

# The Genus *Johannesteijsmannia* H. E Moore Jr.

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## Summary

A revision of the W. Malesian genus *Johannesteijsmannia* (Palmae) is presented. Of the four species described, three represent new species.

## History

In 1856/57 during his collecting trip in the Padang area of the West Coast of Sumatra, J. E. Teysmann of the Botanic Gardens, Bogor, Java, made contact with the Assistant Resident of Lima-puloe district, K. F. Stijman, who subsequently sent a variety of plants to Teysmann when he had returned to Java. Among these plants were fruits of a new palm which Stijman presumably described in an accompanying letter. Teysmann incorporated this collection in his account of his collecting trip in Sumatra (Natuurk. Tijdscht. Ned.-Indie 14 (4, new series) (1857) 321). In Zollinger's introduction to the description of this palm by Reichenbach f. and himself (Linnaea 28 (1856)), the finding of the palm was credited to Teysmann, who probably never saw it in the field but sent fruit and presumably leaves to Europe from Bogor; they named it *Teysmannia altifrons* Reichb. f. et Zoll. in honour of Teysmann. Miquel, however, described Apocynaceous specimens in 1857 as *Teysmannia* (versl. Med. K. Akad. Wetens. Amsterdam). The part of Linnaea 28 containing the description of *Teysmannia* Reichb. f. et Zoll. (Palmae) did not appear until 1858. In any case, Reichenbach f. and Zollinger could hardly have described the palm in 1856 before it had been collected by Stijman and sent to Bogor. By this time *Teysmannia* Miq. (Apocynaceae) had been validated and hence has priority over the palm even though it has been sunk into *Pottsia* Hook. et Arn. H.E. Moore Jr. (1961) has clarified this situation and coined the cumbersome new name *Johannesteijsmannia* H. E. Moore.

In the type description in Linnaea 28, Reichenbach and Zollinger suggest that *Johannesteijsmannia* should be placed next to *Salacca* and *Wallichia* and not far from *Nypa*, and that it shows affinities with the "Pandanaeous genus, *Carludovica*" (Cyclanthaceae).

According to Miquel (1868), the description in Linnaea was based on young sterile shoots from the Botanic Garden, Bogor (possibly grown from the seed sent by Stijman) and inflorescences sent from Sumatra, and that the description of the fruit was erroneous. Miquel (op. cit.) gave an extensive description of the palm, based on more material from Sumatra, and showed that in fruit structure and leaf form, *Johannesteijsmannia* approached the Coryphoideae rather than *Salacca*, *Wallachia* and *Nypa*.

It has not been possible to find the type specimen of *Johannesteijsmannia altifrons*. As Reichenbach's name is used with Zollinger's as the authority for the binomial, although the article in Linnaea 28 is titled "Uber ein neues Palmengeschlecht von der Insel Sumatra, von H. Zollinger" and not "von Reichenbach and H. Zollinger", it suggests that Reichenbach was included in the authority as a courtesy, possibly because the specimen described was in his herbarium. The

palms at Vienna where Reichenbach's herbarium was housed, were destroyed by fire and Prof. Rechinger (in letter) states that the type of *Johannesteijsmannia* was evidently lost during this fire. The specimens labelled by Miquel as collected by Teysmann in Sumatra, formerly in Utrecht herbarium, now in Florence, fit the original description very well and are taken as representative of *Johannesteijsmannia altifrons* in the present study.

Palm and Jochems (1924) wrote a popular account of *Johannesteijsmannia altifrons* in Sumatra with information on the habitat, abundance, uses, and distribution in Sumatra. Ridley (1925) in his "Flora of the Malay Peninsula, 5," described *Johannesteijsmannia* and introduced into the description the new information "stem very short to 7ft tall". As a result of my researches, I can now state that the "stem short" refers to *Johannesteijsmannia altifrons*, and "to 7 ft tall" to *Jt. perakensis* from Gunong Kledang, Perak.

Beccari (1931) monographed the genus with the other known Asiatic Coryphoideae.

*Johannesteijsmannia*, like most palms, has been neglected by plant collectors, and available herbarium material tends to be badly collected with little or no field notes.

## **Johannesteijsmannia** H. E. Moore Jr.

### **Description of the genus**

Solitary, acaulescent to shortly trunked forest undergrowth palms. Stem procumbent and subterranean, in one species (*Jt. perakensis*) becoming erect at maturity, marked with leaf scars. Leaves large, usually at least 3 m in length at maturity, exceptionally 6 to 7 m in length. Petiole extending to the apex of the lamina as a midrib. Leaf sheaths short, in age rotting to form an interwoven mass of brown fibres. Petiole channelled above, convex below, armed with short lateral usually recurved thorns, and often bearing two conspicuous yellow lines along either side. Scurfy brown indumentum abundant on the abaxial surfaces of the petiole. Hastula present as a small, dry, brown, dead strip of tissue at the insertion of the lamina on the petiole. Lamina entire, plicate, diamond-shaped to broadly lanceolate, the upper margin with shallow lobes showing vestiges of induplicate splitting. Lower leaf margins continuous with the margins of the petiole and similarly armed with short recurved thorns. Inflorescence axillary with c.6 tubular, lobed spathes all but the most distal lying in the same plane of insertion (i.e. opposing the subtending leaf). Inflorescence branched, with 1—5(6) orders of branching and 3—1,000 floriferous branches, with many crowded flowers each subtended by a bracteole, flowers grouped in clusters of (1)2—3(4). Flowers creamy-white, sessile, scented (variously) hermaphrodite. Sepals 3, fused to form a tube. Petals 3, valvate, fused minutely at the base. Stamens 6, the filaments connate at their swollen bases to form a ring, minutely epipetalous, abruptly attenuate, short. Ovary superior, composed of three uniovulate carpels,  $\pm$  free at the base but connate at the apex to form a common style. Stigma punctiform. Ovules erect, anatropous, bitegmic, crassinucellate. Fruit usually developing from one carpel only but occasionally two or more rarely three. Pericarp corky, cracking into pyramidal warts, endocarp hard, composed of lignified stone cells. Seed globose, attached at the base, embryo lateral. Endosperm homogeneous and penetrated within from the chalazal end by a convoluted mass of corky integumental and chalazal tissue.

