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SERTULUM DIPTEROCARPACEARUM MALAYENSIUM—VI*

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Twelve species of *Shorea* of the *Balanocarpus* type

SUMMARY

In agreement with earlier suggestions by Symington, *Balanocarpus* is given up, it being an artificial genus. Many of its species are referable to *Shorea*. Of the latter, 12 species are treated, 7 of which are described as new.

EDITOR'S NOTE.—Dr D. F. van Slooten was steadily continuing his revision of the Dipterocarpaceae when his untimely death put a stop to this most useful and painstaking task. During the last few years of his life I had the privilege to be consulted by Dr van Slooten regarding certain aspects of his work and this has made me somewhat familiar with the present paper and some of its problems. As this valuable contribution was not yet ready for the press, I ventured to put it into a definite shape to make it available rather than to leave it unpublished. Therefore, the errors that it may contain are wholly my own responsibility.—M. A. DONK.

The genus *Balanocarpus* has been regarded as distinct by reason of its calyx lobes, which do not exceed the wooden nut but which enclose the very base of it, forming a five-lobed wooden cup by the equally though slightly enlarged strongly imbricate segments of the flowering calyx. Symington has called particular attention to the fact that it seemed to lack natural generic characters, viz. satisfactory and sharply marked distinctions from other groups, as was already superficially realised by his predecessors. A short summary of his study follows here.

In his "Notes on Malayan Dipterocarpaceae—I," Symington (*in* Gdns' Bull., Str. Settl. 7: 129, 153. 1933) dealt mainly with a number of species of *Shorea* from the Malay Peninsula and added to these *Balanocarpus multiflorus* (Burck) Sym., "which is more closely related to a group of *Shorea* including *S. Faguetiana* and *S. hopeifolia* than to some of the other species of its genus." This species was first described as *Doona multiflora* by Burck in 1887. At the same time Symington quite reasonably united with it *Richetia latifolia*, *R. oblongifolia*, *R. acuminata*, and *R. penangiana*, described by Heim in 1891 (*in* Bull. Soc. linn., Paris 2: 976, 979, 980).

* Part I of this series was published *in* Bull. Jard. bot. Buitenzorg III 16: 430-454. 1940; Part II, *in* Bull. bot. Gdns Buitenzorg III 17: 96-138. 1941; Part III, *ibid.* 17: 220-255. 1942; Part IV, *ibid.* 18: 229-269. 1949; Part V, *in* *Reinwardtia* 2: 1-68. 1952.

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The last-named species (the type of the generic name *Richetia* Heim) was referred by King (*in* J. As. Soc. Bengal 62: 131 *pl.* 2. 1893) to the older genus *Balanocarpus*, published by Beddome (*For. Manual Bot.* 237. 1873). Brandis (*in* J. Linn. Soc. 31: 112, 113. 1895) transferred *R. latifolia* and *R. acuminata* to this same genus and reduced *R. oblongifolia* to synonymy under *Balanocarpus latifolius*.

One year later, when studying the genus *Balanocarpus* again, Symington (*in* Gdns' Bull., Str. Settl. 8: 26-29. 1934) gave a short history of the genus and its species. Herein he states that workers such as "Trimen, King, Brandis, and Foxworthy, who have contributed largely to the motley collection of species now included in *Balanocarpus*, have all expressed dissatisfaction with the genus." As to this, Symington himself feels no more comfortable, as appears from his words (*op. cit.* p. 26): "The genus *Balanocarpus*, originally created for two wingless species related to *Hopea odorata* Roxb., has become the repository for dipterocarps of very diverse groups that have failed to conform to conventional generic definition by possessing, when in fruit, an accrescent calyx cup none of the lobes of which have developed into wings." And on page 28 he writes further, "that the disruption of the genus *Balanocarpus* is imminent and that it will be possible to distribute its members among various groups of *Hopea* and *Shorea*."

This disruption Symington carried on in 1938 (*in* Gdns' Bull., Str. Settl. 9: 330), referring five species of *Balanocarpus* to the genus *Shorea*. "I regret," he writes (*op. cit.* p. 319), "the necessity for these changes, but it is a necessity, and my apologies should rather be for not having made the changes sooner." I can fully subscribe to the necessity of this transfer, with the concomitant name changes. For, however important the structure of the fruiting calyx in the Dipterocarpaceae may be, it does not necessarily finally define the status of the genus. There exist several species in various genera with rudimentary wings which bridge the apparent gap between wingless-fruited and winged-fruited ones. Thus in many cases the aspect of the fruiting calyx does not form a valid criterion for separating genera (*Pachynocarpus* from *Vatica*, *Isoptera* from *Shorea*), nor is it a motive for splitting genera such as *Dipterocarpus*, *Dryobalanops*, *Shorea*, *Hopea*, and *Vatica* (section *Isauxis*), which all include wingless species.

Symington went even further and stated that a very close relationship exists between the five species of *Balanocarpus* mentioned above and certain winged-fruited members of *Shorea*, and that there is no essential difference between them. "Together they form a natural group which, for

convenience, I refer to as the *Richetia* group". This implies that the group is built up from wingless-fruited and winged-fruited species, a few of which may in some respects be atypical for it. It may be noticed that this *Richetia* group (meranti damar hitam group) does not have a taxonomic rank, which is the case too with other groups in the genus *Shorea*, referred to by him "somewhat non-comittally." He rightly observes that the allocation of these groups to "a definite botanical rank such as genus, subgenus, section, or subsection" has to be postponed "until a time . . . when a reliable taxonomic treatment of the genus *Shorea* will be produced" (*op. cit.* p. 331). This is the reason why Symington in his last publication (*in Mal. For. Rec.* 16. 1943) follows Desch (*in Mal. For. Rec.* 12: 1. 1936; 14: 1. 1941), who subdivides *Shorea* into groups forming distinct economic units which more or less may be defined botanically without having, however, a single character by which each group can be distinguished.

Table 1 gives an alphabetical list of the names that have been used under *Balanocarpus*, together with the species to which they are now accredited. The list shows that of the numerous names that have been used, only one, *Balanocarpus heimii* King, represents a well-known species still credited to this genus. However, it is doubtful if this anomalous species, which as chengal or penak is only known from the Malay Peninsula, should be retained under this generic name. *Balanocarpus heimii* "differs considerably from *Balanocarpus* as originally described by Beddome, but it is retained in that genus because its exact systematic position is yet uncertain" (Symington *in Mal. For. Rec.* 16: 147. 1943). It is taxonomically related to various species of *Hopea*; this view is supported by the anatomical structure of the wood (Desch *in Mal. For. Rec.* 14: 83. 1941). But botanists have not yet ventured to make the botanical transfer. The most obvious botanical difference is in the flower.

TABLE 1

List of specific names published under *Balanocarpus* and the species to which they are referable.

Balanocarpus

<i>acuminatus</i> (Heim) Brandis (1895)	<i>Shorea multiflora</i> (Burck) Sym. ¹
<i>acuminatus</i> Heim ² (1893)	<i>Balanocarpus heimii</i> King ³
<i>anomalous</i> King ⁴ (1893)	<i>Hopea ferrea</i> Laness. ⁵
<i>bancanus</i> Boerl. ⁶ (1901)	<i>Hopea bancana</i> (Boerl.) Sloot., comb. nov.
<i>brachypterus</i> Foxw. ⁷ (1918)	<i>Hopea brachyptera</i> (Foxw.) Sloot., comb. nov.
<i>bracteatus</i> (Burck) Merr., p.p. (1921)	<i>Hopea bracteata</i> Burck ⁸
<i>bracteatus</i> sensu Merr. (1921) et sensu Foxw. (1932)	<i>Hopea minima</i> Sym. ⁹

TABLE 1 (CONTINUED)

<i>brevipetiolaris</i> (Thw.) Alst. (1931)	See Note 10.
<i>cagayanensis</i> Foxw. ¹¹ (1918)	<i>Hopea cagayanensis</i> (Foxw.) Sloot., comb. nov.
<i>coriaceus</i> (Heim) Brandis (1895)	<i>Shorea richetia</i> (Heim) Sym. ¹²
<i>curtisii</i> King (1893)	<i>Hopea minima</i> Sym. ¹³
<i>erosa</i> Bedd. ¹⁴ (1873)	<i>Hopea erosa</i> (Bedd.) Sloot., comb. nov.
<i>grandifolius</i> Ridl., MS. in Herb. Kew. ¹⁵	<i>Shorea longiflora</i> (Brandis) Sym. ¹⁶
<i>heimii</i> King (1893)	<i>Balanocarpus heimii</i> King ³
<i>hemsleyanus</i> King (1893)	<i>Shorea hemsleyana</i> (King) King ex Foxw., p.p. ¹⁷
<i>latifolius</i> (Heim) Brandis (1895)	<i>Shorea multiflora</i> (Burck) Sym. ¹
<i>longiflorus</i> (Brandis) Foxw., MS. 1934 ¹⁵	<i>Shorea longiflora</i> (Brandis) Sym. ¹⁶
<i>maximus</i> King (1893)	<i>Shorea maxima</i> (King) Sym. ¹⁶
<i>multiflorus</i> (Burck) Sym. (1933)	<i>Shorea multiflora</i> (Burck) Sym. ¹
<i>ovalifolius</i> sensu Foxw., p.p. (1932)	<i>Hopea subalata</i> Sym. ¹⁸
<i>ovalifolius</i> Ridl., p.p. (1920)	<i>Shorea maxwelliana</i> King ¹⁹
<i>ovalifolius</i> Ridl., p.m.p. (1920)	<i>Hopea beccariana</i> Burck ¹⁹
<i>pahangensis</i> Foxw. (1932)	<i>Shorea balanocarpoides</i> Sym. ²⁰
<i>penangianus</i> (Heim) King (1893)	<i>Shorea multiflora</i> (Burck) Sym. ¹
<i>pubescens</i> Ridl. (1922)	<i>Hopea resinosa</i> Sym. ²¹
<i>sibogae</i> Boerl. (1901)	<i>Shorea multiflora</i> (Burck) Sym. ¹
<i>sphaerocarpus</i> Heim (1892)	? <i>Hopea</i> ²²
<i>utilis</i> Bedd. (1873)	? <i>Hopea longifolia</i> Dyer ²³
<i>wrayi</i> King ² (1893)	<i>Balanocarpus heimii</i> King ³
<i>zeylanicus</i> Trim. (1889)	See Note 10.

Notes.—

¹ See this paper p. 320.² *Balanocarpus acuminatus* Heim was described from Wray 813 (Perak), which was also the type for *B. wrayi* King, consisting of very incomplete material with an immature fruit. Ridley (Fl. Mal. Pen. 1: 247. 1922) united it with *B. heimii* King.³ In J. As. Soc. Beng. 62: 133. 1893.⁴ Evidently placed in this genus at a venture in the absence of fruiting material; it has been reduced to *Hopea* by Foxworthy (in J. Mal. Br. Roy. As. Soc. 5: 340. 1927; cf. also in Mal. For. Rec. 10: 126. 1932).⁵ Pl. utiles Col. franç. 330. 1886.⁶ Based on a tree from Banka and cultivated in the Botanic Gardens, Buitenzorg (= Bogor), sub No. VIII.D.48, from 1867 up till the present. In Boerlage's time it was an insufficiently known species owing to the absence of fruit. It ultimately turned out to possess a typical *Hopea* fruit; so there is no longer any doubt about the correctness of the transfer to that genus.⁷ *Balanocarpus brachypterus* from the Philippines "is clearly a close relative of *Balanocarpus curtisii* King" of the Malay Peninsula (cf. Symington in Gdns' Bull., Str. Settl. 8: 27. 1934). — See also Note 13.⁸ In Ann. Jard. bot. Buitenzorg 6: 239. 1887.⁹ Cf. Symington in Gdns' Bull., Str. Settl. 10: 337. 1939.¹⁰ Thwaites described a plant as *Shorea brevipetiolaris* (ex Trimen in J. Bot., Lond. 23: 205. 1885), which was reduced by Brandis (in J. Linn. Soc. Lond. 31: 108. 1895) to *Balanocarpus zeylanicus* Trim. (in J. Bot., Lond. 27: 161. 1889; Handb. Fl. Ceyl. 1: 130. 1893). Livera followed this (in Ann. Roy. Bot. Gdns. Peradeniya, 9: 96. 1924). Alston (in Trimen, Handb. Fl. Ceyl. 6, Suppl.: 26. 1931) transferred *Shorea brevipetiolaris* to *Balanocarpus*, which involved a change in name: *B. brevipetiolaris* (Thw.)

