

A revision of *Madhuca* Buch.-Ham. ex J. F. Gmelin of Peninsular Malaysia

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Abstract: A revision of *Madhuca* in Peninsular Malaysia comprising a total of 29 species and two sections is given. The genus *Madhuca* is herein proposed to be classified into two new sections, namely sect. *Madhuca* and sect. *Ganua* sect. nov.. Included herein also are taxonomic general taxonomic characters, keys to sections and species, distribution, vernacular names, uses, ecology and other notes.

INTRODUCTION

The genus of *Madhuca* Buch.-Ham ex Gmelin is one of the important genera in Sapotaceae. It is estimated there are about 100 species distributed from India through Malesia and south China to New Guinea (Pennington, 1991). A small- to large-sized tree produces high quality *Nyatoh* timber, well known for its fine texture and decorative grains. It's highly valued for paneling, flooring, solid doors, veneer and plywood (Yii and Chai, 2002). The genus is known by various vernacular names such as *Nyatoh*, *Bitis*, *Nyatoh Sundik*, *Nyatoh Balak*, *Nyatoh Leber Daun*, *Putat*, *Kayu Medang Wangi (Temuan)*. *Medang. (Temuan)*.

In the early treatment of *Madhuca* by Lam (1925, 1927) he had distinguished the sections *Dasyaulus* and *Kakosmanthus* and recorded a total of sixty one species. The genus was studied together with *Ganua* by van den Assem in 1953. The last systematic study on *Madhuca* of Malesian region was carried out by van Royen (1960) and he divided the genus into four groups based on the types of tertiary nervation and secondary nerves. Ng (1972) when revising the genus for “*The Tree Flora of Peninsular Malaysia*” recognized 24 species with three species described under *Madhuca* A, B and C and these had been properly identified and named (Omar and Latiff, 2013, 2014; Omar et al., 2015). In 1991 Pennington had showed that *Madhuca* and *Ganua* could not be separated in both vegetative and floral characters and concluded that the two genera are congeneric and followed herein. Turner (1995) listed only 30 species as occurring in Peninsular of Malaysia and Singapore.

In this taxonomic treatment we recognized a total of 29 species in Peninsular and classified in two sections, namely sect. *Madhuca* and sect. *Ganua*. Recently, the authors have described five new species, namely, *M. whitmorei*, *M. latiffiana*, *M. khoongmengii*, *M. pasohensis* and *M. malaysiana*.

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SYSTEMATIC TREATMENT

Madhuca Buch.-Ham. ex J. F. Gmelin
(An Indian plant-name: *Madhuka*)

Syst. Nat. 2, 1 (1791) 799; Mackbride, Contr. Gray Herb. n. s. 53 (1918) 16; Merrill, Enum. Phil. Fl. Pl. 3, 3 (1923) 276, Plantae Elmerianae Borneenisi (1929) 238; Lam, Bull. Jard. Bot. Buitenz. 3, 7 (1925) 152, Bull. Jard. Bot. Buitenz. 3, 8 (1927) 443; Ridley, Fl. Mal. Pen. 5 (1925) 319; Masuamune, Enum. Phan. Born. (1942) 590; Browne, For. Tree Sar. Bru. (1955) 320; van Royen, Blumea 10 (1960) 2; Baehni, Boissiera 11 (1965) 34; Backer & Bakhuizen van den Brink, Fl. Java, 2 (1965) 192; Burgess, Tim. Sab. (1966) 447; Keng, Orders and Families of Malayan Seed Plants (1969) 331; Ng, Tree Fl. Mal. 1 (1972) 401; Anderson, Checklist. Trees Sar. (1980) 316; Pennington, Gen. Sapot. (1991) 154; Kartasubrata et al. (eds.) PROSEA. 5, 1 (1993) 283; Kessler & Sidiyasa, Tree Balikpapan-Samarinda Area, E. Kalimantan (1994) 212; Turner, Gard. Bull. Sing. 47 (1995) 463; Coode et al. (eds.) Checklist of the Flowering plant & Gymnosperms of Brunei Darussalam (1996) 30; Argent et al. (eds.) Manual Non-Dipterocarp Tree Central Kalimantan, 2 (1997) 575. **Type species:** *Madhuca longifolia* (Koenig in L.) MacBride

Synonyms: *Bassia auct. non* Allioni: Koenig ex Linnaeus, Mantissa 2 (1771) 555, *nom. illeg.*, Bentham & Hooker f., Gen. Pl. 2 (1876) 658, Hooker f., Fl. Br. Ind. 3(1882) 543, King & Gamble, J. As. Soc. Beng. 74, 2, Extra 17 (1906) 176, Merrill, Philip. J. Sci. Bot. 10 (1915) 56, A Bibliographic Enumeration of Bornean Plants (1921) 478, Ridley, Fl. Mal. Pen. 2 (1923) 265. **Type.** *Bassia longifolia* Koenig ex L.

Illipe Koenig ex Gras, Bulletin de la Société botanique de France. 11 (1864) 83. **Type.** *Illipe longifolia* Koenig ex L. (Substitute name for *Bassia* Linnaeus (1771), not Allioni 1766)

Vidoricum Rumpf. ex Kuntze, Revis. Gen. pl. 2 (1891) 407.

Ganua Pierre ex Dubard, Rev. Gen. Bot. 20 (1908) 201; Lam, Bull. Jard. Bot. Buitenzorg, Ser. 3, 7 (1925) 118, Bull. Jard. Bot. Buitenzorg, Ser. 3, 8 (1927) 424; van den Assem, Blumea, 7 (2) (1953) 364; Lam, Blumea, 8 (2) (1957) 510. **Type.** *Ganua chrysocarpa* Pierre ex Dubard.

Small- to medium-sized, rarely large trees, laticiferous, up to 2-60 m tall, **Twigs** terete to angular, usually with leaves scar, glabrous to variously hairy, terminal buds 2-15 mm, variously hairy; **stipules** small to large, usually soon caducous, rarely persistent for sometimes or absent; **Leaves** scattered to crowded at apex of the twigs, distinctly stalked, rarely subsessile; blade with entire or revolute margin; lateral veins diminishing and becoming inconspicuous towards leaf margin or joining archingly or inarching forming intramarginal veins; intercostals veins transverse, reticulate or rarely with descending from leaf margin and parallel to lateral veins, in some cases one nerve among the tertiary ones is formed parallel to the lateral veins and reaches the margin or not; **Inflorescence** bisexual, 1 to many-flowered, fascicles, axillary or in the axil of fallen leaves; **Flowers** bisexual, distinctly pedicellate or rarely sessile; calyx, 4, in two whorls of two, rarely 5 or 6 and the inner sepals usually glabrous, membranous and fimbriate, outer sepals thick, usually inner sepals thinner; corolla gamopetalous, (6-) 8-12 (-16)-lobed, usually woolly pubescent between the stamens; stamens (10-) 16-28 (-36), in two or three whorls, sessile, subsessile or with a distinct filaments, inserted in the throat of the corolla, anthers extrorse, usually large and tapering gradually to the acute apex, hairy or glabrous; ovary 5-18-celled, with one ovule in each cell, glabrous or hairy, style filiform, subulate, more or less elongate; **Fruits** 1-6-seeded; pericarp, glabrous or hairy, calyx and style persistent; seeds with narrow, linear or very broad scar; endosperm thin or absent and cotyledons thick in most species.

Distribution. About 100 species found in Asia, Malesia and to the Pacific. Borneo and Peninsular Malaysia are particularly rich in species, about 50 and 30 taxa, respectively. Widely distributed species include *M. burckiana* (the Philippines to New Guinea, but not in Peninsular Malaysia), *M. malaccensis* and *M. motleyana* (the Philippines, Thailand, Peninsular Malaysia to Borneo) and *M. utilis* (Peninsular Malaysia, Sumatra and Borneo). **Habitat.** In Peninsular Malaysia these trees can be found from the peat swamp forests, limestone hill forests to lowland forests and up to 1500 m montane forests.

Vernacular name. The genus has many local names such as “*Nyatuh, Bitis, Melawis, Nyatuh Sundik, Nyatuh Balak* and *Nyatuh Paya* in Malay, *Putat, Mengku, Kayu Medang Wangi* and *Medang* in Temuan. In Sarawak *Ketiau Puteh, Nyatuh Batu, Nyatuh Bulu Merah, Ketiau Merah, Nyatuh Daun Mata Lembing, Nyatuh Jelutong, Ketiau Badas* and *Ketiau Hantu* in Malay, *Nyatuh Semukau, Nyatuh Padi, Nyatuh Kusta* in Iban language, *Kayu Pak-Peting* in Punan. In Sabah *Manatu, Antagiras* in Dusun, *Nyatuh Kemayan, Nyatuh King* in Malay and *Ketiau Paya* in Melanau.

Uses: *Madhuca* is the main genus that produces *Nyatuh* and *Bitis* timbers. *Nyatuh* a medium heavy hardwood is being used for light construction and furniture while *Bitis* is widely used for heavy construction such as heavy duty flooring, posts, doors, door frames and paving blocks. The latex from several species gives gutta-percha of inferior quality, which sometimes used as an adulterant for good quality gutta-percha from *Palaquium gutta* (Hook.) Baillon and *Payena leerii* (Teijsm. & Binn.) Kurz. The fat extracted from seeds is used by local people for lighting and cooking as in *M. motleyana*. In India, nectar extracted from flowers of some species is used for sweetening food and fermenting liquors.

Key to sections and species of *Madhuca* in Peninsular Malaysia

- 1 Leaf lateral veins diminishing and becoming inconspicuous towards leaf margin (Sect. *Madhuca*).....2
- Leaf lateral veins joined at the margin (Sect. *Ganua*).....13
- 2 Intercostals venation mainly reticulate, sometimes with vaguely transverse near the margins.....3
- Intercostals venation mainly transverse, and sometimes with vaguely reticulate in between.....4
- 3 Intercostals venation mainly reticulate to vaguely transverse; pedicels woolly sepals orbicular, 9 x 8 mm, obtuse at apex; stamens 28; fruits woolly 1. *M. erythrophyll*
- Intercostals venation mainly laxly reticulate with sometimes one more or less irregular nerve stronger developed than the others and parallel to the secondary veins; pedicels puberulous; sepals ovate, 5.5 x 4 mm, acute at apex; stamens 14-16; fruits glabrous..... 2. *M. tomentosa*
- 4 Leaf blades pubescent below5
- Leaf blades glabrous below.....6
- 5 Petioles length 1-3 cm, ungrooved or slightly grooved above; midrib flat to prominent above..... 3a. *M. sericea* var. *sericea*
- Petioles length 3-4.5 cm, closed grooved above; midrib slender above3b. *M. sericea* var. *ridleyi*
- 6 Twigs very thick up to 20 mm diameter; inflorescences more than 12-flowered; corolla 16-lobed; stamens up to 34.....4. *M. ridleyi*
- Twigs thin not exceeding 9 mm diameter; inflorescences 1- to 8-flowered; corolla 6- to 12-lobed; stamens 13-22.....7
- Lateral veins prominent on both sides.....8
- Not as above.....9
- 8 Petioles ungrooved to open above; intercostals venation loosely transverse; corolla 10- to 12-lobed, lobes lanceolate..... 5. *M. malaccensis*

- Petioles closed grooved above; intercostals venation densely transverse; corolla 8-lobed, lobes ovate..... **6. *M. korthalsii***
- 9 Lateral veins 21-25 pairs; sepals 10 x 7 mm..... **7. *M. malaysiana***
- Lateral veins not exceeding 15 pairs; sepals 4-7 x 3-4 mm..... **10**
- 10 Leaf blades elliptic; petioles length 1-3 cm..... **11**
- Leaf blades generally lanceolate or elliptic-oblong; petioles length 3-4 cm..... **12**
- 11 Twigs gray, stout, rough, c. 5 mm in diameter; ferruginously puberulous at tip; pedicels 5-10 mm long; filaments very short; styles c. 4-8 mm long..... **8. *M. whitmorei***
- Twigs brown, slender, wrinkled, c. 2.5-3 mm diameter; ferruginously sericeous at tip; pedicels 15 mm long; filaments 2.5 mm long; styles c. 14 mm long..... **9. *M. longistyla***
- 12 Lateral veins grooved, narrowly crested above; petioles flat or slightly grooved above; 6-flowered in nodes; corolla lanceolate, sericeous on the middle-line of the lobes outside..... **10. *M. laurifolia***
- Lateral veins not grooved, prominulous above; petioles open grooved above, narrowly crested; 13-flowered in nodes; corolla obovate, glabrous on outside..... **11. *M. penangiana***
- 13 Intercostals venation mainly reticulate, with sometimes vaguely transverse near the margins..... **14**
- Intercostal venation mainly transverse..... **12. *M. kingiana***
- 14 Leaf blades glabrous below..... **15**
- Leaf blades pubescent below..... **25**
- 15 Intercostal venation reticulate..... **16**
- Intercostal venation reticulate with tertiary nerves parallel to lateral veins..... **22**
- 16 Leaves larger c. 16-48 x 6.5-19 cm..... **17**
- Leaves smaller c. 7-17.5 x 2.5-6.5 cm..... **19**
- 17 Leaf blades elliptic; lateral veins up to 37 pairs..... **13. *M. aristulata***
- Leaf blades obovate or oblong-obovate; lateral veins 12-22 pairs..... **18**
- 18 Petioles length 2.5-4 cm, grooved above; pedicels 18-25 mm long, sepals oblanceolate, 10-14 x 6-8 mm; corolla 14 mm long; ovary hairy; fruits ellipsoid..... **14. *M. hirtiflora***
- Petioles length 1.5-2.5 cm, flat above; pedicels sessile; sepals ovate, 5.5 x 3.5mm; corolla 6 mm long; ovary glabrous; fruits fusiform **15. *M. sessiliflora***
- 19 Leaf margin entire; filaments subulate, c. 1.5-2 mm long..... **20**
- Leaf margin recurved inwards; filaments filiform, \pm 5 mm long..... **16. *M. utilis***
- 20 Leaves fairly closely clustered at end of twigs; petioles flat above, densely reticulate; lateral veins inconspicuous above; corolla 8-11 mm long; stamens 20-26; styles 15-20 mm..... **17. *M. calcicola***
- Leaves loosely clustered to spaced along twigs; petioles narrowly to open grooved above, loosely reticulate; lateral veins prominent above, corolla 6-7 mm long, stamens less than 16; styles not exceeding 8 mm long..... **21**
- 21 Twigs woolly at tips; pedicels to 5 mm long; corolla glabrous on outside..... **18. *M. latiffiana***
- Twigs tomentose at tips; pedicels to 20 mm long; corolla sericeous on outside..... **19. *M. tubulosa***
- 22 Petioles mostly closed or broadly grooved, rarely flat above..... **23**
- Petioles flat above or subangular to cylindrical..... **24**
- 23 Stipules present, filiform, c. 5-10 mm long; midribs slender, impressed above; terminal buds hairy..... **20. *M. palembanica***
- Stipules absent; midribs flat or sunken above; terminal buds glabrous..... **21. *M. pasohensis***
- 24 Stipules up to 5 mm long; midribs hardly prominent, rounded below; petioles thickened at the base; pedicels densely tomentose; sepals orbicular; ovaries hairy; fruits tomentose..... **22. *M. curtisii***

- Stipules extremely small up to 2 mm long; midribs slightly flat to prominulous below; petioles not thickened at the base; pedicels puberulous; sepals ovate; ovaries glabrous; fruits glabrous..... **23. *M. motleyana***
- 25 Petioles flat above, glabrous; corolla 16-lobed..... **24. *M. kunstleri***
- 26 Petioles open or closed groove above, hairy; corolla 7-14-lobed.....**26**
- 27 Leaf blades generally elliptic, frequently obovate.....**27**
- 27 Leaf blades generally lanceolate, oblong-lanceolate or rarely obovate.....**29**
- 27 Petioles length not exceeding 1 cm long; lateral veins 8-11 pairs.....
..... **25. *M. rufa***
- 28 Petioles length more than 1 cm long; lateral veins 14-30 pairs.....**28**
- 28 Stipules minute, lanceolate, 1 x 0.5 mm, puberulous on outside; intercostal venation transverse; sepals hairy inside; corolla lanceolate; stamens 18-23
.....**26. *M. penicillata***
- 29 Stipules larger, lanceolate, up to 6 mm long, woolly on outside; intercostal venation reticulate; sepals glabrous inside; corolla obovate; stamens 14
.....**27. *M. khoonmengii***
- 29 Petioles length 4-5.5 cm; midribs prominent above; sepals smooth; stamens 26-31, styles terete, hooked-shape, 14 mm long..... **28. *M. decipiens***
- Petioles length 1.5-3 cm; midribs broadly grooved above, sepals rugose; stamens 16-17; styles filiform, 3.5-7 mm long.....**29. *M. selangorica***

Based on the characters of the secondary veins, the authors hereby classify the genus into two artificial sections namely, sect. *Madhuca* and sect. *Ganua*, for ease of species classification and identification. In addition, the character of tertiary veins is also useful to discriminate different species in the above sections.

