long, 3.5–6.5cm wide, base (slightly) cordate, apex acuminate to (widely) acute, lateral veins prominent beneath, 9–16 pairs. Petiole 4–6mm long, 1.5–2mm in diameter. Inflorescence terminal or supra-axillary. Flowers solitary? Pedicel 7mm long. Sepals fused, 5mm long, 8mm wide. Outer petals 10–12mm long, 8–9mm wide. Inner petals 9–15mm long, 8–10mm wide. Stamens numerous, apical prolongation tongue-shaped. Carpels numerous. Carpodia numerous, ovoid to ellipsoid, (when Young?) 8mm long, 5mm in diameter, pubescent, verrucose; stalks 10–30mm long; peduncle 10–12mm long.

**Distribution:** Malay Peninsula, Sumatra, Borneo.

**Collector's note:** Flowers dark red.

**Specimens examined:** *Ambriyansyah & Arifin* AA 345; *Endert* 2333; *Leighton* 723.

***Uvaria ovalifolia*** Blume var. *borneensis* Miq., Ann. Mus. Bot. Lugd. Bat. 2:7.1865; *Uvaria ovalifolia* Blume. Fl. Javae, Anonaceae:27.1830. (Fig. 11)

Climber up to 5m tall. Young twigs covered with brown stellate hairs, older twigs sparsely hairy to glabrous. Leaves membranous, glabrous above except on the veins, sparse hairy or glabrous, beneath, hairy on the veins, ovate or oblong-ovate, 12.5–31cm long, 4.5–12cm wide, base cordate rounded or truncate, apex acuminate, to acute, lateral veins prominent beneath, 14–17 pairs. Petiole 5–15mm long, 2–4mm in diameter. Inflorescence terminal, 3–4-flowered. Pedicel 7–12mm long. Sepals connate, 4–5mm long, c. 8–10mm wide. Petals (in bud) 11mm long, 8–10mm wide. Stamens numerous. Carpels numerous. Carpodia numerous, subglobose to cylindrical, faintly constricted between the seeds, 6–17mm long, 7–9mm in diameter, glabrous or with sparse stellate hairs, more or less verrucose; stalks 4–15mm long; peduncle 25–50mm long. Seeds 1–6, in 1–2 series.

