

**XI. KEYS TO THE TAXA OF  
MACARANGA AND MALLOTUS (EUPHORBIACEAE)  
OF EAST KALIMANTAN (INDONESIA)**

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SUMMARY

Keys mainly based on vegetative characters are given to the 27 taxa of *Macaranga* and 20 of *Mallotus* known from or reported for East Kalimantan, Borneo, Indonesia.

INTRODUCTION

Species of the genera *Macaranga* Thou. and *Mallotus* Lour. (*Euphorbiaceae*) often form a characteristic part of secondary vegetations in Malesia. Many are among the first colonizers of disturbed vegetations. A considerable number can also be found in late secondary vegetations and the understorey of primary forests. This wide ecological scope and the more or less well-defined ecological preferences of the various species make them potentially very useful for recognizing the disturbance history of a forest.

A comprehensive key to the species is still much in need. It should emphasize vegetative characters in order to recognize sterile specimens. Those presently available for East Kalimantan are either outdated (Pax & Hoffmann, 1914), incomplete (Keßler & Sidiyasa, 1994), or largely based on the availability of both flowering and fruiting material (Airy Shaw, 1975).

The following keys are based on collections present in L, but 2 species of *Macaranga* reported for the area by Airy Shaw (1975), Keßler & Sidiyasa (1994), and Keßler et al. (1995) were absent there. These have been noted as 'doubtful'. Still, they had to be included for completeness' sake. Generative characters have only been added when identification is impossible otherwise. Please note that these keys were made specifically for East Kalimantan. Identification of plants from outside that area may not be possible, even when the species have been included here. Short notes on the ecology, distribution, and habit of the species are given, but are based on information on the labels of East Kalimantan specimens, only. The distribution ranges have been indicated only roughly (see Map 1).

KEY TO THE GENERA

- 1 Indumentum simple to absent. Twigs solid to hollow (ant-inhabited). Leaves alternate, often peltate, often lobed, base above sometimes with few glands. Inflorescences mostly branched. Male flowers completely surrounded by bracts. Bracts sometimes fimbriate. Stamens up to c. 30, anthers clearly 3- or 4-celled, apicifix, thecae opening apically. Styles usually free, unbranched. Fruits 2–6-locular, sometimes spiny . . .  
..... **Macaranga**

- Indumentum stellate to simple to absent. Twigs solid. Leaves alternate or opposite, sometimes peltate, rarely lobed, base above usually with few glands. Inflorescences mostly unbranched. Male flowers not surrounded by bracts. Bracts never fimbriate. Stamens up to c. 150, anthers 2-celled, basi- to dorsifixed, thecae opening extrorsely. Style apically splitting into (2 or) 3 (or 4) stigmas. Fruits (2- or) 3- (or 4-)locular, mostly spiny ..... **Mallotus**



Map 1. East Kalimantan. The main collecting areas are roughly indicated: Balikpapan, Berau, Kutai, Tarakan.

### MACARANGA

Shrubs to small trees to trees up to 30 m high, dioecious. Indumentum simple. *Bark* sometimes prominently hooped (rings surrounding the stem). *Wood* soft. *Twigs* sometimes hollow and ant-inhabited (small openings), sometimes whitish-glaucous. *Stipules* small and narrowly triangular to very large and ovate to rounded, sometimes recurved and forming an enclosed hollow inhabited by ants. *Leaves* alternate to spirally arranged, small to very large, blades often peltate, sometimes 3(-5)-lobed, pinnate to basally

triplinerved to palmatinerved, sometimes with basal glands above, often gland-dotted below. *Inflorescences* axillary to rarely sub-terminal. *Male inflorescences* mostly branched; bracts large, surrounding the flowers, sometimes fimbriate; flowers 2–150 per node, sepals 2–4, stamens 1–30, anthers 3- or 4-celled, apicifix, disc rarely present, pistil absent. *Female inflorescences* usually branched; bracts persistent to caducous; flowers 1 to several per node, calyx short, ovary 1–6-locular, styles long to short, usually free and unbranched. *Fruit* a leathery to berry-like capsule, smooth to spiny to horned, sometimes with conspicuous glandular patches, dehiscent into bivalved parts. *Seeds* black to red.

## KEY TO THE TAXA

- |  |   |
|--|---|
| 1 Twigs solid . . . . .  | 2   |
| – Twigs hollow (often ant-inhabited) . . . . .   | 29  |
| 2 Leaves pinninerved . . . . .   | 3   |
| – Leaves at base triplinerved to palmatinerved . . . . .   | 10  |
| 3 Vegetative parts completely glabrous . . . . .   | 4   |
| – Twigs, petioles, and/or leaf below hairy . . . . .   | 5   |
| 4 Leaves whitish glaucous below. Basal nerves of equal length or longer than those higher along the midrib . . . . . | 5. <i>Macaranga conifera</i>                        |
| – Leaves not whitish glaucous below. Basal nerves shorter than those higher along the midrib . . . . .               | 17. <i>Macaranga lowii</i> var. <i>kostermansii</i> |
| 5 Vegetative parts with hairs longer than 1 mm . . . . .   | 6   |
| – Vegetative parts with hairs always shorter than 1 mm . . . . .   | 7   |
| 6 Leaves 5–7 cm long, secondary nerves conspicuous above. Pedicels up to 1 cm long . . . . .                         | 9. <i>Macaranga fulva</i>                           |
| – Leaves 7–17 cm long, secondary nerves inconspicuous above. Pedicels 1.5–3 cm long . . . . .                        | 23. <i>Macaranga repando-dentata</i>                |
| 7 Basal nerves shorter than those along the midrib . . . . .   | 8   |
| – Basal nerves of equal length or longer than those along the midrib . . . . .                                       | 9   |
| 8 Twigs and petioles densely hairy. Petioles usually shorter than 2 cm . . . . .                                     | 4. <i>Macaranga brevipetiolata</i>                  |
| – Twigs and petioles mostly sparsely hairy. Petioles usually longer than 2 cm . . . . .                              | 16. <i>Macaranga lowii</i> var. <i>lowii</i>        |
| 9 Leaves below conspicuously whitish glaucous, velvety hairy, secondary nerves not raised . . . . .                  | 5. <i>Macaranga conifera</i>                        |
| – Leaves below not glaucous, not velvety hairy, secondary nerves clearly raised . . . . .                            | 6. <i>Macaranga costulata</i>                       |
| 10 Leaves peltate . . . . .  | 11  |
| – Leaves not peltate . . . . .   | 22  |
| 11 Leaves not lobed . . . . .  | 12  |
| – Leaves lobed . . . . .   | 18  |

