

THE GENUS *BORASSODENDRON* (PALMAE) IN MALESIA

J. DRANSFIELD

Herbarium Bogoriense and Regional Centre for Tropical Biology (BIOTROP)
Bogor, Indonesia

INTRODUCTION

In April 1968 while I was botanising in the Fourth Division of Sarawak, I was shown by Mr. David Senada, District Forest Officer, Bintulu, a tall fan palm growing by the new Bintulu to Miri road, about 15 km from Bintulu. Superficially resembling *Pholidocarpus maiadum* Becc. which grows nearby, this palm was yet distinct in the absence of thorns and the beautiful milky-white, undersides of the leaves. I later collected old male flowers and mature fruit and realised that the palm was a member of the Borassoideae and most closely resembled the Malayan palm *Borassodendron machadonis* (Ridl.) Becc. Further away in Brunei I collected the same palm, and in Europe I have seen specimens of the palm in Kew and Leiden, collected from scattered localities in the Fourth and Fifth Divisions of Sarawak, Brunei, Sabah, and Kalimantan. Examination of my own collections and comparison with other collections has suggested that they all represent one species; during this examination, it has become evident that for the inclusion of the Bornean palm in the genus *Borassodendron*, the description of the genus must be changed. The Bornean palm differs from *B. machadonis* in details of leaf morphology, in the highly compact, much smaller male inflorescence, in the presence of six stamens in the male flower as opposed to nine to fifteen in the latter species and in the smaller female inflorescence. The highly characteristic grooving of the endosperm in *B. machadonis* is present in the Bornean species. The original description of *Borassodendron* by Beccari was based on incomplete material; the following description of the genus not only incorporates information from the new species but also more complete data from *B. machadonis*.

In the preparation of this account it has become evident that the genus *Borassodendron* is extremely close to *Borassus* and can scarcely be maintained as a distinct genus. However, generic limits in the group *Latania*, *Borassus*, *Lodoicea* and *Borassodendron* are very critical and it

seems most useful to name the new Bornean palm *Borassodendron borneensis* until a critical reappraisal of the generic delimitation of palms can be made.

BORASSODENDRON Becc.

Borassodendron Beccari in Webbia 4: 359 (1914).

Tall, solitary, unarmed, dioecious fan palms. Trunk bare, marked with annular leaf scars. Leaves massive; petiole covered with scurfy brown indumentum, split at the base, semi-circular in cross-section, the edges extremely sharp and hard. Lamina palmate, incised into induplicate compound leaflets, further divided by splits into simpler leaflets. Hastula present adaxially, absent abaxially. Transverse lamina veins prominent. Lamina dorsiventral in anatomical structure (Tomlinson (1961) Anatomy of Monocotyledons, Palmae, and personal observation). Male inflorescence axillary, pendulous, compound, branching to produce 10.—20 spikes grouped in two's to five's, and subtended by large spathes becoming fibrous with age. Spikes clothed with spirally arranged coriaceous bracts, joined laterally. Male flowers in groups of two—six in the axil of each bract, exerted one at a time from the enclosing bract, each flower subtended by a bracteole. Calyx bi- or trilobed. Corolla tube narrow, with three ovate, cucullate lobes above. Stamens 6—15, epipetalous, filaments partially fused. Anthers elongate, ovary vestige absent at anthesis. Pollen sphaerical, reticulate, with a single pore. Female inflorescence axillary, pendulous, simple, clothed below with empty caducous spathes and above by densely crowded female flowers, each subtended by a bract. Female flowers solitary, massive, sessile. Sepals three, free, coriaceous and long persistent. Petals three, similar to sepals. Staminodal ring of six triangular lobes present. Ovary ovate depressed, tipped with three to four irregularly verrucose stigmas. Locules three, with one ovule in each. Fruit ovoid, faintly trigonous, borne within the persistent calyx and corolla, tipped with persistent stigmas. Epicarp hard, shiny. Mesocarp fibrous, fragrant. Pyrenes 3, discrete; pyrene wall hard, black, stony, with 8 to 12 shallow longitudinal internal wings penetrating into the seed. Seed with thin testa. Endosperm hard, bony, white, with a central hollow, grooved on the outside by the pyrene wall. Embryo apical. Seedling leaves compound.

DISTRIBUTION: Malay Peninsula, Borneo.

KEY TO THE SPECIES OF BORASSODENDRON

- 1a. Leaves concolourous. Male inflorescence loosely branched, to 2 m long. Male flowers with 9 — 15 stamens.....*B. machadonis*
- 1b. Leaves clothed with dense white indumentum below. Male inflorescence compact, to 40 cm long. Male flowers with 6 stamens.....*B. borneensis*

BORASSODENDRON MACHADONIS (Ridl.) Becc.—Fig. 1

Borassus machadonis Ridl. in J. Straits Brch R. Asiat. Soc. 44: 203 (1905); Flora of the Malay Peninsula 5: 71 (1925, London). — *Borassodendron machadonis* (Ridl.) Becc. in Webbia 4 (2): 361, Fig. 38c & d (1914); Palmae della Tribu Borasseae 13: Fig. 3c, d, Plate 7. (1924, Firenze). —; Holotype: Malay Peninsula, Perak, Sungei Siput, Kamuning, in dense forest, *Machado* (SING).

