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Key to the Malesian species of *Mallotus* (*Euphorbiaceae*)

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Key words

Euphorbiaceae
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Mallotus

Abstract An identification key to all Malesian species of *Mallotus* was still lacking. So far, only keys per section of *Mallotus* or keys per island were generated. This is the first attempt to create a key for all species of *Mallotus* in Malesia.

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INTRODUCTION

The revision of the Malesian species of *Mallotus* Lour. was recently finished (Van Welzen et al. 2009), the results are available via www.nationaalherbarium.nl/euphorbs. The revision was a compilation of various revisions of sections or parts of sections: Part of former sect. *Hancea* (Seem.) Pax & K.Hoffm. (Slik & Van Welzen 2001, Van Welzen et al. 2006), sect. *Mallotus* (Sierra & Van Welzen 2005), sect. *Philippinensis* Pax & K.Hoffm. (Sierra et al. 2005), sect. *Polyadenii* Pax & K.Hoffm. (Bollendorff et al. 2000), sect. *Rottleropsis* Müll.Arg. (incl. sect. *Axenfeldia* Pax & K.Hoffm., Van Welzen & Sierra 2006, Kulju et al. 2007, Sierra et al. 2007a) and sect. *Stylanthus* (Rchb.f. & Zoll.) Pax & K.Hoffm. (Slik & Van Welzen 2001). From a phytogeographical point of view, Malesia includes the three southernmost provinces of Thailand, Malaysia, Singapore, Indonesia, the Philippines, Brunei, East Timor and Papua New Guinea (Raes & Van Welzen 2009). However, as there is a separate website dedicated to the *Euphorbiaceae* of Thailand (www.nationaalherbarium.nl/thaieuph; see also Chayamarit & Van Welzen 2005, Van Welzen & Chayamarit 2007) occurrences in the Thai part of Malesia are not accounted for here.

Identification keys were presented per section (see former references) or they were presented in flora compilations for areas within Malesia: Borneo (Airy Shaw 1975, Slik et al. 2000, Slik & Van Welzen 2004), Java (Backer & Bakhuizen van den Brink Jr 1963), Malay Peninsula (Whitmore 1973), New Guinea (Airy Shaw 1980) and Sumatra (Airy Shaw 1981).

The revisions resulted in several name changes, the description of new species and different circumscriptions of species and genera. *Mallotus* sect. *Oliganthae* Airy Shaw and most of sect. *Hancea* (Seem.) Pax & K.Hoffm. now form genus *Hancea* Seem. together with *Cordemoya* Baill. (Sierra et al. 2007b), while the genera *Neotrewia* Pax & K.Hoffm., *Octospermum* Airy Shaw and *Trewia* L. are united with *Mallotus* (Kulju et al. 2007). Consequently, the keys in all regional island revisions have become outdated. The delimitation of the sections is also still a problem, sections like *Axenfeldia*, *Philippinensis* and *Rottleropsis* appear to be poly- or paraphyletic and are difficult to recognize (Sierra et al. 2010). Therefore, providing a simple key to the sections only (allowing continuing identification in the sectional revisions) is also no option. Thus, the only possibility left was to create a new key and this key is presented here. Large parts are directly based on the keys in the sectional revisions (references above). We invite everybody to try the key and results can be e-mailed to the first author.

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KEY

Distributions mentioned only refer to the distribution within Malesia; the species may also occur outside Malesia.

Behind every species is a reference to a description (which can also be found via www.nationaalherbarium.nl/euphorbs). The numbers before the species refer to the numbers on the website.

1. All leaves (sub)opposite, sometimes one of each pair much smaller and even stipuliform (when caducous then inflorescence opposite to large leaf) 2
1. All leaves alternate (except some of the terminal leaves) 46
2. Each leaf of a pair with different shape, one much smaller, sometimes stipuliform 3
2. Each leaf of a pair with a similar shape, although one somewhat smaller 8
3. Reduced leaf of each pair: blade cordate to obovate, more than 1 cm broad 4
3. Reduced leaf of each pair: blade stipuliform, 1.5–2 mm broad . . . . . 5. *M. brachythyrsus* Merr. (Slik & Van Welzen 2001: 49)
4. Leaf base symmetric to slightly oblique, emarginate. Lower leaf blade surface with few (venation triplinerved) to many glandular hairs (pinnate or triplinerved), often also stellate hairs. Apical extrafloral nectaries on upper leaf blade surface absent or on the nerves (secondary veins) 5
4. Leaf base oblique, asymmetric with one side half heart-shaped, the other almost cuneate. Lower leaf blade surface without or with very few glandular hairs, very seldomly a few stellate hairs, venation pinnate. Apical extrafloral nectaries on upper leaf blade surface in between nerves . . . . . 32. *M. miquelianus* (Scheff.) Boerl. (Slik & Van Welzen 2001: 55)