- 12 Petiole insertion more than 1.4 cm from the base of the blade. Leaves above without glands near petiole insertion . . . . . 13  
 – Petiole insertion less than 1.4 cm from the base of the blade. Leaves above sometimes with 2 glands near petiole insertion . . . . . 16
- 13 Leaf below glabrous to sparsely hairy on the main nerves, always with numerous punctate glands . . . . . 14  
 – Leaves below densely hairy all over, with few to numerous glands . . . . . **25. *Macaranga tanarius***
- 14 Leaves rarely less than 11 cm wide, below densely covered by yellow punctate glands. Capsules dry . . . . . 15  
 – Leaves never more than 11 cm wide, below sparsely, rarely densely covered by yellow punctate glands. Capsules berry-like . . . . . **21. *Macaranga puncticulata***
- 15 Stipules tough (leathery when dry). Leaves leathery when dry, below glaucous, secondary nerves not raised . . . . . **22. *Macaranga recurvata***  
 – Stipules thin (papery when dry). Leaves papery when dry, below not glaucous, secondary nerves raised . . . . . **25. *Macaranga tanarius***
- 16 (12). Leaves below not glaucous, not velvety hairy, secondary nerves clearly raised . . . . . 17  
 – Leaves below conspicuously whitish glaucous, velvety hairy, secondary nerves not raised . . . . . **5. *Macaranga confera***
- 17 Leaves above with two glands near petiole insertion . . . . **6. *Macaranga costulata***  
 – Leaves above without two glands near petiole insertion . . **8. *Macaranga endertii***
- 18 (11). Stipules up to 1.5 cm long, broadly ovate to ovate, apex rounded to acuminate to acute, persistent to caducous, alive on living plant. Leaves shorter than 30 cm . . . . . 19  
 – Stipules up to 4 cm long, ovate, apex acute, persistent, dead and dried out on living plant. Leaves usually longer than 30 cm . . . . . **10. *Macaranga gigantea***
- 19 Twigs glabrous, often whitish glaucous. Stipules broadly ovate, apex rounded to acuminate, rarely acute. Petioles rarely hairy. Leaves often with an emarginate base, blade deeply 3-lobed, below glabrous to hairy . . . . . 20  
 – Twigs hairy, not whitish glaucous. Stipules ovate, apex acute. Petioles hairy. Leaves with a rounded to truncate base, blade shallowly 3- (or 5-)lobed, below hairy . . . . . **7. *Macaranga depressa* forma *strigosa***
- 20 Stipules caducous, rarely persistent (if so than leaves below velvety hairy). Leaves below glabrous to velvety hairy . . . . . 21  
 – Stipules persistent (present with all the leaves!). Leaves below glabrous . . . . . **11. *Macaranga hosei***
- 21 Twigs conspicuous whitish glaucous, openings for ants often present. Stipules ovate with clear acuminate to acute apex. Leaves often with large protruding glands along the margin of the base, leaves below mostly glabrous or with sparse hairs, rarely velvety . . . . . **19. *Macaranga pearsonii***  
 – Twigs mostly not whitish glaucous, without openings for ants. Stipules broadly ovate with rounded to acuminate apex. Leaves without large protruding glands along the margin of the base, leaves below velvety hairy . . . . . **20. *Macaranga pruinosa***

- 22 (10). Leaves not lobed . . . . . 23  
 – Leaves lobed . . . . . 26
- 23 Leaves above glabrous, rarely sparsely hairy on the nerves . . . . . 24  
 – Leaves above hairy all over . . . . . **26. Macaranga trichocarpa**
- 24 Twigs, petioles, and leaves below with sparse to numerous hairs . . . . . 25  
 – Vegetative parts glabrous . . . . . **5. Macaranga conifera**
- 25 Leaves below conspicuously whitish glaucous, velvety hairy, secondary nerves not raised . . . . . **5. Macaranga conifera**  
 – Leaves below not glaucous, not velvety hairy, secondary nerves clearly raised . . . . . **6. Macaranga costulata**
- 26 (22). Leaves deeply 3-lobed, above never hairy, base deeply cordate . . . . . 27  
 – Leaves shallowly 3-lobed (cusped), above hairy, base acute to rounded to slightly cordate . . . . . **26. Macaranga trichocarpa**
- 27 Stipules caducous (if persistent then leaf below velvety hairy). Leaves below glabrous to velvety hairy . . . . . 28  
 – Stipules persistent (present with all the leaves!). Leaves below glabrous . . . . . **11. Macaranga hosei**
- 28 Twigs conspicuous whitish glaucous, openings for ants often present. Stipules ovate with a distinctly acuminate to acute apex. Leaves often with large protruding glands along the margin of the base, leaves below mostly glabrous or with sparse hairs, rarely velvety . . . . . **19. Macaranga pearsonii**  
 – Twigs mostly not whitish glaucous, without openings for ants. Stipules broadly ovate with a rounded to acuminate apex. Leaves without large protruding glands along the margin of the base, leaves below velvety hairy . . . . . **20. Macaranga pruinosa**
- 29 (1). Leaves not peltate . . . . . 30  
 – Leaves peltate . . . . . 31
- 30 Stipules persistent (present with all the leaves!), apex rounded . . . . . **11. Macaranga hosei**  
 – Stipules caducous, apex acute . . . . . **19. Macaranga pearsonii**
- 31 Leaves not lobed . . . . . 32  
 – Leaves lobed . . . . . 37
- 32 Twigs with openings for ants, rarely exceeding 1 mm diam. Stipules recurved, pointing downwards, forming a cavity between twig and stipule . . . . . 33  
 – Twigs either without openings for ants, or, when present, 1–2 mm diam. Stipules erect, pointing upwards or away from the twig, not forming a cavity . . . . . 35
- 33 Stipules shorter than wide, never more than 1.5 cm long (mostly between 0.5 and 1 cm length) . . . . . 34  
 – Stipules longer than wide (like a pair of horns), 1.5–2.5 cm long . . . . . **15. Macaranga lamellata**
- 34 Twigs between nodes not, rarely slightly swollen, glabrous. Stipules often persistent, red when alive. Leaves broadly ovate, below often velvety hairy, rarely glabrous, with numerous yellow glands. Plants mostly growing on dry places . . . . . **2. Macaranga bancana**

- Twigs between nodes often slightly swollen, sometimes hairy. Stipules caducous to persistent, green, rarely red when alive. Leaves ovate to triangular, below glabrous or with sparse hairs, mostly without yellow glands. Plants often growing on alluvial places like swamps and riversides . . . . . **12. *Macaranga hullettii***
- 35 Twigs not conspicuously swollen, openings for ants absent or small (mostly c. 1 mm diam.). Stipules caducous to persistent . . . . . 36
  - Twigs conspicuously swollen, openings for ants large (c. 2 mm diam.). Stipules early caducous. . . . . **21. *Macaranga puncticulata***
- 36 Twigs without openings for ants. Stipules caducous to persistent. Leaves leathery when dry, below densely covered with yellow punctate glands, slightly glaucous. Fruits more than 3 mm diam. . . . . **22. *Macaranga recurvata***
  - Twigs usually with openings for ants. Stipules persistent (present with all the leaves!). Leaves papery when dry, below with few yellow glands, not glaucous. Fruits small, c. 3 mm diam. . . . . **27. *Macaranga winkleri***
- 37 (31). Stipules recurved, pointing downwards, forming a cavity with the stem . . 38
  - Stipules erect, pointing upwards or away from the stem, not forming a cavity with the stem . . . . . 45
- 38 Leaves with large volcano-like glands along the margin of the base . . . . . 39
  - Leaves without large volcano-like glands along the margin of the base . . . . . 40
- 39 Glands along leaf margin with clearly visible openings. Calyx caducous, absent on the fruit. . . . . **1. *Macaranga aetheadenia***
  - Glands along leaf margin without openings. Calyx persistent, present on the fruit . . . . . **24. *Macaranga spec. nov.***
- 40 Stipules shorter than wide, never more than 1.5 cm long (usually 0.5–1 cm long) . . . . . 41
  - Stipules longer than wide, 1.5–2.5 cm long, resembling a pair of horns . . . . . **15. *Macaranga lamellata***
- 41 Stipules not surrounding the stem. Leaves clearly 3- to 5-lobed . . . . . 42
  - Stipules surrounding the stem completely. Leaves often shallowly 3-lobed (cusped) . . . . . 43
- 42 Leaf below glabrous . . . . . **18. *Macaranga motleyana***
  - Leaf below velvety hairy . . . . . **24. *Macaranga spec. nov.***
- 43 Stipules usually red. Leaves not much longer than wide, shallowly to deeply lobed, 14 cm or more wide, below glabrous to densely (velvety) hairy, with or without yellow glands. Plants mostly growing on dry places . . . . . 44
  - Stipules green, rarely red. Leaves clearly longer than wide, shallowly lobed (cusped), usually less than 14 cm wide, below glabrous or with sparse hairs, usually without yellow glands. Plants often growing on alluvial places like swamps and riversides . . . . . **12. *Macaranga hullettii***
- 44 Twigs glabrous. . . . . **2. *Macaranga bancana***
  - Twigs hairy . . . . . **14. *Macaranga indistincta***