Solitary unarmed, dioecious fan palm to 20 m tall. Trunk bare when mature, to 30 cm in diameter at breast height, grey, marked with annular leaf scars. Leaves massive, forming a tattered, untidy crown. Petiole to 4 m, split longitudinally at the base, to 4 cm wide, semicircular in cross-section, covered in scurfy brown indumentum; petiole margins razor-sharp, smooth. Lamina rich midgreen, to 3.5 m in diameter, free of indumentum except on the folds and round the adaxial hastula; lamina divided by ca 12 splits nearly reaching the insertion of the petiole, into compound leaflets; compound leaflets divided more or less through half their length into single-fold induplicate leaflets, to 8 cm wide, inter-leaflet filaments persisting; leaflet tips rounded, leaflets bending and hanging irregularly and untidily; transverse lamina veins prominent; lamina dorsiventral. Male inflorescence, solitary axillary, pendulous, to 2 m in length, branching to produce 15—20 thick spikes of densely crowded flowers. Spathes to 40 cm in length and 10 cm in width, coriaceous, light brown, tubular below, split for two-thirds their length, covered in sporadic brown scurfy indumentum. Upper spathes much smaller. Each spathe subtending 2—3 branches. Inflorescence branches adnate to inflorescence axis to ca 5 cm above insertion of the spathe. Branches channeled, to 1.5 cm in diameter with sharp edges, to 15 cm long from insertion on axis to floriferous region. Spikes to 30 cm long and 3 cm wide, clothed in dense spirals of overlapping bracts joined laterally; bracts densely covered in reddish-brown indumentum, each subtending a condensed scorpioid cymose branching system, bearing 5—7 bracteoles, the ultimate two subtending male flowers, the rest empty. Male flowers exserted at anthesis between the spike bracts; calyx tube irregularly 2 to 3 lobed, 12 x 2 mm. Corolla tube to 13 mm long with 3 apical cucullate lobes 7.5 X 2 mm, dull brown in colour. Stamens 9 to 15; filaments to 1 mm in length, partially joined together; anthers yellow, basifixed, 5 mm in length, with latrorse dehiscence; Pollen grains yellow. Female inflorescence solitary, axillary pendulous, simple, to 60 cm long, of which 10 cm forms a flattened peduncle; inflorescence densely covered with ca 40 flowers, with a terminal sterile portion. Each female flower subtended by a bract, almost invisible behind the calyx and corolla. Calyx with 3 free ovate sepals, to 3 cm in diameter. Corolla with 3 free ovate petals to 3.5 cm in diameter. Staminode ring present, with 6 staminodes. Ovary ovoid, depressed, to 2.5 cm in diameter, with 3—4 verrucose stigmas; locules 3, each with one ovule. Fruit obovoid, purplish-green, to 9 x 10 cm, faintly trigonous, tipped with the remains of the stigmas. Epicarp shiny, hard, ca 0.3 mm thick. Mesocarp 5—10 mm thick,