Sect. *Madhuca*

Syn.: *Madhuca* sect. *Kakosmanthus* H. J. Lam, Bull. Jard. Bot. Buitenz. 3, 7 (1925) 154, pro parte

Madhuca sect. *Dasyaulus* H. J. Lam, Bull. Jard. Bot. Buitenz. 3, 7 (1925) 154, pro parte

Diagnosis: Lateral veins of leaves diminishing and becoming inconspicuous towards leaf margin not forming intramarginal veins; frequently the tertiary veins become more prominent near the margin connecting the secondary veins.

Sect. *Ganua* (Pierre ex Dubard) N. Omar & Latiff sect. nov.

Syn.: *Madhuca* sect. *Kakosmanthus* H. J. Lam, Bull. Jard. Bot. Buitenz. 3, 7 (1925) 154, pro parte

Madhuca sect. *Dasyaulus* H. J. Lam, Bull. Jard. Bot. Buitenz. 3, 7 (1925) 154, pro parte
Ganua Pierre ex Dubard, Rev. Gen. Bot. 20 (1908) 201

Diagnosis: Lateral veins of leaves archingly or inarchingly joined to form intramarginal veins or vein loops.

ENUMERATION OF SPECIES

Sect. *Madhuca*

1. *Madhuca erythrophylla* (King & Gamble) H. J. Lam
(Greek., erythro- = red, phyllon = leaves; red leaves)

Bull. Jard. Bot. Buitenz. 3, 7 (1925) 170, Bull. Jard. Bot. Buitenz. 3, 8 (1927) 453; Ridley, Fl. Mal. Penin. 5 (1925) 320; van Royen, Blumea 10 (1960) 52; Ng, Tree Fl. Mal. 1 (1972) 405; Turner, Gard. Bull. Sing. 47 (1995) 463. Basionym: *Bassia erythrophylla* King and Gamble, J. As. Soc. Beng. 74 (1906) 188; Ridley, Fl. Mal. Penin. 2 (1923) 272 - Type: Peninsular Malaysia, Penang, Curtis 3652 (Holotype SING!, Isotype SING!).

Vernacular name: *Nyatuh*.

Distribution: Sumatera, Borneo and Peninsular Malaysia. In Peninsular Malaysia it occurs in Johor, Penang and Pahang.

Ecology: In low hillsides and ridge tops, logged over forest and undulating land probably below 330 m.

Uses: The timber is possibly used as nyatuh or bitis.

Notes: Reported to be quite common but collected only six times. It seems to resemble *M. tomentosa*, but differs in having leaves not glossy above, hairy below, the large size of the calyx, pedicels and sepals woolly, number of stamens 28, ovary hairy and woolly fruits.

Specimens examined. JOHOR: Compt. 74, Labis FR. 13 Apr. 1967, Kochummen, FRI 2285, (KEP); **PAHANG:** Kemasul FR., 24 July 1958 Kimin, KEP 92452, (KEP); Kemasul FR., 31 May 1958, Kochummen KEP 78696, (KEP); Gunung Lesong., 1 Oct. 1981, Pennington, Wong & Kamarudin bin Saleh, FRI 10249, (KEP); 1 Oct. 1981, Kamarudin Saleh, FRI 28871, (KEP); **PENANG:** Highlands FR, May 1901, Curtis 3652 (SING).

2. *Madhuca tomentosa* H. J. Lam

(Latin, tomentosa = tomentose, with felt-like hair)

Bull. Jard. Bot. Buitenz. sér. 3, 7 (1925) 177, Bull. Jard. Bot. Buitenz. sér. 3, 8 (1927) 460; Ridley, Fl. Mal. Penin. 5 (1925) 342; van Royen. Blumea 10 (1960) 86; Ng, Tree Fl. Mal. 1 (1972) 411; Turner Gard. Bull. Sing. 47 (1995) 465. **Type:** Peninsular Malaysia, Pahang, Temerloh, 10 Aug. 1919, Hamid 4790 (Holotype SING!, Isotype L). **Synonym:** *Madhuca palustris* van Royen, Blumea 10 (1960) 84-86

Vernacular names: *Benku, Nyatuh, Nyatuh balok, Nyatuh balak* and *Susor Pelanduk*.

Distribution: Endemic to Peninsular Malaysia, confined to the southern and eastern parts of Peninsular Malaysia known from Johor, Terengganu and Pahang.

Ecology: Scattered in lowlands and hillside forests at altitude up to 122 m.

Uses: Unknown.

Note: Regarding the type specimen (Hamid 4790 in SING), there were two dates written on the specimen sheet, 10. 8. 1919 and 13. 9. 1920, so it is difficult to ascertain the true date of collection. This species is closely related to *M. erythrophylla*, see under that species.

Specimens examined. JOHOR: Gunung Panti FR., 9 July 1961, Anon., KEP 99208, (KEP); 2 Feb. 1935, Smith, KEP 30202, (KEP); Compt. 1, 5 May 1968, Cockburn, FRI 7809, (KEP); G. Ledang, 26 Nov. 1971, Loh Hoy Shing, FRI 19213, (KEP, SING); Lenggong FR., 10 May 1968, Whitmore, FRI 8674, (KEP, SING); Ulu Endau. Chegar Rambutan, 28 March 1968, Cockburn, FRI 7977, (KEP); Ulu Endau, Labis FR., 23 March 1968, Cockburn, FRI 7890, (KEP); 22 March 1968, Cockburn, FRI 7866 (KEP, SING); S. Kayu, 19 Oct. 1936, Kiah, 32129 (SING); Bukit Trajau Laut, 3 Aug. 1939, Ngadiman, 36934 (SING); S. Kayu, 8 Oct. 1936, Kiah, 31996 (SING); 13 March 1937, Kiah, 32390 (SING); **PAHANG:** Lesong FR., Sg. Jekatih., 20 Feb. 1971, Whitmore, FRI 15944, (KEP, SING); Bukit Susop, 16 Feb. 1929, Jaamat, KEP 16528, (KEP, SING); Temerloh, 22 March 1923, Henderson, 10409 (SING); Jengka FR., Sungai Nering, Temerloh, 27 July 2011, Sani Miran, JJ2-41(UKMB).

3. *Madhuca sericea* (Miq.) H. J. Lam

(Latin, sericea = silky, referring to leaf undersurface).

3 a. *M. sericea* var. *sericea* (Miq.) H.J.Lam

Bull. Jard. Bot. Buitenz. sér. 3, 7 (1925) 163 and 264; Bull. Jard. Bot. Buitenz. sér. 3, 8 (1927) 446; Ridley, Fl. Mal. Penin. 5 (1925) 319; Heyne, Nutt. Pl. Ned. Ind. 2 (1927) 1231; Masamune, Enumeratio Phanerogamarum Bornearum (1942) 592; van Royen. Blumea 10 (1960) 70; Sinclair, Gard. Bull. Sing. 22 (1967) 220; Ng, Tree Fl. Mal. 1 (1972) 410; Pennington, Gen. Sapot. (1991) 158; Kartasubrata et al., PROSEA

5, 1 (1993) 293; Kessler & Sidiyasa, Trees of Balikpapan-Samarinda Area, East Kalimantan, (1994) 214; Turner, Gard. Bull. Sing. 47 (1995) 465; Argent et al. (eds.) Manual of the larger and More Important non-Dipterocarp Trees of Central Kalimantan Indonesia, 2 (1997) 579; **Basionym:** *Payena sericea* Miq., Fl. Ind. Bat. 2 (1856) 1039. **Type:** Sumatra, Bangka, Horsfield s. n. (Isotype K!).

Synonyms: *Bassia argentea* Clarke in Hooker, Fl. Bri. Ind. 3 (1882) 545; King and Gamble, Journ. As. Soc. Bengal 74, 2, Extra 17, (1905) 184; Ridley, Fl. Mal. Penin. 2 (1923) 270; *Kakosmanthus argenteus* (Clarke) Pierre ex Dubard, Rev. Gen. Bot. 20 (1908) 198; Bruggen, Blumea 9 (1958) 133.

Vernacular name: *Nyatuh*.

Distribution: Johor, Malacca, Perak (Peninsular Malaysia), Singapore, Sumatra, Lingga, Bangka, Enggano, Borneo.

Ecology: Drier part of swamps; swampy lowland forest.

Uses: The timber is possibly used as nyatuh, particularly for construction purposes such as house and bridge building.

Specimens examined. JOHOR: Compt. 5 Maokil FR., 25 July 1970, Kochumen, FRI 16100 (KEP, SING); **N. SEMBILAN:** Sungai Menyala FR. Port Dickson, 10 Jun. 1946, Smith, KEP 64578 (KEP); 13 Jun. 1946, Smith, KEP 64678 (KEP); Port Dickson, 17 Jun. 1946, Smith, KEP 64802 (KEP); **MALACCA:** Merlimau, 1892, Derry, 941 (SING); 9 Apr. 1881, Holmberg, 704 (SING); 9 Apr. 1881, Holmberg, 705 (SING); 17 Apr. 1886, Alvins, s n. (SING); **PERAK:** Sg. Plus, Chior FR., Sg. Siput, 5 Oct. 1967, Ng, FRI 5730 (KEP); Ulu Perak: Lenggong: Lata Kehabu, 5° 2' 58" N 100° 56' 45" E., 21 May 2010, Wilkie, FRI 72019 (KEP).

2 **b. *M. sericea* var. *ridleyi*** (Gandoger) Ng
(In honour of H. N. Ridley)

Ng, Tree Fl. Mal. 1 (1972) 410; Turner, Gard. Bull. Sing. 47 (1995) 464

Basionym: *Payena ridleyi* Gandoger, Bull. Soc. Bot. France 65 (1918) 56

Notes: This variety differs from the typical form of the species in having petioles with a closed groove above, 3-4.8 cm, long; midrib above more slender, slightly raised lateral veins 18-22 pairs

Vernacular name: *Nyatuh*.

Distribution: Endemic to Peninsular Malaysia known from Johor and Terengganu.

Ecology: Drier part of swamp; swampy lowland forest.

Notes: This species is closely related to *M. penicellata*, see under that species.

Specimens examined. JOHOR: Labis F.R., 16 Apr. 1966, Ng, FRI 1027, (KEP); Arong FR., Mersing, 27 Apr. 1967, Ng, FRI 5205, (KEP, SING); Boundary 24/25 Arong FR. Extension, Mersing, 29 Apr. 1967, Ng, FRI 5244, (KEP); s. loc., Corner, FRI 70141, (KEP); Kota Tinggi, Mawai, 10 Feb, 1936, Corner s.n. (SING); **TERENGGANU:** Terengganu, Dungun, Jerangau, 25 July 1955, Jalil bin Manar, KEP 81066 (KEP).

4. ***Madhuca ridleyi*** H. J. Lam

(H. N. Ridely, 1855-1956, sometimes Director, Singapore Botanic Garden)

Gard. Bull. Str. Settl. 9, 1, (1935) 105; van Royen. Blumea 10 (1960) 43; Ng, Tree Fl. Mal. 1 (1972) 409; Kartasubrata et al., PROSEA 5, 1 (1993) 293; Turner, Gard. Bull. Sing. 47 (1995) 464. **Type:** Peninsular Malaysia, Pahang, Bukit Serdam, 6 Oct. 1931, Henderson 25055 (Holotype SING!, Isotype KEP!).

Vernacular names: *Nyatuh*, *Mentua taban*.

Distribution: Endemic to Peninsular Malaysia, widespread in Kedah, Kelantan Pahang, Perak and Perlis.

Ecology: In primary forest, scattered on summit of limestone hills, covered in sharp rocks and on seasonally swampy, altitude sea level up to 400 m.

Uses: The timber is possibly used as *nyatuh* or *bitis*.

Notes: *M. ridleyi* is amply distinguished from all other species by having very thick twigs, leaves mostly spatulate, the number of flower is more than 12 on the nodes and flowers structures such as corolla 16-lobed, stamens 34, ovary 18-cells and very numerous, as well as the ovary being glabrous whereas the fruits are densely ferruginously tomentose.

Specimens examined. KEDAH: Langkawi: Pulau Chupak, 19 Feb. 2009, Chew, FRI 63434, (KEP, SING); 9 Feb. 2011, Wilkie et al. FRI 72107 (KEP); Langkawi: Kuah, 9 Dec.1969, Whitmore, KEP 12939, (KEP); P. Langkawi, Dayang Bunting, 10 May 1967, Stone, KLU 6924, (KEP, KLU); 9 Feb. 2011, Wilkie et al. FRI 72103(KEP); Langkawi, Pulau Gasing, 28 Apr. 2004, Zahid et al. ZMS 46 (SING); Langkawi, Selat Panchor FR. 11 Mar. 2009, Rafidah et al. FRI 64287 (KEP); Bukit Batu Ayam, 25 Oct. 1946, Rahim, KEP 12437, (KEP); **KELANTAN:** Bertam, Ulu Kelantan, 29 July 1962, UNESCO Limestone Expedition, 113 (SING); **PAHANG:** Raub, Bukit Serdam limestone, 19 Jun. 1971, Chin, KLU 1071, (KEP, KLU); **PERAK:** Gunung Runtoh, Lenggong, 11 Jun. 1930, Henderson, KEP 23834, (KEP, SING); 31 July 1970, Everett, KEP 14537, (KEP, SING); Taman Awam Gua Tok Giring Lenggong, 3 March 2011, Wilkie et al. FRI 75022 (KEP); 3 Nov. 2012, Naser & Fitri, NA132, NA133 (UKMB); **PERLIS:** Bukit Bintang F.R., 16 Jun.1966, Whitmore, KEP 0489, (KEP, SING); 4 Jun. 1941, Symington, KEP 57055, (KEP); Road to Kampong Batu Pahat, Kangar, 30 Apr. 1963, Yong, KEP 94984, (KEP, SING).

5. *Madhuca malaccensis* (Clarke) H. J. Lam
(Of Malacca, Peninsular Malaysia)

Bull. Jard. Bot. Buitenz. sér. 3, 7 (1925) 167, Bull. Jard. Bot. Buitenz. sér. 3, 8 (1927) 449; Ridley, Fl. Mal. Penin. 5 (1925) 319; Merrill, Uni. Calif. Publ. Bot. 15(1929) 239; Masamune, Enumeratio Phanerogamarum Bornearum (1942) 591; van Royen. Blumea 10 (1960) 44; Ng, Tree Fl. Mal. 1 (1972) 407; PROSEA 5, 1(1993) 291; Turner, Gard. Bull. Sing. 47 (1995) 464; Argent et al. (eds.) Manual of the larger and more important non-dipterocarp trees in Central Kalimantan, 2 (1997) 578, Kochummen, Tree Fl. Pasoh For. (1997) 411; **Basionym:** *Payena malaccensis* Clarke in Hooker, Fl. Bri. Ind. 3 (1882) 547.

Type: Peninsular Malaysia, Malacca, Griffith 3610 (Lectotype K!)

Synonyms: *Bassia malaccensis* (Clarke) King & Gamble, Journ. As. Soc. Bengal 74, 2, Extra 17, (1905) 180

Vernacular names: *Nyatuh*, *Nyatuh Lebar Daun*.

Distribution: Southern Thailand, Singapore and Borneo (Sabah) and Peninsular Malaysia; probably also Sumatra (Bangka). In Peninsular Malaysia it is common and scattered throughout Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Selangor and Terengganu.

Ecology: In primary lowland forests or low undulating country on granite hillsides sometimes on sandy soil, at altitude from 18 to 213 m, sometimes reach to 700-1340 m high.