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5. Venation triplinerved. Stipules 4–11 mm long 6
5. Venation pinnate. Stipules 1.2–4.5 mm long 7
6. Upper surface of leaf blade with apical extrafloral nectaries next to basal ones; apical extrafloral nectaries on upper leaf blade surface on the nerves (secondary veins). Staminate inflorescences up to 23 cm long; staminate bracts 3–7 mm long, pistillate bracts 4–10 mm long . . . . . 20. *M. havilandii* Airy Shaw (Slik & Van Welzen 2001: 52)
6. Upper surface of leaf blade without apical extrafloral nectaries, only nectaries in basal half present. Staminate inflorescences up to 10 cm long; staminate bracts 1.2–1.4 mm long, pistillate bracts 1.5–1.7 mm long . . . . . 31. *M. minimifructus* S.E.C.Sierra (Sierra et al. 2007a: 79)
7. Stipules 1.2–1.5 mm long. Lower blade surface with simple hairs only. — Malay Peninsula . . . . . 11. *M. concinnus* Airy Shaw (Van Welzen et al. 2006: 371)
7. Stipules 1.5–4.5 mm long. Lower blade surface with many stellate hairs. — Moluccas (Sulu Archipelago), Lesser Sunda Islands (Bali, Lombok) . . . . . 21. *M. insularum* (Airy Shaw) Slik (Slik & Van Welzen 2001: 54)
8. Upper leaf blade surface with discoid glandular hairs . . 9
8. Upper leaf blade surface without discoid glandular hairs 16
9. Stipules early caducous to late caducous, small, 0.6–2.5 by 0.4–1 mm 10
9. Stipules late caducous, large, 18–30 by 8–10 mm . . . . . 8. *M. cauliflorus* Merr. (Sierra et al. 2007a: 52)
10. Basal pair of nerves ending in the margin above or below middle of blade. — W Malesia, W New Guinea, Solomon Islands 11
10. Basal pair of nerves always ending in the margin below middle of blade. — New Guinea . . . . . 42. *M. polyadenos* F.Muell. (Bollendorff et al. 2000: 329)
11. Fruit locules ridged or not, without wings. Leaf margin generally entire. Entire plant either pubescent or glabrous 12
11. Fruit locules with long pointed wings. Leaf margin often slightly crenate. Usually only petioles pubescent, otherwise glabrous . . . . . 50. *M. sumatranus* (Miq.) Airy Shaw (Bollendorff et al. 2000: 329)
12. Leaf blades (somewhat) hairy above 13
12. Leaf blades glabrous above 15
13. Domatia (usually) present. Stipules present, scar present when early caducous 14
13. Domatia absent. Stipules absent. — Mainly coastal plant . . . . . 52. *M. tiliifolius* (Blume) Müll.Arg. (Sierra et al. 2007a: 96)
14. Upper surface of leaf blade with 7–17 extrafloral nectaries per side from base to apex. Staminate inflorescences 2.5–4 cm long; flowers with 20–30 stamens. Pistillate inflorescences 3–7 cm long. — Malay Peninsula . . . . . 35. *M. montanus* (Wall. ex Müll.Arg.) Airy Shaw (Sierra et al. 2007a: 83)
14. Upper surface of leaf blade with only basally 0–13 randomly distributed extrafloral nectaries. Staminate inflorescences 3–8.5 cm long; flowers with c. 50 stamens. Pistillate inflorescences 8–31.5 cm long — Solomon Islands . . . . . 43. *M. puber* Bollend. (Bollendorff et al. 2000: 334)