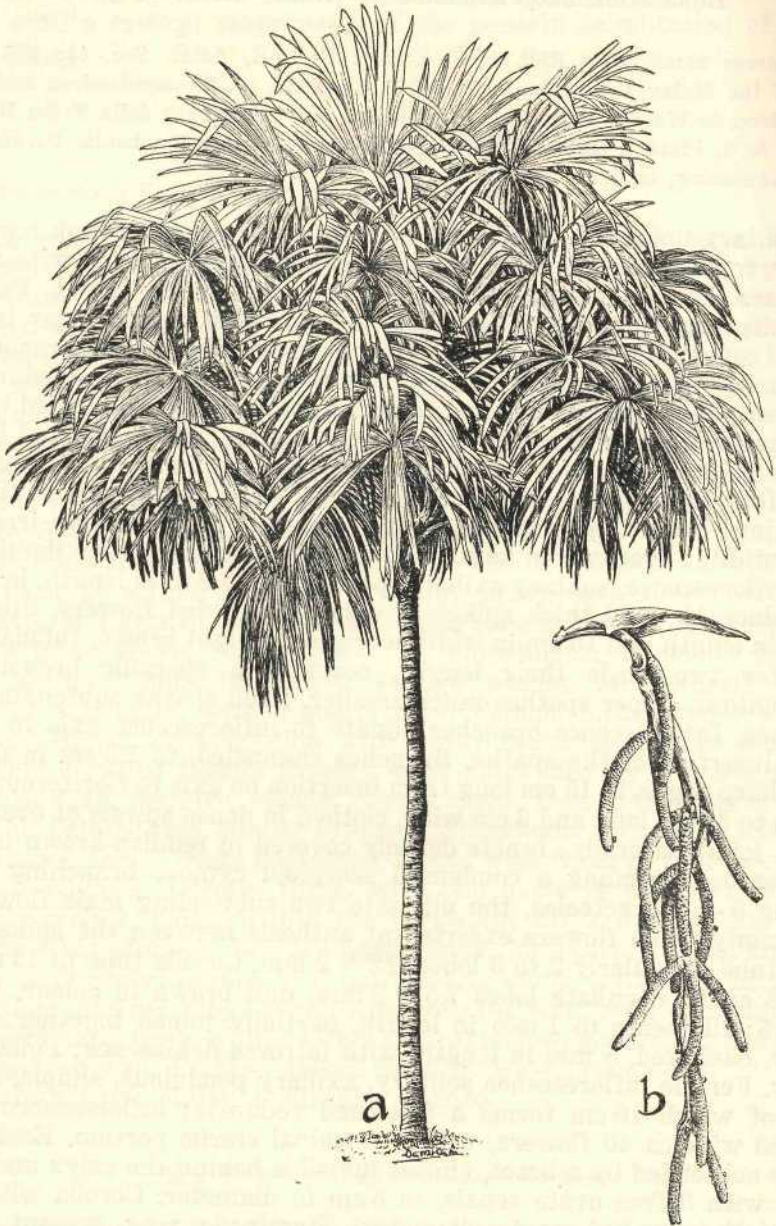


Fig. 1. *Borassodendron machadonis*; a, habit sketch showing the untidily flopping leaves; b, sketch of the large inflorescence.

orangey-yellow, soft, with abundant vertical fibres, sweet-smelling, edible. Pyrenes 3, discrete, 8 x 5 x 4 cm. Endocarp hard, blackish brown, smooth without, ridged within, with vertical flanges of varying heights, 2—6 mm, the largest two lying on a fruit radius. Seeds filling the endocarps; testa to 0.3 mm thick; endosperm hard bony, white, penetrated by the endocarp flanges. Embryo apical. Seedling leaves compound.

DISTRIBUTION: a rare palm of Northern Malaya and peninsular Thailand.

MALAYA. Kelantan: Sungei Ketat, near Batu Bow, February 1924, *Md. Nur* 12028. (K); Gua Musang, 1929, *Henderson* 22713 (BO); Perak: Salak, December 1928, *Md. Haniff and Md. Nur* (K); August 1912, *H. N. Ridley s.n.* (K); Cultivated: Botanic Gardens Singapore, from Machado's seeds, October 1921, *G.A. Best* (K); Botanic Gardens, Singapore, August 1928, *C. X. Furtado* (CGE); Botanic Gardens, Singapore, September 1929, *Md. Nur* (K); Botanic Gardens, Singapore, *E.J.H. Corner* (L).

Kedah, Alor Star, *E.J.H. Corner SH81* (BO) det. Furtado, is not *Borassodendron machadonis* but *Borassus flabellifer*.

Numerous beautiful trees of this palm may be seen in the Botanic Gardens, Singapore; seedlings are abundant in the Botanic Garden Jungle.

Borassodendrom borneensis Dransfield, *spec. nov.* — Fig. 2-6

Differt a *B. machadonis* foliis indumento lacteo infra tectis, inflorescentiis minoribus, floribus masculis staminibus 6.

Palma flabellata, solitaria, dioica, inermis, ad 20 m alta. Truncus nudus, ad 30 cm diametro, griseus, annulato-cicatricosus. Folia grandia e corona arcuata; petiolus ad 4 m, basi longistrorsum, ad 4 cm latus, canaliculatus supra, indumento fusco tectus, durissimus acutissimusque marginibus. Lamina plusminusve circularis ad 4 m diametro, atroviridis supra, infra indumento lacteo dense tecta, plicis indumento fusco disperse tectis; hastula adaxialis ad 2 cm; lamina decem ad duodecem f. issuris in foliola composita paene ad insertionem divisa; foliola composita in foliola plicorum singularium induplicatarum 4—5 cm lata, divisa, filamentis interfoliolis persistentibus; apicem foliolorum rotundates; foliola rigida in piano uno radiantia. Nervuli laterali laminae prominentes; lamina dorsiventralis. Inflorescentia mascula solitaria, axillaris, pendula, ad 40 cm, 15—20 spicas floribus dense tectas formans, ramificans. Spathae 1—2 inferiores vacuae, tubulae infra, acuminato-triangulares supra ad 30 cm longae, et base ad 8 cm latae, brunneolae indumento fusco disperse tectae. Spathae superiores minores, spicas 2—5 aggregatae subtendes. Spathae marcescentes, multas fibras formantes. Spicae ad 12 x 2 cm, axillis spatharum sessiles, bractis imbricatis spiraliter dense tectae, bracteis lateraliter conjunctis; bracteae indumento fusco dense tectae, unaquaeque systemam ramificationis condensatam scorpidoideocymosam subtenta, 4—6 bracteolis unaquaeque florem masculum unum subtenta, praedita. Flores masculi inter bracteis spicarum sub anthesi exserti. Calyx tubiformis