Uses: The timber is probably used as *nyatuh*.

Notes: This species can be easily recognised by its very large leaves, generally broadly obovate, up to 60 cm long. This species is closely related to *M. aristulata* and *M. malaysiana*, see under those species.

Specimens examined. JOHOR: Ulu Endau Labis FR., Comot 280, 23 March 1968, Cockburn, FRI 7895, (KEP, SING); Compt. 285, Ulu Endau, 25 March 1968, Cockburn, FRI

7918, (KEP); G. Besar, Kg. Tepoh, Labis FR., Everett, FRI 14091, (KEP, SING); **KEDAH:** Gunung Inas FR., Compt. 8., 7 Feb. 1968, Burgess, FRI 4962, (KEP); 7 Feb. 1968, Burgess, FRI 4956, (KEP); **KELANTAN:** Ulu Lebir FR., 13 July 1970, Suppiah, FRI 17736, (KEP, SING); Chabang Tongkat FR., 20 Jun. 1968, Suppiah, FRI 25628, (KEP); 20 Jun. 1968, Suppiah, FRI 108874, (KEP); Compt. 20, Jeli FR, 30 Jun. 1968, Chelliah, FRI 23876, (KEP); 30 Jun. 1968, Chelliah, FRI 6512, (KEP, SING); Compt. 18, 2 May 1967, Rahim Ismail, FRI 104255, (KEP, SING); Hutan Simpan Ulu Sat, Bukit Bakar, Machang, 16 March 2008, Teo & Din, KL 5561, (KEP); Compt. 104, Sungei Durian FR. Kuala Krai, 3 May 1967, Rahim Ismail, FRI 104270, (KEP, SING); 3 May 1967, Rahim Ismail, FRI 104272, (KEP, SING); **MALACCA:** Panchor, Apr. 1894, Goodenough, 1830 (SING); s. loc., Alvins, 1000 (SING); s. loc., s. d., Anon. s n. (SING); **N. SEMBILAN:** Pasoh FR, 29 March 1989, Kamarudin, FRI 34544 (SING); 6 Apr. 1975, Chan, FRI 23876, (KEP); 29 Apr. 2005, Abdul Samad, FRI 40365, (KEP, SING); 1988, La Frankie, 3316, (KEP); 12 March 2009, Wilkie & Imin, PW 832, (KEP); 11 March 2009, Wilkie & Imin, pw 838, (KEP, SING); 4 Apr. 1976, Ong Siew Ling, MAP 76, (KEP); 4 Apr. 1976, Ong Siew Ling, MAP 50, (KEP); 13 Oct. 1981, Mat Asri, FRI 25920, (KEP); 26 Apr. 1979, Ng, FRI 22600, (KEP); 15 Nov. 2012, Naser & Abu Hussain, NA 136 (UKMB); Sg. Menyala FR. Near S.P. 105, 29 July 1968, Ng, FRI 6195, (KEP); **PAHANG:** Kemansul FR., 16 Feb. 1936, Browne, KEP 40859 (KEP); Gunung Lesong FR., Sg. Kemelai, 30 Sep. 1981, Pennington, Wong & Kamarudin Saleh, FRI 10243, (KEP); 1 Oct. 1981, Pennington, Wong & Kamarudin Saleh, FRI 10246, (KEP); 30 Sep. 1981, Wong, FRI 32290, (KEP); 1 Oct. 1981, Wong, FRI 32297, (KEP); Gunung Tapis, 28 Sep. 1971, Chang, FRI 19862, (KEP, SING); South East Pahang. Rompin Iron Mine, 9 May 1967, Whitmore, FRI 3621, (KEP); Ulu S. Anak Endau, 3 Apr. 1968, Cockburn, FRI 8043, (KEP, SING); Raub, 19 Apr. 1971, Selvaraj, FRI 19553, (KEP); Sg. Naning, Bentung, 28 March 1968, Wong Swee Ming, FRI 9130, (KEP); Teluk Chempedak F.R., Kuantan, 28 July 1966, Rahim Ismail, 97947 (SING); Temerluh, Kemasul FR. 3 Oct. 1925, Ranger Hamid, KEP 10668, (KEP, SING); **PERAK:** Keledang Saiong FR. 23 Feb. 1982, Kochummen, FRI 29445, (KEP); Batu Puteh, s. d., Wray, 1229, (SING); **SELANGOR:** Kepong, 16 Apr. 1918, Hamid, KEP 1590, (KEP); Ulu Langat, Bukit Punggang FR. Kajang, 31 March 1930, Symington KEP 24101, (KEP, SING); **TERENGGANU:** Sg. Loh near K. Datok, 6 July 1968, Cockburn, FRI 10738, (KEP); 4 July 1968, Whitmore, FRI 8920, (KEP); Ulu S. Loh, G. Mandi Angin, 13 July 1968, Whitmore, FRI 12132, (KEP); Kuala Trenggan, 28 Jun. 1971, Whitmore, FRI 20290, (KEP, SING); Ulu Sungai Terengganu, Jeram Galong, 31 May 1968, Cockburn FRI 8369, (KEP, SING); Ulu S. Trenggan K. Petang, Ulu Terengganu, 4 Jun. 1968, Cockburn, FRI 8473, (KEP, SING); Terengganu Mountain Sg. Kerbat, Kuala Kerbat, Jeram Garok, 24 Jun. 1971, Whitmore, FRI 20207, (KEP, SING); Bukit Kajang, Kemaman, 12 Nov. 1935, Corner, KEP 30399 (KEP, SING); 8 Nov. 1935, Corner, KEP 30332, (KEP, SING); 15 Nov. 1935, Corner, s n. (KEP); Ulu Bendong, Kemaman, 1 Nov. 1935, Corner, s. n. (SING); Ulu Berang, July 1937, Moysey and Kiah SFN 33821 (SING); Dungun, 27. July 1955, Kochummen, KEP 76654 (SING).

6. *Madhuca korthalsii* (Pierre *ex* Burck) H. J. Lam
(P. W. Korthals, 1807-1892, a Dutch botanist in Indonesia)

Bull. Jard. Bot. Buitenz. 3, 7 (1925) 168 and 264, Lam, Bull. Jard. Bot. Buitenz. 3, 8 (1927) 449; Ridley, Fl. Mal. Penin. 5 (1925) 320; Masamune, Enumeratio Phanerogamarum Bornearum (1942) 591; van Royen. Blumea 10 (1960) 87; Ng, Tree Fl. Mal. 1 (1972) 406; Anderson, Chkfst. Trees Sar., (1980) 316; Pennington, Gen. Sapot. (1991) 157; PROSEA 5, 1(1993) 289; Turner, Gard. Bull. Sing. 47 (1995) 463; Argent et al. (eds.) Manual Non-Dipterocarp Tree Central Kalimantan, 2 (1997) 577. **Basionym:** *Bassia korthalsii* Pierre *ex* Burck, Ann. Jard. Bot. Buitenz. 5 (1886) 45.

Type: Sumatra, Padang, Ajer Mantjoer, Korthals, 687 (BM!)

Synonyms: *Illipe korthalsii* (Pierre *ex* Burck) Engl., Bot. Jabrh. 12 (1890) 509; *Vidoricum*

korthalsii (Pierre ex Burck) Kuntz, Revis. Gen. Pl. 2 (1891) 407; *Bassia braceana* King and Gamble, J. As. Soc. Beng. 74, 2, Extra No. 17 (1906) 184; Ridley, Fl. Mal. Penin. 2 (1925) 270; *Kakosmanthus korthalsii* (Pierre ex Burck) Pierre ex Dubard, Rev. Gen. Bot. 20 (1908) 198.

Vernacular names: *Nyatuh*, *Nyatuh Sundik*, *Putat*, *Kayu Medang Wangi* (*Temuan*) and *Medang* (*Temuan*).

Distribution: Sumatra, Borneo and Peninsular Malaysia. In Peninsular Malaysia common and scattered throughout Kelantan, Pahang, Perak and Selangor.

Ecology: In primary hill forest, at altitude up to 360 m.

Uses: The timber is possibly used as *nyatuh* or *bitis*.

Notes: The petals in this species are with golden hairs on the middle line on the outside, contrary to van Royen (1960) when he described it as glabrous on the outside. The specimens KEP CF 590 (KEP!) and KEP 8522 (KEP!) were identified as *M. korthalsii* var. *lanceolata* (King & Gamble) H. J. Lam by Lam and Van Royen in their revisions of *Madhuca* in 1925 and 1960, respectively. The author disagrees with them because the leaves are elliptic or oblanceolate and lateral veins 13-15 pairs not as stated by Lam and Van Royen as lanceolate or oblong-lanceolate and lateral veins 18-22 pairs. This species is closely related to *M. longistyla*, see under that species.

Specimens examined. **KELANTAN:** Temamgan FR., 9 March 1937, Browne, KEP 38482, (KEP); Sungei Lebir below Kuala Relaiat Jentah, 26 Apr. 1976, Stone & Mahmud Sidek, KLU 12467 (KEP, KLU); Jeli, Kelantan, 18 Jun. 1998, Teo, KL 4784, (KEP); **PAHANG:** Lancang, 24 Feb. 1985, Latiff, ALM 826 A 35, (UKMB); 19th mile Genting Sempah road. Valley, 13 Feb. 1980, Kochummen, FRI 29032, (KEP, SING); Genting Sempah, 26 Aug. 1927, Strugnell, KEP 13614, (KEP); Bilut forest Reserve, 1 Oct. 1931, Sayid Ali, KEP 23467, (KEP); 1 Oct. 1931, Sayid Ali, KEP 23458, (KEP); Kuala Lompat, Krau Game Reserve, 19 Apr. 1970, Soepadmo, KLU 739 (KEP, KLU); s. l., 25 July 1891, Anon. 3173 (SING); **PERAK:** Gunung Bubu, Sg. Wang, 30 Aug. 1968, Selvaraj, FRI 6561, (KEP, SING); 27 Apr. 1968, Ng, FRI 6082, (KEP, SING); Manong, Kuala Kangsar, 31 Oct. 1958, Sinclair, 9909 (SING); Pondok Tanjong, 25 March 1924, Burkill & Haniff, KEP 13228 (SING); Kelau Tujoi, 1888, Wray, 1775 (SING); s. l., s. d., Scortechini, 3146 (SING); **SELANGOR:** Bukit Lagong FR., 4 Oct. 1960, Yong, KEP 94273, (KEP, SING); 10 March 1959, Omar, KEP 93370, (KEP); 13 Dec. 1956, Yong, KEP 84611, (KEP); 54 mile Gap road., 18 Aug. 1976, Kochummen, FRI 18397, (FRI); Weld hills Res. K. Lumpur, 4 March 1918, Abd. Rahman, KEP 2812, (KEP); 11 Sep. 1922, Omar, 8522, (KEP); 7 June 1918, Hamid, s. n. (SING); 30 Apr. 1919, Hamid, KEP 972 (KEP); 30 Apr. 1919, Burkill, KEP 972 (SING); Ulu Langat, 28 July 1959, Millard, KL 1628, (KEP); 24 Jan. 1959, Millard, KL 1353, (KEP, SING); Ulu Langat, Bukit Tangkol; K. Panson, 13 Jan. 1959, Millard, KL 1298, (KEP, SING); 5 Aug. 1958, Millard, KL 678, (KEP); Gombak, Dec. 1908, Ridley 137, (KEP); s. loc. & s. d., Anon. 135, (SING); Residency, K. Lumpur, 15 Jun. 1916, C.F. 590 (KEP).

7. *Madhuca malaysiana* Chantaranothai, Latiff & N. Omar (Of Malaysia)

Mal. Nat. J. 67(3)(2015) : 343-344

Vernacular name: unknown.

Distribution: Endemic to Peninsular Malaysia, only known from a few collections from Johor and Pahang.

Ecology: Low undulating seasonal swamp forest, flat land, sandy soil, in primary forest.

Specimens examined. **PAHANG** Chan, FRI 19984 (L, KEP, SING), Lesong Forest Reserve, 25 Jun. 1972; Pennington, Wong & Kamarudin Salleh FRI 10250 (L, KEP), Lesong Forest Reserve, Block 322, 2 Oct. 1981; Kamarudin Salleh FRI 28872 (KEP),

Lesong Forest Reserve, 1 Oct. 1982; Johor : Teo & Din KL 5054 (KEP), Segamat, Hutan Simpan Labis, 13 Aug. 2003; K. M. Kochummen FRI 16072 (KEP), Segamat, Labis Forest Reserve, Compartment 24A, 25 Jul. 1970; Matan KEP 94085 (KEP), Kluang, Labis Forest Reserve, 29 Jul. 1964.

Note: The specimens FRI 10250 and FRI 28872 were identified as *Madhuca* sp. C by Pennington, Wong & Kamarudin Salleh and the specimens FRI 19984 and FRI 16072 were identified as *Madhuca* sp. D by Ng whereas the specimen KL 5054 was identified as *Madhuca sericea* var. *sericea* by Teo and Din. All of them constitute *M. malaysiana* as defined above. This species is closely related to *M. malaccensis* but differs in having woolly twigs at tips, cuneate leaf base, impressed midrib above, a larger number of lateral veins, grooved and crested as well above, less number of flowers in each node and woolly pedicel and on the outside of the sepals.

8. *Madhuca whitmorei* Chantaranothai, Latiff & N. Omar
(In honour of T. C. Whitmore, British botanist)

Mal. Nat. J. 67(3)(2015) : 344-345

Vernacular name: unknown.

Distribution: Endemic to Peninsular Malaysia and known only from the type collection from Pahang.

Ecology: At altitudes to 1500 m high.

Note: *M. whitmorei* is closely allied to *M. penangiana* and *M. rufa* but differs from the former by its cuneate base, midrib is slender and raised above, the petioles shorter, the sepals puberulous on outside, glabrous inside, less ovary cells and shorter style. It differs from the latter by its elliptic leaves, glabrous below, lateral veins diminishing and becoming inconspicuous towards leaf margin, petiole glabrous, pedicel ferruginously puberulous and sepals ferruginously puberulous outside.

Specimens examined. JOHOR: Hutan Simpan Labis Segamat, 13 Aug. 2003, Teo and Din, KL 5054 (KEP); Compt. 24A, 25 July 1970, Kochummen, FRI 16072 (KEP); Kluang, 29 July 1964, Matan, KEP 94085, (KEP); **PAHANG:** Lesong FR., 25 June 1972, Chan, FRI 19984 (KEP, SING); Block 322, 2 October 1981, Pennington, Wong & Kamarudin Salleh FRI 10250 (KEP); 1 Oct. 1981, Kamarudin Saleh, FRI 28872 (KEP).

9. *Madhuca longistyla* (King & Gamble) H. J. Lam
(Latin, longi = long, styla = style, refers to long style).

Bull. Jard. Bot. Buitenz. 3, 7 (1925) 177; Lam, Bull. Jard. Bot. Buitenz. 3, 8 (1927) 460; van Royen, Blumea 10 (1960) 69; Ng, Tree Fl. Mal. 1 (1972) 407; Turner, Gard., Bull. Sing. 47 (1995) 464; Basionym: *Bassia longistyla* King & Gamble, J. As. Soc. Beng. 74, 2, Extra 17 (1905) 185; Ridley, Fl. Mal. Penin. 2 (1923) 270. **Type:** Peninsular Malaysia, Perak, Larut, Jan. 1882, King's Coll. 2680 (Holotype SING!).

Vernacular name: Ketiau.

Distribution: Endemic to Peninsular Malaysia but only known from Perak.

Ecology: Lowlands and freshwater swamps forest, probably at sea-level.

Uses: Source for the ketiau oil, which is used as manure and also finds an outlet as a worm killer in the lawns (Adinan & H. Abu Bakar 1988).

Notes: Only one specimen has mature fruits (Wahid Shamsudin et al., s. n. UKMB). This is possibly the first time this species has been collected with mature fruits since the type obtained by King. *M. longistyla* is closely allied to *M. korthalsii*, but differs from it by its much flowered inflorescences, the sepals nearly glabrous, the corolla smaller and glabrous on outside, the filaments and style are longer. Moreover the petioles are broadly grooved above.