15. Fruit locules without ridges, subglobose. Pistillate inflorescences with relatively long pedicels, 6–55 mm long. — W Malesia, New Guinea . . . . 27. *M. leucodermis* Hook.f. (Bollendorff et al. 2000: 326)
15. Fruit locules ridged lengthwise giving them an angular aspect. Pistillate inflorescences with relatively short pedicels, 1–7(–12) mm long. — W Malesia . . . . . 36. *M. muticus* (Müll.Arg.) Airy Shaw (Bollendorff et al. 2000: 329)
16. Venation of leaf blade pinnate 17
16. Venation of leaf blade (weakly) triplinerved 22
17. Stipules 9–13 mm long. Leaf blades: narrowly obovate, glandular hairs absent. — Malay Peninsula 18
17. Stipules 1.8–6 mm long. Leaf blades: ovate to obovate, glandular hairs absent or present — Malay Peninsula to New Guinea 19
18. Stipules 2.5–3.5 mm wide, persistent. Petioles 14–61 mm long. Leaf blades: base shallowly emarginate, nerves 9 or 10 per side . . . . . 1. *M. actinoneurus* Airy Shaw (Sierra et al. 2007a: 46)
18. Stipules 1.5–2 mm wide, caducous. Petioles 5–15 mm long. Leaf blades: base attenuate, nerves 15–18 per side . . . . . 34. *M. monanthos* Airy Shaw (Sierra et al. 2007a: 83)
19. Lower leaf blade surface without or with a few discoid glandular hairs 20
19. Lower leaf blade surface with many discoid glandular hairs 21
20. Stipules 2–4 by 0.2–0.3 mm. Leaves: petiole 2–8 mm long; blade narrowly elliptic, 8.2–16 by 1.4–4.7 cm. Stamens 25–30 per flower — New Guinea . . . . . 2. *M. attenuatus* Airy Shaw (Sierra et al. 2007a: 47)
20. Stipules 1.8–6 by 0.7–2 mm. Leaves: petiole 4–118 mm long; blade ovate to obovate, 4.8–35.5 by 1.5–19.5 cm. Stamens 30–60 per flower — Borneo, Philippines, Sulawesi . . . . . 13. *M. cumingii* Müll.Arg. (Kulju et al. 2007: 121)
21. Petioles 2–6 mm long. Leaf blades: base cuneate to shallowly emarginate. Staminate inflorescences: nodes per branch 9–68; flowers: sepals 2–3 mm long. Pistillate flowers 2.5–3 mm diam, pedicels 1–3 mm long. — Malay Peninsula . . . . . 6. *M. brevipetiolatus* Gage (Sierra et al. 2007a: 50)
21. Petioles 2.5–20(–35) mm long. Leaf blades: base obtuse, cuneate to shallowly attenuate. Staminate inflorescences: nodes per branch 7–39; flowers: sepals 1.5–2.3 mm long. Pistillate flowers 1.5–2 mm diam, pedicels 0.5–1 mm long. — Java, Borneo and Philippines to New Guinea . . . . . 45. *M. resinosus* (Blanco) Merr. (Sierra et al. 2007a: 88)
22. Petioles apically (strongly) pulvinate. Domatia always present 23
22. Petioles apically not pulvinate. Domatia sometimes present 26
23. Stigmas narrow (0.2–0.7 mm wide) or broad, c. 1 mm wide, not hairy beneath by eye. Spines on ovary individual, not in groups, upper part glabrous or loosely hairy. Bracts 0.7–8 mm long. Pistillate inflorescences up to 14 cm long; staminate ones up to 11 or up to 25 cm long. Upper leaf base without extrafloral nectaries along the midrib or sometimes a single one 24
23. Stigmas broad, 0.6–1 mm wide, densely yellowish stellately hairy beneath. Spines on ovary in groups, completely, densely tomentosely hairy. Bracts (2.3–)3.3–10 mm long. Pistillate inflorescences up to 26 cm long; staminate ones up to 19 cm. Upper leaf base often with several pairs of extrafloral