- 45 (37). Stipules narrowly triangular, 3–5 mm wide, not surrounding the stem . . . 46  
 – Stipules broadly ovate to rounded, more than 5 mm wide, nearly to completely surrounding the stem . . . . . 47
- 46 Leaves with the central lobe 3.5–5 times as long as wide, at base never with overlapping side lobes, below inconspicuously white. . . . . **3. *Macaranga beccariana***  
 – Leaves with the central lobe 1.3–2 times as long as wide, at base often with overlapping side lobes, below bright white . . . . . **13. *Macaranga hypoleuca***
- 47 Stipules persistent (present with all the leaves!), apex rounded. . . . .  
 . . . . . **11. *Macaranga hosei***  
 – Stipules caducous, apex acute . . . . . **19. *Macaranga pearsonii***

### 1. *Macaranga aetheadenia* Airy Shaw

Airy Shaw (1975) 145; Keßler & Sidiyasa (1994) 131; Keßler et al. (1995) 19.

Small trees to trees, up to 15 m high, dbh up to 20 cm. Bark hooped, glaucous white, sap red. Stipules red. Glands along leaf margin red. Fruits greenish-yellow, with yellow glandular bands, glaucous.

Habitat & Ecology — Lowland. In secondary forests, often along roads or skid trails. Inhabited by ants.

Distribution — Berau, Kutai.

Material — Berau (Keßler et al.) 56, 157, 357, PK (Keßler et al.) 1329, 1333.

### 2. *Macaranga bancana* (Miq.) Müll. Arg.

Small trees up to 16 m high, dbh up to 20 cm. Bark smooth, hooped, lenticellate, green-greyish. Inner bark thin, fibrous, pinkish. Wood hard, white with rays. Stipules red. Male flowers yellow-brownish. Fruits green to reddish, with sticky powder-like substance.

Habitat & Ecology — Lowland up to 100 m altitude. Secondary forest, rarely in primary forest. Dry to swampy places, shaded gaps. On sandy loam. Ant-inhabited.

Distribution — Kutai, Balikpapan.

Material — AA (Ambriansyah et al.) 187, Kostermans 12691, Leighton 912, Sidiyasa et al. 829, W (Ambri et al.) 24, W (Ambriansyah et al.) 950, W (Slik) 1043, 1046, 1049.

Note — Often misidentified as *Macaranga triloba* (Blume) Müll. Arg., a species that does not occur in East Kalimantan.

### 3. *Macaranga beccariana* Merr.

Airy Shaw (1975) 145; Keßler et al. (1995) 19.

Small trees up to 10 m high, dbh up to 9 cm. Bole straight, columnar, circular. Bark smooth, lenticelled, hooped, glaucous, greyish-green to whitish, sap clear to red. Male flowers greenish. Fruits greenish-yellow to brownish. Seeds orange red.

Habitat & Ecology — Up to 750 m altitude. In secondary forests, gaps or along roads. Inhabited by ants.

Distribution — Berau.

Material — AA (Ambriansyah) 716, Berau (Keßler et al.) 323, Berau (Goverse et al.) 461, Berau (Arifin et al.) 556.

**4. *Macaranga brevipetiolata* Airy Shaw**

Airy Shaw (1975) 154; Keßler et al. (1995) 19.

Doubtful report. No material seen.

**5. *Macaranga conifera* (Zoll.) Müll. Arg.**

Airy Shaw (1975) 157; Keßler & Sidiyasa (1994) 132; Keßler et al. (1995) 19.

Small trees to trees up to 25 m high, dbh up to 49(–70) cm. Sometimes with small buttresses. Bole straight, somewhat fluted, columnar, circular. Bark smooth, hooped, dippled, lenticelled, cracked, greyish-white, sap red. Inner bark thin, fibrous, whitish to red. Wood white. Leaves glaucous below. Male flowers green. Fruits sticky, green to greyish. Seeds red.

Vernacular name — Buta buta (Balikpapan).

Habitat & Ecology — Lowland up to 100 m altitude. Scrub, secondary forests, and primary forests. Along streams, roads, skid trails. Dry to periodically inundated to marshy terrain. Loam with limestone soils.

Distribution — Berau, Kutai, Balikpapan.

Material — AA (Ambriansyah) 689, AA (Arbainsyah) 1025, bb 16188, 16901, 34248, Berau (Keßler et al.) 376, Endert 4982, Kostermans 5616, 21541, Sidiyasa 632, 823, W (Ambri et al.) 72, W (Ambriansyah et al.) 984, W (Slik) 1056.

**6. *Macaranga costulata* Pax & K. Hoffm.**

Airy Shaw (1975) 156; Keßler et al. (1995) 20.

Small trees to trees up to 30 m high, dbh up to 60 cm. Bark pustulate, dark greyish-brown, sap red. Inner bark pale dirty red. Wood white. Fruits green to yellowish-green. Seeds black.

Vernacular name — Butak (northeastern part of East Kalimantan).

Habitat & Ecology — Up to 1000 m altitude. Mostly in primary forest. Often on open exposed places. On limestone and sandstone.

Distribution — Northern half of East Kalimantan.

Material — Geesink 8956, Kartawinata 1475A, Kostermans 6026, PK (Keßler et al.) 2038.

**7. *Macaranga depressa* (Müll. Arg.) Müll. Arg. forma *strigosa* Whitmore**

Airy Shaw (1975) 146; Keßler & Sidiyasa (1994) 131; Keßler et al. 20.

Bush to small trees up to 7 m high, dbh up to 7 cm. Bark smooth, hooped, lenticelled, pale green, sap clear turning pink to red. Stipules green-brownish. Male flowers grey-green. Fruits green to green-reddish, sap yellow. Seeds red.

Habitat & Ecology — Up to 1200 m altitude. In primary and secondary forests, also in swamp forest. Along roads, streams, forest edges. On sandstone to red clayey loam.

Distribution — Berau, West of Kutai, Balikpapan.

Material — AA (Arifin) 627, AA (Ambriansyah et al.) 2064, Geesink 9044, Kato, et al. B-11254, Kostermans 21643, Van Balgooy 5902 A, 6076, 6124, W (Ambri et al.) 1024, W (Slik) 1045.

### 8. *Macaranga endertii* Whitmore

Airy Shaw (1975) 157.

Shrublet to small tree. Fruits dull green.

Habitat & Ecology — Lowland up to 700 m altitude. In primary forest. Often on ridges or exposed places. Mostly found on limestone.

Distribution — Berau, Kutai.

Material — Endert 5267, Geesink 9315, Kato et al. B-11827.

### 9. *Macaranga fulva* Airy Shaw

Airy Shaw (1975) 154.

Small tree, 4 m high. Bracts brownish.

Habitat & Ecology — On low ridge. Sandy soil.

Distribution — Bulungan district (Northern part of East Kalimantan).

Material — Kostermans 9239.

### 10. *Macaranga gigantea* (Rchb.f. & Zoll.) Müll. Arg.

Airy Shaw (1975) 157; Keßler & Sidiyasa (1994) 131; Keßler et al. (1995) 20.