The species of *Shorea* treated below all belong to the *Richetia* group as distinguished by Symington, but all have fruits of the *Balanocarpus* type, the winged-fruited members having been left out of account, as is also the case with the atypical representatives of the group. They are twelve in number, seven of which are here described for the first time. Six of these new species of *Shorea* are Bornean ones and *S. conica* originates from Sumatra; but all consist of fruiting collections (only of *S. laxa* are the flowers also known). As fruits alone clinch the matter in fixing the "*Balanocarpus*" status, it is quite possible that among the inadequate and

Alst. Trimen himself had already placed it with some doubt in the genus *Balanocarpus*, "as the sepals are not found to form a hard woody 5-lobed cup as described. It may be doubted if it should find a place in the genus." As the description is very inadequate and Symington (*in Gdns' Bull., Str. Settl. 8: 26. 1934*) is of the opinion that *B. zeylanicus* "is possibly most closely related to *Hopea ferrea* Lanessan," I cannot judge of this question as I have not seen any material.

¹¹ "The character of wingless fruit was allowed to overshadow the fact that the flowers are almost identical with those of *Hopea philippinensis* Dyer and the many other characters that these species have in common."—Symington (*in Gdns' Bull., Str. Settl. 8: 27. 1934*). There is also a close relationship of the flowers to those of *Hopea mindanensis* Foxw. (cf. Symington, *op. cit.* p. 32).

¹² See this paper p. 325.

¹³ Symington (*in Gdns' Bull., Str. Settl. 8: 27. 1934*) considers *B. curtisii* a good species, but while removing it "to the genus *Hopea*, a new name must be sought because a *Hopea curtisii* (syn. of *H. sangal* Korth.) already exists" (cf. Symington *in Gdns' Bull., Str. Settl. 10: 337-338. 1939*).

¹⁴ The genus *Balanocarpus* was established by Beddome in 1873 with the species *B. erosa* and *B. utilis* from the Tinevelly mountains in southern Madras, both of which have a wingless fruit with the nut enclosed in a five-lobed woody cup. I have not seen either of them, but Symington (*in Gdns' Bull., Str., Settl. 8: 26. 1934*) says that "it may reasonably be doubted whether the creation of a new genus was justified." He thinks that both of the species are related to *Hopea odorata* Roxb.

¹⁵ Cf. Symington *in Gdns' Bull., Str. Settl. 8: 29. 1934*.

¹⁶ Cf. Symington *in Gdns' Bull., Str. Settl. 9: 330. 1938*.

¹⁷ *In Mal. For. Rec. 10: 167. 1932.* — Cf. also Symington *in Gdns' Bull., Str. Settl. 7: 129, 131. 1933*.

¹⁸ Cf. Symington *in Gdns' Bull., Str. Settl. 10: 339. 1939*.

¹⁹ Cf. Symington *in Gdns' Bull., Str. Settl. 7: 146. 1933; 8: 28. 1934; 9: 325, 326. 1938*.

²⁰ See this paper p. 340.

²¹ "It is shown that the species *B. pubescens* is more correctly referable to the genus *Hopea*. The transfer is here made and a new specific name 'resinosa' is chosen because a *Hopea pubescens* already exists" (cf. Symington *in Gdns' Bull., Str. Settl. 8: 278, 279. 1935*).

²² Very imperfectly known species. I have not had the opportunity of examining authentic material, and the description, based on Beccari 3021 (Heim, *Recherch. Dipt. 77. 1892*; Brandis *in J. Linn. Soc., Lond. 31: 113. 1895*), is insufficient to determine the genus. Moreover, Beccari 3021 is also recorded by Brandis (*op. cit.* p. 71) under the name *Hopea myrtifolia* Miq. Symington (*in Gdns' Bull., Str. Settl. 10: 349. 1939*) considers this a mistake and that it represents an undescribed species of *Hopea*. The duplication of numbers is not mentioned by Symington and it remains uncertain whether the specimen mentioned by Brandis under *Hopea myrtifolia* is the same as that which is the type of *B. sphaerocarpus* Heim.

²³ Reduced to *Hopea longifolia* Dyer by Trimen (*Fl. Ceyl. 1: 130. 1893*) and followed in this by Brandis (*in J. Linn. Soc., Lond. 31: 108. 1895*). — Cf. also Note 14. — *Hopea longifolia* also originates from the Tinevelly Mountains.

unidentified materials available, consisting of sterile or flowering collections, species are hidden which belong here.

SHOREA MULTIFLORA (Burck) Sym. — Fig. 1

Shorea multiflora (Burck) Sym. in Gdns' Bull., Str. Settl. 9: 330. 1938; Desch in Mal. For. Rec. 14: 27, 28 pl. 11 f. 3, pl. 14 f. 3. 1941; 15: 127. 1941; Symington in Mal. For. Rec. 16: 54 fs. 29, 33, 34. 1943.

Doona multiflora Burck in Ann. Jard. bot. Buitenz. 6: 234. 1887.

Richetia latifolia Heim in Bull. Soc. linn., Paris 2: 976. 1891.

Richetia acuminata Heim in Bull. Soc. linn., Paris 2: 979. 1891.

Richetia oblongifolia Heim in Bull. Soc. linn., Paris 2: 979. 1891.

Richetia penangiana Heim in Bull. Soc. linn., Paris 2: 980. 1891.

Balanocarpus penangiannus (Heim) King in J. As. Soc. Bengal 62 (2): 131. 1893; Brandis in J. Linn., Soc., Lond. 31: 109. 1895; Bruhl & King in Ann. Bot. Gdns Calc. 5 (2) 158 pl. 191B. 1896; Burkill in J. Str. Br. Roy. As. Soc. 81: 65. 1920; Foxworthy in Mal. For. Rec. 1: 66. 1921; Ridley, Flor. Mal. Pen. 1: 246. 1922; Foxworthy in Mal. For. Rec. 3: 58 2 pls. 1927; 8: 11. 1930; 10: 143. 1932.

Hopea multiflora (Burck) Brandis in J. Linn. Soc., Lond. 31: 60. 1895, non Foxworthy in Mal. For. Rec. 10: 119. 1932; Boerlage, Cat. Pl. Phan. Hort. bot. bogor. col. 2: 102. 1901.

Balanocarpus latifolius (Heim) Brandis in J. Linn. Soc., Lond. 31: 112. 1895; Foxworthy in Mal. For. Rec. 10: 145. 1932.

Balanocarpus acuminatus (Heim) Brandis in J. Linn. Soc., Lond. 31: 113. 1895.

Hopea multiflora (Burck) Brandis var. *venosa* Boerl., Cat. Pl. Phan. Hort. bot. bogor. col. 2: 102. 1901.

Balanocarpus sibogae Boerl., Cat. Pl. Phan. Hort. bot. Bogor. col. 2: 112. 1901.

"*Balanocarpus spec.* Nos. 21097 and 21309," Sloat. ex Merr., Pl. Elm. born. in Univ. Calif. Publ. Bot. 15: 200. 1929.

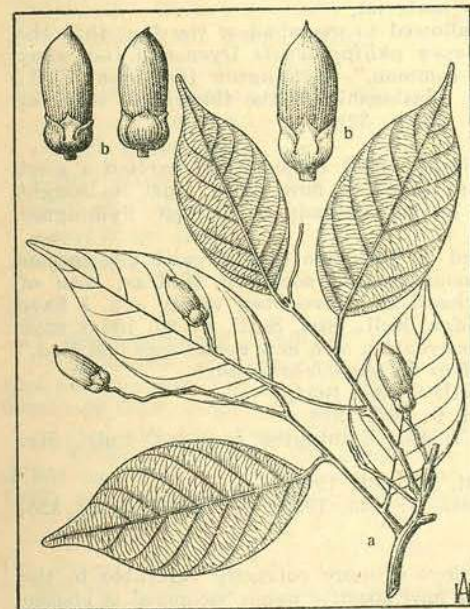


FIG. 1. *Shorea multiflora* (Burck) Sym.: a, fruiting twig ($\times 0.5$); b, mature fruits (nat. size). — After King's Coll. 3707 from Perak.

Balanocarpus multiflorus (Burck) Sym. in Gdns' Bull., Str. Settl. 7: 153 pl. 47. 1933; Desch in Mal. For. Rec. 12: 37, 38 pl. 6 f. 2. 1936.

TYPE.—Teijsmann 12063HB (in Herb. Kew.; in Herb. Bogor. sub no. 74641). — Illustrative specimens.—Curtis 1393, and VII.B.20 and 20a, cult. in Hort. Bogor.

Branches and branchlets dark-coloured, lenticellate, glabrous the very tips excepted. *Stipules* very small, caducous. *Leaves* coriaceous, usually ovate or ovate-oblong, but varying greatly in shape from elliptic to lanceolate, acuminate, but varying between attenuate and caudate, the acumen blunt or acute, 0.5—2.0 cm long (the leaves following the cotyledons have "remarkably long acuminations: these acuminations are so long that when the leaf is just expanding they make up one-half of its length, and at maturity one-third"—Burkill, *op. cit.* pp. 81, 65-66), the base cuneate or (sub)rounded, slightly unequal-sided, averaging about 7.0—9.0 × 3.0—4.0 cm or less, but variable in size (to 13.0 × 7.0 cm); upper surface glossy or slightly shining, usually drying to a greyish blue or a pale greenish colour, lower surface dull or hardly shining and mostly of a light (golden-) brown when dry, both surfaces glabrous; midrib not or hardly elevated above, (slightly) prominent beneath; main nerves 6—10 pairs, visible and usually slightly raised on both sides, but often very conspicuous on the lower surface, spreading and curved upwards near the margin; tertiary nerves rather obscure, partly originating from the midrib between and parallel to the secondary nerves, forming tertiary reticulations which are rather obscure above and hardly visible beneath, or clearly defined; domatia often present on the lower surface in a number of 1—4 in the axils of the two lowest pairs of nerves, very conspicuous, with a distinct glabrous ostium, or occasionally hardly developed, or (frequently) entirely absent; *petioles* slender, not thickened in the upper half, shallow-grooved above, glabrous, 0.75—1.5 cm long. *Inflorescences* axillary and terminal, solitary or sometimes in pairs, very fine and slender, rather lax, the panicles not overtopping the leaves, up to 6.0 and 8.0 cm long; axis and branches hoary-pubescent, glabrescent and dark-coloured; ultimate branchlets up to 8-flowered; bracts and bracteoles not seen. *Flowers* very small, pedicellate, elongate in bud, second, 5.0 mm long, when expanded 6.0 mm across; pedicels densely hoary-pubescent, about 1.0—1.5 mm long. *Sepals* subequal (the 3 inner slightly broader than the 2 outer), deltoid or broadly ovate, (sub)acute, about 1.0 mm long and wide, densely stellate-puberulous on the portions exposed in bud, glabrous inside, the 3 inner ones membranous at the edges. *Petals* much contorted in bud, linear, about 4.0 mm long and 1.0 (at the base 1.5) mm wide, the lower portion coherent, the upper two-thirds spreading when expanded, obtuse, the margins induplicate (boat-shaped), minutely puberulous outside, glabrous inside, many-nerved. *Stamens* 15, 2 rows of which are epipetalous, minute, of 3 different lengths, 0.5—1.0 mm long (excluding the appendage); filaments 0.3—0.5 mm long, partly flattened and dilated, partly filiform, anthers about 0.25 mm long, appendage of connective unbranched, curved, very thin, 0.35—0.5 mm long. *Ovary* ovoid, 0.5 mm long, at the base 0.5 mm in diam., minutely puberulous the base excepted, tapering into the very short, 0.5 mm long glabrous style. *Fruiting calyx-segments* equal in length, the 3 inner ones broader than the 2 outer, much shorter than the nut, closely embracing the lower third but quite free from it, forming a woody cup 4.0—7.0 mm high (including the teeth), thickened and concave at the base, the teeth chartaceous and free, deltoid, (sub)acute, sparsely stellate-hairy,

glabrescent; stalk 2.0 mm or less, sparsely stellate-hairy. *Nut* (ob) ovoid, ellipsoid or oblong, narrowing towards the apex and slightly apiculate by the remnant of the style, striate, greyish or pale brownish tomentose, 1.5—2.25 cm long, about 0.75(—1.25) cm wide.