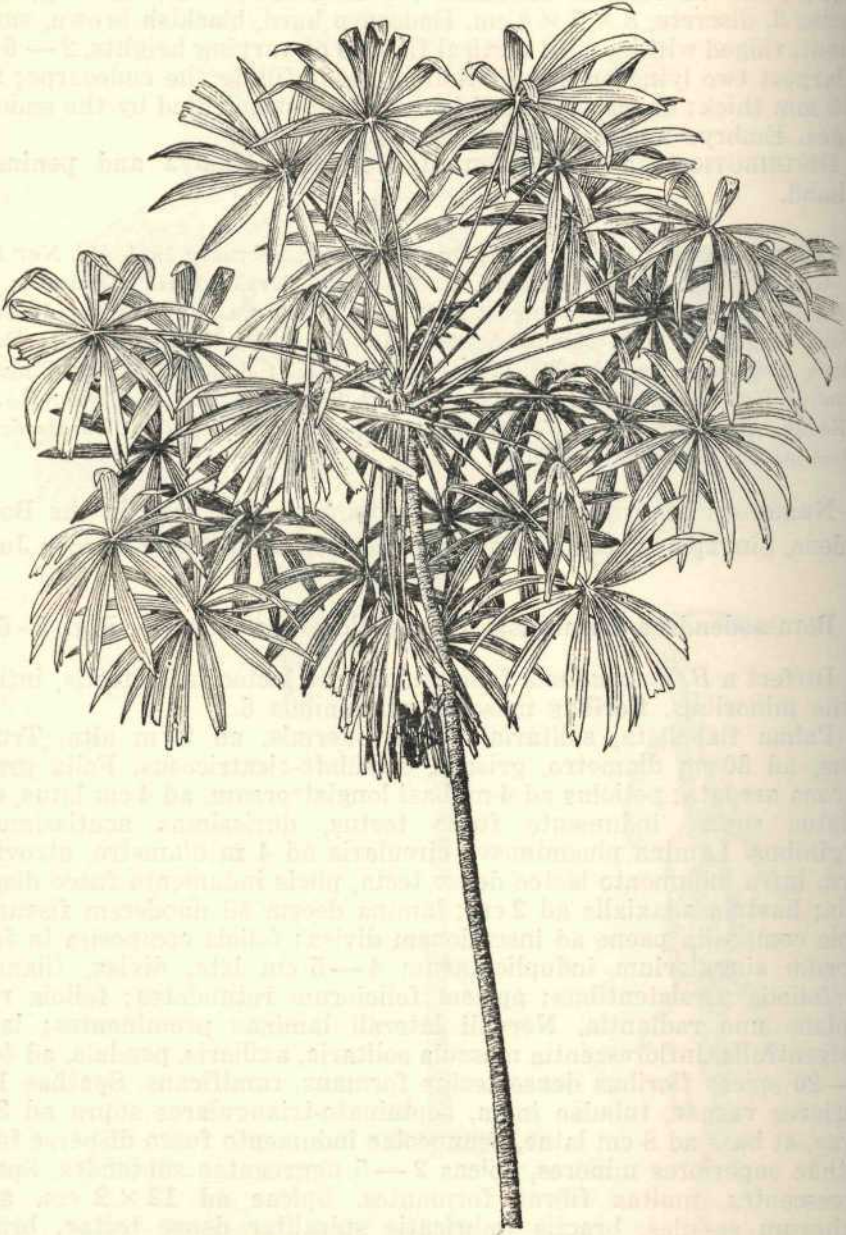


Fig. 2. *Borssodendron borneensis*: habit sketch showing the elegantly arching petioles and the arcuate leaflets.