nectaries along midrib . . . . . 7. *M. caudatus* Merr. (Van Welzen & Sierra 2006: 376)

24. Midrib sparsely hairy to hairy on lower surface. Stellately bundled hairs stiff, pointing all directions (3-dimensional), giving no silvery reflection 25
24. Midrib glabrous on lower surface. Stellately bundled hairs soft, in a horizontal plane (2-dimensional), usually providing a silver sheen abaxially . . . 54. *M. wrayi* King ex Hook.f. (Van Welzen & Sierra 2006: 384)

25. Margin (entire to) serrulate to serrate. Bracts of terminal buds 2–10 mm long. Stipules early caducous. Spines of fruit only basally hair . . . . . 24. *M. lancifolius* Hook.f. (Van Welzen & Sierra 2006: 376)
25. Margin entire. Bracts of terminal buds c. 1.5 mm long. Stipules present along upper few leaves, late caducous. Spines of fruit completely loosely hairy . . . . . 48. *M. spinifructus* Welzen & S.E.C.Sierra (Van Welzen & Sierra 2006: 382)

26. Plants from New Guinea 27
26. Plants not from New Guinea, but from Malay Peninsula up to the Philippines and Moluccas 33

27. Discoid glandular hairs absent 28
27. Discoid glandular hairs present 30

28. Stipules 3–7 mm long. Leaf blades length/width ratio 1.6–2.6, domatia present. Staminate inflorescences with 5–8 nodes per branch. Pistillate inflorescences racemes or umbel-like 29
28. Stipules 1–1.8 mm long. Leaf blades length/width ratio 1.1–1.4, domatia absent. Staminate inflorescences with 35–47 nodes per branch. Pistillate inflorescences racemes . . . . . 16. *M. didymochryseus* Airy Shaw (Sierra et al. 2007a: 61)

29. Leaf blades: lower surface with scattered hairs, apex cuspidate. Staminate inflorescences 5–14 cm long; flowers: pedicels 6–10 mm long, filaments hairy. Pistillate inflorescences 2.7–4 cm long . . . . . 25. *M. lauterbachianus* (Pax & K.Hoffm.) Pax & K.Hoffm. (Sierra et al. 2007a: 74)
29. Leaf blades: lower surface with few hairs, apex acute, acuminate to caudate. Staminate inflorescences 4.5–6 cm long; flowers: pedicels 3–4.5 mm long, filaments glabrous. Pistillate inflorescences 12–17 cm long . . . . . 30. *M. macularis* Airy Shaw (Sierra et al. 2007a: 78)

30. Extrafloral nectaries marginal, domatia sometimes present. Fruits smooth or spiny, spines 15–80 31
30. Extrafloral nectaries along the midrib, also all over the blade, domatia absent. Fruits spiny, spines 500–600 . . . . . 14. *M. darbyshirei* Airy Shaw (Sierra et al. 2007a: 58)

31. Petioles 1–2.5 mm wide. Leaf blades: lower surface densely to sparsely hairy, domatia absent. Stamens 45–120. Fruits smooth or spiny 32
31. Petioles 0.8–1 mm wide. Leaf blades: lower surface sparsely hairy, glabrescent, domatia sometimes present. Stamens 29–45. Fruits spiny . . . . . 10. *M. claoxyloides* (F.Muell.) Müll.Arg. (Sierra et al. 2007a: 53)

32. Leaf blades broadly ovate to ovate, length/width ratio 1–1.3. Stipules absent. Staminate flowers 2.8–5.5 mm diam; filaments 0.5–2.3 mm long. Fruits 5–15 mm long, surface spiny . . . . . 52. *M. tiliifolius* (Blume) Müll.Arg. (Sierra et al. 2007a: 96)
32. Leaf blades ovate to elliptic, length/width ratio 1.4–1.8. Stipules present. Staminate flowers 5–6 mm diam; filaments 2.5–5 mm long. Fruits 17–22.5 mm long, surface smooth . . . . . 53. *M. trinervius* (K.Schum. & Lauterb.) Pax & K.Hoffm. (Sierra et al. 2007a: 99)

33. Indumentum only with stellately-tufted hairs. Fruits indehiscent, 10–19 by 4–19 mm, surface smooth or with slightly verrucose to spiny-like projections; wall c. 0.1 mm thick 34
33. Indumentum with simple, tufted and/or stellately-tufted hairs. Fruits dehiscent or indehiscent, if indehiscent then 18–29 by 21–35 mm, surface rugose, wall 2–8 mm thick 35

34. Indumentum of appressed, brown-yellow hairs. Pistillate flowers 3–4 mm diam, pedicels 1.3–2 mm long. Fruits ellipsoid, 10–12 by 4–4.4 mm, without ridges when dry, surface smooth, sparsely hairy. — Sumatra, Java . . . . . 4. *M. blumeanus* Müll.Arg. (Sierra et al. 2007a: 48)
34. Indumentum of erect, yellow hairs. Pistillate flowers 0.8–1.2 mm diam, pedicels 0.8–1.2 mm long. Fruits spheroid, 15–19 by 15–19 mm, with 3 longitudinal ridges when dry, surface slightly verrucose, densely hairy. — Sumatra . . . . . 47. *M. sphaerocarpus* (Miq.) Müll.Arg. (Sierra et al. 2007a: 93)

35. Leaf blades: lower surface sparsely to densely hairy, broadly ovate to obovate, domatia sometimes present. Stipules present 36
35. Leaf blades: lower surface densely hairy, broadly ovate to ovate, domatia absent. Stipules absent . . . . . 52. *M. tiliifolius* (Blume) Müll.Arg. (Sierra et al. 2007a: 96)