Tree up to 58 m high, but with an average size of 30 m. *Trunk* straight, up to 30 m, exceptionally up to 35 m high, having an average length of 18 m, making up at least half the total height of the tree, but often two-thirds and sometimes even four-fifths of it; usually with small buttresses up to 3 m high and extending 2 m along the ground. *Crown* large, dense, spreading, with slender hanging branches. *Bark* (greyish-) brown- or dark-coloured, in transverse section yellow or yellowish-brown, not or shallowly fissured longitudinally, flaking off in large or in smaller pieces, which in Muaratewe (Centr. Dusun Distr., South-East Borneo) are said to be used by the Dyaks for the walls of their houses (bb.23053). *Inner bark* either with a small or with a large quantity of usually dark resin, which is black or (dark) brown, sometimes reddish, fading to dark if it is lighter coloured when fresh. This damar hitam or, as it is called by Forbes (2917) damar tjengal hitam, recorded by Endert in his "Hars-onderzoek" on page 295 (cf. van Slooten, Sertulum IV in Bull. bot. Gdns Buitenz. III 18: 229. 1949) under *B. multiflorus* Sym. and *Balanocarpus* (a), is according to him (in Tectona 18: 138. 1925) of inferior quality; it is used for caulking prahus (bb.23333) and, by the Dyaks, for lighting purposes (bb.23053). Burckley (in Mal. For. Rec. 11: 40-42. 1932) considers the tree liable to confusion with other trees bearing the name damar hitam-I (i.a. *S. resina-negra*), though the damar is quite different in composition and in its less black colour. After all, the name of damar hitam is applied to a group of dark-coloured resins. *Sapwood* (yellowish-) white. *Heartwood* yellowish, greyish-brown or reddish, sharply demarcated from the sapwood. In spite of Foxworthy, who considers the wood of *B. penangianus* to be apparently very little used (l.c., 1: 66) and not durable (l.c., 8: 11), the timber is fairly durable and according to Endert (in Tectona 18: 166. 1925) belongs to the 4th class of durability (bb.3112, 3113, and 3121). This soft hardwood is a yellow meranti, useful for pillars, planks, deck beams, telephone poles, furniture, ornamental work, supports for houses built in the river, prahus, etc. It is easy to fell, to split, to saw, and to plane, and it cracks, shrinks, and warps only slightly; it is moderately resistant to attack by sea and river pileworms, white ants, *Cryptotermes* sp., powderpost beetles, *Xylocopa*, and rotting. Leaves bright glossy green with a bluish tinge, pale green or yellowish green underneath. Inflorescences yellow with red. *Flowers* very abundant, giving the entire

crown a (pale or golden) yellow appearance. *Filaments* and *ovary* yellowish green. *Fruit* silvery grey.

It is impossible to discover any definite periodicity in flowering and fruiting. In the collections examined by me, *S. multiflora* has been found in flower from March to October—Foxworthy (*op. cit.*, 3: 59) adds to this January—and in fruit from May to March. One may believe that the tree may be found in flower and in fruit during every month in the year.

Shorea multiflora is usually a second storey tree of the dense jungle, found on dry rich soil in clayey (or rocky) localities growing along (steep) hill slopes, on top of hills or upon ridges; less often it has been found on flat land. It occurs rarely along or near water; in British North Borneo it is said (S.H.4458 and 4480) to be found 3—4 chains from the shore or from the edge of the mangrove, while Elmer (21097) says that it is known in Tawau from along upper reaches of tide water. Symington (*l.c.* 16: 54) says that "it has been recorded in low-lying, semi-swampy localities, but typically it is a hill form, inhabiting ridges at the lower levels of hill dipterocarp forest." The tree is usually of scattered occurrence from near sea level up to about 700—800 m, though it is mainly found at an altitude of 400 m or less, where it seems to reach its best development. In the surroundings of Panobasan (Tapanuli) it grows between 525 and 700 m above the sea, on P. Marsala the altitudinal limit is 175, on P. Penang 600 m. It is (fairly) common to (fairly) rare locally, sometimes even abundant, in which case it is more or less gregarious as on P. Marsala (bb.19359 sqq.), on the West-Coast of Sumatra (bb.23484 sqq.), in Sintang (bb.17604) in West and in Upper Dyak (bb.19998) in South-East Borneo. As regards the Malay Peninsula, *S. multiflora* is to be found throughout the peninsula, showing marked gregarious tendencies in hilly country, according to Desch (*l.c.* 12: 38; 14: 27); while Burckley remarks (*in Mal. For. Rec.* 11: 40. 1932) that damar hitam-II (*B. penangianus*) was once abundant in Penang (cf. also Burkill *in J. Str. Br. Roy. As. Soc.* 81: 65-66. 1920). According to Foxworthy (*op. cit.* 3: 58) in 1927 it was difficult to find in commercial sizes. Although the species is rather widely distributed, there are considerable areas where it seems not to be found. It is noteworthy that from Sarawak only the three *Richetia* types are known, based on Beccari materials and all originating from the G. Matang near Kuching, while in West Borneo only a couple of numbers have been collected which may safely be referred to this species.

Reliable names, which are locally in general use, are the following:

damar (h)itam: P. Penang, Perak, Selangor; Tapanuli (Angkola and Sipirok),

damar - or rasak tanduk: P. Marsala,

rasak - or suranti limau manis: West-Coast of Sumatra (Pariaman),

banjutan: British North Borneo (cf. also Keith *in* North Borneo For. Rec. 2: 12, 238. 1938).

For Malacca the name *singga* is recorded (a name also applied to certain species of the Burseraceae which produce a black resin), while Watson (*in* Mal. For. Rec. 5: 137, 162. 1928) mentions the names *singga betul*, *songi*, and *sungi*.

Regarding the typification of *S. multiflora* the following points are to be considered.

When Burck published and described *Doona multiflora* for the first time, he cited as specimens seen: "In Sumatra: Sibogha (Teysmann)," "In Hort. Bot. Bog. colitur." It may be assumed that this refers to Teysmann's collecting trip in the Sibolga district—where he collected from January 23 to February 6, 1856—and that he sent on that occasion living specimens to the Botanic Gardens at Buitenzorg. Burck's short description contains no indication as to which material he based his name on. At present two flowering branches are extant, one at Bogor and the other at Kew. The first (now sheet-number BO 74641) is accompanied by a label written by Burck and bears the legend "Cult. in Hort. Bog." The Kew specimen is provided with a number in the original HB-series, "HB 12063." Its label also has "Sumatra, Siboga, Cult. in Hort. Bog." It is peculiar that this HB-number is absent at Bogor and no duplicate is known to exist. Neither specimen, therefore, shows evidence that it was collected by Teijsmann *in loco* and it seems very probable that both numbers are twigs of the tree grown at Buitenzorg, which was 30 years old in 1887, the time that Burck described his new *Doona multiflora*. The original material from Sumatra seems to be lost. Actually, Boerlage stated long ago in his "Catalogus" (1901) that Teijsmann's specimens could not be traced in the Buitenzorg Herbarium and for that reason be placed, I presume, a question mark against Sumatra as the growing locality, notwithstanding Burck's clear statement.

Only after 1865 was a regular record kept of all plants and seeds received in the Gardens. Before that year no data are contained in the Garden files relating to the plants kept, whence they came, who sent them, or when they were received or where placed in the grounds. The tree, in Burck's time cultivated in the Buitenzorg Gardens, apparently never carried a garden-number and it is impossible to establish when it was

removed or died. It is certain that the other specimens of *S. multiflora* in the Bogor Gardens have no relation to the tree, referred to by Burck; this is proved by their garden-number.

In his "Catalogus" Boerlage mentioned "*Hopea Mengarawan* Hort. Bog., Bangka" as synonymous with *S. multiflora*, which species was called by him *Hopea multiflora* Brandis. Boerlage referred to a tree cultivated in the Bogor Botanic Gardens. It has been kept since 1892, bore the number VIII.D.31, and flowering twigs are preserved in the Bogor Herbarium. These specimens are labelled "Bdd. 89-34," a reference to the old garden books indicating that living material was sent as No. 34 in box No. 89 by Buddingh—who was at that time an interpreter at Muntok—from Bangka to Buitenzorg. The living specimens were received on August 21, 1867, and in the Herbarium they were identified it seems, as *Hopea mengarawan*, which is the reason for Boerlage's entry. In the Garden files, however, the specimen was entered as an *Aquilaria*, bearing the vernacular name mengarao, in accordance with some other *Aquilaria*'s sent in the same year by Buddingh from Bangka and which were known as mengarao and menkaras. It may be assumed that an error was made in the Gardens as regards the identity of the young tree. As regards the vernacular names mistakes are easily made. There is, I think, no reason to doubt the origin of the plant though I saw no other specimens from Bangka. In view of the facts that numerous dipterocarps occur on the island and that *S. multiflora* is comparatively common in a rather wide area of distribution, it is likely to occur on Bangka also.

Boerlage was not very successful when identifying dipterocarps. His inaccurate determinations quite naturally led him to assume the existence of "varieties" in order to explain away the discrepancies between his specimens and the descriptions by other authors he used when naming specimens. On the other hand, he was unaware—necessarily so, as he had only small ranges of specimens at his disposal—of the wide variability of some characters. He distinguished e.g. in *Hopea multiflora* Brandis a variety *nervosa*, which was said to have stouter nerves in the leaves than the remainder of that species. The type specimens of this variety *nervosa* Boerlage, a tree cultivated in the Bogor Gardens sub No. VIII.D.27, has nerves in the leaf which are certainly within the limits of variability shown by *S. multiflora*. — The place of origin of this tree is uncertain. Boerlage recorded with some reserve "Sumatra"; but the labels on the herbarium specimens contain no information on the point.

The variability of *S. multiflora* is illustrated by the publication of four species: *Richetia latifolia* Heim (based on Beccari 2892), *R. acuminata*

Heim (based on Beccari 2942), *R. oblongifolia* Heim (based on Beccari 2511), and *R. penangiana* Heim (based on Curtis 429). Regarding these species, Symington remarked (*op. cit.* 7: 153): "These four collections are undoubtedly all of the same species but are representative of the variation found in leaf size and shape." I am of the same opinion and should like to add that this variability is also found in the domatia which may be absent or present and in the latter case situated on the lower surface of the leaf close to the insertion of the petiole between the lowermost side-nerves. They are absent in Curtis 429, also absent in the paratype of *Doona multiflora* but present in the other type specimens, and, numbering one to four, may sometimes easily be seen but may also be hardly developed and even absent in many leaves, e.g. in the type specimen of *Balanocarpus sibogae*. Symington, however, does not mention domatia for *S. multiflora*. In his key of the meranti damar hitam group (*op. cit.* 16: 47. 1943) he even, quite incorrectly, considers *S. multiflora* as against *S. hopeifolia* to be a species with leaves "without intermediate nerves or domatia."