Small trees to trees up to 25 m high, dbh up to 35 cm. Rarely with spreading small buttresses. Bole straight, columnar, circular. Bark thin, smooth, hooped, lenticelled, greyish, sap pink to red. Inner bark thin. Wood soft. Male flowers green. Fruits yellowish to pale grey, waxy, pustulate.

Vernacular name — Sorao (Kutai).

Habitat & Ecology — Lowland (one specimen from 1400 m altitude: Kato et al. B-10214). In secondary forests. Along roads, on steep slopes, in large gaps.

Distribution — Tarakan, Berau, Kutai, West of Berau and Kutai, Balikpapan.

Material — bb 25145, Endert 1845, 2434, Kato et al. B-10214, Leighton 570, PK (Keßler et al.) 900, 1328, Van Balgooy et al. 5912, W (Ambri et al.) 10, 1001, Wiriadinata 653, Wiriadinata et al. 1073.

### 11. *Macaranga hosei* King ex Hook.f.

Keßler et al. (1995) 20.

Small tree to 8 m high. Male flowers green.

Habitat & Ecology — Lowland. In primary and secondary forests. In valley. On sandstone. Ant inhabited?

Distribution — Malinau, NW part of East Kalimantan.

Material — Geesink 8927.

**12. *Macaranga hullettii* King ex Hook. f.**

Airy Shaw (1975) 147; Keßler et al. (1995) 20.

Small trees up to 12 m high, dbh up to 11 cm. Bark smooth, hooped, sometimes dippled, greenish to greyish, sap red. Inner bark thin, yellow, fibrous. Stipules green but sometimes tinged red to dark red. Male flowers green to greenish-yellow. Fruits green to green-yellow to pink-grey to purplish-brown.

Habitat & Ecology — Up to 850 m altitude. Primary to secondary forests, also in swamp forests. Often along streams and in swampy places, along roads, on open places. On sandstone to sandy loam. Ant inhabited.

Distribution — Along border with Malaysia, West of Kutai, Kutai, Balikpapan.

Material — AA (Ambriansyah et al.) 1676, Endert 3089, 4081, 4671, Geesink 9299, Keßler 611, 619, Kostermans 4321, Sidiyasa 805, Ueda et al. B-11586, Van Valkenburg JVV 1261, W (Ambri et al.) 266, 636, W (Slik) 1052.

**13. *Macaranga hypoleuca* (Rchb. f. & Zoll.) Müll. Arg.**

Airy Shaw (1975) 147; Keßler & Sidiyasa (1994) 131; Keßler et al. (1995) 20.

Small trees up to 17 m high, dbh up to 50 cm. Bole straight, columnar, circular. Crown rounded. Bark smooth, hooped, greyish-white, sap red. Inner bark thin, fibrous. Stipules whitish-greenish. Male flowers green. Fruits glaucous, greyish-black. Seeds red.

Vernacular name — Sedaman (Sembakung Dayak).

Habitat & Ecology — Lowland, up to 85 m altitude. Primary and secondary forests, also in scrub. Disturbed sites, along roads, streams, sometimes on alluvial places. Clayey to sandy clay soil. Ant inhabited.

Distribution — Tarakan, border with Malaysia, Berau, Kutai, Balikpapan.

Material — AA (Ambri et al.) 1494, Berau (Keßler et al.) 52, 158, 272, Iwatsuki, et al. B-7216, Leighton 394, Murata et al. 797, Paymans 20, Sauveur 57, Van Balgooy et al. 5884, 5916, W (Ambriansyah et al.) 943, 980, W (Ambri et al.) 1009.

**14. *Macaranga indistincta* Whitmore**

Airy Shaw (1975) 148; Keßler & Sidiyasa (1994) 131; Keßler et al. (1995) 21.

Small tree up to 15 m high, dbh up to 15 cm. Male flowers yellow green.

Habitat & Ecology — 450 m altitude. Ant inhabited.

Distribution — Kutai.

Material — Endert 3266.

**15. *Macaranga lamellata* Whitmore**

Small tree up to 10 m high, dbh up to 8 cm. Bole straight, circular. Bark smooth, hooped, sap red. Fruits red-yellowish.

Habitat & Ecology — Lowland. In primary forest. Ant inhabited.

Distribution — Berau, Balikpapan.

Material — AA (Ambri et al.) 48, 84.

**16. *Macaranga lowii* King ex Hook.f. var. *lowii***

Airy Shaw (1975) 154; Keßler & Sidiyasa (1994) 132.

Small tree up to 19 m high, dbh up to 16 cm. Bole straight. Crown pyramidal. Bark smooth, shallowly cracked, greyish, sap red. Inner bark thin, dark red. Wood white to pinkish with faint reddish rays. Male flowers green to creamish to white. Fruits pale green, sometimes with long red stigmas.

Habitat & Ecology — Up to 350 m altitude. Mainly in primary forests but also in secondary forests. Understorey plant. On well drained sandy loam soils.

Distribution — Berau, Kutai, Balikpapan.

Material — Berau (Keßler et al.) 740, Kato et al. B-6122, Kostermans s.n. (1954), Kostermans 4062, 4121, 4160, 6428, 10065, Leighton 72, 1025, Ramlanto 28, Sauveur 25, 26, Sidiyasa 476, 762, 1181 A, 1248, W (Ambri et al.) 57, W (Slik) 1044, 1048.

**17. *Macaranga lowii* King ex Hook.f. var. *kostermansii* Airy Shaw**

Airy Shaw (1975) 155; Keßler & Sidiyasa (1994) 132.

Small tree up to 15 m high, dbh up to 11 cm. Bark smooth, grey-white, sap red. Stipules crowded, red. Leaves with 2 dark red glands at base. Inflorescences dark red? Male flowers green-yellowish. Young fruits red, stigma green.

Habitat & Ecology — Lowland up to 150 m altitude. Mostly in primary forest but also in secondary forest. On slopes or ridges, along skid trails. On sandy loam.

Distribution — Berau, Balikpapan.

Uses — Fire wood.

Material — Berau (Keßler et al.) 379, 616, Kostermans 4344, 10156, Sidiyasa 754, 756.

**18. *Macaranga motleyana* (Müll. Arg.) Müll. Arg.**

Airy Shaw (1975) 148; Keßler & Sidiyasa (1994) 131; Keßler et al. (1995) 21.

Small trees up to 20 m high, dbh up to 25 cm. Bole circular. Bark slightly fissured to smooth, hooped, glaucous, greenish-white, sap clear turning red. Inner bark pale reddish-brown. Wood pale red? Stipules green to red. Male flowers green to yellowish to blue-green. Fruits glaucous, greenish-white with yellow glandular bands.

Vernacular name — Lempong suit (Kutai).

Habitat & Ecology — Lowland up to 200 m altitude. Mostly in secondary forest, sometimes in primary forest. Riverbanks, along roads, exposed ridges. On limestone to red loamy clay. Ant inhabited.

Distribution — Berau, West of Kutai, Kutai, Balikpapan.

Material — AA (Arbainsyah et al.) 2033, AA (Hamdi) 2113, Berau (Keßler et al.) 61, 293, 296, Berau (Slik) 582, Endert 4959, Kostermans 5011, 6023, 21417, Kramadibrata 248, PK (Keßler et al.) 843, 1972, 1988, Van Balgooy et al. 5883, W (Slik) 1050, Wiradinata et al. 63.

**19. *Macaranga pearsonii* Merr.**

Airy Shaw (1975) 153; Keßler & Sidiyasa (1994) 131; Keßler et al. (1995) 21.

Small trees to trees up to 25 m high, dbh up to 30(–75) cm. Sometimes small buttresses. Bole columnar. Bark slightly fissured, smooth, hooped, lenticelled, glaucous, greyish, sap red. Inner bark pink-red. Wood white, bitter odour. Stipules green. Leaves glaucous below. Male flowers grey-green. Fruits greenish-yellow to reddish.