Teluk Bahang, Jan. 1885, Curtis 1545 (SING); Jan. 1885, Curtis, 159 (SING); Batu Ferengi, 22 March 1901, Curtis, 2254 (SING); March 1901, Curtis, 3589 (SING); **PERAK:** S. Pangkor F.R., Pangkor Island 20 Feb. 1967, Whitmore, FRI 3067, (KEP); 1952, Wyatt-Smith, E 13, (KEP); Aug. 1952, Ibrahim Ismail, KEP 76015, (KEP); Pulau Rumbia Sembilan Island, 25 Jan. 1953, Anon. KEP 76567, (KEP); **SELANGOR:** Residency Kuala Lumpur, 15 June 1896, Hamid 590 (SING); **TRENGGANU:** Jambu Bongkok, 7 Oct. 1957, Anon. KEP 78559 (KEP) Bukit Kajang: Kemaman, 8 Nov. 1935, Corner, KEP 30335, (KEP, SING).

11. *Madhuca penangiana* (King & Gamble) H. J. Lam
(Of Penang, Peninsular Malaysia)

Bull. Jard. Bot. Buitenz. sêr. 3, 7 (1925) 168, Bull. Jard. Bot. Buitenz. sêr. 3, 8 (1927) 449; Ridley, Fl. Mal. Penin. 5 (1925) 319; van Royen. Blumea 10 (1960) 89; Ng, Tree Fl. Mal. 1 (1972) 408; Kartasubrata et al., PROSEA 5, 1(1993) 292; Turner, Gard. Bull. Sing. 47 (1995) 464. **Basionym:** *Bassia penangiana* King & Gamble, Journ. As. Soc. Bengal 74, 2, Extra 17, (1905) 188; Ridley, Fl. Mal. Penin. 2 (1923) 269.

Type: Peninsular Malaysia, Penang, Moniot Road., Curtis, 1450 (Holotype SING!).

Vernacular names: *Mempisang*, *Nyatuh*.

Distribution: Endemic to Peninsular Malaysia scattered throughout the north-western part of Peninsular Malaysia (Kedah, Penang and Perak).

Ecology: In primary forest, hillsides and ridge tops, at altitude 180-1220 m.

Uses: The timber is possibly used as *nyatuh*.

Nates: This species is closely related to *M. laurifolia* and *M. whitmorei*, see under those species.

Specimens examined. KEDAH: G. Jerai F.R. Trail to Padang Tok Sheikh, 27 Dec. 2012, Sani & Naser, SM 2404 (UKMB); May 1996, Saw, FRI 44625, (KEP); 13 March 2009, Chew, 67369 (KEP, SING); 27 July 1957, Kochummen, KEP 84903, (KEP); 30 March 1982 Kochummen, FRI, 29478, (KEP); 4 Aug. 1957, Kochummen, KEP 84903, (KEP); 7 March 1957, Kochummen, KEP 85147 (KEP); 4 March 1957, Kochummen, KEP 85102 (KEP); 2 Aug. 1957, Kochummen, KEP 85173, (KEP); 25 Apr. 1957, Kochummen, KEP 84811, (KEP); 7 March 1957, Kochummen, KEP 85165, (KEP); Kedah, Peak, June 1893, Ridley, 5506 (SING); Sik Catchment area, 22 Feb. 1960, Kochummen, FRI 80915, (KEP); Sungai Petani, 17 July 1996, L. E. Teo, KL 4608 (KEP); Peak, 10 Dec. 1962, Kochummen, KEP 99969 (KEP, SING); Peak, 23. May 1957, Kochummen, s. n., (KEP); H. S. Gunung Bungsu compt. 26, 24 Sep. 1967, Shofe bin Sood, KEP 90055 (KEP); Bt. Enggang, 5 July 1957, Kochummen, KEP 83508, (KEP); 5 July 1957, Kochummen, KEP 83527, (KEP); 10 July 1957, Kochummen, KEP 83576, (KEP); 11 July 1957, Kochummen, KEP 83827, (KEP); 1 July 1956, Amin and Omar, KEP 81225, (KEP); **PENANG:** Hill, Penang, 5 May 1938, Kiah, KEP 35354, (KEP, SING); Penara Bukit, March 1888, Curtis 1450 (SING); Waterfall, 24 Apr. 1924, Haniff and Nur, 3405 (SING); Tanjung Tokong, Feb. 1928, Haniff, 21123 (SING); Penara Bukit, Aug. 1893, Curtis 3063 (SING); **PERAK:** Kledang Saiong FR., Batu Gajah, 4 Apr. 1968, Ng, FRI 6034, (KEP, SING); Gunung Bubu F.R. 22 March 1971, Chan, FRI 19128, (KEP).

Sect. *Ganua* (Dubard) N. Omar & Latiff sect. nov.

12. *Madhuca kingiana* (Brace ex King & Gamble) H.J.Lam
(Sir George King 1840-1909, British botanist and sometimes superintendent of the Calcutta Botanic Gardens, India).

Bull. Jard. Bot. Buitenz. 3, 7 (1925) 159; Ridley, Fl. Mal. Penin. 5 (1925) 319; Pennington,

Gen. Sapot. (1991) 157; Kessler & Sidiyasa, Trees of Balikpapan-Samarinda Area, East Kalimantan (1994) 213; Turner, Gard. Bull. Sing. 47 (1995) 463; Coode, et al. Checklist of the Flowering plant & Gymnosperms of Brunei Darussalam (1996) 306. **Basionym:** *Bassia kingiana* Brace ex King & Gamble, J. As. Soc. Beng. 74, 2, Extra No. 17 (1906) 178. **Type:** Peninsular Malaysia, Perak, Larut, King's collector 3314 (holotype SING not observed).

Note. Many authors (e.g. van den Assem, 1953, van Royen, 1960, Chai & Yii, 2002) pointed out that the type specimen is in herbarium of Singapore Botanical Garden (SING), but the author failed to locate it when he visited that herbarium.

Synonym: *Ganua kingiana* (Brace ex King & Gamble) van den Assem, Blumea 7 (1953) 373-5, Ng, Tree Fl. Mal. 1 (1972) 399.

Vernacular name: *Nyatuh*.

Distribution: Sumatera, Borneo and Peninsular Malaysia. In Peninsular Malaysia, throughout Pahang, Perak, Negri Sembilan, Johor and Terengganu.

Ecology: In primary lowland and hill forests, sometimes by streams at altitude 18-420 m.

Uses: The timber is locally used as *nyatuh*.

Notes: This species is closely related to *M. sessiliflora*, see under that species.

Specimens examined. JOHOR: Ulu Endau Labis FR, 26 Mar. 1968, Cockburn, FRI 7924 (KEP, SING); 25 Mar. 1968, Cockburn, FRI 7916 (KEP, SING); 30 Mar. 1968, Cockburn, FRI 8012 (KEP, SING); 22 Mar. 1968, Cockburn, FRI 7876 (KEP, SING); 30 Mar. 1968, Ogata, FRI 105011 (KEP, SING); Labis FR., 13 Apr. 1967, Kochummen, FRI 2280 (KEP); Gunung Janing Barat, H.S. Labis, Endau, 25 Oct. 1985, Saw Leng Guan, FRI 34204 (KEP); N W Gunung Belumut upper Camp, 15 May 1968, Whitmore, FRI 8754, 8803 (KEP, SING); Gunung Panti F. R., 17 Nov. 1966, Ng, FRI 1675, 1682 (KEP, SING); 5 Mar. 1968, Cockburn, FRI 7825 (KEP); 6 Mar. 1968, Cockburn, FRI 7852 (SING); 18 Sep. 1963, Chew, 719 (SING); Arong FR Extension, Mersing, 28 Apr. 1967, Ng, FRI 5247 (KEP, SING); 24th mile Kota Tinggi Jemaluang Rd. 29 Apr. 1967, Ng, FRI 5284 (KEP); Lenggong FR., 10 May 1968, Whitmore, FRI 8653 (KEP, SING); 66 Kluang F.R. 12 July 1959, Hassan Mohd, KEP 92238 (KEP); Sg. Sarah, Mersing F. R., 17 July 1957, Embong Ismail, KEP 92273 (KEP); Bukit Tinjau Laut, 6 August 1939, Corner, s. n. (SING); **PAHANG:** Rompin, Ulu S. Anak Endau, 3 Apr. 1968, Cockburn, FRI 8045 (KEP, SING); Lesong F. R. Sg. Kemelai., 30 Sep. 1981, Pennington, Wong & Kamarudin Saleh, FRI 10240 (KEP); 30 Sep. 1981, Wong, FRI 32285 (KEP); Ulu Kuantan, s. d., Craddock, s. n. (SING); **PERAK:** NE from Kg. Ayer into G. Bubu Massif, 22 Feb. 1970. Everett, FRI 13942 (KEP, SING); Ijok F.R. 14 Feb. 1939, Landon, FRI 35729 (KEP); Chior FR., Lasah, S. Siput, 2 May 1955, Shamsudin, FRI 51281 (KEP); 22, Bintang Hijau F. R., 23 Nov. 1966, Rahim Ismail, KEP 98547 (KEP, SING); Chioh FR, K. Kangsar, 11 July 1967, Rahim Ismail, KEP 99819 (KEP, SING); Bujang Melaka F. R., 16 Oct. 2012, Naser Omar, NA 124 (UKMB); **TERENGGANU:** Compt. 5. Jerangau, 25 July 1955, Hashim, KEP 81138 (KEP).

13. *Madhuca aristulata* (King & Gamble) H. J. Lam
(Latin, *aristulata* = bearded, refers to the hairs at tips of stamens).

Bull. Jard. Bot. Buitenz. 3, 7 (1925) 167, Bull. Jard. Bot. Buitenz. 3, 8 (1927) 449; Ridley, Fl. Mal. Penin. 5 (1925) 319; van Royen, Blumea 10 (1960) 31; Ng, Tree Fl. Mal. 1 (1972) 404; Pennington, Gen. Sapot. (1991) 157; Turner, Gard. Bull. Sing. 47 (1995) 463; **Basionym:** *Bassia aristulata* King & Gamble, J. As. Soc. Beng. 74 (1906) 177; Ridley, Fl. Mal. Penin. 2 (1923) 266.

Type: Peninsular Malaysia, Perak, Gopeng, Scortechini 1984a (Isotype, SING!).

Vernacular name: *Nyatuh*.

Distribution: Endemic to Peninsular Malaysia, known from only three collections in Kedah and Perak.

Ecology: In primary forest, at low altitude.

Uses: The timber is probably used as *nyatuh* and gives good gutta-percha (Burkill, 1935).

Notes: This species is poorly known, and our knowledge is only based from a few collections. It is closely related to *M. malaccensis* but differs from it in having rather larger flowers, with the corolla tube densely filled with hairs, 26 stamens and the midrib is impressed.

Specimens examined. Kedah: Bukit Kuala Ketang, G. Bintang, 20 Apr. 1928, Haniff, 21122 (SING); Gunung Bintang, Forest Reserve, 8 Apr. 1968, Sidek bin Kiah, S. 286 (SING); Perak: Gopeng, 23 Sep. 1909, Scortechini, KEP 1984 (KEP).

14. *Madhuca hirtiflora* (Ridl.) H. J. Lam
(Latin, *hirtus*= hairy, *florus* = flower, refers to hairy flowers)

Lam, Bull. Jard. Bot. Buitenz. 3, 7 (1925) 160; Ridley, Fl. Mal. Penin. 5 (1925) 319; Lam, Bull. Jard. Bot. Buitenz. 3, 8 (1927) 444; Turner, Gard. Bull. Sing. 47 (1995) 463.

Basionym: *Bassia hirtiflora* Ridl., Ridley, Fl. Mal. Penin. 2 (1923) 266. **Type:** Peninsular Malaysia, Perak, Sungai Siput, Md. Haniff & Md. Nur, 6949 (Holotype SING!).

Synonym: *Ganua hirtiflora* (Ridl.) van Royen, Blumea 10 (1960) 112; Ng, Tree Fl. Mal. 1 (1972) 398.

Vernacular name: *Nyatuh*.

Distribution: Sumatera, Borneo and Peninsular Malaysia in the latter known from Johor, Pahang and Perak.

Ecology: Beside streams, in lowland dipterocarp forests, scattered in dry hillside forests, at altitudes below 150 m.

Notes: This species is closely related to *M. khoonmengii*, see under that species. Furthermore, this species is very distinctly characterised by large flowers and thick woolly indumentum of the flowers.

Specimens examined. JOHOR: Sungai Kemapan, Endau, Kluang Wildlife Reserve, 4 Sept. 1985, Saw Leng Guan, FRI 34167 (KEP); Along Sungai Jasin, H. S. Labis, 7 August 1985, Saw Leng Guan, FRI 34099 (KEP); Gunung Janing Barat, H. S. Labis, 6 August 1985, Saw Leng Guan, FRI 34083 (KEP); 14th mile Mawai-Jemalung Road, 9 Feb. 1935, Corner, FRI 29037 (KEP, SING); Labis FR., Ulu Endau, 25 Mar. 1968, Cockburn, FRI 7913 (SING, KEP); **PAHANG:** Ulu Sg. Penil, Lesong F.R., 1 Oct. 1981, Kamarudin Saleh, FRI 28867 (KEP); 1 Oct. 1981, Pennington, Wong and Kamarudin bin Saleh, FRI 10247 (FRI). **PERAK:** Kledang Saiong FR, Batu Gajah, 5 Apr. 1968, Ng, FRI 6066 (KEP, SING); N 4° 32.144' E 101° 00.244', Hutan Lipur Papan, 28 Dec. 2012, Naser Omar, NA 143 (UKMB); 4 May 1968, Ng, FRI 6059 (KEP, SING); Sungai Siput, 12 Dec. 1920, Hanif and Nur, 6949 (SING).

15. *Madhuca sessiliflora* van Royen
(Latin, *sessilis* = without stalk, *flora* = flower, refers to the flowers without stalk)

Blumea 10 (1960) 30; Ng, Tree Fl. Mal. 1 (1972) 410; Turner, Gard. Bull. Sing. 47 (1995) 464. **Type:** Peninsular Malaysia, Johor, Kluang, 14 Mile Mawai-Jemalung Road., 9 Feb. 1935, Corner 29024 (Holotype SING!, Isotype SING!).

Vernacular name: unknown

Distribution: Endemic to Peninsular Malaysia and only known from Johor.

Ecology: Drier part of swamp, lowland forest.

Notes: Only one specimen was in mature fruits (KEP s.n. barcode 161526). This is possibly the first time this species has been collected with mature fruits since the type obtained by Corner in 1935. *M. sessiliflora* is distinguished from other species by having sessile flowers,

but it remarkably resembles *M. kingiana* in leaves characters but differs in having chartaceous leaves, reticulate intercostal venation, corolla with 6 lobes, 12 stamens, ovary 5-celled and fusiform fruit.

Specimens examined. JOHOR: Kota Tinggi Jemaluang Rd., 29 Apr. 1967, Ng, FRI 5280, (KEP, SING); 29 Apr. 1967, Ng, FRI 5275, (KEP, SING); 29 Apr. 1967, Ng, FRI 5283, (KEP, SING); Buaya Sangkut falls, Bukit Sengongong, 28 March 1986, Wong & Saw, s.n., barcode 161526 (KEP); 13 ½ m.s. Mawai-Jemaluang Road, 8 Feb. 1935, Corner, 28994 (SING); 13 May 1935, Corner, 29429 (SING); S. Kayu, Jemaluang Rd., 24 June 1935, Corner, 29024 (SING); 24 June 1935, Corner, s. n. (SING).

16. *Madhuca utilis* (Ridley) H. J. Lam ex Heyne
(Latin, *utilis* = useful; refers to the usefulness of the timber)

Heyne, Nutt. Pl. Ned. Ind. 2, (1927) 1231; Lam, Bull. Jard. Bot. Buitenz. sér. 3, 8 (1927) 460; Masamune, Enum. Phan. Born. (1942) 592; van Royen. Blumea 10 (1960) 99; Ng, Tree Fl. Mal. 1 (1972) 411; Pennington, Gen. Sapot. (1991) 159; Kartasubrata et al., PROSEA 5, 1 (1993) 293; Turner, Gard. Bull. Sing. 47 (1995) 465; **Basionym:** *Payena utilis* Ridl., J. As. Soc. Str.Br.79 (1918) 94; Fl. Mal. Pen., 2 (1923) 265; Lam, Bull. Jard. Bot. Buitenz. sér. 3, 7 (1925) 150. **Type:** Peninsular Malaysia, Selangor, Ulu Selangor, 9. 4. 1914, Mhd. Hashim, 477 (Holotype, K).