The similarity of *Hopea multiflora* and *Balanocarpus sibogae* to *B. penangianus* King was already stressed by Boerlage (*l.c.* pp. 102, 112) but he made no reduction. Boerlage had seen no fruits of *Hopea multiflora* and he was unacquainted with both fruits and flowers of *Balanocarpus sibogae*. This latter is cultivated in the Bogor Botanic Gardens (nos. VII.B.20 and 20a) and its origin is the Siboga district. Schwenk sent seedlings of dipterocarps to Bogor in 1855 (cf. Teysmann *in* J. bot. néerl. 1: 369. 1861). As place of origin only Pulu Marsala, an islet in the Bay of Tapanuli, is referred to. The name Boerlage gave (*B. sibogae*) and the record of the locality on the herbarium label ("Siboga") might indicate that the consignment originated from the part of Sumatra that is opposite Pulu Marsala. Nevertheless, the records indicate that Schwenk's plants came all from Pulu Marsala. The explanation may be that Pulu Marsala once formed part of some administrative unit or district called "Sibo(l)ga."

SPECIMENS EXAMINED.—MALAY PENINSULA.¹ Kedah (*Kep.* 8905, meranti legong; 27470). — P. Penang (*Kep.* 1844, 2470, 2562, 10846, and 11656; King's coll. 1534; Curtis 1: fl. Sept. 1884; Curtis = 1: fl. March 1901; Curtis 429: fr. Sept. 1885, type of *Richetia penangiana* Heim; Curtis = 429: fl. July 1901; Curtis 1393: fl. and fr. March—July 1888, July 1893, April anno?; Curtis = 1393: fl. and fr. March 1893, fl. March 1901; Curtis 3605; Sg.F.3142, 3145, 3264, 3284, 3293, 3348, 3403, 4369, 3492, 3714, 3748, 4573, 4650). — Perak. Larut Distr. (King's coll. 3707, 3333); Kuala Kangsar Distr. (*Kep.* 0114, rengkong); Kinta Distr., Keledang Saiong F.R. (*Kep.*

¹ Foxworthy was mistaken in his reference to the materials cited by him in 1932 (p. 121) to *Hopea multiflora* (Burret) Sym. According to Symington (1933, p. 154; *in* Gdns' Bull., Str. Settl. 8: 19, 21, 22, 26. 1934) they are a mixture of *H. semicuneata* Sym. and *H. sangal* Korth.

8843, 25428, 25449, 25508, 28982, 28983); Batang Padang Distr. (Kep. 4571, damar laut); Lower Perak Distr. (Kep. 27850). — Selangor. Ulu Selangor Distr. (Kep. 12954; Kep. 22073, rasak); Kuala Lumpur Distr. (Kep. 9971, 10819, 14830, 14831). — Negri Sembilan. Kuala Pilah Distr. (Kep. 1790; Kep. 12823, sungi). — Malacca (Kep. 2006, 2064). — Pahang. Kuantan (Kep. 8135, meranti bunga); Pekan (Kep. 15756, 15770, damar katop).

SUMATRA. A t c h i n. Singkel Distr. (bb.13664, tjako). — East-Coast. Langkat Distr. (bb.8652, semantoh; bb.25523, meranti merah); Asahan (Krukoff 241, damar semut). — Tapanuli. P. Marsala [Schwenk, anno 1855, type of *Balanocarpus sibogae* Boerl., cult. in Hort. Bog. sub Nos. VII.B.20 and 20a—see above; bb.17663 and 18613, (damar) kuro; bb.17664, damar simalut; bb.19365, 19375, and 19390, rasak bunga; bb.3766, 18700, 18701, 18714, 19344, 19359, 19370, 19378, 20211, 20212, 20441, 20442, 23333, 30225]; Sibolga Distr. (Teijsmann 12063HB, type of *Doona multiflora* Burck—see above; bb.26988, meranti piangin; bb.28186, meranti hursik; bb.28437, piangin); Angkola and Sipirok Distr. (bb.17667, 18625, and 23657, tupei or tupèh; bb.23966—23971). — West-Coast (Korthals 1340, in Herb. Lugd.-Bat.; Heyne s.n., damar itam); Lubuksikaping Distr. (bb.17693, kepala tupai); Ophir Distr. (bb.18721, ?rangau or rasak kuning); Pariaman Distr. (bb.23484 and 23489, rasak bamban; bb.23486—23488, rasak rabung; bb.23485, rasak kiau; bb.23490—23495); Padang Distr. (bb.19506, rasak bamban); Painan Distr. (bb.3112, rasak tundjang; bb.3113, rasak damar; bb.3116, mandirawan; bb.3121, rasak bungo). — Riouw. P. Karimon (bb.17230, 17342, and 21281, riung or riung daun halus). — Bencoolen. Seluma Distr. (bb.14551 and 15469, semurau). — Palembang. Rawas Distr. (Forbes 2917 and s.n.); Lematang Ulu (Grashoff 235, kemurau). — Banka (Buddingh: "Hoepa Mengarawan Hort. Bog.," cult. in Hort. Bog. sub No. VIII.D.31—see above).

BORNEO. British North Borneo (S.H. 66 and 9403, according to Keith in North Borneo For. Rec. 2: 92, 238. 1938.—Not seen by me). — East-Coast Res. Sandakan Kabili-Sepilok F.R. (S.H.4383 and 4452, sisilau; S.H.1857, 4714; S.H.-A.3525, -A.3584), Betotan (S.H.4471); Elphinstone Prov., Tawau (S.H.4480, selangan kacha; Elmer 21097, 21309); Semporna Distr., Pababag I. (S.H.4458, gagil). — Sarawak. G. Matang? (Beccari s.n.); G. Matang (Beccari 2892, type of *Richetia latifolia* Heim; Beccari 2942, type of *R. acuminata* Heim; Beccari 2511, type of *R. oblongifolia* Heim). — West Borneo. Sintang Distr. (bb.17604, rasak tembaga; bb.18692, bubuk). — South-East Borneo. Bulungan Distr. (bb.11658). — Kutei Distr. (bb.22913, berembuku). — Upper Dusun Distr. (bb.10941, mukut; bb.11124, djingaan or mahasulit; bb.20510, rasak gunung). — Central Dusun Distr. (bb.23506, karambuku pringit; bb.29688 and 29691, palèpèk djennah). — Upper Dyak Distr. (bb.19995, mukut; bb.19998, bingkirai). — Lower Dyak Distr. [bb.8164, 17391, 17654, and 19868, (damar) murau; bb.19956, damar mahambung; bb.19961, bunjit].

Cultivated in the Botanic Gardens, Bogor: VIII.D.27, type of *Hoepa multiflora* Brandis var. *venosa* Boerl., VII.B.20 and 20a, and VIII.D.31.—For all these, see above.

2. *Shorea induplicata* van Slooten, *spec. nov.*—Fig. 2

TYPE.—For. Dept. Sarawak A.0582.

A congeneribus foliis lanceolatis, marginibus valde revolutis, paginae inferioris indumento scabro fructibusque subglobosis vel obovoideis facile distinguenda.

Branches pale or greyish brown, sordidescens, scabrous stellate-tomentose, glabrescent. *Stipules* not seen. *Leaves* coriaceous, lanceolate or ovate-lanceolate, acuminate, the acumen usually acute, up to 1.0 cm long, the base rounded, slightly unequal-sided, the margins strongly revolute, 9.0—14.0 cm long, 2.0—3.5(—4.0) cm wide; upper surface slightly shining,

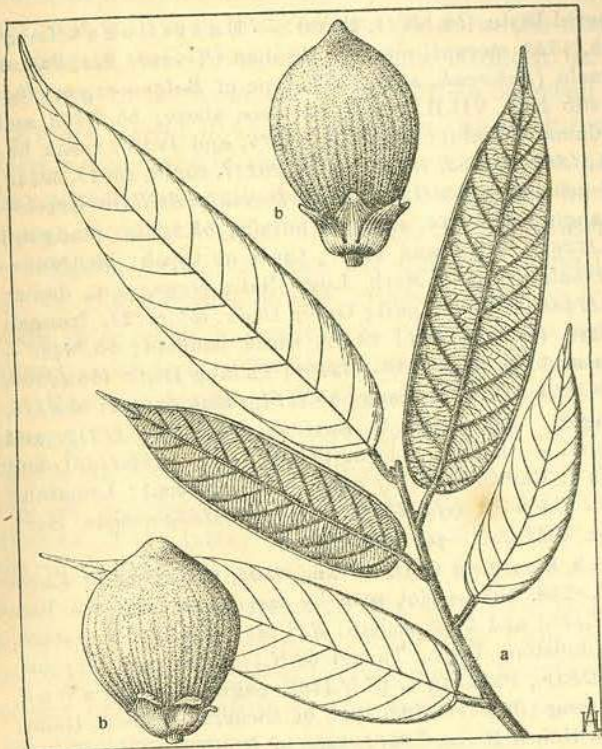


FIG. 2. *Shorea induplicata* Sloot.; a, sterile twig ($\times 0.5$); b, mature fruits (nat. size). — After A.0582 from Sarawak.

usually drying to a greyish blue or a greenish colour, glabrous, lower surface dull, brown or pale brown, scabrous and apparently lepidote owing to very small tufted hairs on midrib, veins and reticulations; midrib slightly sunken above, prominent beneath, curved upwards near the margin; tertiary nerves parallel and conspicuous beneath; domatia absent; *petioles* thickened over almost the whole length, scabrous as are the branches, 1.0 cm long or somewhat less. *Flowers* unknown. *Fruiting calyx-segments* subequal in length, the 3 inner ones slightly longer than the 2 outer, much shorter than the nut, embracing the lower fourth but quite free from it, forming a woody cup about 7.0 mm high (including the teeth), thickened and concave at the base, the teeth chartaceous

and free, subpatent and sometimes slightly reflexed, deltoid, obtuse, glabrescent; stalk 1.0 or 2.0 mm long. *Nut* subglobose or obovoid, attenuate in the upper third, blunt at the top, striate, fulvous-tomentose (red and velvety when fresh: For. Dept. Sar. A.0582), about 2.5 cm across or 2.5 cm long and 2.0 cm wide.

This Bornean species, imperfectly known by the absence of flowers, seems to be rather rare and collections are very few. It was first collected in 1933 in the Sanggau District of West Borneo; this specimen was in leaf only. The fruiting specimen obtained in 1935 in Sarawak is now selected as the type of this species, which is a typical member of "*Balano-*

carpus," but a very peculiar one. It has such distinctive leaves that it can be described as new with confidence.

Shorea induplicata was first collected under the name tengkujung (bb.17608), and mentioned in 1935 by Endert in his "Harsonderzoek" under the black resins as *Shorea* (j) (p. 50) and in the "Voorloopig Rapport" of 1937 as *Shorea* (87) (p. 13). According to the field notes of bb.17608 the bark contains a large quantity of resin. This damar tengkujung¹ is black when young, but becomes greyish when old.

SPECIMENS EXAMINED.—BORNEO. Sarawak. Sempadi For. Res. (near Lundu), low hill (*For.Dept.Sar. A.0582*, fr. Aug. 1935, lon kuning; tree, 21 m high). — Judging from an annotation by Symington in *Herb. Kepong*, the species was also found near Lundu by *Foxworthy* (*Bur. Sc. 13*), in swampy land, 3.0—4.0 m above sea level; vern. name mangbesi. "Extraordinary engkabang from Sarawak . . . with large 'balanocarpus'-fr.; leaves hairy beneath and recurved along the margins. Young branchlets red tomentose to lanate." I have not seen this specimen. — West Borneo. Sanggau Distr., Pampang Dua, primary forest on hilly ground, sand, 20 m (bb.17608, tengkujung; tree, 23 m high, trunk about 17 m; very common, but growing scattered).

3. *Shorea collaris* van Slooten, *spec. nov.*—Fig. 3

TYPE.—bb.20650.