**Distribution:** Borneo.

**Ecology:** In Mixed Dipterocarp Lowland Forest or in (Lowland) Secondary Forest.

**Collector's notes:** Young buds greenish brown. Flowers yellow. Fruits yellowish, orange or yellow ripening red.

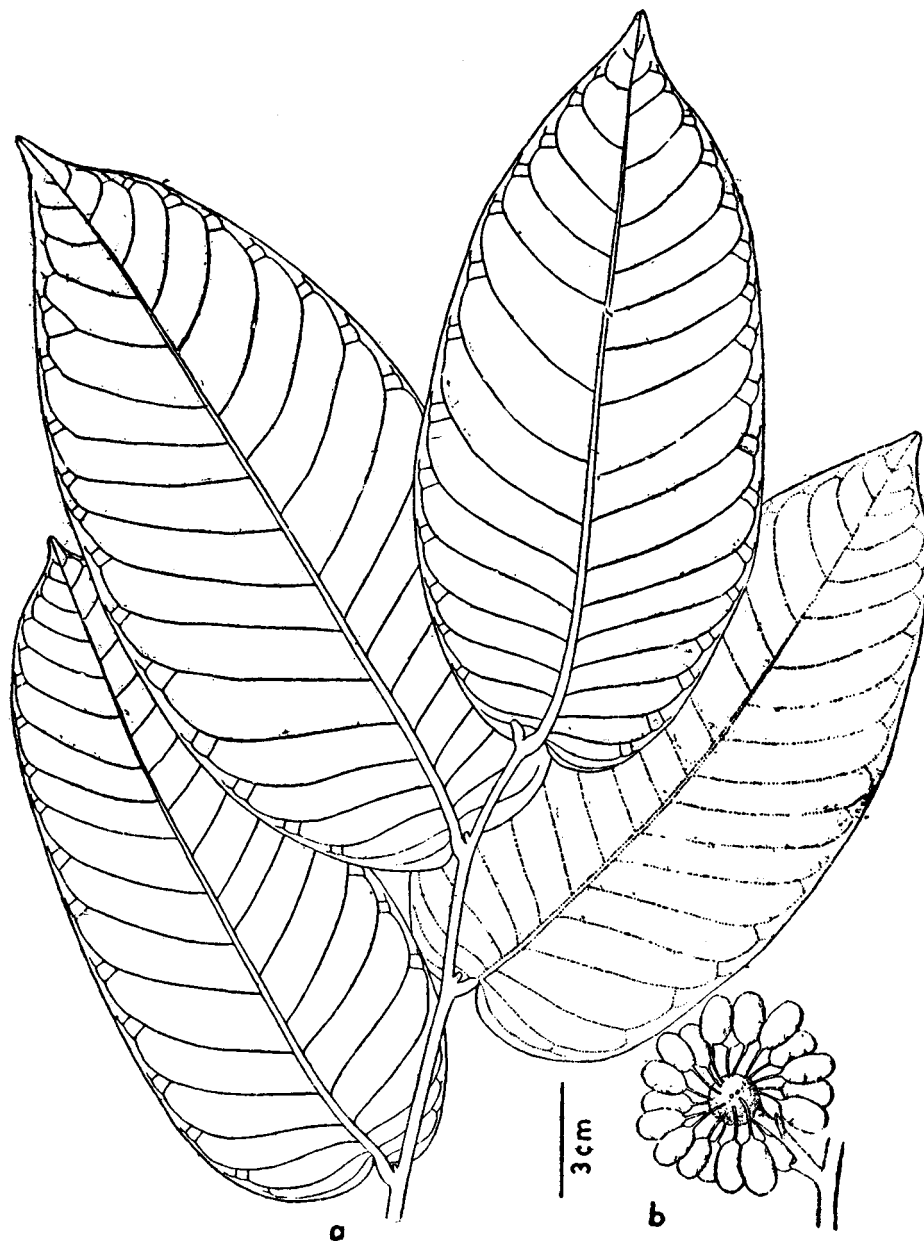


Fig. 11. *Uvaria ovalifolia* Bl. var. *borneensis*. a. Habit b. Infrutescence (W 811)

*Specimens examined:* Ambriansyah & Arifin W 811; Endert 2088, 2513; Kessler 648; Leighton 384; Kade Sidiyasa 752.

### Xylopia L.

Trees with simple hair. Flowers bisexual, axillary, solitary or on short cymes, often fragrant. Sepals 3, connate at base, petals 6, valvate, spoon-shaped at base. Stamens transversely septate with large pollen grains. Ripe carpels elongated or cylindrical to ovoid. Seeds several.

#### Key to the species

- 1a Leaves glaucous beneath, purplish brown pubescent, fruitlets elongate, numerous, c. 10–13cm long, stilt roots present.....**X. ferruginea**
- b Leaves not glaucous beneath, fruitlets oblong to oblong-obovate, 3–15, up to 5cm long, trees without stilt roots, but usually with buttresses.....2
- 2a Midrib glabrous above, carpodia 3(–4).....**X. malayana**
- b Midrib pubescent above, carpodia 10–15.....**X. elliptica**

**Xylopia elliptica** Maingay ex Hook. f. & Thomson, Fl. Brit. Ind. :86.1872.

Trees up to 40m tall. c. 45cm in diameter. Bole straight, buttresses up to 1.2m tall. Bark smooth, greyish-yellow. Young twigs pubescent. Leaves elliptic, c. 4–8cm long, 2–3.5cm wide, base cuneate, apex acuminate, pubescent beneath, midrib pubescent above, secondary veins scarcely visible, 6–8 pairs. Flowers axillary, up to 1.5cm long. Sepals broadly ovate, c. 3mm long. Outer petals flat, inner ones triquetrous. Stamens many, septate. Carpels 15–20. Carpodia 10–15, oblong, up to 2.5cm long, c. 1.2cm in diameter, stalks up to 0.8cm long. Seeds 5–6.