Synonym: *M. stenophylla* Lam Bull. Jard. Bot. Buitenz. sér. 3, 7 (1925) 179; Ridley Fl. Mal. Pen. 5 (1925) 342; *Isonandra utilis* (Ridley) Baehni, Boissiera, 2 (1965) 84.

Vernacular names: *Betis*, *Saminai*, *Buah Seminai*, *Belian* and *Nyatuh*.

Distribution: Sumatra, Borneo and Peninsular Malaysia. In Peninsular Malaysia it is common and scattered throughout Johor, Pahang, Perak, Selangor and Terengganu.

Ecology: In primary forests, low undulating lowland dipterocarp forests, at altitudes to 150 m high.

Uses: The timber is used as bitis, for heavy constructional work, paving blocks, agricultural implements and turnery. Strugnell (1931) claimed *M. utilis* is rather difficult to work, opens a little but not to split and is easy to polish. Mee (1934) pointed out it to be a good timber for handles of changkul or hoes.

Notes: This species can easily be recognized by its leaves crowded at ends of twigs, obviously revolute margin, membranous and leaves glaucous below and the scar of seeds are very large where covering about third to half of seed surface.

Specimens examined. JOHOR: Bandar Tenggara, Sg. Linggiu Dam, 24 July 1991, Zainudin & Hamid, AZ 3706 (UKMB); 24 July 1991, Lesmy, FRI 35929, (KEP); 19 mile, Mawai-Temaluang Rd., 4 Jun. 1937, Corner, KEP 32992, (KEP, SING); Ulu Sedili FR. S. Lenggong, 22 Jun. 1968, Whitmore, FRI 12247, (KEP); Mersing, F. R., 14 May 1950, Anon., KEP 70146, (KEP); 18th miles Mersing Rd., 3 May 1921, Watson 5822 (syntype KEP!); Kota Tinggi, Sg. Butu., 4 Feb. 1950, Anon., KEP 52410, (KEP); Sungai Kayu, 10 Oct. 1936, Kiah, KEP 52410, (KEP); 10 Oct. 1936, Kiah 32019 (SING); 11 Apr. 1936, Corner, s. n. (SING); 8 m. s., Jemaluang Kluang, 30 Aug. 1967, Anon., 1625, 1626 (SING); **PAHANG:** Menjail F.R., G. Lesong, 1 Jun. 1920, Lambak, KEP 2747 (KEP, SING); Bolah FR. 18 July 1933, Arip, KEP 17210, (KEP); Sawak, Res. Ulu Rompin, 7 Aug. 1928, Soh, KEP 15483, (KEP); Sg. Bulah F. Res., 7 Apr. 1935, Omar, KEP 13323, (KEP); Ulu Sepayang Lesong Reserve, 19 July 1918, Henbery, KEP 1681, (KEP); Compt. 7, Baloh FR., Kuantan, 25 July 1966, Rahim Ismail, FRI 97914, (KEP, SING); Baloh Reserve Kuantan, 19 Nov. 1929, Soh, KEP 8187 (KEP); Compt. No. 8. Baloh F. Kuantan, 23 Sep. 1932, Awang, KEP 6641 (KEP); **PERAK:** Changkat Jong F. Res. Lower Perak, 27 Feb. 1968, Ng, FRI 5872, (KEP); 10 Sep. 1967, Ng, FRI 5664, (KEP); 2 Feb. 1916, Burgess, KEP 10835, (KEP); Trolak F.R. 15 March 1967, Kochummen, FRI 2224, (KEP); 12 Feb. 1937, Jaamat, KEP 43443, (KEP); Compt 1B. Tanjung Tualang FR., 10 Jun. 1939, Ismail Bin Shamsudin, KEP 45673, (KEP); K. Saiong Reserve, 21 Feb. 1934, Anon., KEP 33787, (KEP); 29 Dec. 2012, Sani & Naser.

SM 2400, (UKMB); Sungkai, RF., 1 March 1922, Harun, KEP 33787, (KEP); 1 March 1922, Harun C F. 7408 (KEP, SING); s. loc., Feb. 1916, Anon., CF, 2873, (KEP); Ayer Kuning, 21 Feb, 1916, Hashim 9 (SING); SELANGOR: Ulu Selangor, Rantau Panjang north F.Res., 26 Aug. 1960, Othman, KEP 70774, (KEP); 26 July 1918, Sanger Davis s. n. (SING); 5 Nov. 1930, Tachow, KEP 23232, (KEP); 9 Apr. 1914, Hashim, CF. 477, (KEP); Kepong, 28 Oct. 1930, Roger & Hamid, KEP 23627, (KEP); 20 Nov. 1930, Anon., KEP 23606, (KEP); Catchment area Reserve, 3 Nov. 1930, Long, KEP 21997, (KEP); Sungai Buloh Res., 8 March 1928, Jaamat, KEP 14941, (KEP); 23 July 1924, Anon., KEP 9582, (KEP, SING); Ulu Selangor, Bukit Cheraka FR. 16 Jun. 1959, Yaacob Bin Abdullah, KEP 70565, (KEP); Bukit Cheraka, FR., Kajang, 23 Oct. 1937, Klang, Anon., KEP 38164, (KEP); 21 July 1927, Strugnell, KEP 13107, (KEP); Ulu Selangor, 1909, Stephens s.n. (SING); Non-Dipterocarp Arboretum, FRI, Kepong, 11 sep. 1981, Pennington & Asri, FRI 10209 (KEP); Ulu Klang Catchment area, 19 May 1925, Hamid & Jaamat, KEP 10257, (KEP, SING); FRIM, Kepong, Sep. 1974. Loh FRI 021542 (KEP); Nursery, FRIM, 6 Feb. 1968, Ng, FRI 5830, (KEP); Kuala Lumpur, 26 Oct. 1916, Anon., 8 (SING); 10 Feb. 2001, Tan Hooi Mieng HM 002 (KLU); Ayer Hitam Reserve, Kajang, 3 Feb. 1931, Somerville, KEP 26371, (KEP); 3 Feb. 1931, Somerville, KEP 26372, (KEP); 3 Feb. 1931, Somerville, KEP 26374, (KEP); 9 Feb. 1931, Somerville, KEP 26378, (KEP); 9 Feb. 1931, Somerville, KEP 26379, (KEP); 12 Feb. 1931, Somerville, KEP 26380, (KEP); 12 Feb. 1931, Somerville, KEP 26381, (KEP); Kajang, 21 May 1918, Burgess, KEP 10836, (KEP); **TERENGGANU**: Compt. 24 Bukit Bauk, FR. Dungun, 20 Jun. 1967, Chelliah, FRI 104381, (KEP); Jambu Bongkok FR., 7 Oct. 1957, Anon., KEP 78557, (KEP); Virgin Jungle Reserve Compt. 9A., Bt. Bauk FR., 17 Jun. 1967, Whitmore, FRI 3897, (KEP); 24 May 2005, Sani Miran & Shamsul Khamis, SM 694 (UKMB); 24 May 2012, Naser, NA 102, 103 (UKMB); Compt. 23, behind Masjid Kampung Serdang, 24 May 2012, Naser, NA 101, (UKMB); Marang, 23 July 1951, Yusof bin Ahmad, KEP 67301, (KEP).

17. *Madhuca calcicola* Van Royen
(Latin, calci = calcium, cola = living, refers to living on limestone)

van Royen, Blumea 10 (1960) 96; Ng, Tree Fl. Mal. 1 (1972) 405; Turner, Gard, Bull. Sing. 47 (1995) 463 **Type**: Kedah, Langkawi, Tasik Dayang Bunting, 17 Nov. 1941, Corner, s. n. (Holotype SING!, Isotype SING!).

Vernacular name: unknown

Distribution: Endemic to Peninsular Malaysia, only known from Tasik Dayang Bunting, Langkawi, Kedah.

Ecology: In forest on limestone, at low altitude.

Notes: It is closely related to *M. tubulosa* and *M. latiffiana* but differs from both species in having intercostal venation densely reticulate, sepals puberulous on insides, corolla glabrous on outside, stamens 20-26, style filiform, 15-20 mm. Moreover, this species grows on limestone hill.

Specimens examined. Kedah: Langkawi, Tasik Dayang Bunting, 17 Nov. 1941, Corner, s. n. (SING); 6° 12' 26.52" N 99° 47' 03.99" E, 29 Nov. 2012, Naser, NA 140 (UKMB); 29 Nov. 2012, Sani & Naser, SM 2391 (UKMB); Langkawi, Batu Puteh, 20 Nov. 1941, Corner, s. n. (SING).

18. *Madhuca latiffiana* N. Omar
(In honour of Dato' Dr. A. Latiff, Botanist at Universiti Kebangsaan Malaysia).

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Vernacular name: *Nyatuh*.

Distribution: Endemic to Peninsular Malaysia, known only from Pahang and Terengganu

Ecology: In undulating land, lowland dipterocarp forest, at altitude up to 120 m high.

Note: Ng noted on KEP 77985, as possibly *Ganua* (*Madhuca*) sp. and it does not match any other collection he had seen. Pennington, Wong and Kamarudin bin Saleh identified the other specimens (FRI 10239, FRI 28869) as a possible new species but they did not publish it. The species is closely related to *M. tubulosa* in leaves morphology but differs by its woolly twigs, the flowers densely clustered and often appearing to be terminal, pedicel shorter, corolla glabrous and the ovary with 5-cells. Likewise *M. latiffiana* resembles *M. calcicola*, see under that species. However, the four specimens observed all have buds. Assuming if mature flowers are available the measurements for outer sepals, inner sepals and corolla would be a little bigger. For example, in *M. korthalsii* they are 5-6 x 4 mm, 5-6 x 3-4 mm and 6-9 mm long, respectively, in *M. pasohensis* they are 6-8 x 5-7 mm, 6-8 x 5-7 mm and 11 mm long, respectively and in *M. tubulosa* they are 3.5-6 x 3-5 mm, 4.5-5 x 3-4 mm and 6-7 mm long, respectively. As the buds of *M. latiffiana* are close to the size of those of *M. korthalsii*, we expect the size of outer sepals, inner sepals and corolla would be about those of *M. korthalsii*.

Specimens examined. PAHANG: Rompin, Margin of Game Reserve, Ulu Sungai Teroh, Lesong FR., 29 Sept. 1981, Pennington, Wong & Kamarudin bin Saleh, FRI 10239 (KEP); N. side of Gunung Lesong, 1 Oct. 1981, Kamarudin bin Saleh, FRI 28869 (KEP); **TERENGGANU:** Dungun, Bukit Bauk FR., Compt. 9/11., 2 Oct. 1957, Wyatt-Smith, KEP 77985 (KEP).

19. *Madhuca tubulosa* H. J. Lam
(Lat., tubulosa = tube-like, refers to tubular corolla)

Bull. Jard. Bot. Buitenz. sér. 3, 8 (1927) 456; van Royen. Blumea 10 (1960) 95; Ng, Tree Fl. Mal. 1 (1972) 411; Pennington, Gen. Sapot. (1991) 159; Turner, Gard. Bull. Sing. 47 (1995) 465. **Type:** Peninsular Malaysia, Johor, Ruyabong; May 1918, Hashim 1184 (Holotype SING!, Iso-lectotype KEP!, Syntype KEP!).

Vernacular names: *Nyatuh*, *Sundik*.

Distribution: Endemic to Peninsular Malaysia, known only from Johor, Pahang and Terengganu.

Ecology: In primary lowland dipterocarp forest, low undulating country and on ridge top primary forests, at altitude from 30 to 400 m high.

Uses: unknown

Notes: The type material in the Singapore herbarium is indicated as being collected by Foxworthy but the material in the Kepong herbarium as being collected by Hashim. It is difficult to ascertain the true collector since both collected in the same area, probably it was collected by both. This species resembles *M. calcicola* and *M. latiffiana* see, under those species.

Specimens examined. JOHOR: Penyabong, 9 May 1918, Hashim, KEP, 1184, (KEP); Panti, 27 July 1923, Bain, KEP 5998, (KEP); Labis FR. Ulu Endau, 30 March 1968, Ogata, FRI 110444, (KEP, SING); 30 March 1968, Cockburn, FRI 7989, (KEP, SING); Labis FR., compt. 285, Ulu Endau, 25 March 1968, Cockborn, FRI 7915, (KEP); Ulu Endau, 30 March 1968, Cockborn, FRI 7991, (KEP); Ulu Endau Johor/ Pahang Border, 31 March 1968, Cockburn, FRI 8021, (KEP); 31 March 1968, Cockburn, FRI 8030, (KEP); Ulu Endau, lower slope of G. Janing, 27 March 1969, Cockburn, FRI 7964, (KEP); Mersing, 3 Apr. 1968, Ogata, FRI 105043, (KEP, SING); summit of Bt. Kendok, Ulu Endau, 31 March 1968, Ogata, FRI 105020, (KEP, SING); Kluang FR. 31 Jan. 1966, Ng, FRI 97968, (KEP); Kluang FR. 3 Feb. 1968, Ng, FRI 98006, (KEP); Kluang, FR., 3 Feb. 1966, Ng, FRI 98008, (KEP); Kluang FR. 3 Feb. 1966, Ng, FRI 98012, (KEP); Sungai Jasin, H.S. Labis, 7 Aug. 1985, Saw, FRI 34100, (KEP, SING) Arong FR., Mersing, 27 Apr. 1967, Ng, FRI 5239, (KEP);

Arong FR., Mersing, 25 Apr. 1967, Ng, FRI 5196, (KEP, SING); Compt. 6, slope of G. Arong, Mersing, 23 Apr. 1967, Ng, FRI 5160 (KEP, SING); Labis FR., 17 Apr. 1966, Ng, FRI 1037, (KEP, SING); Kota Tinggi-Jemaluang Rd., 29 Apr. 1967, Ng, FRI 5285, (KEP); N. Johor NW Gunung Belumut, 15 May 1968, Whitmore, FRI 8816, (KEP, SING); Segamat Wild Life Sactuary Kuala Palong FR.N., 31 May 1970, Everett, FRI 14260, (KEP, SING); 1 Jun. 1970, Everett, FRI 14264, (KEP, SING);Kuala Kemapan Sungai Endau, at Kuala Kemapan, 5 Sep. 1985, Wong, FRI 30890 (KEP); Sungei Sarang Ketam, 3 Sep. 1985, Wong, FRI 30878 (KEP); 3 Sep. 1985, Wong, FRI 34163 (KEP); Kluang, Endau-Rompin S.P., Sg. Selai, G. Chabang, G. Chabang Tiga 25 Aug. 2007, Mohd Hairul, 58950 (KEP); Mersing FR. 4 July 1957, Jalil, KEP 77815 (KEP); Mersing, July 1957 Kochummen, KEP 77925, (KEP); **PAHANG:** Lesong F.R. Sg. Kemelai, 30 Sep. 1981, Pennington, Wong & Kamarudin Saleh, 10244, (KEP); 30 Sep. 1981, Pennington, Wong & Kamarudin Saleh, 10242, (KEP); 26 June 1972, Chan, FRI 19806, (KEP, SING); Bkt. Peta, Sungai Kemelai, Rompin, 30 Sep. 1981, Kamarudin Saleh, 28859, (KEP); **TERENGGANU:**Bukit Bauk FR., 20 Jan. 1967, Kochummen, FRI 2408, (KEP, SING); Bukit Bauk FR., 14 Nov. 1967, Kochummen, FRI 2612, (SING); Bt. Bauk VJR, Dungun, 14 May 1976, Chan, 25048 (SING); s. loc., 11 Dec. 1935, Vesterdal, 105 (SING); Bt. Bauk FR. Dungun, 15 May 1976, Chan, 25065 (KEP, SING).