SPECIES: 4

DISTRIBUTION: North Sumatra, Malay Peninsula, and Borneo.

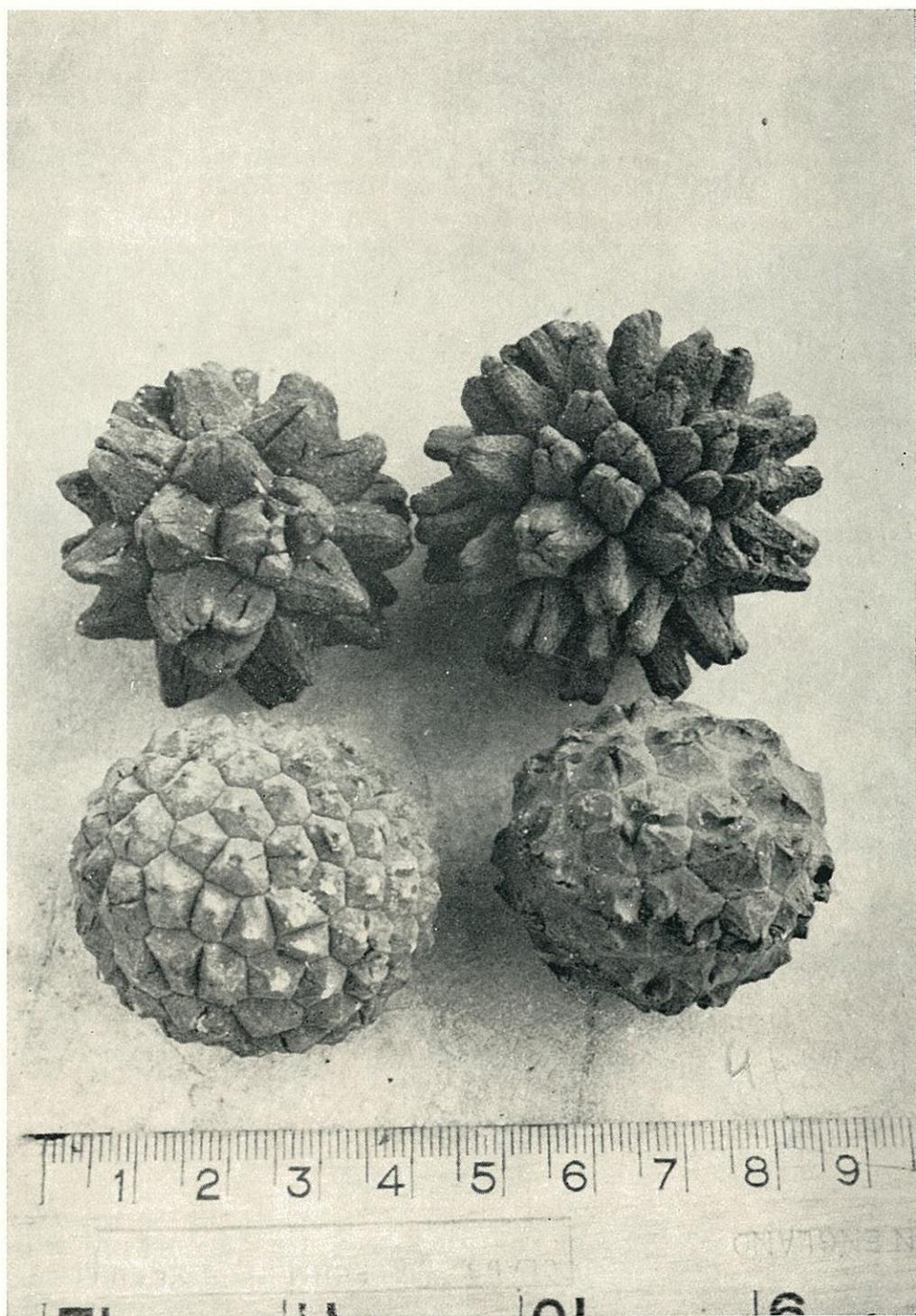


Plate 1. THE FRUITS OF JOHANNESTEIJSMANNIA Top left: *Jt. altifrons*; top right: *Jt. perakensis*; bottom left: *Jt. magnifica*; bottom right: *Jt. lanceolata*.



Plate 2. Orang asli house thatched with daun payong Ulu Semenyih, Selangor.