*Distribution:* Malay Peninsula and Borneo.

*Specimens examined:* Ambriansyah & Arifin AA 7 = W 457; Ambriansyah & Arifin W 602; Achmat bb 34421; Kostermans 38 (= bb 35049), 6634, 13109; Paymans 164; Kade Sidiyasa 280, 818.

**Xylopia ferruginea** (Hook. f. & Thomson) Hook. f. & Thomson, Fl. Brit. Ind. :83.1872.

**Xylopia altissima** Boerl. Ic. Bogor. :t. 73.1899., syn. nov.

*Vernacular name:* Banitan merah (M)

Medium-sized tree up to 30m high, c. 35cm in diameter. Bole with numerous stilt-roots. Bark surface red to reddish brown, smooth to cracking, lenticellate. Inner bark pinkish brown, sapwood and heartwood white. Young twigs rusty pubescent. Leaves 10–20cm long, 3.5–6cm wide, oblong, base rounded often unequal, apex pointed, coriaceous, shining and glabrous above, glaucous and rusty brown beneath, secondary veins 12–14 pairs, midrib sunken



## Annonaceae of Balikpapan

above. Flowers 1–3, axillary. Petals spoon-like, c. 4cm long, rusty tomentose; outside. Carpida elongate, cylindrical, 10–13cm long, 0.5cm in diameter, constricted a little bit between the 6–8 seeds when unripe, splitting at the ventral suture at maturity, showing the blue against the dark red inner fruit wall.

*Distribution:* Thailand, Malay Peninsula, Sumatra and Borneo.

*Habitat:* Common usually along rivers and in swamps.

*Note:* Most of the Bornean material was identified as *Xylopi* *altissima* Boerlage. After examining type material of *X. altissima*, I failed to see any difference with *X. ferruginea* and have been compelled to make *X. altissima* a synonym.

*Specimens examined:* Ambriansyah & Arifin W 131, W 930; Achmat bb 34470; Van Balgooy 5911; Endert 5089; Kessler 620; Kostermans 15 (= bb 35026), 7706, 10102; Neth. Ind. For. Serv. bb 16136, bb 16961; Soegeng Rekso-dhardjo 96.

*Xylopi* *malayana* Hook. f. & Thomson, Fl. Ind. :125. 1855.

Trees up to 35m tall, up to 70cm in diameter. Bole straight, buttresses elbow-like, up to 1.5m tall. Bark brownish, smooth. Young twigs usually glabrous, with numerous lenticels. Leaves oblong-elliptic, 8–14cm long, 3.5–6.5cm wide, base and apex acute, glabrous on both sides including midrib, secondary veins clearly visible, c. 8 pairs. Flowers 1–3, axillary, c. 2.5cm long. Sepals connate, inner petals flat, outer ones triquetrous. Stamens many. Carpels 3–4. Carpida 3(–4), oblong-obovate, up to 5cm long, up to 3cm in diameter, sessile; peduncle and pedicel c. 1cm long, c. 0.5cm in diameter, pinkish to brown, splitting open irregularly, showing the 4–5 black seeds with a white aril against the dark red inner fruitwall.

*Distribution:* Malay Peninsula, Sumatra and Borneo.

*Specimens examined:* Ambriansyah & Arifin AA 598; Ambriansyah & Arifin W 432, W 532, W 591, W 630, W 801, W 1007; Kade Sidiyasa 598; Kostermans 4488, 4512, 5653, 5970, 5977, 6451, 6464, 7001, 7213, 8895, 9133, 9677, 10154, 10205; Leighton 66, 154.

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