20. *Madhuca palembanica* (Miq.) Forman
(Of Palembang, Sumatera, Indonesia)

In Coode et al. (Ed.), A Checklist of the flowering plants and gymnosperms of Brunei Darussalam (1996) 306; Argent et al., Manual of the larger and more important non-dipterocarp trees in Central Kalimantan, 2 (1997) 579; Chai & Yii, Tree Flora of Sabah and Sarawak 4 (2002) 254-257; **Basionym.** *Podocarpus palembanicus* Miq., Fl. Ind. Bat., Suppl. (1861) 252 & 589. **Type:** Sumatra, Palembang, Muardua, Teijsmann, 3891 (Holotype U, Isotype BO)

Synonym. *Ganua palembanica* (Miq.) van den Assem & Kostermans, Blumea (1954) 482; Lam, Blumea 8 (1957) 512; Anderson, Chklst. Trees Sar., (1980) 315

Vernacular names: *Nyatuh, Taban.*

Distribution: Known ony from Johor.

Ecology: Lowlands, Low undulating country, primary forest.

Uses: It is tapped for gutta-percha.

Note: Ng (1972) discriminated some specimens such as FRI 5245, (KEP); FRI 5248 (KEP); FRI 5251, (KEP); FRI 5253(KEP); FRI 5256 (KEP); KEP 77931, (KEP); KEP 84759, (KEP) and KEP 99238, (KEP) as *Madhuca* sp. B. Currently it is identified as *M. palembanica*, constituting a new record for Peninsular Malaysia, This species is amply distinguished from all other species by having narrow and long leaves.

Specimens examined. JOHOR Gunung Arong 9 Apr. 1999, Teo KL 4887, (KEP); , 27 Apr. 1967, Ng, FRI 5245, (KEP); Ng, FRI 5248, FRI 5251, (KEP); 28 Apr. 1967, Ng, FRI 5253, FRI 5256 (KEP); 28 Feb. 1952, Omar, KEP 77931, (KEP); 25 July 1957, Jamil bin Daud, KEP 84759, (KEP); 14 July 1961, Kochummen, KEP 99238, (KEP); 5 July 2012, Sani Miran & N. Omar SM 2313 (UKMB), 5 July 2012; N. Omar 107 (UKMB); 26 July 2012 Sani Miran SM 2314 (UKMB).

21. *Madhuca pasohensis* N. Omar et Latiff
(Of Pasoh Forest Reserve, Negeri Sembilan, Malaysia)

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Vernacular names: *Nyatuh gelugor* and *Sepol*.

Distribution: Endemic to Peninsular Malaysia, apparently confined mostly to Pasoh Forest Reserve and once collected from Senaling Forest Reserve, which is just outside Pasoh Forest Reserve, Negeri Sembilan

Ecology: In primary lowland dipterocarp forest.

Notes: Both the late Mr. K. M. Kochummen and Dr. J. F. LaFrankie first identified these specimens as a possible new species but they didn't publish and herein named after Pasoh Forest Reserve where it mostly occurs. It is easily recognized by the flowers which are large in size, pedicels and outer sepals which are glabrous, inner sepals which are tomentose (except along the middle line. It is related to *M. motleyana* but differs in having much larger flowers and the petioles broadly grooved. Perhaps it is closer to *M. barbata* of Borneo but differs from it in its loosely clustered, outer sepals completely glabrous, inner sepals tomentose outside, longer and glabrous corolla and hirsute ovary.

Specimens examined. NEGRI SEMBILAN: Pasoh Forest Reserve, 19 Apr. 1989, La Frankie, 7002, (KEP); 13 Sep. 1981, Kochummen, KEP 31526, (KEP); 2 March. 1974, Yap, SK 529, (KEP); 2 March 1976, Mat Asri, FRI 21665 (KEP, SING); 16 March 1976, Ang Khoon Cheng, FRI 23489 (KEP, SING); 14 June 1976, Ang Khoon Cheng, FRI 27505 (KEP, SING); Main trail PMT 20, 23 Oct. 1981, Ang Khoon Cheng, FRI 27758 (KEP); 30 Sep. 1966, Whitmore, FRI 871 (KEP); 6 Feb. 1938, Browne, 46057 (KEP); 10 March 2009, Wilkie, Imin, Chan, C. & Mohd. Nazri, PW 830, PW 834, (KEP); 12 March 2009, Wilkie, Imin, Chan and Mohd Nazri, PW 848, (KEP); 15 Nov. 2012, Naser & Abu Hussain, NA 137 (UKMB); Senaling F. Reserve compt No. 6, Kuala Pilah, 14 March 1950, Itam b. Atong, KEP 63855 (KEP).

22. *Madhuca curtisii* (King & Gamble) Ridl.

(Charles Curtis, 1852-1928, Horticulturist, Superintendent of Gardens and Forests, Penang, 1884-1903, great collector and founder of the Waterfall Gardens, Penang).

Ridley, Fl. Mal. Penin. 5 (1925) 319; Pennington, Gen. Sapot. (1991) 157; Kartasubrata et al. (eds.) PROSEA. 5, 1 (1993) 288; Turner, Gard. Bull. Sing. 47 (1995) 463; Coode, et al. Checklist of the Flowering plant & Gymnosperms of Brunei Darussalam (1996) 306.

Basionym: *Bassia curtisii* King and Gamble, J. As. Soc. Beng. 74, 2, Extra No. 17 (1906) 181. **Type:** Peninsular Malaysia, Penang, Government Hill, Curtis 1451a, (Holotype SING! & Lectotype KEP!).

Synonyms: *Ganua chrysocarpa* Pierre ex Dubard, Bull. Mus. Hist. Nat., Paris 14 (1908) 407, Lam, Bull. Jard. Bot. Buitenz. 3, 7 (1925) 130, Lam, Bull. Jard. Bot. Buitenz. 3, 8 (1927) 429; van Royen, Blumea 10 (1960) 111; *G. curtisii* (King & Gamble) Lam Bull. Jard. Bot. Buitenz. 3, 7 (1925) 126; Bull. Jard. Bot. Buitenz. 3, 8 (1927) 425; Van den Assem, Blumea, 7 (1953) 388; Ng, Tree Fl. Mal. 1 (1972) 397; Anderson, Chklst. Trees Sar., (1980) 315; *Isonandra curtisii* (King & Gamble) Baehni, Boissiera, 2 (1965) 84; *Bassia perakensis* King and Gamble, J. As. Soc. Beng. 74, 2, Extra No. 17 (1906) 183; *Madhuca perakensis* (King and Gamble) Ridl., Fl. Mal. Penin. 5 (1925) 319; *M. chrysocarpa* (Pierre ex Dubard) Ridl., Fl. Mal. Penin. 5 (1925) 342.

Vernacular name: *Nyatuh*.

Distribution: Johor, Penang, Pahang, Perak, Negri Sembilan, and Trengganu (Peninsular Malaysia), Borneo and Sumatra.

Ecology: In primary lowland forest, at altitude up to 500 m altitude.

Uses: The timber is probably used as *nyatuh*.

Notes: *M. curtisii* closely resembles *M. motleyana* but differs in having the midrib flat to slightly raised above, hardly prominent and rounded below the pedicels and sepals densely tomentose, sepal orbicular, ovary villous and fruits hairy.

Specimens examined. JOHOR: Compt. 5, Batu, Endau F. R., 15 July 1953, Anon. KEP 54224 (KEP); Kota Tinggi, Naui Heng Rub., Dec. 1925, Teruya, 301 (SING); 1930, Teruya,

1210 (SING); **PAHANG:** Ulu Sungai Anak Endau, 3 Apr. 1968, Cockburn, FRI 8104, (KEP, SING); 4 Apr. 1968, Cockburn, FRI 8124, (KEP, SING); 5 Apr. 1968, Cockburn, FRI 8154, (KEP); Game Reserve, Ulu Sengai Teroh, Lesong F. R., 29 Sept. 1981, Pennington, Wong & Kamarudin, Saleh, FRI 10238, (KEP); 29 Sept. 1981, Wong Khoon Meng, FRI 32278, (KEP, SING); **PENANG:** Penang Hills, Hill side, 5 May 1966, Ng, FRI 1055, (KEP, SING); 5 May 1966, Ng, FRI 1056, (KEP, SING); Highland reserve, Oct. 1900, Curtis, 3531, (SING); Apr. 1900, Curtis, 1451d, (SING); Government Hill, July. 1901, Curtis, 3536, (SING); July 1893, Curtis, 1451f, (SING); 25 Oct. 1900, Curtis, s n, (SING); Oct. 1890, Curtis, s n, (SING); Aug. 1941, Curtis, 1451, (SING); March 1893, Curtis, 1451a, 1451f, (SING); May 1893, Curtis, 1451c, (SING); Batu Feringgi, May 1901, Paul, s. n. (SING); **PERAK:** From Kg. Ayer into G. Bubu Massif, 19 Feb. 1970, Everett, FRI 13903, (KEP); Compt. 303, Kinta Hills F. R., 6 Oct. 1966, Ng, FRI 1645, (KEP); Sg. Wang, Bubu FR, 27 Apr. 1968, Ng, FRI 6088, (KEP); 27 Apr. 1968, Ng, FRI 6103, 6104, (KEP); 28 Apr. 1968, Ng, FRI 6108, (KEP); 27 Apr. 1968, Ng, FRI 6088, (KEP); Kledang Saiong F. R., 23 Feb. 1982, Wong, FRI 32363, (KEP); 29 Dec. 2012, Sani & Naser, SM 2401 (UKMB); 2 ¼ mile Maxwell Hill Road., 30 Oct. 1969, Kochummen, FRI 2918 (KEP, SING); Taiping, Waterfall hill, 1883, Wray, June 512, (SING); 1889, Wray, s n (SING); s. d. Wray, s. n. (SING); Taiping Perak, 19 Dec. 1923, De Zylva, 9609, (SING); Larut hills, Derry (Curtis 3695), (SING); 8 Nov. 2012, Fitri SM 2393 (UKMB); **TERENGGANU:** Jerangau, 5 July 1955, Mohd. Yusoff Bin Puteh, FRI 81056, (KEP).

23. *Madhuca motleyana* (de Vriese) J. F. Macbride
(James D. Motley, ?-1859; civil engineer and plant collector, mainly in Borneo)

Macbride, Contr. Gray Herb. Hav. Univ. n. s., 53 (1918) 18; Ridley, Fl. Mal. Penn. 5 (1925) 320; Pennington, Gen. Sapot. (1991) 158; Kartasubrata et al. PROSEA 5, 1 (1993) 297; Kessler & Sidiyasa Trees of Balikpapan-Samarinda Area, East Kalimantan (1994) 213; Turner, Gard. Bull. Sing. 47 (1995) 464. Argent et al. (eds.) Manual of the larger and more important non-dipterocarp trees in Central Kalimantan, 2 (1997) 578.

Basionym: *Isonandra motleyana* de Vriese, Nat. Tijds. Ned. Ind. 21 (1860) 308.

Type: Borneo, Kalimantan, Banjarmasin, Motley 857 (Holotype K! Isotype L!)

Synonyms: *Sideroxylon glabrescens* Miq., Fl. Bat., Suppl. (1860) 44; King and Gamble, Journ. As. Soc. Bengal 74, 2, Extra 17, (1905) 187; Ridley, Fl. Mal. Penn., 2 (1923) 271; *Payena latifolia* Burck, Annales du Jardin Botanique de Buitenzorg, 5 (1886) 58; *Payena rubropedicellata* Burck, Annales du Jardin Botanique de Buitenzorg, 5 (1886) 55; *Payena bankensis* Burck, Annales du Jardin Botanique de Buitenzorg, 5 (1886) 54; *Illipe motleyana* (de Vriese) Engl., Bot. Jahrb. 12 (1890) 509; *Ganua motleyana* (de Vriese) Pierre ex Dubard, Rev. Gen. Bot. 20 (1908) 202; Mirrill, J. Str. Br. Roy. As. Soc., Spec. No. (1921) 478; Lam, Bull. Jard. Bot. Buitenz. sér. 3, 7 (1925) 122, Bull. Jard. Bot. Buitenz. sér. 3, 8 (1927) 424; Heyne, Nutt. Pl. Ned. Ind. 2 (1927) 1230; Heyne, Nutt. Pl. Ned. Ind. 3 (1927) 1469; Masamune, Enumeratio Phanerogamarum Borneorum, (1942) 588; Van den Assem, Blumea, 7 (1953) 382; Van den Assem and Kostermans, Blumea, 8 (1954) 482; van Royen, Blumea 10 (1960) 112; Ng, Tree Fl. Mal. 1 (1972) 399; Anderson, Chklst. Trees Sar., (1980) 315.

Vernacular names: *Nyatuh Ketiau, Ketiau, Puiang, Bengku, Kehijau* or *Basong, Mengku* and *Nyatuh Paya*.

Distribution: This species is known from Sumatra (Belitung and Riau), Borneo, Thailand and Peninsular Malaysia. In Peninsular Malaysia common and scattered throughout Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu.

Ecology: In primary lowland forests and distributed from coastal freshwater forests, peat swamp forests and some collections were from heath forest at altitude from 60 to 360 m high. In Pahang, the Pekan Nenas Road Virgin Jungle Reserve. Dominated by *Campnosperma*.

Uses: *M. motleyana* produces moderately hard reddish nyatuh timber, suitable for making solid doors, cabinets and furniture. It also produces latex quite freely. The fat from seeds is used by local people for cooking and lighting.

Notes: This species is closely related to *M. curtisii* and *M. pasohensis*, see under those species.