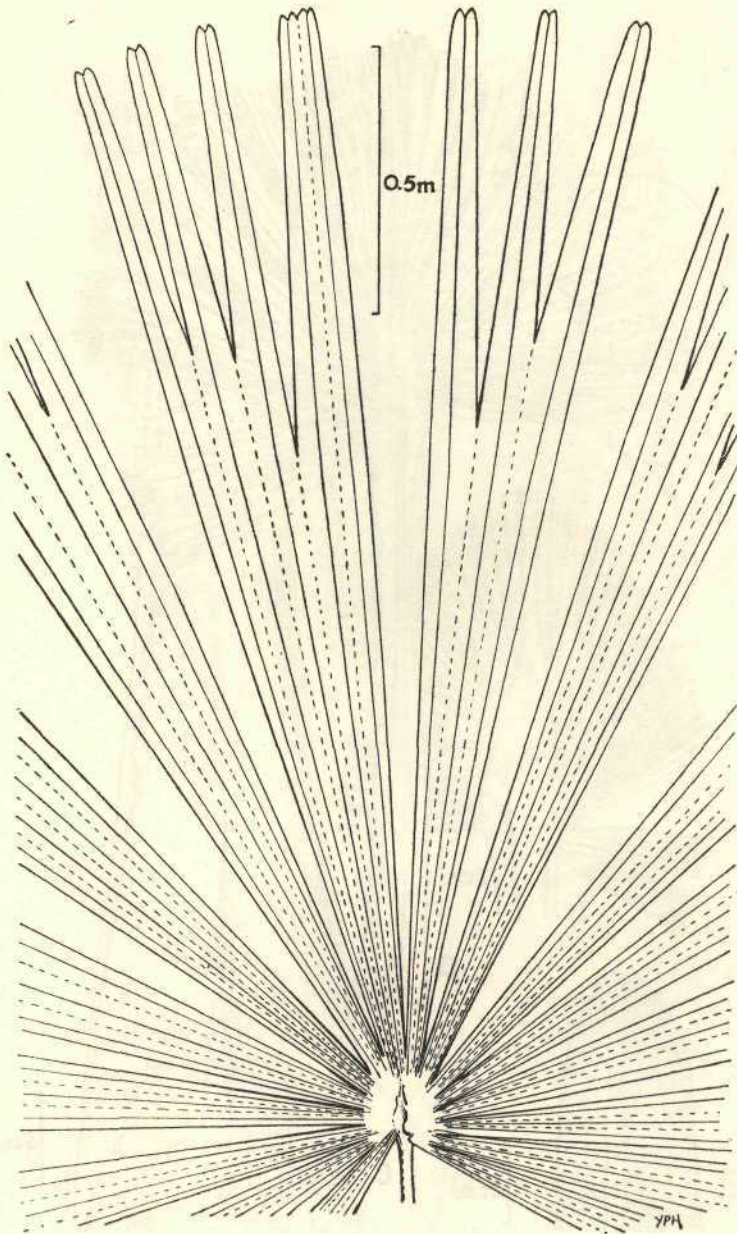


Fig. 3. *Borassodendron borneensis*: the leaf showing dissection of the lamina (Dransfield 774a).

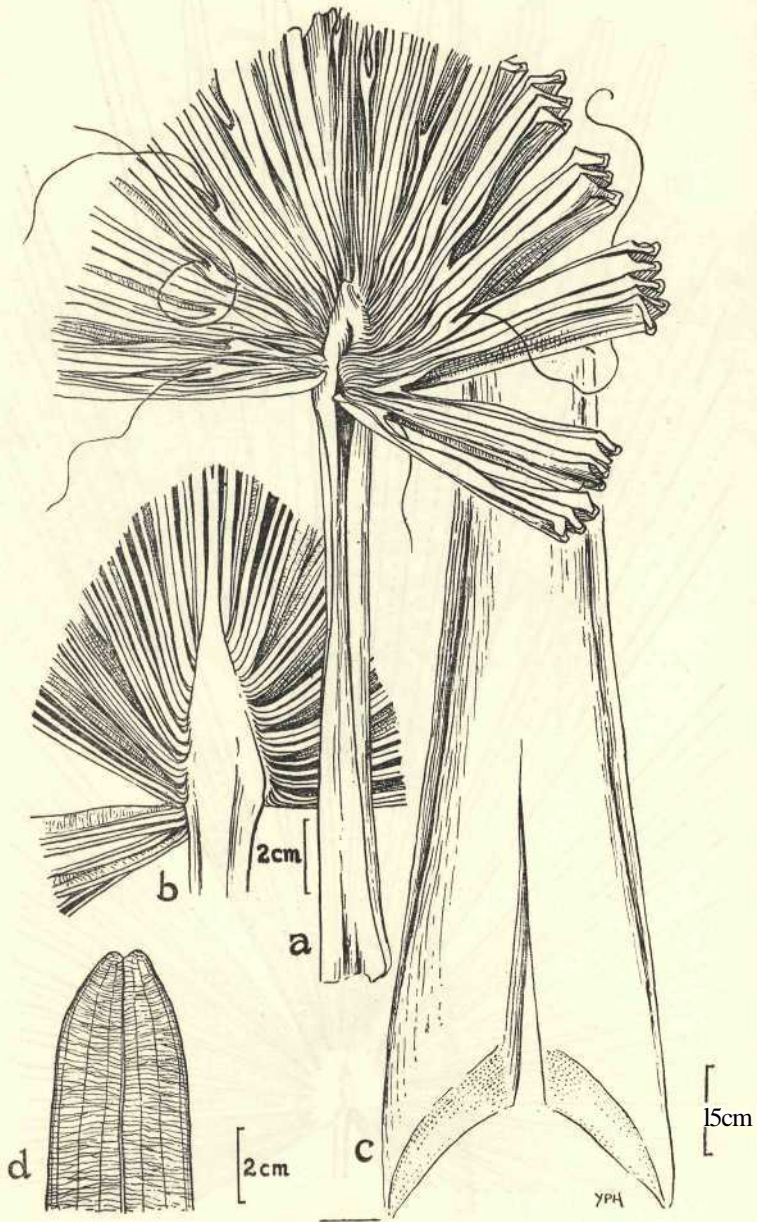


Fig. 4. *Borassodendron borneensis*: a, lamina insertion on petiole showing hastula and interleaf let filaments, adaxial view; b, lamina insertion abaxial view; c, leaf base showing the longitudinal split; d, induplicate leaflet tip (*Dransfield 774a*).