Species nova, *S. multiflorae* (Burrk) Sym., *S. induplicatae* Sloot., etc. *e sectione Richetia fructibus exalatis valde affinis, sed fructuum dimensionibus, calyce fructifero nucem basi non arcte circumcludente laciniisque patentibus collare efformantibus facile cognoscenda.*

Branches and branchlets brown, lenticellate, glabrous. *Stipules* not seen. *Leaves* chartaceous, ovate-oblong, from below the middle attenuate and acuminate, the acumen usually acute and up to 0.75 cm long, or the margins parallel and caudate-acuminate at the apex, the base rounded or one-sided subcuneate, the margins slightly revolute, 9.0—12.0 cm long, 3.0—5.0 cm wide; upper surface shining, drying to a greyish blue or a brownish grey colour, lower surface dull or slightly shining, pale brown when dry, both surfaces glabrous; midrib only slightly sunken above, prominent beneath; main nerves 9—11 pairs, scarcely raised on the upper surface, prominent beneath, curved upwards near the margin; tertiary nerves parallel and visible on both sides, reticulations often punctate; domatia absent; *petiole* slender, the very base thinner than the upper portion, glabrous, 1.0—1.5 cm long. *Flowers* unknown. *Fruiting calyx-segments* about equal in size, much shorter than the nut, not closely embracing the very base but surrounding it as a detached collar, the teeth patent the tips of which are reflexed, deltoid, about 7.5 cm long and wide at the base, the basal portion woody and thick, glabrous; stalk 2.0 mm or

¹ Not to be confused with the damar tangkujung named by Schuitemaker (*in Tectona* 26: 232, 1933) and originating from Sanggau, Sekadau, Tajan, and Meliau in West Borneo, which probably represents *S. faguetiana* Heim (cf. Endert, *op. cit.* p. 52).

less. *Nut* obovoid or ellipsoid, attenuate in the upper third, slightly apiculate by the basal remnant of the style, narrowed at the base, striate, fulvous-tomentose (greyish when fresh: bb.20650), 2.5—3.0 cm long. 2.0 (or only 1.5) cm wide.

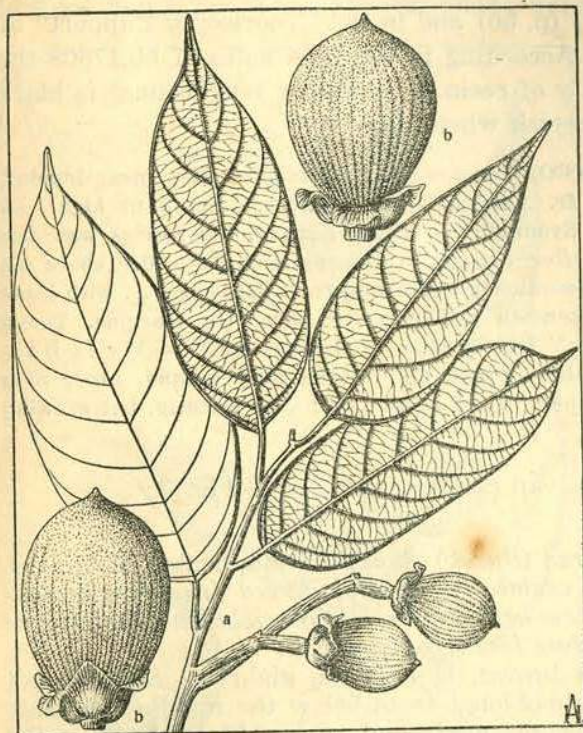


FIG. 3. *Shorea collaris* Sloot.: a, fruiting twig ($\times 0.5$); b, mature fruits (nat. size). — After bb. 20650 from Upper Mahakam.

Mahakam District of South-East Borneo, where it is found on hills or streepey ground. It seems to be (very) common locally, even growing gregariously (bb.20479 and 20658). It was first collected in February 1936 (type); the two other specimens, cited below, date also from this month and from March 1936. Although these two specimens are sterile, I am uniting them with *S. collaris* without hesitation by the leaf structure and leaf shape. As to their size, the leaves of bb.20658 exceed somewhat the figures given (about 17.0×6.0 cm with 13 pairs of nerves); they obviously originate from a young branch.

SPECIMENS EXAMINED.—BORNEO. South-East Borneo. Upper Mahakam, Long Pahangai (bb.20650, boko; type), Sg. Suwani (bb.20479, hutang), Lumpoko (bb.20658, tegelam).

Tree up to 27 m high with a straight bole of 20 m; the buttresses are about 1.5 m high, extending 2.0—3.0 m along the ground. *Outer bark* dark brown (or grey: bb.20658), shallowly longitudinally fissured, slightly scaling off in small plates, in transverse section yellow; *inner bark* with a small quantity of blackish resin. *Sapwood* yellow (or white: bb.20658). *Heartwood* grey (or yellow: bb.20658), sharply demarcated from the sapwood; timber floating when fresh. *Wood* easy to work, used for light construction (planks, hoardings).

Shorea collaris is only known from the Upper

4. *Shorea subcylindrica* van Slooten, *spec. nov.*—Fig. 4

TYPE.—For. Dept. Sarawak A.0615 (fruit). — Illustrative specimen showing the flowers, For. Dept. Sarawak A.0663.

Shoreae collari Sloot. *valde affinis sed foliis in sicco dure et crasse coriaceis, non vel vix acuminatis, calyce fructifero nucem basi arcte circumcludente nucisque forma distincta.*

Branches and branchlets glabrous, dull greyish, later becoming dark, shallowly grooved. *Stipules* not seen. *Leaves* thickly and firmly coriaceous when dry, oblong or ovate-oblong, attenuate or hardly acuminate, blunt at the top, the base rounded-cuneate, (strongly) unequal-sided, rounded on one side, cuneate on the other, the margins slightly revolute, 11.0—15.0 × 4.0—5.5 cm; both surfaces shining when dry, brown or slightly reddish brown, glabrous; midrib elevated above, prominent beneath; main nerves 9—11 pairs, slightly or not raised on the upper surface, prominent beneath, curved upwards near the margin; tertiary nerves parallel and visible beneath; domatia absent; *petiole* robust, grooved, glabrous, 1.25—1.5 cm long. *Inflorescences* axillary and terminal, solitary or ramified at the very base and seemingly in pairs,

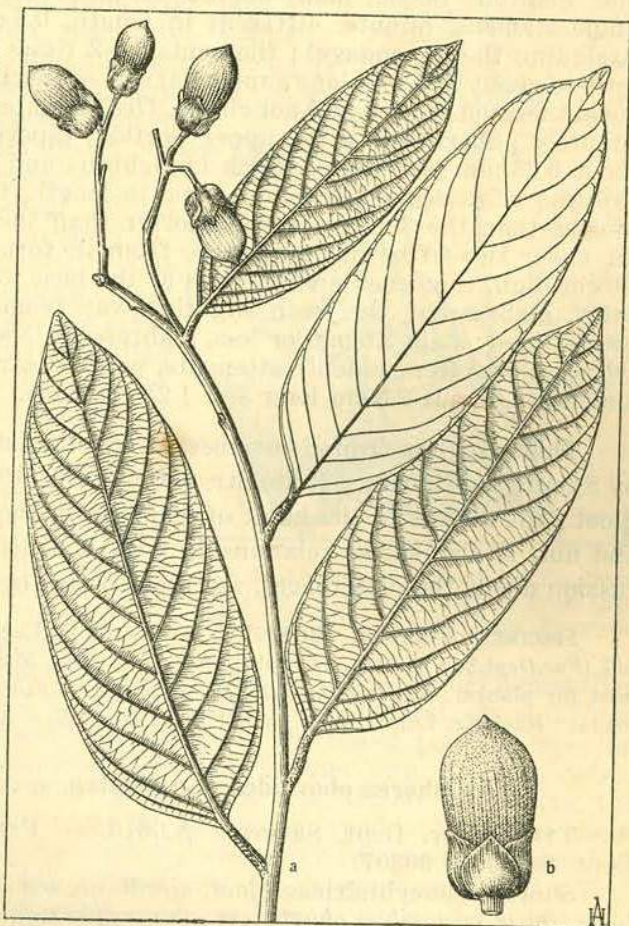


FIG. 4. *Shorea subcylindrica* Sloot.: a, fruiting twig (× 0.5); b, mature fruit (nat. size). — After A.0615 from Sarawak.

very fine and slender, rather lax, the panicles not overtopping the leaves, up to 10.0 cm long; axis and branches sparsely greyish-fulvous stellate-tomentose when young, later becoming dark and glabrescent or glabrous; ultimate branchlets up to 5-flowered; bracts and bracteoles not seen.

temporarily), since the differences when more extensive material becomes available may turn out to be only relative. An ultimate amalgamation would not be contradicted by the place of origin, which for the numbers A.0615 and A.0616 is the same (the actual spots apparently lie very close together), or by the vernacular name, which in both cases is reported as *lun*. The bark of the two trees is grey and the wood is used for planks.

The two species are maintained separately on the basis of the following differences:

Shorea subcylindrica

Branchlets glabrous.

Leaves firmly coriaceous, usually attenuate, (markedly) unequal-sided, brown or reddish brown when dry, with 9—11 pairs of main nerves, 11.0—15.0 × 4.0—5.5 cm.

Petioles 1.25—1.5 cm long.

Inflorescences up to 10.0 cm long.

Appendage of connective not ciliate.

Nut oblong-ovate or subcylindric-obovate, 2.5 cm long.

Shorea obovoidea

Branchlets in the beginning tomentose.

Leaves chartaceous, usually acuminate, base slightly unequal, upper surface greyish or yellowish green when dry, with 8—9 pairs of main nerves, 8.0—10.0 × 3.0—4.0 cm.

Petioles 1.0 cm long.

Inflorescences up to 4.0 cm long.

Appendage of connective not ciliate.

Nut obovoid or obovate-elliptic, 1.75—2.0 cm long.

Not until adequate herbarium material is available can the question of the identity of the two species be solved.

SPECIMENS EXAMINED.—BORNEO. Sarawak. Lundu, Sg. Semengoh F.R., on hill (*For.Dept.Sar. A.0616*, fr. Febr. 1936, *lun*); 6th mile F.R., on hill (*For.Fl.Sar. 00307*, fl. Sept. 1925, *sasak puteh*).

Under the Sarawak material cited above Symington noted that in his opinion four bb. numbers from Borneo in the Bogor Herbarium¹ may perhaps be assigned to his species "S." They certainly do not form adequate material, as they are all sterile. Moreover, I myself take the view that one of these numbers² definitely does not belong here. In contrast, I consider that several other bb. numbers³ can be included here. However, these also are sterile, so that I cite these seven numbers separately below under great reserve. That considerable caution is necessary also appears from the fact that the vernacular names of most of them are found together in "Herkomst damar" (p. 12) under *Shorea* (55), which belongs to the *Shorea's* yielding black resin, but this does not check with the resin data from bb.10018 and 11039.

¹ Viz., 10018, 11039, 17600, and 21243.

² Viz., 17600.

³ Viz., 11053, 11671, 18162, and 18693.

BORNEO. West Borneo. Sintang Distr., Munggo Pelangkan, hilly ground, 13 m (*bb.18693*, beromet; resin black; rare and scattered). — South-East Borneo. Tidung Lands, Banusan, hilly ground, 12 m (*bb.18162*, kakan bato). — Bulungan Distr., Kaberang (Sg. Bengalun), steepy ground, 150 m (*bb.11671*, tengkawang, very common). — Upper Dusun Distr., Muaralaung, along tide-river on level ground, 80 m (*bb.10018*, mukut; resin yellowish white; rather common), Kelapèh, on hill, 200 m (*bb.11039*, tahan lintung; resin colourless; rare and scattered; *bb.11053*, mahubang or mawoi; very rare), Puruktjahu, on level ground, 150 m (*bb.21243*, bambareng; rather common).

6. SHOREA RICHETIA (Heim) Sym.—Fig. 6

Shorea richetia (Heim) Sym. in Gdns' Bull., Str. Settl. 9: 330. 1938.

Richetia coriacea Heim in Bull. Soc. linn., Paris 2: 975. 1891.

Balanocarpus coriaceus (Heim) Brandis in J. Linn. Soc., Lond. 31: 112 pl. 2 f. 25, 26. 1895; Symington in Gdns' Bull., Str. Settl. 8: 27. 1934.