Habitat & Ecology — Up to 500 m altitude. In secondary forest to scrub lands, rarely in primary forest. Along roads, disturbed sites, sometimes in periodically flooded areas. Inhabited by ants.

Distribution — Berau, West of Kutai, Kutai, Balikpapan.

Material — AA (Ambriansyah et al.) 288, AA (Arifin et al.) 1645, Berau (Keßler et al.) 277, Endert 5158, Leighton 1084, PK (Keßler et al.) 899, 977, 989, 1002, 1446, 2347, Rahayu 140, Sidiyasa 670, Van Balgooy et al. 5920-A, 5948-B, W (Slik) 1057, Wiriadinata 1182.

**20. *Macaranga pruinosa* (Miq.) Müll. Arg.**

Keßler & Sidiyasa (1994) 131; Keßler et al. (1995) 21.

Small trees up to 15 m high, dbh up to 20 cm. Bark smooth, hooped, whitish-grey, sap red. Inner bark red-brown, granular. Male flowers pale green. Fruits green.

Habitat & Ecology — Lowland. Primary and secondary forests, swamp forests. Disturbed sites, along streams.

Distribution — Berau?, Balikpapan.

Material — Sidiyasa 790, W (Ambri et al.) 1010, W (Slik) 1051.

**21. *Macaranga puncticulata* Gage**

Small tree, 8 m high. Leaves glaucous below. Fruits green.

Habitat & Ecology — Lowland. In swamp forest. Sometimes ant inhabited.

Distribution — West of Balikpapan.

Material — PK (Keßler et al.) 2210.

**22. *Macaranga recurvata* Gage**

Airy Shaw (1975) 149.

Tree, 30 m high, dbh 45 cm. Bark smooth, dark brown. Inner bark red. Wood reddish

Habitat & Ecology — 500 m altitude. In *Agathis* forest. On acid, sandy soil.

Distribution — (Berau), Kutai.

Material — Kostermans 13113.

**23. *Macaranga repando-dentata* Airy Shaw**

Airy Shaw (1975) 155.

Doubtful report. No material seen.

**24. *Macaranga spec. nov.*, Davies, ined.**

Small trees to trees up to 25 m high, dbh up to 30 cm. Bark hooped, white, sap red.

Habitat & Ecology — Lowland. In secondary forest. Often along roads. Ant inhabited.

Distribution — Berau.

Material — Berau (Keßler et al.) 36, 38.

**25. *Macaranga tanarius* (L.) Müll. Arg.**

Airy Shaw (1975) 158; Keßler & Sidiyasa (1994) 131; Keßler et al. (1995) 22.

Bush to small tree up to 15 m high, dbh up to 20 cm. Bole straight, circular. Bark smooth, hooped, greenish-grey, sap red. Inner bark red, fibrous. Stipules green. Male flowers green-yellowish. Fruits glaucous, greenish-white. Seeds black.

Habitat & Ecology — Scrub and secondary forests, sometimes in primary forest. On disturbed sites, along roads, open places, along streams, ridges. On sandstone.

Distribution — Berau, Kutai, Balikpapan.

Material — AA (Ambriansyah) 1155, AA (Ambri et al.) 1616, 1619, AA (Arbainsyah et al.) 2045, Berau (Keßler et al.) 28, 31, 370, Geesink 8904, Leighton 885, PK (Keßler et al.) 745, 786, 787, 1077, 1114, 1130, 1159, 1291, 1292, 1320, 2285, Van Balgooy et al. 5882, W (Ambri et al.) 298, W (Ambriansyah et al.) 971, W (Slik) 1053, Wiriadinata 1146.

**26. *Macaranga trichocarpa* (Rchb. f. & Zoll.) Müll. Arg.**

Airy Shaw (1975) 158; Keßler & Sidiyasa (1994) 131; Keßler et al. (1995) 22.

Bush to 5 m high, dbh up to 10 cm. Bark smooth, greyish to orange brown, sap clear turning red. Male flowers green to creamish. Fruits green.

Habitat & Ecology — Lowland up to 360 m altitude. Secondary forest, especially scrub lands. Forest edges, roadsides, gaps, dry ridges. Often in pure stands. On sandy loam to red-yellow podsol.

Distribution — Berau, Kutai, Balikpapan.

Material — AA (Ambri et al.) 477, 1592, AA (Ambriansyah et al.) 186, AA (Arifin et al.) 1643, 1804, Berau (Slik) 578, 579, 580, Endert 1534, 4811, 4812, Forman 460, Kartawinata 1317, Kostermans 10026, Leighton 218, 373, Marsemi 14, Meijer 1915, Murata et al. B-455, B-479, PK (Keßler et al.) 863, 1131, 1231, 1388, 2119, Van Balgooy 5718, W (Slik) 1047.

**27. *Macaranga winkleri* Pax & K. Hoffm.**

Airy Shaw (1975) 131; Keßler et al. (1995) 22.

Small trees up to 15 m high, dbh up to 18 cm diam. Bole straight, columnar, circular. Bark smooth, hooped, lenticelled, greenish-grey, sap clear turning red. Inner bark thin, fibrous, white. Stipules red. Petioles red. Male flowers green with yellow-red stamens. Fruits grey-green to yellowish.

Vernacular names — Menuang (Punan), Serekong (Kutai), Tisit (Tunjung Benua).

Habitat & Ecology — Up to 500 m altitude. In primary and secondary forests. Disturbed sites, forest edges, gaps, roadsides, riversides, land slips, steep slopes. On yellow sandy loam. Ant inhabited.

Distribution — Berau, border with Malaysia, Kutai, Balikpapan.

Material — AA (Ambri et al.) 1200, AA (Arbainsyah) 1869, 1928, Berau (Keßler et al.) 117, 358, Endert 2200, 4032, Kostermans 10531, 13156, Leighton 264, Mogeia 2668, Murata et al. B-1123, B-1277, PK (Keßler et al.) 910, 953, 973, 2031, Sidiyasa 502, 531, TFB 1254, Van Valkenburg et al. JVV 1065, W (Ambri et al.) 767, Wiriadinata 694.

## MALLOTUS

Shrubs, small trees, or trees up to 35 m high, dioecious. Indumentum simple to stellate. *Bark* sometimes prominently hooped (rings around stem). *Wood* soft to hard. *Stipules* mostly small, often caducous. *Leaves* alternate to opposite, then often unequal in size or shape, mostly small; blades sometimes peltate, never lobed, pinninerved, triplinerved, or palmatinerved, sometimes with hairy domatia, often with basal glands on the upper sides, below often gland-dotted, sometimes also above. *Inflorescences* axillary to terminal, racemes to thyrses. *Male inflorescences* mostly as unbranched thyrsoïd racemes; bracts small, often caducous; flowers 1–9 per node, sepals 3 or 4, stamens 15–150, anthers 2-celled, basi- to dorsifixed, connective often widened, disc rarely present, pistil absent. *Female inflorescences* mostly as unbranched racemes; bracts small, often caducous; flowers 1, rarely 2 per node, sepals 2–9, ovary (2- or 3- (or 4-)locular, style long to short, apically splitting into (2 or) 3 (or 4) stigmas, papillae plumose. Fruit a capsule, smooth to spiny to winged, dehiscent into bivalved parts. Seeds black to red.