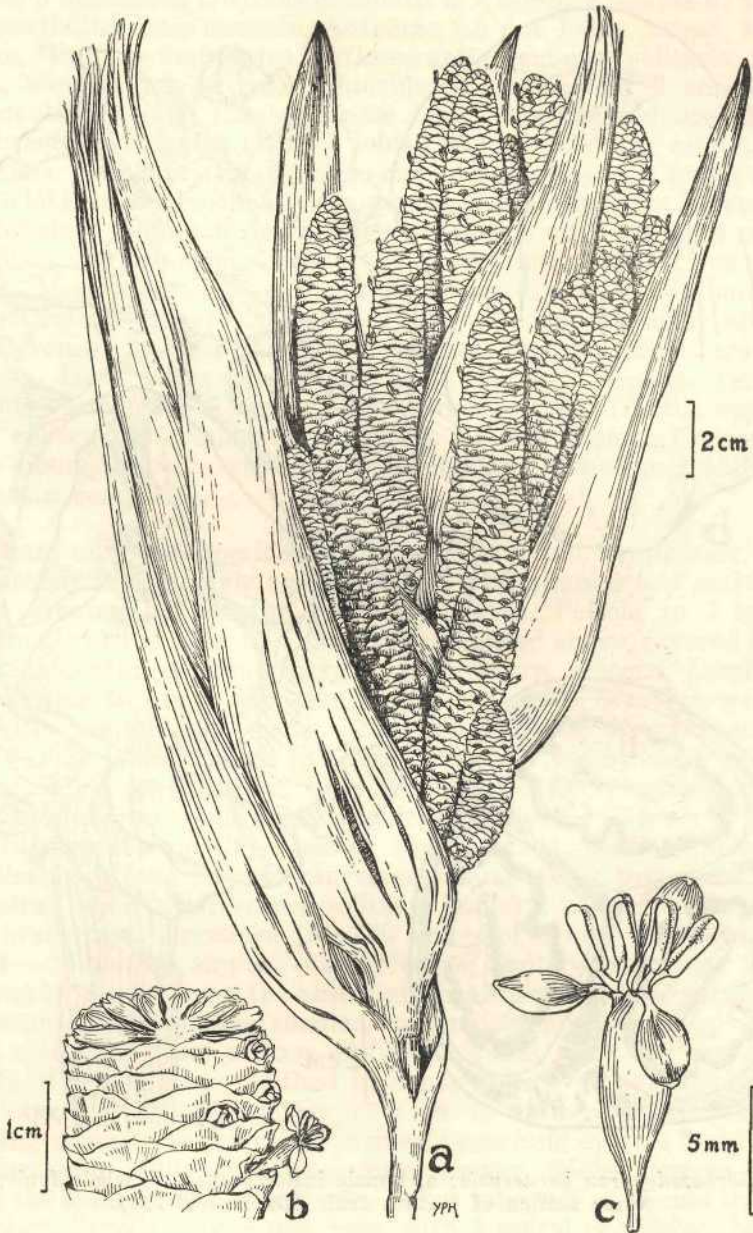


Fig. 5. *Borassodendron borneensis*: a, male inflorescence; b, portion of spike; c, single male flower (Dransfield 774a).