36. Leaf blades: ovate to obovate, nerves 3–10 per side. Stipules triangular to linear-triangular, 0.6–12 by 0.5–5 mm. Fruits spiny or smooth 37
36. Leaf blades: elliptic, nerves 2 or 3 per side. Stipules deltoid, 0.4–0.5 by 0.4–0.5 mm. Fruits smooth. — Borneo . . . . . 28. *M. longinervis* M.Aparicio (Sierra et al. 2007a: 76)

37. Stipules 1.5–12 mm long. Fruits spiny capsules or rugose drupes 38
37. Stipules 0.6–1.3 mm long. Fruits smooth capsules . . . . . 35. *M. montanus* (Wall. ex Müll.Arg.) Airy Shaw (Sierra et al. 2007a: 83)

38. Extrafloral nectaries marginal throughout blade, sometimes also all over the blade. Fruits capsular, dehiscing . . . 39
38. Extrafloral nectaries basal or marginal on lower half, never all over the blade (except sometimes *M. nudiflorus*, then fruits indehiscent drupes) 42

39. Leaf blades with 4–6(–9) nerves per side. Stipules 0.5–1 mm wide 40
39. Leaf blades with 7–9 nerves per side. Stipules 1.5–5 mm wide 41

40. Leaf blades drying green to green-brown. Stipules linear-triangular. Pistillate inflorescences with entire or trilobed bracts; pistillate flowers: buds ellipsoid, style 2–4 mm long, stigmas 0.8–1 mm wide. Staminate flowers with connate filaments. — Borneo, Philippines . . . . . 12. *M. connatus* M.Aparicio (Sierra et al. 2007a: 54)
40. Leaf blades drying brown. Stipules narrowly triangular. Pistillate inflorescences with trilobed bracts; pistillate flowers: buds ovoid, style 0–1(–2) mm long, stigmas 1–1.3 mm wide. Staminate flowers with filaments free to slightly connate at the base. — Sumatra, Java, Borneo, Lesser Sunda Islands . . . . . 46. *M. rufidulus* (Miq.) Müll.Arg. (Sierra et al. 2007a: 91)

41. Stipules densely hairy outside. Petioles 2–3 mm wide. Leaf blades length/width ratio 1.7–2.6. Staminate flowers 4.8–5.2 mm diam, filaments connate in lower half, hairy. Pistillate inflorescences 15–34 cm long; flowers: pedicels 6–11 mm long. Fruits 17–20 mm long. — Malay Peninsula, NW Borneo . . . . . 18. *M. eximius* Airy Shaw (Sierra et al. 2007a: 64)

41. Stipules scatteredly hairy to glabrous outside. Petioles 1.3–1.8 mm wide. Leaf blades length/width ratio 1.5–1.9. Staminate flowers 3–4.2 mm diam, filaments free, glabrous. Pistillate inflorescences 9.4–16 cm long; flowers: pedicels 1–2 mm long. Fruits 7–7.5 mm long. — Myanmar, Thailand, Malay Peninsula, Sumatra, Java, Borneo (Sabah), Philippines, Sulawesi . . . . . 26. *M. leucocalyx* Müll.Arg. (Sierra et al. 2007a: 75)

42. Extrafloral nectaries 1 or 2 per side, at least one pair always present on the first pair of nerves 43

42. Extrafloral nectaries 1–7(–17) per side, always below the nerves 44

43. Stipules 2–4 mm long. Leaf blades obovate. Inflorescences with triangular bracts. Staminate flowers: pedicels 1.8–2.2 mm long, stamens 22–32. Pistillate flowers: stigmas 0.7–1 mm long. Fruits 3–4 mm long. — Malay Peninsula . . . . . 15. *M. decipiens* Müll.Arg. (Sierra et al. 2007a: 59)

43. Stipules 5–6 mm long. Leaf blades ovate to obovate. Inflorescences with narrowly triangular to linear-triangular bracts. Staminate flowers: pedicels 2–4 mm long, stamens 28–50. Pistillate flowers: stigmas 3.5–6 mm long. Fruits 8–12 mm long. — Malay Peninsula, Sumatra, Java . . . . . 17. *M. dispar* (Blume) Müll.Arg. (Sierra et al. 2007a: 62)

44. Leaf blades: first pair of nerves ending in the lower half of the largest leaves, nerves 3–10 per side. Stipules 1.6–10 mm long 45