TYPE.—Beccari 2888.

Branches dark or greyish coloured, lenticellate, glabrous. *Stipules* not seen. *Leaves* thickly coriaceous, elliptic or oblong-elliptic, acuminate, the acumens broad, blunt and about 0.5 cm long, the base cuneate and equal-sided, 5.5—7.5(—10.0) cm long, 2.5—3.5(—5.0) cm wide; upper surface shining, lower surface dull or slightly shining, both surfaces dark brown and glabrous; midrib not or slightly depressed above, prominent beneath; main nerves 5—6 pairs, faint on the upper surface, slightly raised beneath, spreading and curved upwards near the margin, which is slightly revolute; tertiary reticulations obscure above and hardly prominent beneath; domatia absent; *petioles* rather thick, glabrous, drying black, 0.5—0.75 cm long. *Flowers* unknown. *Fruiting calyx-segments* equal in length of the 2 outer a little smaller than the 3 inner, much shorter than the nut, closely embracing the lower third (or half) but quite free from it, forming a woody cup up to 1.0 cm high (including the teeth), thickened and concave at the base, the teeth chartaceous, free and blunt, glabrous, drying black; stalk 4.0 mm or less, glabrous. *Nut* almost cylindrical or (ob)ovoid, suddenly narrowing towards the often oblique apex, apiculate by the remnant of the style, the apex acute and up to 3.0 mm

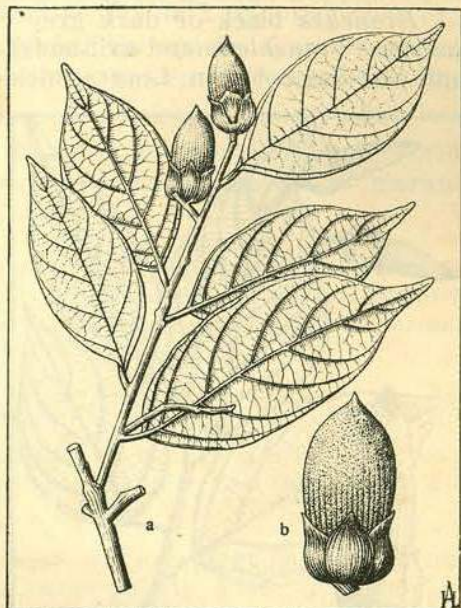


FIG. 6. *Shorea richetia* (Heim) Sym.: a, fruiting twig ($\times 0.5$); b, mature fruit (nat. size). — After Beccari 2888 from Sarawak.

long, longitudinally striate and fulvous-tomentose, 2.0—2.5 cm long, 1.0—1.2 cm wide.

Heim founded his genus *Richetia* upon this species (Beccari 2888) and three other ones now all reduced to *S. multiflora* (Burck) Sym. At present no additional collections are known except Beccari 2544, originating from the same locality as the type. The species is very closely related to *S. multiflora* (Burck) Sym., from which it is readily distinguishable by vegetative characters. The fruits, though essentially similar, differ somewhat in size and in the nature of the woody cup, while the thickened sepals are markedly larger in *S. richetia* (Heim) Sym.

SPECIMENS EXAMINED.—BORNEO. Sarawak. G. Matang (Beccari 2888, fr. Dec. 1866; Beccari 2544, very young fr. Sept. 1866).

7. *Shorea conica* van Slooten, *spec. nov.*—Fig. 7

TYPE.—bb.26497.

Shoreae richetiae (Heim) Sym. *foliorum forma et in sicco etiam colore subsimilis, sed nucibus elongato-conicis statim distinguenda.*

Branches black or dark grey coloured, not or sparsely lenticellate, glabrous; *branchlets* (and axil-buds) densely pubescent, very soon glabrescent. *Stipules* not seen. *Leaves* thickly chartaceous or subcoriaceous, ovate



FIG. 7. *Shorea conica* Soot.: a, fruiting twig ($\times 0.5$); b, mature fruit (nat. size).
— After bb.26497 from Indragiri.

or rarely oblong, acuminate, the acumen broad, blunt and 0.5—1.0 cm long, the base obliquely cuneate or one-sided subrounded, the margins slightly revolute, (5.0—)6.0—8.0(—10) cm long, (2.5—)3.5—4.5 cm wide; upper surface dark grey or greyish-black coloured, slightly shining, lower surface reddish-, brownish- or greyish-green coloured, dull or hardly shining, both surfaces glabrous; midrib not or hardly sunken above, raised beneath; main nerves 4—6 pairs, faint on the upper surface, raised beneath, strongly arcuate in their upper half, the highest of them reaching the acumen of the leaf or nearly so; tertiary nerves parallel to each other, obscure above, visible beneath; domatia absent; *petioles* rather thick, the very base hardly or not thinner than the upper portion, shallowly grooved, glabrous or extremely scantily

pubescent and immediately glabrescent, black, 0.75—1.0 cm long. *Flowers* unknown. *Infructescences* terminal and axillary, obviously solitary,

robust, simple or slightly ramified (bb.31148), hoary or yellow-brownish pubescent, up to 5.0 cm long. *Fruiting calyx-segments* nearly equal in size, inner ones scarcely longer than the 2 outer, much shorter than the nut, closely embracing the lower third but quite free from it, forming a woody cup up to 1.2 cm long, thickened and concave at the base, the teeth deltoid; blunt, stellate-pubescent, glabrescent, up to 7.0 mm long; stalk 2.0—3.0 mm. *Nut* elongate, conoid, over whole the length gradually attenuate towards the top which is blunt, substriate, densely yellow-brown tomentose the top excepted, 3.0—3.2 cm long, the base 1.0 cm in diam.

Tree up to about 37 mm high with black or dirty green resin used for lighting purposes and as putty (bb.26486). The bark is suitable for walls of houses and for floors.

Shorea conica is a small-leaved Sumatran species being found up to an altitude of 75 m. It grows on level ground, which may or may not be periodically inundated during the west monsoon; it may also be found on hills. Locally it usually is (rather) common, though always growing as scattered specimens. It is distinguishable by the few-nerved leaves which mostly are typically ovate, rather distinctive and dark coloured when dry. There is only little difficulty in identifying the species from vegetative characters alone. The conoid nut, which is known only from the type and after which the tree has been named, is elongate and rather long compared with those of allied species, that of *S. dolichocarpa* Sloot. excepted. In the Indragiri Uplands the species is usually known as maranti kepala tupai.

SPECIMENS EXAMINED.—SUMATRA. East-Coast. Labuanbatu Distr. (bb.8973, maranti pugil; bb.31148, samarupa tjengal). — R i o u w. Indragiri Uplands (bb.26497, fr. Dec. 1938; bb.26486, maranti rambai; bb.27446, maranti kunjit; bb.27533, maranti tempalo; bb.27547, 27582, and 28555).

8. SHOREA PELTATA Sym.—Fig. 8

Shorea peltata Sym. in J. Mal. Branch Roy. As. Soc. 19 (2): 158 pl. 6. 1941; Desch in Mal. For. Rec. 14: 27. 1941; Symington in Mal. For. Rec. 16: 56 f. 29. 1943.

TYPE.—For. Dept. F.M.S. 49356.

“*Branchlets* slender, lenticellate, glabrous except at the very young tips, drying reddish-brown in colour. *Leaves* peltate, ovate or ovate-elliptical, caudate acuminate at the apex, rounded at the base, margin frequently slightly revolute, from about 8.0 × 4.0 to 18 × 9.0 cm., glabrous, drying greenish-grey on the upper surface and yellow-brown on the lower; midrib neither elevated nor markedly depressed on the upper surface; main nerves 8 to 10 pairs, visible on both surfaces but faint on the upper surface; reticulations about equally distinct on both surfaces; petioles inserted about 0.6 to 1.6 cm. from the basal margin of the leaf, rather

slender, 1.5 to 2.5 cm. long, rugose on the upper portion and dark red-brown when dry; stipules minute, caducous. *Panicles* terminal and axillary in the axils of the terminal two or three leaves; racemes solitary, 4 to 8 cm.

long, pale stellate-hairy; branchlets solitary or paired, simple or forked, markedly zig-zag when mature, up to 1.5 cm. long, 4 to 8-flowered. *Flowers* about 2.0 mm. apart, subsecund; bracteoles minute, ovate, caducous; buds elongate, about 6.0 mm. long when mature, subsessile. *Sepals* subequal, subovate, blunt or pointed, pale tomentose outside. *Petals* linear, sericeous on the portion exposed in bud, yellow. *Stamens* 15, pairs alternating with single stamens, of three heights; anthers 2-celled; filaments 2 to 3 times as long as the anthers, broad at the base, narrow in the upper half; appendage to connective awn-like, about twice as long as the anthers, minutely ciliate in the upper half. *Ovary* ovate-conical, glabrous on the lower portion, minutely pubescent on the upper; style cylindrical rather shorter than the ovary, glabrous; stigma minute, apparently simple.

Fruits sessile; calyx lobes subequal, imbricate, acute or blunt at the apex, woody at the base, sparsely fulvous hairy or glabrescent, united at their bases to form a short woody receptacle which embraces the base of the nut; nut

elliptic or obovoid, pointed, about 3.5 cm. long when fully mature, minutely striated and pale fulvous tomentose."—Symington.

Tree up to 27 m high (bb.27511), unbuttressed; bole brown with light patches, rather smooth, but with warty portions from which exudes a little yellowish damar" (Symington, *l.c.*, 1943). Bark with a large quantity of dirty green resin (bb.27510). *Sapwood* pale (Symington, *l.c.*, 1943). *Flowers* yellow (49356, type).

This species "has been found only in north east Johore . . . In the north east corner of Mersing Forest Reserve . . . it is reported to occur

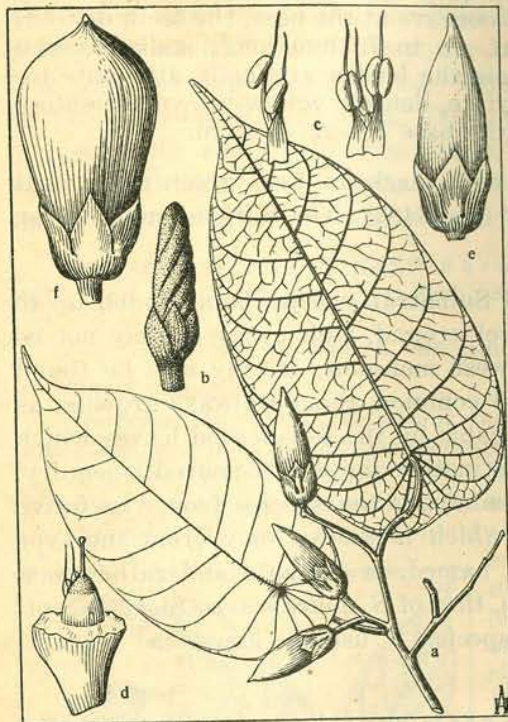


FIG. 8. *Shorea peltata* Sym.: a, fruiting twig ($\times 0.5$); b, flower bud ($\times 3$); c, stamens; d, ovary; e, immature fruit (nat. size); f, mature fruit (nat. size). — Drawing of a and e based on Kep.50848; flower parts and mature fruit on Kep.49356 and 50849 after Symington, both from Johore.

'in fair profusion.' It seems to show a gregarious tendency in low-lying jungle" (Symington, *l.c.*, 1943). Most of the specimens from Johore originate from "tanah pamah," which means level land, probably subject to inundation (less swampy than "paya"). It may also be found on hillslopes, which is more in accordance with the habitat of the Sumatran trees, which are growing on steep ground 60 m above the sea.

Shorea peltata, in a part of the Johore-specimens called "sama rupa meranti," is named meranti telepok in For. Dept. F.M.S. 50848, which name has been coined for this species by Symington as it "is intended to suggest as analogy between its peltate leaves and those of the lotus (*Nelumbium speciosum* Willd. = telepok)." Both of the bb.-numbers from Riouw mention the Malayan name mangu.