## Uses

The leaf of *Johannesteijsmannia* makes excellent thatching for aborigine huts and temporary shelters, either used directly, or sewn into ataps. In the Malay Peninsula it is unusual to see whole villages thatched with the leaves of *Johannesteijsmannia*. In Ulu Semenyih, Kajang, Selangor, one such aborigine village exists, where the thatch consists mostly of *Johannesteijsmannia* and some *Eugeissona* (see Plate 2). In Johore, Chinese logging huts in Mersing, Jemeluang and Kluang Forest Reserves, are very often walled and thatched with the leaves of *Johannesteijsmannia*. In Sumatra, Palm and Jochems (Palm and Jochems 1924) found the leaves of *Johannesteijsmannia*, in the form of ataps, used to the exclusion of the more usual thatching material made from *Metroxylon sagu* and *Nypa fruticans* in the area around Tandjungpura on the Batang Serangan in Atjeh, North Sumatra. According to these authors, atap of *Johannesteijsmannia* lasts from three-four years (depending on the thickness of the thatch and the pitch of the roof) whereas that of *Nypa* will last up to six years or more; however, *Johannesteijsmannia* thatch cost less than half the price of nipa-thatch.

According to an aborigine in Ulu Semenyih, Selangor, *Johannesteijsmannia* thatch in his village lasts three years. Burkill ((1935) 1966) records six years for nipa-thatch in Malaya and even longer for that of the sago palm.

A single leaf of *Johannesteijsmannia* makes a excellent umbrella (hence the Malay name "daun payong"—umbrella leaf).

The colonies of *Johannesteijsmannia altifrons* around Wray's Camp on Gunung Tahan, Pahang, have provided leaves for wind-shelters for the numerous expeditions camping at this exposed camp-site.

The young endosperm is reputedly edible.

## Native Names

## MALAY PENINSULA

daun payong — umbrella leaf  
pokok payong — umbrella tree  
daun sal  
sal  
koh  
pokok koh  
pokok sang

## SUMATRA

belawan (Miquel 1868, Beccari 1931)  
sang (Palm and Jochems, 1924)  
siemienjak boewah maseh (Miquel 1868)  
sieboesoeng boewah masah (Miquel 1868)

## BORNEO

daun ekor buaya (Malay) — crocodile's  
tail leaf  
sumuruk (Iban)

## Natural History

Flowering in the four species of *Johannesteijsmannia* occurs apparently at irregular intervals. Gregarious flowering has been observed in *Jt. altifrons* in January 1968 at S. Lalang F. R., and *Jt. magnifica* in May 1968 at S. Lalang. The flowering of the latter species followed the end of the long drought of January to March 1968 and coincided with flowering in many trees — it seems reasonable to suppose this flowering was climatically induced. In the former species it is not obvious what factor was responsible for gregarious flowering. In all species during 1967/68 it was unusual not to find one or two plants in flower in the populations at any given time.

The flowers of *Johannesteijsmannia* are variously scented, those of *Jt. altifrons* of sourmilk and sewage, those of *Jt. perakensis* sweetly, those of *Jt. magnifica* of *Tropaeolum majus*, and those of *Jt. lanceolata* of coumarin. Large numbers of Nitidulid beetle larvae and adults, Staphylinid beetles, Dipterous larvae, thrips, ants, termites and spiders can be observed among the inflorescences at anthesis, and many flowers show signs of being chewed. It is probable that pollination takes place by the unspecialized process of "mess and soil" (Faegri and van der Pijl 1966).

Nothing has been discovered, directly related to the dispersal of the fruit. Fruit occasionally show signs of having been chewed and it is possible rodents are of importance in dispersal. During germination of the seed, the cotyledonary sheath elongates to about 10 cm pushing the seedling into the ground; there is no cotyledonary ligule and the seedling most closely resembles that of *Phoenix dactylifera* (see Gatin 1906). The first photosynthetic leaf resembles that of *Licuala* spp. i.e. entire, but with a minutely dentate apex. Tomlinson (1960) suggests that burying of the seedling in the ground is an adaptation to dry conditions; this seems unlikely in *Johannesteijsmannia*, and it is not known what adaptive significance if any, this burying of the seedling in *Johannesteijsmannia* has.

### The Species of *Johannesteijsmannia*

Before the present investigations, only one species of the genus had been recognized (*Jt. altifrons* (Reichb. f. et Zoll.) H. E. Moore). I have recognized three new species in Malaya: *Jt. perakensis*, *Jt. magnifica* and *Jt. lanceolata*. It is thought that these new species have remained unrecognized owing to 1) the rarity of the species, 2) the general lack of interest in palms, 3) the difficulties of collection which tend to inhibit botanists from making collections of palms, 4) the difficulties in representing adequately a palm on a normal herbarium sheet, rendering many palm specimens virtually useless for taxonomic purposes, and 5) the lack of any extended fieldwork concentrated on the genus over a whole year.