44. Leaf blades: first pair of nerves ending in the upper half, nerves 3–5 per side. Stipules 1.5–3 mm long . . . . . 22. *M. korthalsii* Müll.Arg. (Sierra et al. 2007a: 72)

45. Fruits drupes, 18–29 by 21–35 mm. Leaf blade margin subentire (to rarely basally serrate with 1–7 minute teeth per side); lower surface glabrous to densely hairy, without discoid glandular hairs (or few), hair-tuft domatia sometimes present. Stamens (25–)45–75(–130) per flower. Pistillate calyx connate, 4.7–6.4 mm high . . . . . 37. *M. nudiflorus* (L.) Kulju & Welzen (Kulju et al. 2007: 124)

45. Fruits capsules, 8–10 by 13–16 mm. Leaf blade margin completely denticulate; lower surface sparsely hairy, sparsely covered with discoid glandular hairs, domatia absent. Stamens 30–40 per flower. Pistillate sepals free, 4.5–5 mm long. . . . . 49. *M. subcuneatus* (Gage) Airy Shaw (Sierra et al. 2007a: 94)

46. Leaves subpeltate or peltate 47

46. Leaves not peltate 56

47. Petioles and young twigs glabrous or with few scattered hairs (naked eye). 48

47. Petioles and young twigs conspicuously hairy (naked eye) 49

48. Leaf blade usually broadly ovate to orbicular, length/width ratio 0.7–1.9, margin slightly wavy (to dentate), apex acute to acuminate, lower surface with two to several conspicuously large hair tufts at petiole insertion (except in eastern Papua New Guinea and the Solomon Islands), rarely hairy domatia present higher along the midrib, often glaucous, (sparsely to) densely gland-dotted, venation ending in the margin . . . . . 19. *M. floribundus* (Blume) Müll.Arg. (Slik & Van Welzen 2001: 33)

48. Leaf blade ovate to obovate, length/width ratio (1.3–)2–4, margin often dentate, apex acuminate to aristate, lower surface without conspicuous large hair tufts at petiole insertion (hair tufts can be present, but are similar to those in axils of veins higher up the midrib), hairy domatia usually present in axils of most veins along the midrib, not glaucous, not (to densely) gland-dotted, venation ending parallel to the margin . . . . . 39. *M. peltatus* (Geiseler) Müll.Arg. (Slik & Van Welzen 2001: 41)

49. Fruits drupes. Stipules absent. Connective distinctly broadened, umbrella-like, with thecae underneath. Leaves subpeltate, c. 3 mm. — New Guinea 50

49. Fruits capsules. Stipules present, often early caducous. Connective of stamens slender to somewhat broadened, not umbrella-like with thecae underneath. Leaves subpeltate to peltate, 3–80 mm. — Malesia 51

50. Leaf blade coriaceous with 0–6 marginal extrafloral nectaries per side (next to 2 (or 4) basal ones). Pistillate sepals 1.5–2 mm long. Ovary (3 or) 4 (or 5)-locular. Fruits 5–8 by 8–10 mm . . . . . 9. *M. chromocarpus* Airy Shaw (Sierra et al. 2005: 238)

50. Leaf blade papery with 9–20 marginal extrafloral nectaries per side (next to 2(–4) basal ones). Pistillate sepals 2.7–4.5 mm long. Ovary (7 or) 8 or 9-locular. Fruit 9–12 by 18–22 mm . . . . . 41. *M. pleiogynus* Pax & K.Hoffm. (Kulju et al. 2007: 128)

51. Plants not smelling of fenugreek. Staminate inflorescences panicles. Pistillate inflorescences racemes, panicles or spikes; pistillate calyx basally to almost apically connate, lobes regular, persistent 52

51. Plants smelling of fenugreek. Staminate inflorescences thyrsoid racemes. Pistillate inflorescences racemes; pistillate calyx caducous to persistent, completely enclosing ovary with only stigmas exerted, torn open into irregular lobes when fruit develops 54

52. Domatia, if present, without a dense tuft of woolly hairs. Leaf blade not thickened near petiole insertion, rarely curved upwards. Pistillate inflorescences in racemes and/or panicles 53

52. Domatia with a dense tuft of woolly hairs. Leaf blade thickened near petiole insertion, frequently curved upwards. Pistillate inflorescences in spikes . . . . . 29. *M. macrostachyus* (Miq.) Müll.Arg. (Sierra & Van Welzen 2005: 254)