"*Shorea peltata* is a typical member of the *Richetia* group, but it is quite distinct from any described member of the group in having peltate mature leaves" (Symington, *op. cit.* p. 159, 1941). Though both of the specimens from Sumatra are sterile, they undoubtedly represent *S. peltata*, practically agreeing entirely with the original description. On this description I should like to comment, that in bb.27510 the acumina are distinctly blunt and those in bb.27511 partly acute, the last being more in accordance with Symington's description and picture. As one has to reckon with the possibility, that in the future fertile materials may show some differences, as well as with the words of Symington (*op. cit.* 159, 1941), that he has "material of at least two underscribed Bornean species which have peltate leaves," I thought it preferable to take over his description unaltered.

Symington (*l.c.*, 1941, 1943) records that *S. peltata* is "a small tree, rarely exceeding 2.0 ft girth," which mention may be due to the fact that he knew small trees of 6, 9, and 14 m only. This also makes clear that the leaves of the Johore materials are much thinner than those from Sumatra.

As to the wood *S. peltata* belongs in the "meranti damar hitam" group [cf. *S. multiflora* (Burek) Sym.] of which the "timbers are of the general utility type, but were they to be more readily available in commercial quantities they might secure recognition as excellent joinery woods" (Desch, *l.c.*). In practice this is of little importance for *S. peltata*, according to Symington (*l.c.*, 1943) this species being "too small to be of importance as a timber producer," a judgment based perhaps also on the fact that Symington knew only small trees.

The numbers For. Dept. F.M.S. 49661, 49663 and 50848 (see below) are not cited by Symington. On the contrary he describes and pictures the type (49356, with flowers) and the mature fruits of 50849. I have not

seen these specimens. The mature fruits figured are considerably swollen in the upper portion, rounded at the apex and "pointed," but the fruits of 50848, which are obviously not yet fullgrown, are attenuate.

SPECIMENS EXAMINED.—MALAY PENINSULA. Johore: Compt. 2 and 3 Jemaluang F.R. (Kep. 35751 and 49351—49355, the last named number with fl. buds April 1939; Kep. 49356¹: low-lying land; Kep. 49361, young fr. July 1940); 24th mile Mersing to Kota Tinggi Rd. (Kep. 49661; Kep. 49663, fr. July 1940; Kep. 50848, fr. Sept. 1940, and Kep. 50849).

SUMATRA. Riau: Indragiri Uplands near Danau Mengkuang, in primary forest on steep soil, 60 m (bb.27510 and 27511, mangu; growing scattered).

9. *SHOREA BALANOCARPOIDES* Sym.—Fig. 9

Shorea balanocarpoides Sym. in Gnds' Bull., Str. Settl. 9: 330. 1938; Desch in Mal. For. Rec. 14: 27, 28 pl. 11 f. 2, pl. 13 f. 3. 1941; 15: 127 pl. 39 f. 1. 1941; Symington in Mal. For. Rec. 16: 47 fs. 29, 30. 1943.

Balanocarpus pahangensis Foxw. in Mal. For. Rec. 10: 145. 1932; Desch in Mal. For. Rec. 12: 37, 38 pl. 6 f. 4. 1936.

TYPE.—Kep. 15768. — Paratype of flower Kep. 15760.

Branches dark coloured, glabrous. *Stipules* not seen. *Leaves* chartaceous, elliptic or oblong, acuminate and the acumen broad, blunt and 0.75—1.0 cm long or (in seedlings) narrow and up to 3.0 cm long, the base broadly rounded to (sub)truncate or very slightly cordate (according to Symington, *op. cit.* p. 49, 1943, in seedlings and saplings even subpeltate), usually unequal-sided, rounded on one side, cuneate on the other, the margins (slightly) revolute, 9.9—13.0(—18.0) × 4.0—6.0(—7.0) cm, those of immature trees even up to 21.0 × 11.0 cm large; upper surface shining, drying to a greyish green or blue, lower surface dull or hardly shining, greenish brown when dry, both surfaces glabrous; midrib sunken or hardly raised above, prominent beneath, glabrous; main nerves 6—8(—10) pairs, visible above, raised beneath, glabrous, curved upwards near the margin, the upper nerves reaching the acumen of the leaf or nearly so; tertiary nerves parallel, visible above, hardly raised

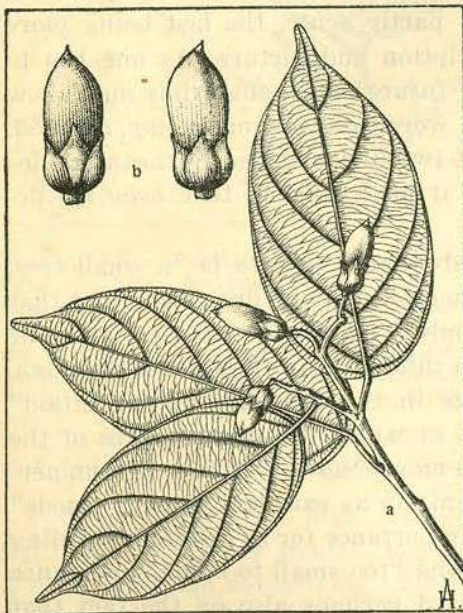


FIG. 9. *Shorea balanocarpoides* Sym.: a, fruiting twig (× 0.5); b, mature fruits (nat. size). — After Kep.15768 from Pahang.

¹I have not seen this number.

beneath; domatia absent; *petioles* rather robust, rugose and black when dry, 1.0—1.5(—2.0) cm long. *Inflorescences* axillary and terminal, seemingly always solitary but often forked at the very base, up to about 12.0 cm long; axis coarsely brownish stellate-tomentose, branches and branchlets densely greyish or yellowish stellate-tomentose; branchlets solitary or forked; ultimate branchlets up to 1.5 cm long and up to 7-flowered. *Flowers* 1.0—3.0 mm apart, rather fine, elongate in bud (5.0—6.0 mm long), when expanded 1.0 cm across; pedicels densely greyish stellate-tomentose, 1.0 mm long; bracts falling very early, ovate, brownish, ciliate. *Sepals* deltoid, acute at the apex, all about 1.0 mm long and wide, the margins of the 2 inner ones membranous, densely stellate-tomentose on the portions exposed in bud, glabrous inside. *Petals* much contorted in bud, linear, 7.0—8.0 mm long and 1.0 (at the base 1.5) mm wide, the lower portion coherent, the upper five-sevenths spreading when expanded, obtuse, the margins induplicate, fringed, both surfaces glabrous, many-nerved. *Stamens* 15, of 3 different lengths, epipetalous pairs (being the largest and the smallest) alternating with single stamens, 0.75—about 1.0 mm long (excluding the appendage); filaments 0.5—about 0.75 mm long, 2—3 times as long as the anthers, the flattened part rather broad; anthers oblong, about 0.25 mm long, appendage to connective unbranched, curved, very fine, hardly longer than the anther, seemingly very minutely scabrous at the end. *Ovary* ovate-conical, about 0.75 mm high and wide, glabrous at the lower, minutely pubescent on the upper portion, tapering into the short style which is glabrous at the top. *Fruiting calyx segments* equal in length, much shorter than the nut, closely embracing the lower third but quite free from it, forming a woody cup 6.0—7.0 mm high (including the teeth), thickened and concave at the base, the teeth woody and deltoid, acute or blunt, glabrescent; stalk 1.0 mm or less, glabrescent. *Nut* sub-cylindrical, attenuate in the upper portion, the apex pointed and often oblique, striate, pale brownish tomentose, soon glabrous or nearly so, up to 2.0 cm long and about 0.75 cm wide.

Usually medium-sized tree, up to 45 m high; *bole* long and straight; *buttresses* absent, or short and stout, to narrow in old specimens; *crown* heavy, dark, broad-leaved; small exudations of a dirty dark damar with a yellow crust are common on the bole. *Bark* dark brown to black with light patches scattered about on old scales. *Sapwood* dull yellow, clearly differentiated from the brown *heartwood*; timber used for planks.

Shorea balanocarpoides grows on low undulating land, along ridges and hill slopes, often on banks near streams. According to Foxworthy *Balanocarpus pahangensis* is a tree of frequent occurrence in the lowland forests of Perak, Trengganu and Pahang from near sea level up to about 340 m; it has been found as high as about 600 m. Symington says (*op. cit.* p. 49), that the species occurs in the Peninsula from Kedah to the Kinta district of Perak, on the west, and from Kelantan to the north-east of

Johore, on the east. Desch (*l.c.*, 1936) mentions that *Balanocarpus pahangensis* shows marked gregarious tendencies in hilly country. The Sumatran plants bb.28054 to 28058 inclusive all originate from the same locality at an altitude of 210 m; they are growing along water on slightly sloping ground and are common locally. Here the species is known as tjengal. In Perak and Trengganu the name damar katop or damar katup is in general use, while other names have also been recorded (see below).

In contradistinction with Foxworthy who described as *Balanocarpus pahangensis* the flowers from Kep. 15760, here their description is taken from Kep. 27488, the first-named specimen not having been at my disposal. Because of this, perhaps, the dimensions of the flowers given by me somewhat differ from those by Foxworthy. According to him the petals are 5.0—6.0 mm and the anthers 0.1 mm long, while he states that the awn of the connective is about twice as long as the anther. He also mentions that the sheet with flowers (15760) has slightly larger leaves than the (fruiting) type, some of them being 13.0 cm long and 6.0 cm wide. The largest leaves of 27488 are even 18.0 × 9.0 cm in size. Yet, the identification may be adopted as being correct, as well as that of the Sumatran materials cited below; these are all sterile, most of them representing seedlings or immature trees with still larger leaves (see the description).

SPECIMENS EXAMINED.—MALAY PENINSULA. Kedah (Kep. 27488, meranti hijau, fl. Dec. 1937; Kep. 44956, damar katop, fr. Sept. 1937). — Perak. Tg. Malim F.R. (Kep. 16282, merawan), Kuala Kangsar Distr., Sg. Siput (Kep. 39166, meranti asing; Kep. 39175, and 39179—39183), Kinta Distr., Keledang Saiong F.R. (Kep. 16109; Kep. 24514, 24644, and 25424, merawan; Kep. 28062, 28970, and 32161, damar laut daun besar; Kep. 33721, resak; Kep. 33755, 33756, 33796, and 33797, damar hitam; Kep. 39184—39187, 39189). — Kelantan (Kep. 32802, resak gelombang; Kep. 32811, and 32814, resak; Kep. 33428, kala daun besar; Kep. 38453, damar katop; Kep. 50522, balau merah; Kep. 50530, 50605). — Trengganu (Kep. 26703, 26714, 43056, 43060; Kep. 44128, 44129, and 44758, damar hitam daun besar). — Pahang. Kuantan Distr., Baloh F.R. (Kep. 8152, merawan lampong, fl. Sept. 1928), Bt. Goh F.R. (Kep. 29667, damar hitam), Pekan Distr., Rompin (Kep. 15768, meranti pahang, fr. Jan. 1929).

SUMATRA. A t e h i n. Meulaboh, on slope of hill, 50 m (bb.8872, damar hitam; rather common). — East-Coast. Upper Langkat Distr., on slope of hill, 40 m (bb.9163, merawan; very common but scattered); Serdang, Silinda F.R. (bb.28054—28058, tjengal; common).

10. *Shorea dolichocarpa* van Slooten, *spec. nov.*

TYPE.—Kep. 35535.

Shoreae peltatae Sym. et *S. conicae* Sloot. ut videtur plurimum affinis, sed foliorum (non-peltatorum) et nucis (obovato-oblongae) forma et nucis magnitudine distincte differt.