## KEY TO THE TAXA

- 1 Leaves peltate ..... 2
- Leaves not peltate ..... 6
- 2 Petiole insertion usually more than 5 mm from blade base. Plants often with a strong smell (fenugreek) when dry. Inflorescences never branched ..... 3
- Petiole insertion usually less than 5 mm from blade base. Plants never smelling of fenugreek when dry. Male inflorescences branched ..... 4
- 3 Vegetative parts glabrous. Leaves below with conspicuous hair tufts in the axils of the basal nerves ..... **3. *Mallotus floribundus***
- Vegetative parts extremely hairy. Leaves below without conspicuous hair tufts in the axils of the basal nerves ..... **6. *Mallotus lackeyi***
- 4 Leaves rarely 3-cusped, base rounded to truncate to cordate, rarely attenuate, above often with 2 glands near petiole insertion. Fruits woolly, smooth or with numerous soft, spine-like appendages ..... 5
- Leaves quite often 3-cusped, base cuneate to attenuate, above always with 2 glands near petiole insertion. Fruits not woolly, with few robust spine-like appendages ..  
..... **13. *Mallotus paniculatus***

- 5 Sap colourless, not turning black. Fruits without spine-like appendages ..... 8. *Mallotus macrostachyus*  
 – Sap turning black. Fruits with numerous soft, spiny appendages ..... 10. *Mallotus mollissimus*
- 6 (1). Leaves opposite, unequal, one of each pair extremely small (less than 1 cm) and stipule-like (check carefully because these leaves seem to be alternate at first glance) ..... 7  
 – Leaves alternate to opposite, if opposite and unequal, then the smaller leaf cordate or the same shape as the larger leaf, never stipule-like ..... 11
- 7 Petioles of large leaves less than 1 cm long ..... 8  
 – Petioles of large leaves more than 1 cm long ..... 9
- 8 Vegetative parts hairy ..... 2. *Mallotus eucaustus*  
 – Vegetative parts glabrous ..... 15. *Mallotus penangensis*
- 9 Twigs and petioles glabrous, leaves below glabrous to sparsely hairy ..... 10  
 – Twigs, petioles, and leaf below hairy ..... 17. *Mallotus stipularis*
- 10 Petioles mostly more than 1 mm thick, up to 5(–8) cm long. Leaves ovate, rarely elliptic. Male inflorescences conspicuously branched, both female and male inflorescences with numerous reddish-orange glands producing a sticky yellow exudate ..... 4. *Mallotus griffithianus*  
 – Petioles mostly less than 1 mm thick, up to 2(–3) cm long. Leaves elliptic to ovate. Inflorescences never branched and without sticky yellow exudate. .... 19. *Mallotus tenuipes*
- 11 (6). Majority of leaves alternate, sometimes apically also opposite ..... 12  
 – Majority of leaves opposite ..... 19
- 12 Leaves at base triplinerved ..... 13  
 – Leaves pinninerved ..... 14. *Mallotus peltatus*
- 13 Vegetative parts hairy. Twigs, petioles, and leaves below mostly creamish brown, contrasting sharply with the green upper sides ..... 14  
 – Vegetative parts glabrous. Twigs, petioles, and leaves below never creamish brown. (section *Polyadenii*: its three species can only be distinguished if female inflorescences are present) ..... 17
- 14 Leaves without glands, or with 2 glands close to the petiole insertion ..... 15  
 – Leaves with more than 2 glands along the basal margin of the leaf. .... 16. *Mallotus repandus*
- 15 Leaves rarely 3-cusped, base rounded to truncate to cordate, rarely attenuate, above often with 2 glands near petiole insertion. Fruits woolly, smooth or with numerous soft, spine-like appendages ..... 16  
 – Leaves quite often 3-cusped, base cuneate to attenuate, above always with 2 glands near petiole insertion. Fruits not woolly, with few robust spine-like appendages . .... 13. *Mallotus paniculatus*
- 16 Sap colourless, not turning black. Fruits without spine-like appendages ..... 8. *Mallotus macrostachyus*

- Sap turning black. Fruits with numerous soft, spiny appendages ..... **10. Mallotus mollissimus**
- 17 Female pedicels c. 5 mm long. Fruits with large wings or angular carpels ..... 18
- Female pedicels 1.5–2.5(–4) cm long. Fruits with rounded carpels ..... **7. Mallotus leucodermis**
- 18 Fruits with angular carpels, spine-like wings absent ..... **12. Mallotus muticus**
- Fruits with spine-like wings, 1.5–3 cm long ..... **18. Mallotus sumatranus**
- 19 (11). Leaves opposite, clearly unequal in size. Stipules persistent. Small leaves clearly differing in shape compared to the large leaves. Petioles of the small leaves 1–3 (–5) mm long ..... 20
- Leaves all opposite to majority of leaves opposite, slightly unequal in size. Stipules caducous to persistent. Small leaves more or less the same shape as the large leaves. Petioles of the small leaves longer than 5 mm ..... 21
- 20 Petioles of large leaves always longer than 1 cm. Large leaves at base triplinerved to rarely pinninerved ..... **1. Mallotus dispar**
- Petioles of large leaves 1–7 mm long. Large leaves pinninerved ..... **9. Mallotus miquelianus**
- 21 Vegetative parts glabrous. Stipules early caducous. Majority of leaves opposite, leaves not to slightly differing in size or petiole length (section *Polyadenii*: its three species can only be distinguished if female inflorescences are present) ..... 22
- Vegetative parts glabrous to hairy. Stipules persistent to caducous. Leaves opposite, conspicuously differing in size and petiole length ..... 24
- 22 Female pedicels c. 5 mm long. Fruits with large wings or angular carpels ..... 23
- Female pedicels 1.5–2.5(–4) cm long. Fruits with rounded carpels ..... **7. Mallotus leucodermis**
- 23 Fruits with angular carpels, spine-like wings absent ..... **12. Mallotus muticus**
- Fruits with spine-like wings, 1.5–3 cm long ..... **18. Mallotus sumatranus**
- 24 Leaves with several (more than 2) conspicuous glands at the base, placed along the leaf margin, on the lamina, not on the nerves ..... 25
- Leaves with two conspicuous glands at the base, placed on the first pair of nerves ..... **20. Mallotus wrayi**
- 25 Stipules early caducous. Leaves with second pair of nerves originating circa halfway up or higher on the blade ..... **5. Mallotus korthalsii**
- Stipules often present with the upper leaf pairs. Leaves with second pair of nerves originating clearly less than halfway up the blade .... **11. Mallotus moritzianus**

### **1. Mallotus dispar** (Blume) Müll. Arg.

Airy Shaw (1975) 169; Keßler & Sidiyasa (1994) 133.

Small trees up to 15 m high. Male flowers pale yellow. Fruits pale green or green with red spines.

**Habitat & Ecology** — Lowland up to 300 m altitude. In primary dipterocarp forest, disturbed sites in primary forest and logged-over forest. On undulating terrain. Sand and limestone soils.

**Distribution** — Berau, Balikpapan.

**Material** — Kato et al. B-11760, Kostermans 13762, 21345, Sidiyasa 440, 525.

## 2. *Mallotus eucaustus* Airy Shaw

Airy Shaw (1975) 162.

Small trees up to 15 m high, dbh up to 25 cm. Bole straight, circular. Bark smooth, hooped, lenticelled, pale brown to grey. Male flowers red. Fruits whitish-green to green-brown.

**Habitat & Ecology** — Lowland up to 100 m altitude. In primary dipterocarp forest or recently logged forest. Understorey tree. On ridges, near roads, undulating and flat land. On sand, tuff, clayey loam.

**Distribution** — Berau, Kutai.

**Material** — Berau (Keßler et al.) 164, 174, 194, Berau (Arifin et al.) 563, Berau (Ambriansyah et al.) 589A, Berau (Keßler et al.) 615, Endert 4831, Kostermans 9320.

## 3. *Mallotus floribundus* (Blume) Müll. Arg.

Airy Shaw (1975) 172; Keßler et al. (1995) 22.