53. Stipules linear triangular, 10–17 by 0.8–1.2 mm. Indumentum always very soft-floccose, flocci up to 6 mm long, never tomentose. Leaves up to 80 mm peltate, blade 10.5–58 by 9–45 cm, domatia absent. Pistillate flowers sometimes with staminodes, ovary without individually visible spines. Fruit spines straight, hairs forming a continuous layer . . . . . 3. *M. barbatus* Wall. ex Müll.Arg. (Sierra & Van Welzen 2005: 251)

53. Stipules narrowly triangular,0.7–1.5 by 0.1–0.3 mm. Indumentum sometimes soft-floccose, flocci up to 4 mm long, rarely tomentose. Leaves up to 40 mm peltate, blade 10–29 by 8–25 cm, domatia absent or present. Pistillate flowers never with staminodes, ovary with individually visible spines. Fruit spines curly, hairs not forming a continuous layer . . . . . 33. *M. mollissimus* (Geiseler) Airy Shaw (Sierra & Van Welzen 2005: 257)

54. Stipules caducous to persistent, up to 9 mm long. Upper leaf surface conspicuously yellow-red gland-dotted (to not or sparsely gland-dotted, but then stipules 5–9 mm

long), lower surface usually gland-dotted (sometimes very densely so) 55

54. Stipules early caducous, up to 5 mm long. Upper leaf surface without or with only a few yellow-red glands, lower surface gland-dotted or not . . . . . 39. *M. peltatus* (Geiseler) Müll.Arg. (Slik & Van Welzen 2001: 41)

55. Stipules usually semi-persistent, 5–9 mm long, sometimes placed c. 3 mm above petiole insertion. Leaves usually very large, ovate (to obovate), 5–33.5 by 3–21 cm, peltate part 7–38 mm, lower surface usually sparsely gland-dotted (usually 0–16 glands per cm^2). Staminate inflorescences up to 32 cm long, up to 64 nodes with flowers; bracts caducous to persistent, narrowly triangular to triangular, 1.5–6.5 mm long; buds ovoid. Pistillate inflorescences up to 37 cm long, up to 54 nodes with flowers; bracts caducous to persistent, narrowly triangular, 3.5–7 mm long. Fruits echinate — Borneo and the Philippines . . . . 23. *M. lackeyi* Elmer (Slik & Van Welzen 2001: 38)

55. Stipules caducous to (semi-)persistent, 2.5–5 mm long, placed at petiole insertion. Leaves usually small, ovate to broadly ovate to orbicular, 3–16 by 2–15 cm, peltate part 3–22 mm, lower surface usually very densely gland-dotted (often exceeding 100 glands per cm^2). Staminate inflorescences up to 11 cm long, up to 38 nodes with flowers; bracts caducous, triangular to ovate to broadly ovate, 1.5–2.8 mm long; buds globose. Pistillate inflorescences up to 14.5 cm long, up to 18 nodes with flowers; bracts caducous, triangular to ovate to broadly ovate, 1.8–3.8 mm long. Fruits verrucose to echinate — Malay Peninsula . . . . . 51. *M. thorelii* Gagnep. (Slik & Van Welzen 2001: 47)

56. Upper leaf blade surface with discoid glandular hairs . 57

56. Upper leaf blade surface without discoid glandular hairs 63

57. Domatia (usually) present. Stipules present, scar present when early caducous 58

57. Domatia absent. Stipules absent. — Mainly coastal plant . . . . . 52. *M. tiliifolius* (Blume) Müll.Arg. (Sierra et al. 2007a: 96)

58. Plants without smell of fenugreek. Fruits smooth, spineless, but sometimes wings or ridges. Pistillate calyx basally to halfway connate, regularly lobed. Stipules 0.8–2.5 mm long (early caducous) 59

58. Plant usually smelling of fenugreek. Fruits armed with spines. Pistillate calyx usually completely enclosing ovary, splitting irregularly in fruit. Stipules 1.8–5 mm long (early caducous) . . . . . 39. *M. peltatus* (Geiseler) Müll.Arg. (Slik & Van Welzen 2001: 41)

59. Basal pair of nerves ending in the margin above or below middle of blade. — W Malesia, W New Guinea, Solomon Islands 60

59. Basal pair of nerves always ending in the margin below middle of blade. — New Guinea . . . . . 42. *M. polyadenos* F.Muell. (Bollendorff et al. 2000: 329)

60. Fruit locules ridged or not, without wings. Leaf margin generally entire. Entire plant either pubescent or glabrous 61