*J. altifrons* is widespread but local; it is common in East Johore, and locally abundant on ridge-tops in the north of Malaya, apparently quite common in parts of North Sumatra (Palm and Jochems 1924), very local in West Sarawak and unrecorded, apparently, in Kalimantan, Sabah and Brunei. *Jt. perakensis* is known from two parallel mountain systems in Perak, and is the only species known in this area. *Jt. magnifica* is known from Ulu Semenyih, Selangor, and a few hills in North-eastern Negri Sembilan, and *Jt. lanceolata* is known from Ulu Semenyih (where it grows with *Jt. magnifica* and 1.5 km away from *Jt. altifrons*). There is an old collection referable to *Jt. lanceolata* from near Temerloh in Pahang; Whitmore (pers. comm.) collecting just south of this area near Temerloh in 1969 was unable to find any daun payong, and aborigines in the area apparently did not know of its occurrence. However, it may still survive in the area to the north (see Fig. 1 distribution map).

### A Key to the Species of *Johannesteijsmannia*

- (1) Plant tree-like with a trunk up to 4 m tall, inflorescence branches divaricate ..... *Jt. perakensis* J. Dransfield
- (1) Plant "stemless"



Fig. 1. DISTRIBUTION MAP OF JOHANNESTEIJSMANNIA IN THE MALAY PENINSULA

- (2) Leaves relatively narrow. 6—8 times as long as broad. Inflorescence with 3—6 pachycaul branches, to 1 cm in diameter, bearing spirals of papillate-petalled flowers. .... *Jt. lanceolata* J. Dransfield
- (2) Leaves relatively broad. Inflorescence with 20 or more leptocaul branches not more than 2.5 mm in diameter. Petals not papillate.
- (3) Leaves very broad, with dense grey-white indumentum on the lower surface of the lamina. Inflorescence with c. 1000 branches, fruits bright red brown with corky warts 2—3 mm high .....  
..... *Jt. magnifica* J. Dransfield
- (3) Leaves glabrous below. Inflorescence with c. 20—100 branches, fruits dull brown with warts 7—9 mm high .....  
..... *Jt. altifrons* (Reichb. f. et Zoll.) H. E. Moore

**Johannesteijsmannia altifrons** (Reichb. f. et Zoll.) H. E. Moore Jr. *Linnaea* 28 657-60 (1856), 1858, *Principes* 5(4) 116, 1961. Type locality: not known precisely but probably in the "Lima Puloe" province, Sumatra, West Coast. Stijman—communicated by Teysmann.

#### DESCRIPTION

Solitary, acaulescent, undergrowth palm. Stem subterranean procumbent to 15 cm in diameter. Leaves c. 20—30 erect, large, to 6 m tall. Petiole to 2.5 m x 2 cm, leaf sheaths to 40 cm rotting to form a network of brown fibres. Petiole armed with short thorns to 1 mm; petiole with lateral yellow lines prominent or not. Lamina to 3.5 x 1.8 m, diamond-shaped, with scurfy brown scales along the costa and at the short marginal lobes. Plicae to 20 or more on either side of the costa with fine anastomosing veins between the main veins of the folds. Lower leaf margin armed with short spines, as is the petiole.

Inflorescence axillary, at first erect and then pendulous from the primary axis. Spathes covered in fugaceous scurfy brown hairs, cream at first, then turning brown, five-six in number, 10—20 cm x 6—8 cm, tubular at the base, inflated above, split on one side, with acute apices. Peduncle 30—50 cm long, tomentose, c. 2 cm in diameter, branching to produce three orders of branches, floriferous branches 1.5—2.5 mm in diameter, to 100 cm long, c. 20—100 in number, greenish and covered in dense white tomentum; densely covered in flowers. Flowers glabrous, white, ± acute in bud, solitary or grouped in 2's or 3's, rarely 4's, borne on prominent tubercles, each subtended by a minute bracteole. Calyx short, 2 mm high, fleshy, glabrous, shallowly three-lobed. Petals fleshy, white, to 4 mm long, twice as long as broad, triangular, fused at the base into short tube c. 0.5 mm in height. Staminal ring minutely epipetalous, abruptly contracted above into six filaments. Anthers oval. Pollen grains white. Ovary glabrous with three carpels free at the base, at the apex connate into a common style. 0.8 mm in length, fruit 3.9—4.6 cm in diameter, usually developing from one carpel, rarely from two—three carpels, covered in 60—80 brown corky warts, 6.2—8.2 mm in height. Endocarp woody to 1 mm thick. Endosperm bony to 2.5 cm in diameter, penetrated at the base by corky integumental tissue. Embryo lateral.



Fig. 2. JOHANNESTEIJSMANNIA ALTIFRONS  
A: inflorescence, B: flower

## COLLECTIONS EXAMINED

## SUMATRA

1 — TEYSMANN s.n. Sumatra (ex U. now in FI). 2 — TEYSMANN s.n. Sumatra (ex L. now in FI). 3 — No collector mentioned, (June 25/1881) Sumatra (ex. CAL. in K). 4 — TEYSMANN 313, Raw, W. Kust Sumatra (BO). 5 — S.C.J. JOCHEMS (1924) Batang Serangan, O. Kust, Sumatra (BO, K, L). 6 — A. H. BATTEN-POOLL 5 — 7, (July 1939) Wassernar, Atjeh, Sumatra (SING).