Specimens examined. JOHOR: Tg. Penawar East, 22 Feb.1968, Cockburn, FRI 7609, (KEP); Mawai, 21 May 1934, Corner, KEP 28442, (KEP); Sungai Pendas, 14 Feb. 1937, Corner, KEP 32253, (KEP, SING); S. Plateau, H. S. Labis, 24 Apr. 1986, Saw, FRI 34219, (KEP, SING); Kirih, Mudah, Ulu Sg. Benut, 20 Jan. 1952, Zakaria B. Sulong, KEP 72904, (KEP); 14 mile Muar- Parit Ssulong Rd., 4 Jun. 1952, Abdullah Jaafar, KEP 74105, (KEP); Mersing, Gunung Arong FR., Compt. No. 27, 30 Jun. 1957, Salah bin Khalil, KEP 84620, (KEP); Sungai Tiram, 11 July 1954, Sinclair 40328 (SING); 6 July 1931, Hashim, 24921 (SING); Sg. Jenan, Aug. 1900, Ridley, 13489 (SING); Kampong Hubong, Endau, 14 July 1959, Kadim and Noor KN 288 (SING); Sungai Kayu, 23 Oct. 1936, Kiah 32154 (SING); Sungai Ban, 1894, Ridley, 6496, (SING); KEDAH: Yan Kechil, 6 Oct. 1944, Salih, KEP 8974, (KEP); **KELANTAN:** Kemahang FR. Tanah. Merah, 9 July 1960, Wan Hasan, KEP 84797, (KEP); 9 July 1960, Othman, KEP 93573, (KEP); **MALACCA:** Merlimau, 1892, Terry, 1026 (SING); **N. SEMBILAN:** Port Dickson, 19 May 1919, M. Loop, 0592 (SING); Pasoh F.R.18 Jun. 1919, Kinsey, KEP 1918, (KEP, SING); 11 March 2009, Wilkie & Imin, Pw 837 (KEP); 15 Nov. 2012, Naser & Abu Hussain, NA 139 (UKMB);Pengkalan Kempas, 19 May 1919, Usope, 592, (KEP, SING); **PAHANG:** Kuala Terpai, Chenai Res. Rampin, 18 Apr. 1919, Watson, KEP 3172, (KEP, SING); Tanjung Api, Kuantan, 18 Dec. 1920, Yeob, KEP 3605, (KEP, SING); Mile 3 ½ Pekan Nenas Rd. Virgin Jungle Reserve, 18 May 1967, Whitmore, FRI 3820 (KEP, SING); Fort Iskandar, Tasik Bera, 22 Jun.1968, Cockburn, FRI 10658 (KEP); Kuantan, 29 Sep.1933, Awang, KEP 17225, (KEP); Kuala Tasik, Temerloh. 16 May 1932. Faerander, KEP 26028, (KEP); Bukit Goh F.R.Kuantan, 19 July 1934, Ismail, KEP 29626, (KEP); Kemasul FR. Temerloh, 17 Aug. 1933, Temerloh, KEP 29958, (KEP); 8 Sep. 1933, Ahmad, KEP 29960, (KEP); 10 Feb.1936, Browne, KEP 40685, (KEP); 13 Feb.1936, Browne, KEP 40713, (KEP); Pinlas Salah. Ulu Rompin., 11 Jun.1935, Awang, KEP 31626, (KEP); Pekan Rd., Kuantan, 2 Jan. 1937, Jaamat and Saw, KEP 43195 (KEP); Pekan, Ulu Bebar, Anon., KEP 65669, (KEP); Ulu Sg. Belat, 13 Feb. 1951, Anon., KEP 65692, (KEP); Pekan, Meuchali F. Res. 13 Jun. 1952, Mohd. Bin Ngah, KEP 67628, (KEP); Kuantan, 3 ½ mile Pekan Nersi, 26 Sep. 1957, Anon. KEP 77961, (KEP); 2 Apr. 1964, A. Rahman Yusof, KEP 87267, (KEP); S. Land Batu, Pekan-Batu Balek, 1964, Awang Sulong, KEP 92705, (KEP); Compt. 6, Menchali F.R., Rompin, 2 Sep. 1966, Rahim Ismail, KEP 98917, (KEP, SING); PERAK: H. S. Pulau Tiga, 2 Sep. 1985, Saw, FRI 34067, (KEP);Sg. Perak,7 July 1947, Strugnell, FRI 57306, (KEP); State Land Bota Kiri, 19 Sep. 1947, Kinta, KEP 54693, (KEP); s. loc., 26 Sep. 1916, Anon., s n. (SING); **SELANGOR:** Telok F.R., Klang, 23 Feb. 1967, Ng, FRI 1963, (KEP); Telok F.R., Klang, 23 Feb. 1967, Ng, FRI 1968, (KEP); Telok F.R., Klang, 23 Feb. 1967, Ng, FRI 1971, (KEP, SING); 22 Apr. 1937, Anon., KEP 41662, (KEP);14 March 1967, Ng, FRI 1982, (KEP, SING); 23 July 1919, Hamid, KEP 3265, (KEP); 8 Oct. 1931, Watson, KEP 27071, (KEP); Bintang F.R. Klang, 7.Oct.1981, Pennington & Kochummen, FRI 10259, (KEP); Sungai Tinggi, Tanjong Karang, K., 16 Oct.1937, Nur, KEP 34107, (KEP, SING); Carey Island K. Langat, 27 Jan. 1937, Symington, KEP 43301, (KEP); Klang, Olak Lempit, 27 Apr.1937, Symington, KEP 43689, (KEP); Ulu Selangor, 22 Oct. 1958, Anon., KEP 71575, (KEP); Kuala Lumpur, 14 Aug. 1977, L. C. Lau, FRI 116239 (KEP); Sepang, Nov. 1941, Deuny s. n. (SING) ; Sepang, Nov. 1941, Derry, s. n. (SING); **TERENGGANU:** Marang, 20 Oct. 1937, Arnot, KEP 44785, (KEP); Jerangau. 21 July 1955, Oin Bin Ahmad, KEP 79852, (KEP); 25 July 1955, Abu Kassim bin Ibrahim, KEP 79874, (KEP); 21 July 1955, Abu Awid, KEP 81002, (KEP); 25 July 1955, Abu Ibrahim, KEP 81129, (KEP); 25 July 1955, Abu Ibrahim, KEP 81130, (KEP); 24 July 1955, Abu. Awid, KEP 81270, (KEP); 27 July 1955, Abu Kassim bin Ibrahim, KEP 81369, (KEP); 24 July 1955, Hashim b. Mansor, KEP 81409, (KEP); Sungai Pelek, Sep. 1950, Derry s. n. (SING).

24. *Madhuca kunstleri* (Brace) H. J. Lam
(H. H. Kunstler 1837-1887, the German explorer-botanist in Malaya)

Bull. Jard. Bot. Buitenz. sér. 3, 7 (1925) 158, Bull. Jard. Bot. Buitenz. sér. 3, 8 (1927) 444; Ridley, Fl. Mal. Penin. 5 (1925) 319; Masamune, Enumeratio Phanerogamarum Bornearum, (1942) 591; van Royen. Blumea, 10 (1960) 16; Ng, Tree Fl. Mal. 1 (1972) 406; Anderson, Chkfst. Trees Sar., (1980) 316; Pennington, Gen. Sapot. (1991) 157; Kartasubrata et al., PROSEA 5, 1 (1993) 290; Turner, Gard. Bull. Sing. 47 (1995) 464. **Basionym:** *Bassia kunstleri* Brace ex King & Gamble, Journ. As. Soc. Bengal 74, 2, Extra 17, (1905) 178. **Type:** Peninsular Malaysia, Perak, Larut, August 1884, King's coll. 6410 (syntype BM!). van Royen pointed out that type specimen is Kunstler s. n. (SING), but the author failed to locate it when he visited the Herbarium of Botanical Gardens of Singapore.

Vernacular name: *Nyatuh*.

Distribution: Endemic to Peninsular Malaysia known from Johor, Kedah and Perak.

Ecology: In primary lowland dipterocarp forest, at altitude from 245 to 1134 m.

Uses: The timber is possibly used as *nyatuh* or *bitis*.

Notes: This species is easy to recognize by its ovoid, tomentose nut and fruit calyx lobes suborbicular.

Specimens examined. JOHOR: Labis F. R., 15 Apr. 1966, Ng, FRI 1020, (KEP); Ridge top Gunung Belumut, 23 Sep. 1970, Suppiah, FRI 17831, (KEP); **KEDAH:** B. Kuala Bintang, G. Bintang, 18 Apr. 1928, Haniff, 21085 (SING); **PERAK:** Larut, August 1884, King's coll. 6410 (SING, KEW); Larut Hill, Tea Gardens, Oct. 1901, Derry & Curtis, 3694 (SING); June 1893, Ridley, 5536 (SING); Kledang Saiong FR, Batu Gajah, 4 Apr. 1968, Ng, FRI 6053, (KEP, SING); 23 Feb. 1982, Wong, FRI 32362, (KEP); 4 Apr. 1968, Ng, FRI 6047 (KEP); 29 Dec. 2012, Sani & Naser, SM 2402 (UKMB); Sg. Wang, Bubu FR, 27 Apr. 1968, Ng, FRI 6089 (KEP, SING); Anon, FRI 6090, (KEP, SING); 27 Apr. 1968, Ng, FRI 6095, (KEP, SING); 26 Jun. 1968, Saleh Mohd. Nor, FRI 6192, (KEP, SING); 29 Aug. 1969, Selvarraj, FRI 6551, (KEP, SING); s. d., Wray, 3201 (SING); Waterfall hill, Aug. 1888, wray, 2643, (SING); Maxwell's Hill, 18 Nov. 1968, Whitmore, FRI 12878, (KEP, SING); 25 Aug. 1971, Kochummen, FRI 16437, (KEP, SING); Taiping, 30 Oct. 1969, Everett, FRI 13590, (KEP, SING).

25. *Madhuca rufa* (King & Gamble) Van Royen
(Latin, *rufus* = reddish; refers to indumentum)

van Royen, Blumea 10 (1960) 55; Ng, Tree Fl. Mal. 1 (1972) 409; Turner, Gard. Bull. Sing. 47 (1995) 464; **Basionym:** *Isonandra rufa* King and Gamble, J. As. Soc. Beng. 74 (1905) 166; Ridley, Fl. Mal. Penin. 2 (1923) 261; Bull. Jard. Bot. Buitenz. 3, 7 (1925) 109, Bull. Jard. Bot. Buitenz. 3, 8 (1927) 421. **Type:** Peninsular Malaysia, Perak, Gopeng, King's Collector 4550 (Isotype SING).

Vernacular name: *Nyatuh*.

Distribution: Borneo and Peninsular Malaysia. In Peninsular Malaysia uncommon and known by a few collections from Perak.

Ecology: In lowland dipterocarp forests especially on low hills.

Notes: This species is poorly known, and our knowledge is based from two collections from Perak. This species is closely related to *M. whitmorei*, see under that species.

Specimens examined. PERAK: Kuala Kangsar, Keledang Saiong Reserve, 6 Feb. 1934, Sow, KEP 33624, (KEP); Parit FR., Kinta, 5 Apr. 1935, Symington, KEP 39457 (KEP).

26. *Madhuca penicillata* (King & Gamble) H. J. Lam
(Latin, *penicillata* = with tuft of hairs: refers to the hairs at the tip of stamens)

Bull. Jard. Bot. Buitenz. sêr. 3, 7 (1925) 166; Bull. Jard. Bot. Buitenz. sêr. 3, 8 (1927) 447; Ridley, Fl. Mal. Penin. 5 (1925) 319; van Royen. Blumea 10 (1960) 62; Ng, Tree Fl. Mal. 1 (1972) 408; PROSEA 5, 1(1993) 292; Turner, Gard. Bull. Sing. 47 (1995) 464. **Basionym:** *Bassia penicillata* King and Gamble, Journ. As. Soc. Bengal 74, 2, Extra 17, (1905) 179; Ridley, Fl. Mal. Penin. 2 (1923) 268. **Type:** Peninsular Malaysia, Pulau Pinang, Seberang Perai, Tasik Gelugor, Mar. 1902, Curtis 3737 (Holotype SING!)

Vernacular names: *Nyatuh* or *Melawis*, *Bunga sundik*, *Sundik Mayang* and *Minjato*.

Distribution: Endemic to Peninsular Malaysia and known from Kelantan, Negri Sembilan, Perak, Selangor and Terengganu.

Ecology: In primary lowland dipterocarp forest, hill side at altitude 60-180 m high.

Uses: The timber is possibly used as *nyatuh* or *bitis*.

Notes: *M. penicillata* resembles *M. sericea* but differs in having the large size flowers, large angle divergence of lateral veins and intercostals venation slender, main ones reticulate, minor ones transverse nervation often one nerve more distinctly developed and parallel to the secondary nerve, so this species has been badly confused with it.

Specimens examined. KELANTAN: Sg. Lebir, Betong, 14 Sep. 1967, Whitmore, FRI 4378, (KEP); Ulu S. Aring near K. Telong, 21 Sep. 1967, Whitmore, FRI 4455, (KEP, SING); Ulu Kelembai, Batu Mengkebang, 12 Nov. 1951, Abu Bakar, KEP 68314, (KEP); **N. SEMBILAN:** Pasir Panjang F. R., 26 Jan. 1967, Ng, FRI 1851, (KEP, SING); PERAK: Kg. Gajah FR., 23 Nov. 1958, Kochummen, KEP,31, (KEP); Slim River, 2 Dec. 1966, Ng, FRI 1807, (KEP, SING); 4 Apr. 1968, Ng, FRI 6056 (KEP, SING); 29 Dec. 2012, Sani & Naser, SM 2399 (UKMB); Pondok Tanjung, 7 Aug. 1934, Symington, KEP 37372, (KEP); Trolak F.R., 20 March 1967, Chelliah, KEP 104644, (KEP); SELANGOR: Sungai Buloh F.R., 11 Apr. 1918, Hamid, KEP 1580, (KEP, SING); Bukit Cheraka Res. Klang, 7 Aug. 1919, Yunus, KEP 3468, (KEP); 1 Jun. 1932, Anon. KEP 29214, (KEP); Compt. 27, 17 Oct. 1935, Symington, KEP 40754, (KEP); Compt. 106) Rantau Panjang FR., 18 Aug. 1933, Symington, KEP 32660, (KEP); **TERENGGANU:** Ulu Besut, Bt. Jebak Puyoh, 2 March 1968, Cockburn, FRI 8275, (KEP); Dungun, 24 July 1955, Mohd. Amin bin Ibrahim, KEP 79867 (KEP).

27. *Madhuca khoonmengii* N. Omar et Latiff
(In honour of Dr. Wong Khoon Meng, Herbarium Singapore Botanic Gardens.)

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Vernacular names: *Nyatuh*, *Nyatuh Tembaga*

Distribution: Endemic to Peninsular Malaysia; known only from Johor and Pahang.

Ecology: In lowland dipterocarp forest.

Notes: The specimens FRI 10234, FRI 32267, KEP 105161, KEP 70189 and KEP 93755 were identified as *Madhuca* sp. nov. separately by Pennington, Wong Khoon Meng, van Royen and Ng, but not published. This species is related to *M. elmeri* Merr. ex H. J. Lam known from Borneo and *M. hirtiflora*, but differs from the former in having rounded base, intercostal venation is reticulate near the margin, petioles, pedicels and filaments longer and petioles narrow-grooved above. From the latter the species differs in leaves elliptic, woolly below, pedicels shorter, flowers smaller, corolla glabrous without, ovary glabrous, with 10-celled and styles shorter.

Specimens examined: JOHOR: Kota Tinggi, Panti, FR., 20 July 1961, Jamaluddin Md. Isa, KEP 93755 (KEP); 14 Feb. 1950, Sulaiman Bin Manja, KEP 70189 (KEP); Rengam VJR J1, 22 Nov. 1973, Zainuddin Sohadi, FRI 021625 (KEP); Mersing, Tenggaroh FR., Logging area, 6 Apr. 1968, Ogata, KEP 105161(KEP). **PAHANG:** Bukit Ibam road Segamat-Kuantan highway junction, 28 September 1981, Pennington & Wong, FRI 32267 (KEP).

28. *Madhuca decipiens* Sinclair
(Latin, *decipiens* = misleading, refers to its status)

Gdns' Bull. Sing. 22 (1967) 215. **Basionym:** *Payena grandiflora* Ridley (in part) J. Roy As. Soc. Str. Br. 61 (1912) 28, Ridley Flora 2 (1923) 262. **Type:** Singapore; Sungai Murai, Ridley 6497 (K!)

Distribution: Known from Singapore, Sumatera and Peninsular Malaysia and in the latter restricted in Pahang, Johor and Malacca.

Ecology: In lowland dipterocarp forest at altitudes to 240 m.

Notes: This species is closely related to *M. selangorica*, see under that species.

Specimens examined. JOHOR: Kota Tinggi, Panti F. R., 14 Nov. 1950, Motan, KEP 53938 (KEP); 17 Nov. 1966, Ng, KEP 1726 (KEP); 17 Nov. 1966, Ng, FRI 1725 (KEP, SING); Ulu Kalang, 1 Jun. 1923, Holttum, KEP 10884 (KEP, SING); 8 Feb. 1968, Cockburn, FRI 7544 (KEP); Johor Lenggong FR., 10 May 1968, Whitmore, FRI 8655 (KEP, SING); 13 Jun. 1996, Teo & Tarelli, KL 4598 (KEP); Gunung Pulai, 24 Apr. 1922, Nur & Kiah S. F. N. 7785 (SING); Kluang, Gunung Belumut, FR., 11 Nov. 2010, Sani & Nik BG 3-3-5 (UKMB); 227 Aug. 2012, Sani & Nik SM 2315 (UKMB); **MALACCA:** Panchor, July 1893, Goodenough, 1268 (SING); **PAHANG:** G. Benom, Ulu Sg. Krau, 22 March 1967, Whitmore, FRI 3348 (SING).

29. *Madhuca selangorica* (King & Gamble) Sinclair
(Of Selangor, Malaysia)

Gard. Bull. Sing. 22 (1967) 217; Ng, Tree Fl. Mal. 1 (1972) 410; Pennington, Gen. Sapot. (1991) 158; Turner, Gard. Bull. Sing. 47 (1995) 464. **Basionym:** *Payena selangorica* King and Gamble, Journ. As. Soc. Bengal 74, 2, Extra 17, (1905) 175; Ridley, Fl. Mal. Penin. 2 (1923) 264; Bull. Jard. Bot. Buitenz. sér. 3, 7 (1925) 132; Bull. Jard. Bot. Buitenz. sér. 3, 8 (1927) 439; Bruggen, Blumea 9 (1958) 131. **Type:** Peninsular Malaysia, Selangor, Ayer Hitam Forest Res., Abdul Rahman 10527 (Holotype SING!, Isotype KEP!).

Synonym: *Madhuca dubardii* H.J Lam, Bull. Jard. Bot. Buitenz. sér. 3, 7 (1925) 162; Bull. Jard. Bot. Buitenz. sér. 3, 8 (1927) 444; van Royen, Blumea 10 (1960) 104.

Vernacular names: *Mentua taban*, *Taban manggis*.