Branches greyish or dark in colour when dry, slightly grooved and lenticellate, glabrous. *Stipules* not seen. *Leaves* firmly coriaceous, ovate, shortly and broadly acuminate, the acumen very blunt, about 0.5 cm long, the base broadly rounded, often unequal-sided, the margins not revolute, 8.0—12.0(—14.0) cm long, 4.0—6.0(—7.0) cm wide; upper surface drying greenish grey, glossy, lower surface greenish or brownish, shining, both surfaces glabrous; midrib not or hardly elevated above, raised beneath; main nerves 5—6 pairs, visible above, raised beneath, strongly arcuated in their upper half, the highest of them reaching the acumen of the leaf or nearly so; tertiary nerves subparallel, rather far from each other, scarcely visible or obscure above, visible beneath; domatia absent; *petioles* (rather) thick, black when dry, shallowly grooved, glabrous, 1.0—1.5 cm long. *Infructescences* terminal (and axillary?), solitary, slender, ?simple, glabrous. *Fruiting calyx-segments* nearly equal in size, the 3 inner ones hardly broader than the 2 outer, much shorter than the nut, closely embracing the lower fifth or sixth but quite free from it, forming a woody cup up to about 0.7 cm long, thickened and concave at the base, the teeth deltoid, broad and membranous, hardly stellate-pubescent, soon glabrous; stalk 1.0 mm. *Nut* lengthwise extended, oblong or obovate-oblong, in the upper third attenuate, pointed, striate, yellow-brown tomentose, "tinged purple" when fresh (For. Dept. F.M.S. 35535), 3.5—4.0 cm long, 1.5 cm wide.

The alliance of this Brunei species, which has been described here from the type only, apparently is first of all with *S. peltata* Sym. and *S. conica* Sloot., both of which are species of Central Sumatra and the southern part of the Malay Peninsula. Symington has already—speaking generally—drawn attention (*in* Gdns' Bull., Str. Settl. 9: 310-320. 1938) to the phenomenon that several dipterocarps in Brunei are clearly much more closely related to certain Malay Peninsula species than to any other described forms. *Shorea dolichocarpa* is characterized by its large nuts, which are broadest in the middle and attenuate in the upper portion, and not at all conoid. The leaves are firmly coriaceous, rather large and broadly rounded near the very base, but not peltate.

All specimens cited below, except the type, are sterile. Yet one may safely conclude that they all belong here, representing Symington's *Shorea spec.* "I 1" (see under *S. obovoidea* Sloot. in this paper). — Kep. 35529 is a seedling and shows that the opposite cotyledons are caudate at the top and (sub)cordate at the base.

SPECIMENS EXAMINED.—BORNEO. Brunei, Tutong R. (Kep. 12999, low hill, barik or pasir kerasik; timber used for planks; Kep. 35535, 35528, and 35529, top of ridge, 80 m, fr. Aug. 1938, "copious black exudations of damar like damar siput," viz. *S. faquetiana* Heim); Ukong, low ridges (Kep. 30576, damar mantok; trunk grey-green with black damar); Ladang Hills, Bt. Kinta (Kep. 28655; tree, 45 m high, bark red and flaking).

11. SHOREA XANTHOPHYLLA Sym.

Shorea xanthophylla Sym. in Gdns' Bull., Str. Settl. 9: 342 pl. 24. 1938.

TYPE.—Kep. 36776 (= S.H. 3998). — Paratype of fruit, For. Dept. Sar. 00277.

Branchlets grey- or reddish-brown, pale puberulous towards the ends. *Stipules* not seen. *Leaves* chartaceous, oblong, acuminate, the base rounded or subcordate, equal- or hardly unequal-sided, the margins not or hardly revolute, 19.0—37.0 × 6.0—10.0 cm; both surfaces glabrous, shining above when dry, lower surface dull or hardly shining and drying pale brown or greenish-yellow, usually of a greener tinge above; midrib very slightly elevated above, prominent beneath; main nerves 9—13 pairs, faint or slightly sunken above, prominent beneath, curved upwards near the margin; tertiary nerves subparallel, invisible or faint above, visible beneath; domatia absent; *petioles* robust or very thick, rugose, glabrous, 1.0—2.0 cm long. *Inflorescences* axillary and terminal, solitary or a few together, fine and slender, lax, up to 14.0 cm long; axis and branches pale tomentose; ultimate branchlets up to 6-flowered. *Flowers* very small, ovate-lanceolate in bud; pedicel pale tomentose, 1.0—1.5 mm long. *Sepals* subequal, ovate-rotundate, mucronate rounded or emarginate at the apex, about 1.5 mm long and wide, tomentose on the portions exposed in bud, glabrous inside, the 3 inner ones membranous at the edges, whether or not ciliate along the margins. *Petals* much contorted in bud, oblong or obovate-oblong, about 4.0 mm long and 1.5 mm wide, the lower portion coherent, the upper two-thirds spreading when expanded, obtuse or truncate, the margins induplicate (boat-shaped), minutely tomentose on the portions exposed in bud, glabrous inside, many-nerved. *Stamens* 15, pairs alternating with single stamens, of 3 different lengths, 0.75—1.0 mm long (excluding the appendage); filaments 1—2 times as long as the anthers; anthers elliptic-oblong, about 0.25 mm long; appendage of connective filiform, a curved awn, about as long as the anther, minutely ciliate towards the end. *Ovary* ovate-conical, about 1.0 mm long, glabrous below, tomentose in the upper portion, tapering into the very short style, which is glabrous and about 0.5 mm long. *Fruiting calyx-segments* subequal, much shorter than the nut, closely embracing the lower third but quite free from it, forming a woody cup up to about 1.0 cm high, broadly ovate to deltoid, deciduously fulvous-tomentose. *Nut* obovoid, pointed, striate, fulvous-tomentose, 2.0—2.5 cm long and 1.5 cm wide.

Symington thinks *S. xanthophylla* extremely close to *S. multiflora* (Burck) Sym. It differs markedly, however, from this as well as from the other species treated in this paper, in the size of the leaf and the length of inflorescence.

It appears to be a small or medium-sized tree up to 45 m high of level land or low hills. According to Symington (*op. cit.* p. 343) there can be little doubt that the timber should be classified as "white meranti sub-group 2" as distinguished by Desch (*in Mal. For. Rec.* 12: 37. 1936);

it is used for furniture (S.H.-A.3512). The flowers are said to be white (S.H. 4562), yellow (S.H. 4366), lemon yellow (S.H. 3998), yellow ochre (S.H. 4557) and yellow green (S.H.-A.3512); they have been collected in March, April, May, and September. The fruiting specimen dates from August 1935.

I have not yet met with material from Borneo outside British North Borneo and Sarawak which may safely be referred to this species. To bb.7074 from the Sambas District, West Borneo, with the vernacular name njagot, Symington added a label with the annotation "aff. *S. xanthophylla* Sym." In my opinion this specimen cannot represent the species in view of the habit of the leaves.

SPECIMENS EXAMINED.—BORNEO. British North Borneo. Labuan & Int. Res. Beaufort (Kep. 41108 [= S.H. 5496], selangan kuning); — East-Coast Res. Sandakan: Betotan (Kep. 36776 [= S.H. 3998], karai batu; Kep. 38933 [= S.H. 4557], selangan babi), Kabili-Sepilok F.R. (Kep. 38742 [= S.H. 4366] and 38938 [= S.H. 4562], pisang pisang; S.H.-A.3512, selangan babi). — Sarawak. Sg. Babong, Beseri (For. Dept. Sar. 00277).

12. *Shorea laxa* van Slooten, *spec. nov.*

TYPE.—Kep. 48191.

Shoreae peltatae Sym. *probabiliter plurimum affinis, sed foliis maturis haud peltatis, inflorescentiis laxioribus, floribus maioribus magis distantibus appendicibusque eciliatis facile distinguenda.*

Branches light-coloured, pale fulvous and scabrous stellate-tomentose, soon glabrous and drying black. *Stipules* not seen. *Leaves* coriaceous, ovate or ovate-elliptical, acuminate and the acumen broad, blunt and about 0.5 cm long, or caudate-acuminate with a narrow, sharp acumen up to 1.5 cm long, the base usually markedly unequal-sided, (sub)truncate and (sub)rounded, that on young or immature trees peltate and rounded, the margins slightly revolute, 12.0—19.0 × 4.5—8.0(—10.0) cm, peltate leaves even larger; upper surface (slightly) shining, drying to a greyish green or blue, lower surface less shining, brownish green or reddish when dry, both surfaces glabrous; midrib not or hardly raised above, prominent and slightly scurfy tomentose beneath, soon glabrous; main nerves 7—10 pairs, visible above, prominent beneath, glabrous, curved upwards near the margin, the upper nerves reaching the acumen of the leaf or nearly so; tertiary nerves parallel, not or hardly visible above, slightly raised beneath; domatia absent; *petioles* robust, rugose, greyish tomentose when young, very soon glabrous and drying black, 1.0—2.0 cm long. *Inflorescences* axillary and terminal, solitary, slender, lax, up to about 16.0 cm long; axis, branches and branchlets densely greyish stellate-tomentose; ultimate branchlets solitary, simple or forked, up to 2.5 cm long, 3—6-flowered. *Flowers* 3.0—6.0 mm apart, rather large, elongate in bud (7.0 mm long), when expanded about 1.0 cm across; pedicels densely greyish stellate-tomentose, 1.0—1.5 mm long. *Sepals* deltoid or subovate, pointed,

unequal, the 2 outer about 2.0 mm, the 3 other ones about 1.5 mm long and wide, the margins of the 2 inner ones membranous and fringed, densely stellate-tomentose on the portions exposed in bud, glabrous inside. *Petals* somewhat fleshy, linear-oblong, 7.0—8.0 mm long, 2.0 (near the base about 2.5) mm wide, the lower portion coherent, the upper two-thirds spreading when expanded, obtuse, densely stellate-puberulous outside, glabrous inside, many-nerved. *Stamens* 15, of 3 different lengths, epipetalous pairs alternating with single stamens, 1.0—1.5 mm long (excluding the appendage); filaments about 0.75 mm long, 3 times as long as the anthers, the flattened part rather broad; anthers oval, about 0.25 mm long, appendage to connective unbranched, not curved, very fine, twice as long as the anther. *Ovary* ovate-conical, 1.0 mm long, at the base 0.75 mm wide, glabrous on the lower, minutely pubescent on the upper portion, tapering into the short style which is glabrous at the top. *Fruit* oblong-obovate, apiculate, striate, about 3.0 cm long and 1.75 cm wide, the calyx-segments forming a woody cup closely embracing the lower third or fourth of the nut.

The species here described as *Shorea laxa* occurs along slopes, on low hill sides, and ridges in Brunei, where it has been collected at altitudes up to 180 m. If the annotation on the label of For. Dept. F.M.S. 28691 is correct, the tree can apparently reach a total height of about 60 m. It is readily recognizable by its leaves which are peltate when young and by its large and lax inflorescences and comparatively large flowers. That it is a representative of the former so-called "*Balanocarpus*" group may be deduced from a picture by Symington. I do not know after which collecting number it has been figured; it has been inserted by him in the picture of For. Dept. F.M.S. 48191. I have not seen the fruits themselves as they were lacking in the material I studied, so that my description is not complete.

Describing *S. peltata* from Johore, Symington writes that he has material "of at least two Bornean species which have peltate leaves"; he undoubtedly alluded to these specimens, which he temporarily put aside as *Shorea spec.* 'H I.'

SPECIMENS EXAMINED.—BORNEO. Brunei. Bt. Andulan F.R. (*Kep.* 30600; bark brown grey, mottled; *Kep.* 30613; bark dark brown, damar cloudy; *Kep.* 37083, rusak); Bt. Puan (*Kep.* 48191, fl. Sept. 1939, damar hitam; flowers yellow); Tutong R. (*Kep.* 35534; *Kep.* 35552, geroun); Labi Hills (*Kep.* 28691, rusak, bark, grey black flaking; *Kep.* 30462, bark blackish with yellow flakes, small irregular fissures, damar black); Bt. Patoi (*Kep.* 35466; bark scaling or irregularly cracked, inner bark pale brown and sapwood pale, both of them exude dark damar; damar exudations of old damar on bole).