## MALAY PENINSULA

1 — DR. GIMLETTE s.n. Serasa, Kelantan (SING). 2 — H. N. RIDLEY 3123 (1891) Tahan woods, Pahang (SING). 3 — R. E. HOLTUM 19118 (1928) Gunung Muntahak, Johore (SING). 4 — H. N. RIDLEY (1893) Tahan Woods, Pahang (FI). 5 — T. C. WHITMORE, FRI 3854 (1967) Ulu Endau, Johore/Pahang (KEP). 6 — FRI 94873, Gunung Arong Forest Reserve, Johore (KEP). 7 — DRANSFIELD (1967) Lenggor Forest Reserve, Johore. 8 — DRANSFIELD (1967) Kota Tinggi — Mersing Road, Johore. 9 — DRANSFIELD 916 (1968) Sungei Lalang Forest Reserve, Selangor. 10 — DRANSFIELD 610 (1968) Tahan Woods, Pahang. 11 — DRANSFIELD 688 (1968) Bukit Koh, Ulu S. Kenyam, Pahang.

## BORNEO

1 — O. BECCARI, P. B. 1942 (1866) Mattang, Sarawak (FI). 2 — O. BECCARI, P. B. 3645 (1867) Mattang, Sarawak (FI). 3 — E. F. W. BRUNIG 47450 (1956) Bukit Tambi, Bako, Sarawak (SING). 4 — E. F. W. BRUNIG, S. 9544 (1957) Bako, Sarawak (SAR). 5 — CARRICK AND ENOCH, JC. 162 (1959) Bako, Sarawak (SAR, KLU). 6 — J. W. PURSEGLOVE 5538 (1957) Bako, Sarawak (SING). 7 — DRANSFIELD 760 (1968) Bako, Sarawak.

## COUNTRY UNKNOWN

One specimen without label in U, probably from Sumatra.

Besides the above records obtained from herbarium specimens records have been communicated by Forest Staff, Forest Department, Malaya, Dr. T. C. Whitmore, and Malay aborigines, and some records have been obtained from Beccari (1931) and Ridley (1925). All records with localities have been incorporated in the map of the distribution of the genus *Johannesteijsmannia* (see Fig. 1 distribution map).

## HABITAT

*Jt. altifrons* like the other members of the genus is a plant of primary forest; it is never found in belukar (secondary regrowth) and it rarely survives any clear-felling of trees. It can, however, survive in selectively logged forest, but often sustains considerable damage from falling trees and scorching when exposed to direct sunlight. Within primary forest *Jt. altifrons* is a plant of ridge-tops and hill slopes on well-drained soils, often with a rich mor humus layer and occasionally podsolized. In Johore it occurs at 65 m above sea level on the gently sloping hills between fresh-water swamps. In Sarawak in Bako National Park, Kuching, *Jt. altifrons* occurs as low as 100 m above sealevel. Palm and Jochems (1924) record it at 25 m above sealevel. These records, however, are exceptionally low, the majority of populations occurring on hill slopes above 300 m. On Gunung Tahan, Pahang, *Jt. altifrons* grows at 1,000 m at the junction of Lower



Plate 3. JOHANNESTEIJSMANNIA ALTIFRONS Slender form from Bako National Park, Sarawak.



Plate 4. *JOHANNESTEIJSMANNIA ALTIFRONS* Northern hill-top form. Bukit Koh, Kuala Kenyam Taman Negara, Pahang.

and Upper Montane forest (sensu Richards 1952, — non Robbins 1968), growing with *Livistona tahanensis*, *Dipteris conjugata*, *Weinmannia blumei*, *Dacrydium elatum* and *Podocarpus neriifolius*. Another high record for *Jt. altifrons* is on Gunong Mandi Angin on the borders of Kelantan, Trengganu and Pahang where it grows at 1,200 m (Whitmore, pers. comm.). In most of its localities, *Jt. altifrons* is found in Hill Dipterocarp forest; in the low-lying Johore localities it is found in Lowland Dipterocarp forest, and in Sarawak in Kerangas forest (heath forest) on deeply podsolized soils. In all localities visited, soils are well drained. However Miquel (1861) records *Jt. altifrons* in Sumatra as growing as a swamp-palm, in maritime swamps similar to the habitat of *Nypa* — this seems highly unlikely when the Malayan and Bornean habitats are considered. Palm and Jochems (1924) record *Jt. altifrons* as occurring abundantly on the higher ground, but being absent from swamps. *Jt. altifrons* is not confined to soils derived from any one rock type, being found on granite-, rhyolite-, shale-, and sandstone-derived soils. Its main requirements appears to be one of well-drained soils.

Despite the abundance of apparently suitable habitats, *Jt. altifrons* is absent from large areas of Malaya. For example it is absent from more or less the whole of the Main Range of Malaya except for one record at Sungei Lalang, Ulu Semenyih, in Selangor. The two valley systems parallel to the Ulu Semenyih — Ulu Gombak and Ulu Langat — are well botanized and have large aborigine populations, and if *Jt. altifrons* grew there, it would have been recorded. Yet the three valleys are more or less identical in geology, vegetation, and aspect. The palm is such a conspicuous plant, and so well known to aborigines and Malaya that it is fairly safe to assume that absences represent real absences, and not lack of exploration. Similarly *Jt. altifrons* is absent from large areas of Taman Negara (the National Park), Pahang, being found only on Gunong Tahan, and on Bukit Koh near Kuala Kenyam. Bertam, *Eugeissona tristis* is similarly very local in the National Park, being known only from Bukit Jeram Panjang on the Tembeling River.