Distribution: Endemic to Peninsular Malaysia and scattered throughout Selangor and only one specimen from Pahang.

Ecology: In Primary forest hillsides.

Uses: Unknown.

Notes: The species is closely related to *M. decipiens* Sinclair but differs from it in being small tree, twigs thinner c. 3-4 mm thick, leaves smaller, petioles shorter, the flowers smaller, the sepals rugose, corolla 8-lobed, stamens 16-17 and styles shorter and not crooked.

Specimens examined. SELANGOR: Bukit Lagong, Selangor, 28 Sep. 1959, Kochummen, KEP 153 A, (KEP); Seremban Dist. N. S., 10 Oct. 1923, Kinsey, KEP 9524, (KEP); Ampang, FR. 21 Feb. 1925, Hamid, KEP 9981 (KEP); 18 Sep. 1981, Pennington, Kochummen & Wong, FRI 10220 (KEP); 21 March 1970, Kochummen, FRI 16002 (KEP, SING); 20 July 1929, Symington, KEP 20200, (KEP); 4 May 1976, Kochummen, FRI 023189, (KEP, SING); 3 March 1982, Kochummen, FRI 29463, (KEP); 18 Sep. 1981, Kochummen, FRI 31524, (KEP); Bukit Tunggul, 16 March 1926, Strong, KEP 11115 (KEP, SING); 23 March 1926, Strugnell, KEP 11116 (KEP, SING); Sungai Lalang Kajang, 31 March 1930, Symington, KEP 24097, (KEP, SING); Bt. Lagong FR. 6 May 1947, Wyatt-Smith, KEP 63105, (KEP); Compt. No. 8., 11 Dec. 1956, Hamid bin Saad, KEP 81094 (KEP); Anon., 135 (KEP); Taman Paku Pakis UKM Bangi, 25 Sep. 2012, Naser Omar, NA 141 (UKMB); **PAHANG:** Raub, Feb. 1929, Symington, KEP 20203, (KEP).



Figure 7.1 Holotype of *M. erythrophylla* (Curtis 3652, SING)

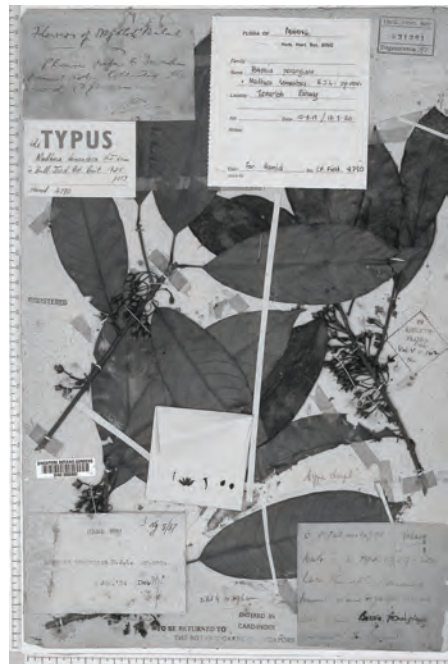


Figure 7.2 Holotype of *M. tomentosa* (Hamid 4790, SING)



Figure 7.3 Isotype of *M. sericea* var. *sericea* (Horsfield s. n., K)



Figure 7.4 Holotype of *Madhuca ridleyi* (Henderson, 25055, SING).



Figure 7.5 Lectotype of *M. malaccensis* (Griffith 3610, K)



Figure 7.6 Type of *M. korthalsii* (Korthals 687, BM)

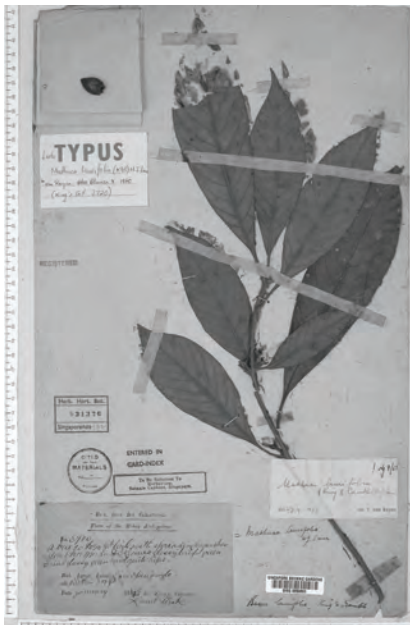


Figure 7.9 Holotype of *M. longistyla* (King 2680, SING)

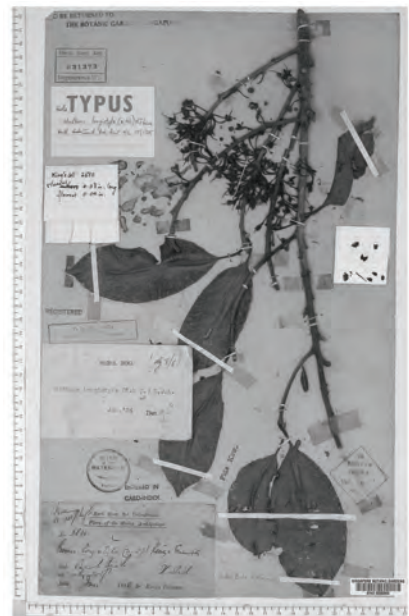


Figure 7.10 Lectotype of *M. laurifolia* (King 3720, SING)



Figure 7.11 Holotype of *M. penangiana* (Curtis, 1450, SING)

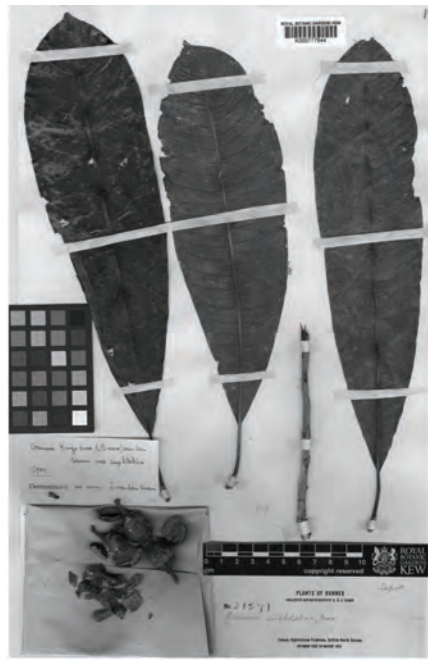


Figure 7.12 Type of *M. kingiana* (Elmer, 21571, K)

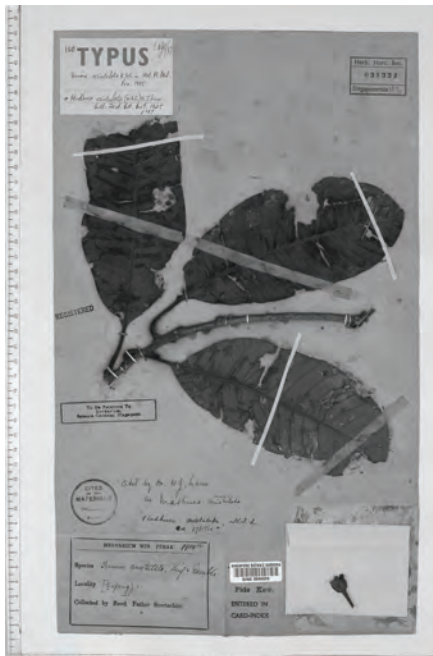


Figure 7.13 Isotype of *M. aristulata* (Scortechini 1984a, SING).

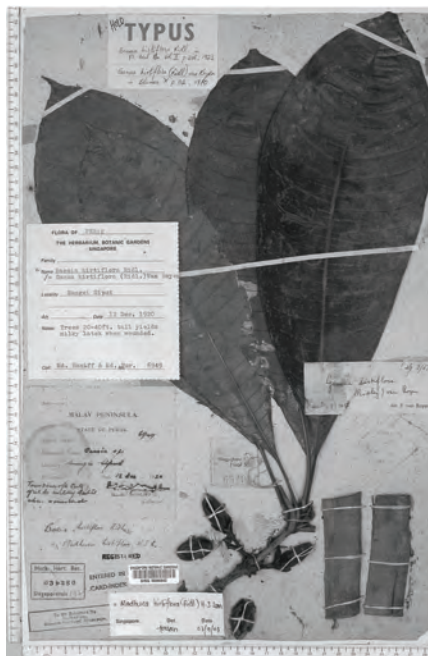


Figure 7.14 Holotype of *M. hirtiflora* (Hanif & Nur, 6949, SING).

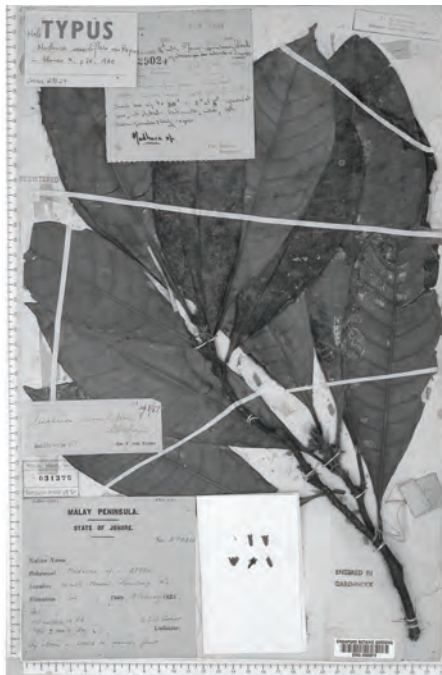


Figure 7.15 Holotype of *M. sessiliflora* (Corner 29024, SING)



Figure 7.16 Holotype of *M. utilis* (Hashim CF 477, K)

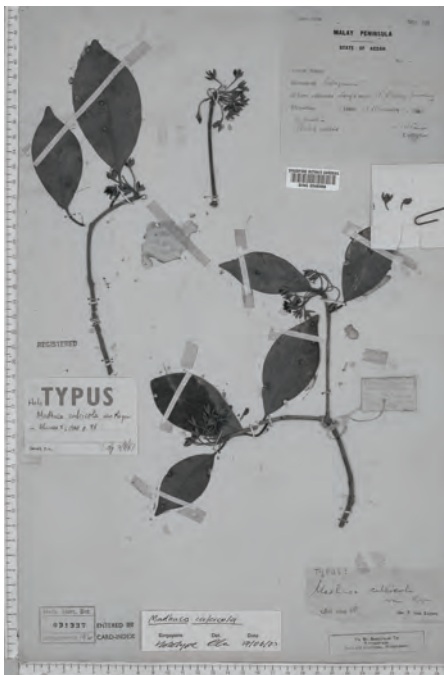


Figure 7.17 Holotype of *M. calcicola* (Corner, s. n., SING).

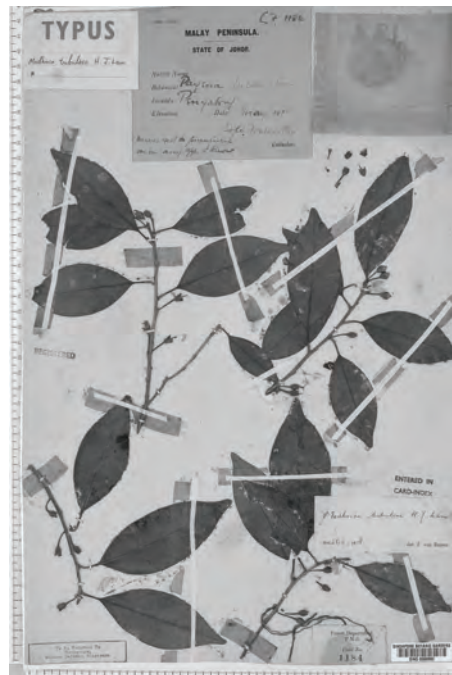


Figure 7.19 Holotype of *M. tubulosa* (Hashim 1184, SING)

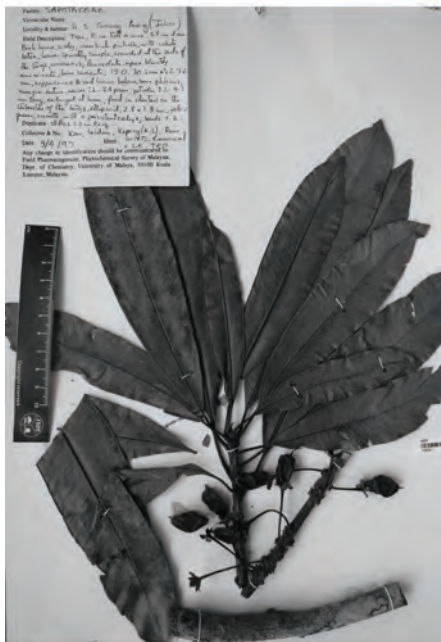


Figure 7.20 Habit of *M. palembanica*
(Teo, 4887, KEP)

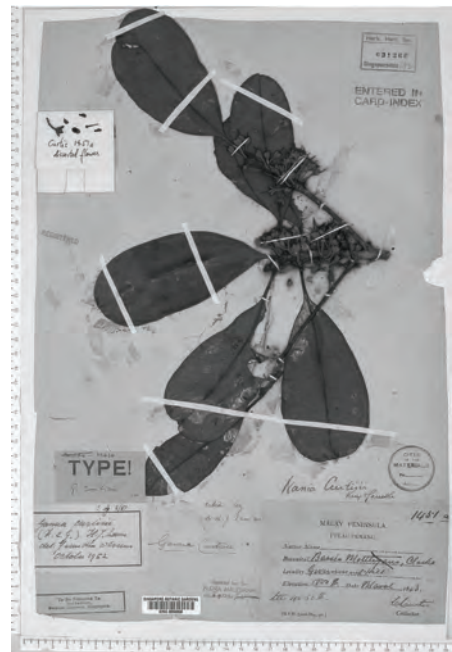


Figure 7.22 Holotype of *M. curtisii*
(Curtis 1451a, SING).



Figure 7.23 Isotype of *M. motleyana*
(Motley 857, K)



Figure 7.24 Syntype of *M. kunstleri*
(King's Coll. 6410, BM)



Figure 7.25 Type of *M. rufa*
(Sow, KEP 33624)



Figure 7. 26 Holotype of *M. penicillata*
(Curtis, 3737, SING)



Figure 7.28 Type of *M. decipiens*
(Ridley 6497, K)



Figure 7. 29 Holotype of *M. selangorica*
(Abdul Rahman 10527, SING)

SPECIES INSUFFICIENTLY KNOWN

1. *Madhuca cuprea* (King & Gamble) H. J. Lam, Bull. Jard. Bot. Buitenz. Sér. 3 (1925) 177.

Basionym. *Bassia cuprea* King & Gamble J. As. Soc. Beng. 74, 2, Extra 17 (1906)

2. *Madhuca obtusifolia* (King & Gamble) van Royen, Blumea 10 (1960) 51-52.
Basionym. *Bassia obtusifolia* King & Gamble J. As. Soc. Beng. 74, 2, Extra 17 (1906)

The above species were described by King and Gamble (1906) as *Bassia*. There are no voucher specimens in all the Herbaria visited, including K and L websites, probably they are at CAL, which the authors had not visited. Therefore, the authors and previous authors like Ridley (1923), Lam (1925) and Ng (1972) had not seen any materials of these species. Regarding *M. obtusifolia*, van Royen (1960) had claimed that the type specimens are in SING, K and CAL. but the authors had not seen them in SING, neither in K Website. The authors have decided to exclude these species from this treatment.

3. *Madhuca prolixa* (Pierre & Dubard) Yii & P. Chai, Gard. Bull. Sing. 53 (2001) 345
Basionym. *Ganua prolixa* Pierre & Dubard, Bull. Mus. Hist. Nat., Paris 14 (1908) 409
4. *Madhuca vulpina* Vink, Blumea, 46 (2001) 197

These two species were described from Borneo, but Yii and Chai (2001, 2002) pointed out that *M. prolixa* and *M. vulpina* also occur in Peninsular Malaysia. The authors were also unable to observe any materials of these species from any herbaria in Malaysia and Singapore, hence excluded also from this treatment. The authors also contacted Dr. Paul Chai (SAR), one of the above co-authors regarding the above but received no reply with regards to their recognition of *M. prolixa* and *M. vulpina*. Hence, the authors had to list the above species under this category.

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