Small tree.

**Habitat & Ecology** — Lowland. Secondary forest. Along rivers or in hilly terrain.

**Distribution** — Berau, Kutai.

**Material** — Endert 2196, Kostermans s.n. (1963).

## 4. *Mallotus griffithianus* (Müll. Arg.) Hook. f.

Airy Shaw (1975) 163; Keßler et al. (1995) 22.

Small tree up to 7 m high, dbh up to 10 cm. Bark smooth, hooped, lenticellate, grey, sap yellow. Male flower buds dark red. Fruits pale brown to dark red.

**Habitat & Ecology** — Lowland up to 110 m altitude. In primary dipterocarp forest to recently logged forest. On ridges, undulating terrain, plateaus, along roads. On sandy, loamy or tuff soil.

**Distribution** — Berau, Kutai, Balikpapan.

**Material** — Berau (Keßler et al.) 200, 201, Berau (Goverse et al.) 473, Berau (Keßler et al.) 618, Berau (Arifin et al.) 999, Endert 4919, Kostermans 6685, 7019.

## 5. *Mallotus korthalsii* Müll. Arg.

Airy Shaw (1975) 170; Keßler et al. (1995) 22

Shrub to small tree up to 8 m high, dbh up to 15 cm. Small buttresses. Bark smooth. Wood hard. Fruits green.

**Habitat & Ecology** — Lowland up to 280 m altitude. In primary dipterocarp forest (secondary forest also). Hilly terrain.

Distribution — Berau, Balikpapan.

Material — Kato et al. B-5524, Kostermans 21595, Wiriadinata 816.

### 6. *Mallotus lackeyi* Elmer

Airy Shaw (1975) 172; Keßler & Sidiyasa (1994) 133; Keßler et al. (1995) 23.

Shrub to small tree up to 10 m high, dbh up to 10 cm. Bole crooked. Bark smooth to knobby to flaky, grey-green to whitish. Inner bark red-brown. Wood white. Male flowers white to pale yellow. Fruits green.

Habitat & Ecology — Lowland up to 500 m altitude. In primary dipterocarp forest to secondary forest (logged and burnt). In understorey, along roads, along streams and rivers, on inundated terrain but also on dry slopes. No odour when cut, but with a strong smell (fenugreek) when dried.

Distribution — Berau, Kutai, Balikpapan.

Material — AA (Ambriansyah et al.) 207, 675, 1678, Berau (Ambriansyah et al.) 805, Endert 3488, 4694, 5153, Kostermans 21264, 21591, Leighton 762, PK (Keßler et al.) 1100, Sidiyasa 438, 1157, 1171.

### 7. *Mallotus leucodermis* Hook.f.

Airy Shaw (1975) 167.

Trees up to 35 m high, dbh up to 55 cm. Steep buttresses present to absent. Bole straight. Bark rough to smooth, dippled, brittle, with small flakes, greyish-brown to dark brown. Inner bark fibrous, hard, pink-red to brown. Wood hard, white to pinkish. Male flowers white. Fruits green.

Habitat & Ecology — Lowland. In mixed dipterocarp forest and sometimes in secondary forest. On ridge, moist place, near logging road. In well drained, loamy soil, sometimes mixed with limestone.

Distribution — Berau, Kutai, Balikpapan.

Material — AA (Ambri et al.) 24 (= W 474), AA (Ambriansyah) 2152, bb 11895, Berau (Arifin et al.) 725, Kostermans 5686, Leighton 512.

### 8. *Mallotus macrostachyus* (Miq.) Müll. Arg.

Airy Shaw (1975) 165; Keßler & Sidiyasa (1994) 133; Keßler et al. (1995) 23.

Small trees up to 12 m high, dbh up to 15 cm. Bole not straight. Bark smooth, lenticelled, brown. Male flowers green to yellow. Fruits green to creamish.

Vernacular name — Kayu kapit mawat (Kenyah).

Habitat & Ecology — Lowland up to 750 m altitude. Mostly in secondary forest, but occasionally also in primary mixed forest. Along trails, roads, forest edges, in clearings. Undulating terrains.

Distribution — Tarakan, West of Kutai, Kutai, Balikpapan.

Material — AA (Ambri et al.) 1720, AA (Arifin et al.) 1753, Kramadibrata 137, Murata et al. B-572, B-3028, PK (Keßler et al.) 1298, Sidiyasa 1214, 1282, Van Balgooy et al. 5902, Van Valkenburg JVV 1208, W (Ambri et al.) 78.

**9. *Mallotus miquelianus* (Scheff.) Boerl.**

Airy Shaw (1975) 163; Keßler & Sidiyasa (1994) 133.

Shrubs to small trees up to 5 m high, dbh up to 5 cm. Stem sometimes fluted. Male flowers from green to yellow or white. Fruits green to brown-red.

**Habitat & Ecology** — Lowland up to 400 m altitude. Primary and secondary forests. On slopes, near streams, along roads, on inundated terrain, on hilly terrain as well as flat terrains. Alluvial and limestone soils.

**Distribution** — Tarakan, Berau, Kutai, Balikpapan.

**Material** — AA (Ambriansyah) 663, Afandi Ma'roef AM 216, Endert 1866, 5114, 5185, Iwatsuki et al. B-7301, B-7302, Kostermans 217, 5344, 6011, 9637, 10696, 21571, 21596, Leighton 430, Meijer 2091, Nedi 733, PK (Keßler et al.) 1968, 2281, Sidiyasa 436, 1172, Van Slooten 2137, Wiriadinata 289.

**10. *Mallotus mollissimus* (Geisel.) Airy Shaw**

Airy Shaw (1975) 165; Keßler et al. (1995) 23.

Small trees up to 10 m tall, 15 cm diam. Bark lenticellate, greyish-brown to brown. Sap black. Male inflorescences brownish, flowers yellow to white. Fruits greenish to brown.

**Habitat & Ecology** — Lowland up to 270 m altitude. Secondary forest (logged, burnt, plantations). Along roads, streams and rivers.

**Distribution** — Berau, Kutai, Balikpapan.

**Material** — AA (Ambri et al.) 1628, AA (Arifin et al.) 1708, bb (Dachlan) 2126, Berau (Keßler et al.) 120, PK (Keßler et al.) 789, 794, 796, 1102, 1203, 1302, 1303, 1350, 1351, 1989.

**11. *Mallotus moritzianus* Müll. Arg.**

Airy Shaw (1975) 170.

Shrub to small tree up to 8 m high, dbh up to 10 cm. Bark smooth, brown. Inner bark 3 mm thick, yellowish. Wood yellowish-white. Male flowers green to pale yellow to white. Fruits green.

**Habitat & Ecology** — From lowland up to 1000 m altitude. Primary and secondary forest. Flat and undulating country, brook banks, near kampung, periodically inundated land, logged-over forest. Sandstone and alluvial soils.

**Distribution** — Tarakan, Berau, Kutai.

**Material** — Berau (Keßler et al.) 701, Berau (Ambriansyah et al.) 883, Endert 5098, 5167, Kato et al. B-11888, Kostermans s.n. (1963), Kostermans 13985, 21548, Meijer 2452, Sidiyasa 1213.

**12. *Mallotus muticus* (Müll. Arg.) Airy Shaw**

Airy Shaw (1975) 167; Keßler et al. (1995) 23.

Trees up to 35 m high, dbh up to 70 cm. Buttresses up to 7 m high, 1 m protruding. Bole straight, slightly fluted. Bark smooth, flaky, grey-white to brown. Inner bark fibrous, hard. Wood white. Fruits green to red-green.

Vernacular names — Kelepuek, Perupuk (Modang Dayak).