#### TAXONOMIC NOTES

*Jt. altifrons* varies considerably over its geographical range; depredations by aborigines and Malays for thatching, and forestry practices tend to obscure the pattern of variation in reducing the leaf size of the palm by leaf cutting and exposure to greater light intensities. Populations in the North of Malaya, in Pahang and Kelantan, and in Selangor on hill slopes and ridge-tops, usually have larger, more numerous leaves, and inflorescences with a larger number of branches than those of the populations of lowland Johore and Sarawak. It is sometimes possible to deduce the origin of a particular specimen if it is well collected. From the photograph in Palm and Jochems (1924) it appears that the Batang Serangan populations are most similar to those of lowland Johore and Sarawak. Plants at 1,000 m on Gunong Tahan approach in size those of lowland Johore but there is an observable gradation in size from large Hill Dipterocarp forest plants at 500 m to the small mountain forms at 1,000 m, as the mountain is ascended. Typical mature plants from Hill Dipterocarp forest at Sungei Lalang F. R., Ulu Semenyih, Selangor, had an average of 28 leaves per plant, leaves 5.5 m tall, lamina 3.5 m x 1.2 m: in contrast, typical plants from Sungei Kayu Aru, on the road between Kota Tinggi and Mersing, lowland Johore, had 20 leaves per plant, leaves 3.3 m tall, lamina 2.3 m x 1 m. Despite this variation in leaf size, floral structure appears to be constant. Owing to the scarcity of

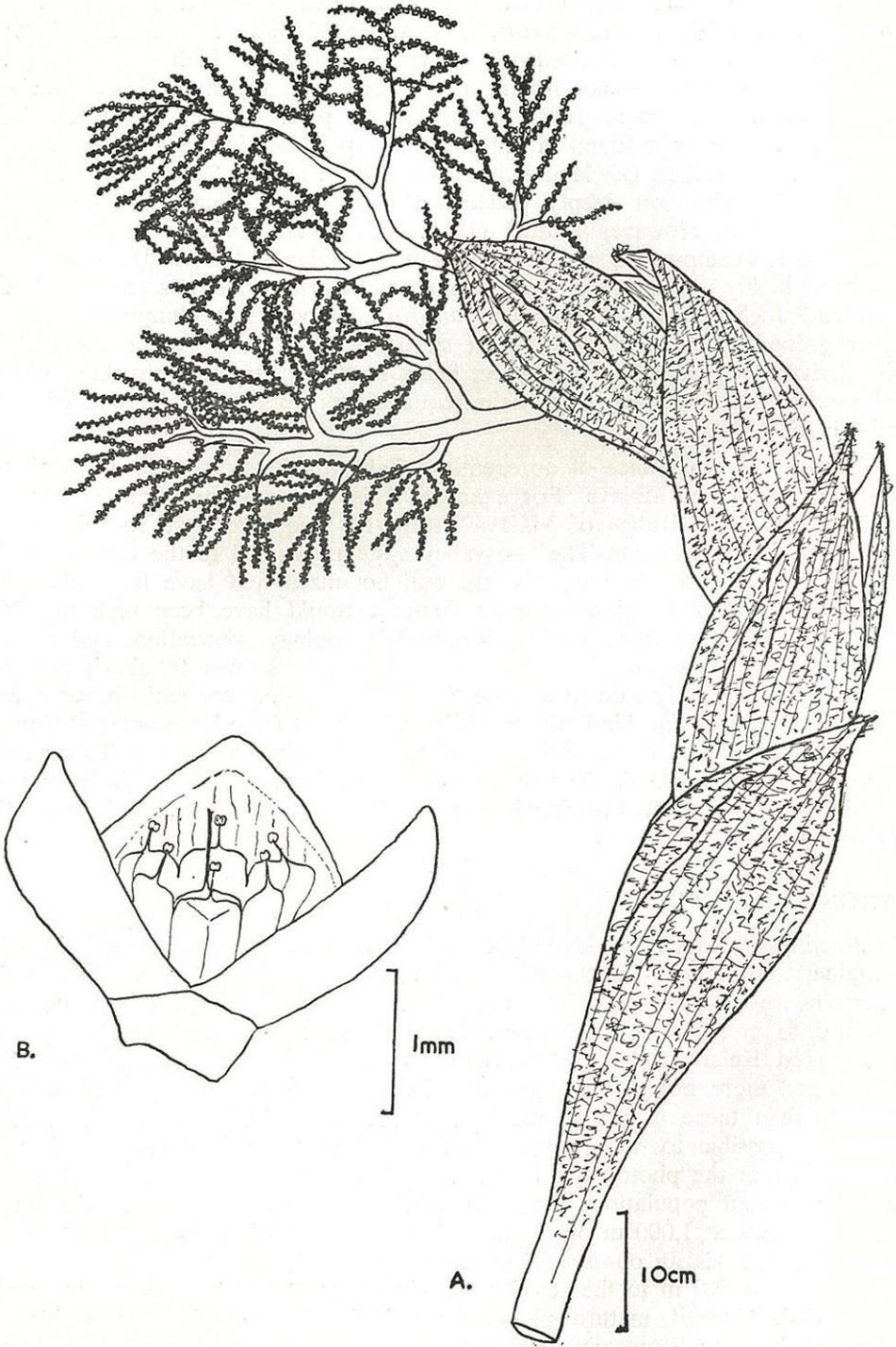


Fig. 3. JOHANNESTEIJSMANNIA PERAKENSIS  
A: inflorescence, B: flower

flowering material it has not been possible to pursue this problem further. It is possible that some of the variation in size is environmentally induced; on Gunong Tahan the soils at 1,000 m where the palm occurs are extremely poor podsols derived from weathering quartzite, whereas lower down the soils are derived from sandstones and are not podsolized. Some of the variation, however, is probably genetically controlled; many of the populations are isolated and the chances of cross pollination with other populations are minute, so circumstances are ideal for divergence of populations. It is only possible to speculate on the significance of the variation: unwieldy plants such as *Jt. altifrons* present too many difficulties for experimental work.