60. Fruit locules with long pointed wings. Leaf margin often slightly crenate. Usually only petioles pubescent, otherwise glabrous . . . . . 50. *M. sumatranus* (Miq.) Müll.Arg. (Bollendorff et al. 2000: 329)

61. Fruit locules without ridges, subglobose. Pistillate inflorescences with relatively long pedicels, 6–55 mm long. — W Malesia, New Guinea, Solomons 62

61. Fruit locules ridged lengthwise giving them an angular aspect. Pistillate inflorescences with relatively short pedicels, 1–7(–12) mm long. — W Malesia . . . . . 36. *M. muticus* (Müll.Arg.) Airy Shaw (Bollendorff et al. 2000: 329)

62. Upper surface of leaves basally with impressed glands on first pair of nerves (or veins). Fruits 8–15 by 10–25 mm diam. Entire plant usually glabrous. Leaf base acute to obtuse and sometimes slightly emarginate; petiole often more or less pulvinate at both ends. — W Malesia, New Guinea . . . . . 27. *M. leucodermis* Hook.f. (Bollendorff et al. 2000: 326)

62. Upper surface of leaves basally with numerous small glands randomly distributed around petiole attachment. Fruits 5–8 by 7–10 mm diam. Entire plant usually pubescent (sometimes glabrous). Leaf base broadly rounded to cordate; petiole usually not pulvinate at both ends. — Solomon Islands . . . . . 43. *M. puber* Bollend. (Bollendorff et al. 2000: 334)

63. Shrubs to trees, no climbers. Ovaries (2 or) 3–5-locular 64

63. Climber. Ovary (1 or) 2- or 3-locular . . . . . 44. *M. repandus* (Rottler) Müll.Arg. (Sierra et al. 2005: 234)

64. Leaf blade of largest leaves up to 2 times as long as broad 65

64. Leaf blade of largest leaves more than 2 times as long as broad 68

65. Stipules present, scar present when early caducous. Domatia (usually) present 66

65. Stipules absent. Domatia absent. — Mainly coastal plant . . . . . 52. *M. tiliifolius* (Blume) Müll.Arg. (Sierra et al. 2007a: 96)

66. Margin of leaf blade unlobed; largest extrafloral nectaries up to 1.5 by 0.7 mm; lower surface sparsely hairy. Fruits armed with 65–80 spines or unarmed but with longitudinal ridges 67

66. Margin of leaf blade sometimes with 2 lobes; basal extrafloral nectaries 1.8–5 by 1–2.5 mm; lower surface densely hairy, colouring brownish grey to coppery when dry. Fruits with few spines (< 20) . . . . . 38. *M. paniculatus* (Lam.) Müll.Arg. var. *paniculatus* (Sierra & Van Welzen 2005: 263)

67. Fruits dehiscent, armed with 65–80 spines. Petioles 2–60 mm, leaf blade elliptic to obovate, 4–17 by 2.5–9 cm. Connective widened, not umbrella-like. — New Guinea . . . . . 10. *M. claoxyloides* (F.Muell.) Müll.Arg. (Sierra et al. 2007a: 53)

67. Fruits indehiscent, with 3 longitudinal ridges, spines absent. Petioles 56–80(–130) mm long; leaf blade ovate to elliptic, sometimes slightly falcate, 12–32 by 10–18 cm. Connective umbrella-like. — Sumatra . . . . . 47. *M. sphaerocarpus* (Miq.) Müll.Arg. (Sierra et al. 2007a: 93)

68. Fruits and ovaries unarmed, without spines. Plants not smelling like fenugreek. Discoid glandular hairs absent, then leaves slightly hairy underneath, or often densely present, reddish, then leaves densely hairy underneath 69

68. Fruits and ovaries armed with spines. Plants usually smelling of fenugreek. Discoid glandular hairs creamish, sparsely present; blades sparsely to densely hairy underneath . . . . . 39. *M. peltatus* (Geiseler) Müll.Arg. (Slik & Van Welzen 2001: 41)

69. Discoid glands absent. Leaf blades sparsely hairy underneath, venation pinnate. — Malay Peninsula . . . . . 1. *M. actinoneurus* Airy Shaw (Sierra et al. 2007a: 46)

69. Discoid glands often densely present, especially on fruits, reddish. Leaf blades densely hairy underneath, venation triplinerved. — Malesia . . . . . 40. *M. philippensis* (Lam.) Müll.Arg. (Sierra et al. 2005: 230)

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