Habitat & Ecology — Lowland, up to 300 m altitude. In primary forest, swamp forest and secondary forest. On periodically inundated terrain, swampy terrain, dry terrain, along rivers, around villages, along roads.

Distribution — Berau, Kutai, Balikpapan.

Material — AA (Ambri et al.) 400, 1474, AA (Arifin et al.) 1653, Berau (Keßler, et al.) 255, Endert 2089, 5096, Kostermans 12644, 21010, 21132, 21443, 21716, PK (Keßler et al.) 1405, 1960.

### 13. *Mallotus paniculatus* (Lam.) Müll. Arg.

Airy Shaw (1975) 166; Keßler & Sidiyasa (1994) 133; Keßler et al. (1995) 23.

Small trees to trees, up to 15 m high, dbh up to 25 cm. Bole straight. Bark smooth, cracked, lenticellate, greyish-brown, sap red. Inner bark fibrous, pale brown. Leaves brownish below, with two greenish glands near petiole insertion. Male flowers yellow to white, buds brown. Fruits greenish-brownish, spiny. Seeds black.

Vernacular name — Butaq (Tunjung Benua).

Habitat & Ecology — Lowland, up to 200 m altitude. In primary forest (gaps), secondary forests (old and young), scrub and alang-alang. Along roads, streams, on landslides and slopes.

Distribution — Berau, Kutai, Balikpapan.

Material — AA (Ambriansyah et al.) 1159, AA (Ambri et al.) 1187, 1190, 1606, AA (Ambriansyah et al.) 1696, AA (Arbainsyah) 1849, 1934, AA (Hamdi) 2119, Berau (Keßler et al.) 81, 270, Berau (Goverse et al.) 429, 430, Bomdaad (?) TFB1243, Endert 1606, Kostermans 21262, Leeuwenberg et al. 13107, Leighton 382, PK (Keßler et al.) 825, 875, 1054, 1089, 1164, 1244, 1435, 2071, 2076, 2356, 2383, Ramlanto 16, Sidiyasa 298, 639, Soetisna 16, W (Ambri et al.) 138.

### 14. *Mallotus peltatus* (Geisel.) Müll. Arg.

Airy Shaw (1975) 173; Keßler & Sidiyasa (1994) 133.

Shrubs to small trees up to 6 m high, dbh up to 10 cm. Bole sometimes fluted. Male flower with green calyx and yellow to white stamens. Fruits green.

Habitat & Ecology — Lowland up to 450 m altitude. In primary and secondary forests. Along streams and rivers, along roads, and inundated terrains. Found on limestone soils.

Distribution — Berau, Kutai, Balikpapan.

Material — AA (Ambriansyah et al.) 242, 991, AA (Arifin et al.) 1787, Endert 3028, 4021, 4087, 4772, Kato et al. B-4781, B-5363, B-6531, Kostermans 21017, 21137, Sidiyasa 1140, 1141.

### 15. *Mallotus penangensis* Müll. Arg.

Airy Shaw (1975) 164; Keßler & Sidiyasa (1994) 133.

Small trees to trees up to 25 m high, dbh up to 30 cm. Sometimes buttresses present, small, merging into fluted base of bole. Bark smooth, hooped, whitish-grey to pale

brown-blackish. Inner bark thin, brittle, granular, pale brown to brown to purplish-red. Wood pale brown to white. Specimens at high altitudes (above 450 m) with domatia. Male flowers white to red. Fruits reddish-green.

**Habitat & Ecology** — Lowland up to 600 m altitude. In primary dipterocarp forest, secondary forest and in a plantation. Mostly understorey tree in hilly terrain. On sandstone, limestone, sandy loam, clay, well drained soils.

**Distribution** — Berau, Kutai, Balikpapan.

**Material** — bb 12129, Berau (Keßler et al.) 101, 150, Kostermans 4940, 5512, 5948, 5950, 6356, 7563, 7625, 10229, 14053, Leighton 73, 1026, Sauveur K 3, 132, Sidiyasa et al. 557, Sidiyasa 1246, Soewanda 35396, W (Ambri et al.) 2, 99, 333, 335, Wiriadinata 324.

#### **16. *Mallotus repandus* (Willd.) Müll. Arg.**

Small tree.

**Habitat & Ecology** — Low hills.

**Distribution** — Berau.

**Material** — Kostermans s.n. (1963).

#### **17. *Mallotus stipularis* Meijer ex Airy Shaw**

Airy Shaw (1975) 164.

Small tree, up to 10 m high, dbh up to 9 cm. Bark smooth, hooped, greyish-brown. Inner bark thin, brittle. Fruits green when young.

**Habitat & Ecology** — Lowland. Primary and secondary forest. Understorey tree, sometimes in logged-over forest.

**Distribution** — Berau.

**Material** — Berau (Arifin et al.) 561, Berau (Ambriansyah et al.) 602,

#### **18. *Mallotus sumatranus* (Miq.) Airy Shaw**

Airy Shaw (1975) 167.

Small trees up to 12 m high, dbh up to 20 cm. Bole sometimes twisted. Fruits green-brown to reddish-brown.

**Habitat & Ecology** — Lowland. In primary forest and swamp forest. Along river, in swamp.

**Distribution** — Kutai.

**Material** — AA (Ambri et al.) 446, Endert 1498, 1989.

#### **19. *Mallotus tenuipes* Airy Shaw**

Airy Shaw (1980) 393.

Small trees up to 17 m high, dbh up to 25 cm. Sometimes small buttresses. Bole straight. Bark 1 mm thick, smooth, hooped, finely cracked, greyish to lilac-brown to brown. Inner bark pale brown to red-brown. Wood pale brown to cream. Male flowers white. Fruits pale green to yellow when young.

Habitat & Ecology — Lowland up to 220 m altitude. In primary and secondary forest. On steep slopes, ridges, along survey road. On well drained sandy loam or sandy clay.

Distribution — Tarakan, Berau, Kutai, Balikpapan.

Material — AA (Ambri et al.) 1742, Berau (Keßler et al.) 604, Kostermans 6229, 6693, 8632, 9134, 10155, 10178 B, 10179, Leighton 1091, Sauveur 100, Van Balgooy et al. 5965, W (Ambri et al.) 83.

## 20. *Mallotus wrayi* King ex Hook. f.

Airy Shaw (1975) 171.

Shrubs to small trees up to 19 m high, dbh up to 15 cm. Bole sometimes crooked, branching midway up. Bark thin, smooth, pale greyish-brown. Inner bark pale. Wood straw coloured. Male flowers green to cream to yellow-white. Fruits greyish-green to brown.

Habitat & Ecology — Lowland up to 1100 m altitude. In primary and secondary forest. Understorey, on ridges, along streams, open places, disturbed sites, flats. Well drained soils.

Distribution — Tarakan, Berau, Kutai.

Material — AA (Ambriansyah) 774, Berau (Slik) 584, Berau (Keßler et al.) 856, Endert 3735, 5173, Forman 445, 456, Kato et al. B-4772, B-10212, B-11441, Kostermans 21077, 21092, Leighton 92, McDonald et al. 3456, Murata et al. 941, Sidiyasa 1157-A, Wiriadinata 612, 715, 811.

## ACKNOWLEDGEMENTS

The identification and nomenclature problems I faced while working on *Macaranga* could not have been solved without the invaluable help of T.C. Whitmore and S.J. Davies. I am very grateful for their help. I would also like to thank Jan Frits Veldkamp and Peter van Welzen for carefully checking this manuscript.

This study is supported by a grant of the Netherlands Foundation for the Advancement of Tropical Research (WOTRO), within the Priority Programme 'Biodiversity of Disturbed Ecosystems'.

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