***Johannesteijsmannia perakensis* J. Dransfield, sp. nov.**

#### DIAGNOSIS

*Jt. altifrons* multo affinis, sed differt caule ascendenti trunci instar, inflorescentiae ramis in ordinibus quattuor divaricatis, floribus fragrantibus alabastro rotundatis, fructu maiore verrucis pluribus praedito.

#### DESCRIPTION

Palma solitaria, aetate caule ascendenti robusto ad 4 m alto et 15 cm diametro, annulato-cicatricoso. Folia erecta grandia ad 4 m longa. Petiolus ad 1 m longus, 2 cm latus. Lamina ad 3 m longa, ad 1.6 lata, squamis furfuraceis fuscis intra secus costam et in lobis brevibus marginalibus tecta. Plicae numerosae ad 20 utrimque, inter plicas nervulis lateralis anastomosantibus. Margo folii inferior spinis brevibus (ad 1 mm) armatus atque petiolus. Petiolus duobus striis luteis notatus. Vagina folii fibrosa marcescens reticulum fuscum formans.

Inflorescentia axillaris corona foliorum arcuata. Spathae fugaceo-furfuraceae, primo cremeae dein fuscentes, 5—6 numero, 20 cm longae et 8 cm latae, basi tubulosae superne inflatae, apicibus acutis, imo latere fissae. Pedunculus tomentosus ad 50 cm longus et 2 cm latus, ordinibus quattuor divaricatis ramosus. Rami floriferi 50—100, ad 2.5 mm diametro, ad 10 cm longi, viriduli, albotomentosi, floridi. Flores albi glabri, alabastro rotundati, solitarii vel bini vel terni aggregati, in tuberculis prominentibus insidentes, unusquisque bracteola minuta subtentus. Calyx brevis ad 1 mm altus, carnosus, glaber, paullo 3—lobatus. Petala carnea alba, ad 3 mm longa, late triangularis basi in tubo breve connata. Annulus staminalis minute epipetalus, in filamenta 6 aequalia superne abrupte subulata. Antherae ovaes. Grana pollinis alba. Ovarium glabrum carpellis 3 basi liberis, apice in stylo communi 0.8 mm longo connatis. Fructus ad 5 cms diametro, plerumque a carpello uno evolutus, raro a 2—3 carpellis, c. 60 verrucis suberosis fuscis sordidis ad 9 mm altis, tectus. Endocarpium lignosum ad 1 mm crassum. Endospermium osseum ad 2.5 cm diametro, basi integumentorum contextu suberoso penetratus. Embryo lateralis.

Malay Peninsula: Perak, in monte Gunong Kledang in Hill Dipterocarp Forest. J. Dransfield 871, Holotypus, June 1968; (K) et in monte Gunong Bubu, Whitmore FRI 0673.

Very similar to *Jt. altifrons* Reichb. f. et Zoll. but differs from this in the ascending stem, forming a trunk, inflorescence with four orders of divaricate branching, sweet-smelling flowers, rounded bud, and the larger fruit with more numerous warts.

Solitary palm, in age with a robust ascending stem to 4 m high and 15 cm in diameter, marked with annular scars. Leaves large, erect to 4 m high. Petiole to 1 m long, 2 cm wide. Lamina to 3 m long, to 1.6 m wide, clothed with brown scurfy scales along the underside of the costa, and at the short marginal lobes. Plicae numerous, to 20 or more on each side of the costa, with small anastomosing lateral nerves between the plicae. Leaf margin armed with short spines (to 1 mm) as is the petiole. Petiole marked with two yellow lines. Leaf base fibrous, withering to form a brown network of fibres.

Inflorescence axillary, arching out of the crown. Spathes covered in fugaceous scurfy scales, at first cream than becoming brown, 5—6 in number, 20 cm long and 8 cm wide, tubular at the base, inflated above, split on one side, with acute apices. Peduncle tomentose to 50 cm long and 2 cm wide, with four orders of divaricate branches. Floriferous branches 50—100, to 2.5 mm in diameter, to 10 cm long, greenish, covered in white tomentum, densely covered in flowers. Flowers glabrous, white, rounded in bud, solitary or grouped in 2's or 3's, borne on prominent tubercles, each subtended by a minute bracteole. Calyx short to 1 mm high, fleshy and glabrous, shallowly three-lobed. Petals fleshy, white, to 3 mm long, broadly triangular, connate in a short tube at the base. Staminal ring minutely epipetalous, abruptly contracted above into six filaments. Anthers oval. Pollen grains white. Ovary glabrous with three carpels free at the base, at the apex, connate into a common style 0.8 mm long. Fruit to 5 cm in diameter, usually developing from one carpel, rarely from 2—3 carpels, covered in circa 60 corky warts, dirty-brown in colour and 9 mm high. Endocarp woody to 1 mm thick. Endosperm bony to 2.5 cm in diameter, penetrated at the base by corky integumental tissue. Embryo lateral.