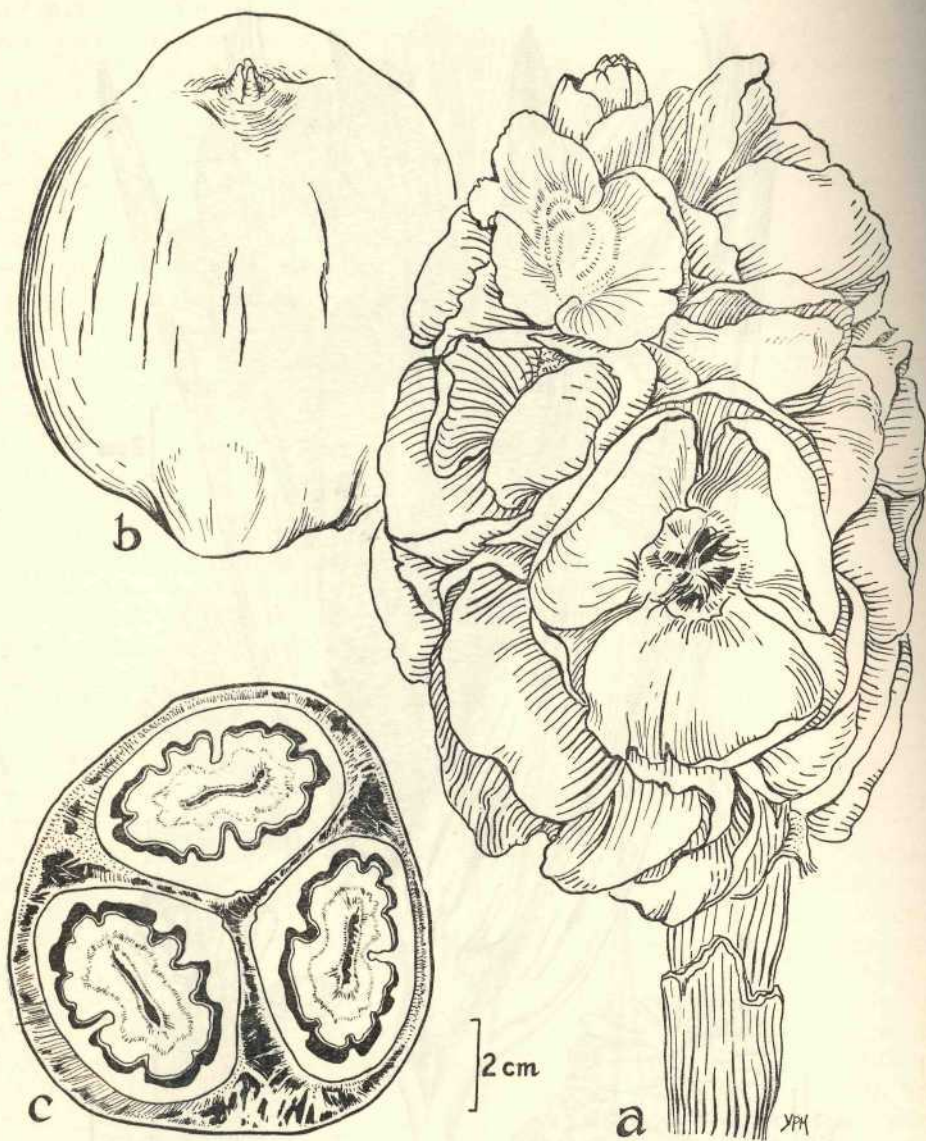


Fig. 6. *Borassodendron borneensis*: a, female inflorescence; b, whole fruit; c, transverse section of mature fruit (Dransfield 774).

ad 9 x 1.5 mm irregulariter 2 — 3 lobatus. Tubus corollae 9 mm longus cum lobis 3 apicalibus tristibus cucullatis 5 x 1 mm. Stamina 6; filamenta 1 mm, partialiter base connata. Antherae 2.5 mm longa, luteae, basifixae, latrorsae. Grana pollinis lutea. Inflorescentia feminea, solitaria, axillaris, pendula, simplex ad 40 cm, pedunculo ad 10 cm, ad 2 cm diametro; inflorescentia 15 — 20 floribus dense tecta. Spathae caducae non visae. Flores bracteis subtentis. Calyx 3 lobis coriaceis ad 3 cm, ad 4 cm aetate crescentibus. Corolla calycis similis, cum 3 lobis liberis. Corona staminodiorum 6 lobis triangularibus. Ovarium non visum. Stigmata 3, persistentia. Flores bracteis subtentis. Calyx 3 lobis coriaceis ad 3 cm, ad 4 cm aetate stigmatibus persistentibus. Epicarpium nitidum, durum, ca 0.3 mm crassum. Mesocarpium 5 — 10 mm crassum, aurantiaco-luteum, molle, fibris verticalibus numerosis, fructus *Prunus persicae* odoratum, apparenter edule. Pyrenae 3, discretae, 9 x 5 x 4 cm. Endocarpium durum, atro-brunneum, laeve extra; porcatum intra, 10 — 12 lamellis verticalibus altitudinis variae, 2 — 6 mm, duobus maximis radio fructus superjectis. Semina endocarpia complenta; testa ad 0.3 mm crassa. Endospermium osseum album, lamellis endocarpii penetratum. Embryo apicalis. Folia plantularum composita.

Solitary unarmed dioecious fan palm, to 20 m tall. Trunk bare, to 30 cm in diameter at breast height; grey, marked with annular leaf scars. Leaves massive, arching out of the crown of leaves. Petiole to 4 mm, split longitudinally at the base, to 4 cm wide, channeled above, covered in scurfy brown indumentum; petiole margins razor-sharp, smooth. Lamina more or less circular, to 4 m in diameter, dark green above, densely covered with milkywhite. indumentum below, the folds covered in sporadic brown indumentum; adaxial hastula to 2 cm; lamina divided by ca 10 — 12 splits nearly reaching the insertion, into compound leaflets; compound leaflets further divided into single fold induplicate leaflets, 4 — 5 cm wide, inter-leaflet filaments persisting; leaflet tips rounded; leaflets mostly stiff and radiating in one plane; transverse lamina veins prominent; lamina dorsiventral. Male inflorescence solitary, axillary, pendulous, to 40 cm in length, branching to produce 15 — 20 spikes of densely crowded flowers. Lower 1 — 2 spathes empty, tubular below, acutely triangular above, to 30 cm long by 8 cm wide at the base, light brown, covered in sporadic brown indumentum. Upper spathes smaller, subtending spikes in groups of 2 — 5. Spathes rotting to form a mass of fibres. Spikes to 12 X 2 cm, sessile in the axils of the spathes, clothed in dense spirals of overlapping bracts joined laterally; bracts densely covered in brown indumentum, each subtending a condensed scorpioid cymose branching system bearing 4 — 6 bracteoles each subtending one male flower. Male flowers exerted between the spike bracts at anthesis. Calyx tube to 9 x 15 mm irregularly 2 — 3 lobed. Corolla tube 9 mm long, with 3 apical cucullate lobes, 5 x 1 mm, dull brown in colour. Stamens 6; filaments 1 mm, partially fused together at the base. Anthers 2.5 mm yellow, basifixed, with latrorse dehiscence. Pollen grains yellow. Female inflorescence solitary, axillary,

pendulous, simple, to 40 cm long, of which 10 cm forms a peduncle, circular in cross-section, to 2 cm in diameter; inflorescence densely covered with 15 — 20 flowers. Spathes caducous, not seen. Flowers subtended by bracts. Calyx of 3 ovate coriaceous lobes to 3 cm, increasing in size with age to 4 cm. Corolla similar to calyx, with 3 free lobes. Staminode ring of 6 triangular lobes present. Ovary not seen. Stigmas long persistent, 3. Fruit obovoid, faintly trigonous, grey brown, to 10 x 11 cm, tipped with the remains of the stigmas. Epicarp shiny, hard, ca 0.3 mm thick. Mesocarp 5 — 10 mm thick, orangey-yellow, soft, with abundant vertical fibres, smelling of peaches, apparently edible. Pyrenes 3, discrete, 9 x 5 x 4 cm. Endocarp hard, blackish brown, smooth without, ridged within by 10 — 12 vertical flanges of varying heights, 2 — 6 mm, the largest two lying on a fruit radius. Seeds filling the endocarps; testa to 0.3 mm thick. Endosperm hard, bony, white, penetrated by the endocarp wings. Embryo apical. Seedling- leaves compound.

TYPUS: Male plant, *J. Dransfield 774a* (accompanied by female 77A) Mile 10, Bintulu to Miri new road, Bintulu, 4th Division, Sarawak (K).

DISTRIBUTION: in Lowland Dipterocarp Forest in Borneo, in 4th and 5th Division, Sarawak, Brunei, Sabah, and Northern Kalimantan.

VERNACULAR NAMES: Bindang, bidang, budang (Iban).

BORNEO. Sarawak: 4th Division, Bintulu, Mile 10 Bintulu — Miri new road, April 1968, *J. Dransfield 774, 774a* (K) ; 4th Division, Bintulu, Ulu Sungei Sinonok, vicinity of 2nd survey camp, October 1963, *M. Hotta 14241* (KUCH). —• Brunei: Brunei, Lamunin Road, Ladan Hills Forest Reserve-, April 1968, *J. Dransfield 800* (ITH). — Sabah: Kabili - Sepilok Forest Reserve, February 1937, *Keith, B.N.B. For. Dept. 7207* (K, L, BO) ; Sandakan, Sungei Paitan Forest Reserve, *AjiJc b. Gohol, San. 23956* <K>. —• Kalimantan: Central Kutei, Belajan River, near Long Bleh, *Kostermans 10366* (L). Kutei, S. Mentoko, Sangata, June 1971, ? *J. Dransfield 1559* (BO), 1560 (BO).

In the Bintulu area, *B. borneensis* is a local palm of low hills in Lowland Dipterocarp Forest. It occurs in small populations of both sexes on hilltops and hillslopes, but may be absent from large areas of apparently suitable forest nearby. On one hilltop near Bintulu, regeneration is abundant. The apex is edible and tasty, and is collected by Ibans for sale in Bintulu market at about one Malaysian dollar each; the taste is sweet and fragrant and the texture crisp. As more areas of forest become accessible, *B. borneensis* may be in danger from such destructive collecting of the apices. The populations in the Kutei Nature Reserve, Kalimantan Timur, show damage caused by the depredations of orang-utan; according to Mr. Peter Rodman (pers. comm.) orang-utans use the palm as an important food source, pulling out developing leaves, and eating the soft meristematic tissue at the leaf bases. In Brunei, I have observed only male trees in

the Lamunin Hills population. Besides the specimens quoted, I have also observed trees in the area north of S. Sotek, Balikpapan.

ACKNOWLEDGEMENTS

I should like to thank Mr. David Senada and Enche Zainuddin of the Forest Department, Bintulu, for assistance in the field, Sdr. Damhuri, artist of Herbarium Bogoriense, for preparing the habit sketches, Miss Yap Pak How, artist of Sabah Forest Department, for preparing the analytical drawings, and Dr. T. C. Whitmore and Prof. H. E. Moore for permission to have drawings made from their photographs.