Malay Peninsula: Perak; on the hills of Gunong Kledang in Hill Dipterocarp forest. J. Dransfield 871, Holotype, June 1968: (K) and on Gunong Bubu, Whitmore FRI 0673.

#### COLLECTIONS EXAMINED

1 — H. N. RIDLEY (1898) Bukit Keledang, Perak (SING). 2 — C. CURTIS 3350 (1898) Kledang, Kinta, Perak (SING). 3 — R. LONG (1909) Kledang Hills, Perak (K). 4 — ex Penang Botanic Gardens (1909) source unknown (K). 5 — MD. HANIFF and MD. NUR, Sing. F.N. 6958 (1920) Sungei Siput, Perak (K, SING). 6 — MACHADO s.n. & s.a. Kamuning, Perak (SING). 7 — J. DRANSFIELD 871 (1968) Kledang Saiong Forest Reserve, Perak. (K) 8 — T. C. WHITMORE, FRI 0673, Gunong Bubu, Perak (SING, KEP).

#### HABITAT

In the Kledang Saiong Forest Reserve near Ipoh, Perak, *Jt. perakensis* is an abundant palm, growing gregariously on hill slopes and ridge-tops from about 175 m to 850 m. At the southern end of the range near Parit, it is equally abundant on hill slopes and ridge-tops; in the Virgin Jungle Reserve it is confined to slopes and is absent from ridge-tops. Soils are well drained and derived from granite. Much of the Forest Reserve has been selectively-logged, but *Jt. perakensis* has survived the logging in many places. On Gubong Bubu, Whitmore records the palm as locally very common on ridge-tops at 800 m.



Plate 5. *JOHANNESTEIJSMANNIA PERAKENSIS* Kledang-Saiong Forest Reserve, Perak.



Plate 6. *JOHANNESTEIJSMANNIA MAGNIFICA* (left) AND *Jt. LANCEOLATA* (right) S. Lalang Forest Reserve, Selangor. (Photo Courtesy of HO Sai Yuen, Kepong).

## TAXONOMIC NOTES

*Jt. perakensis* and *Jt. altifrons* are more closely related than the other species of the genus. The separation of *Jt. perakensis* as a distinct species is justified on the basis of the characters in the diagnosis (see above) and the great isolation of the populations. The nearest populations of *Jt. altifrons* are in (1) West Kelantan separated from the Perak Hills by 100 km and the intervening Main Range rising to 2,400 m and nowhere in this region below 1,000 m, (2) Sungei Lalang in Selangor 200 km to the South, and (3) the Batang Serangan in East Sumatra 300 km to the West and separated by the Straits of Malacca. Isolation was probably even more effective during the Pleistocene at the maximum sea level, when, with sea level circa 80 m above present levels (Walker 1954), the Bubu massif and the Kledang-Saiong massif were probably isolated as islands off the main Malayan landmass.

In badly collected specimens it is usually difficult to distinguish *Jt. perakensis* from *Jt. altifrons*. Infructescences are usually represented, and these always have divaricating floriferous branches.

***Johannesteijsmannia magnifica* J. Dransfield, sp. nov.**

## DIAGNOSIS

Differt a speciebus ceteris foliis latissimis, lamina infra indumento lacteo tecta, inflorescentia ordinibus 5—6 ramosa, petalis angustis reflexis.

## DESCRIPTION

Palma solitaria acaulescens, caule subterraneo procumbente ad 15 cm diametro. Folia erecta grandia latissima ad 5 m longa, lamina ad 3 m longa et 2 m lata, superne glabra, infra indumento lacteo vestita, costa marginibusque lobatis nudis. Plicae numerosae ad 20 utrinque inter plicas nervulis lateralis anastomosantibus. Margo inferior folii spinis brevibus (ad 15 mm) armatus atque petiolus. Petiolus duobus striis conspicuis notatus. Vagina folii fibrosa ad 25 cm longa marcescens reticulum fuscum formans.

Inflorescentia axillaris e cumulo foliorum mortuorum et fragmentorum plantarum aliorum in corona collectante arcuata. Spathae primo cremeae, dein fuscentes, 5—6, 26 cm longae et 7 cm latae, basi tubulosae superne inflatae, apicibus acutis, uno latere fissae indumento albo dense tectae. Pedunculus tomentosus ad 80 cm longus, 2 cm diametro, ordinibus 5—6 ramosus. Rami floriferi 500—1,000, ad 1.5 mm diametro ad 7 cm longi albi glabri, floridique. Flores glabri, alabastro acuti, solitarii vel bini vel terni aggregati, in tuberculi prominentibus insidentes, unusquisque bracteola minuta subtentus. Calyx brevis ad 0.5 mm altus, carnosus glaberque, paullo 3—lobatus. Petala ad 15 mm longa, angustetriangularia, 3—plo longiora quam latiora, carnosae albae, reflexa, basi in tubo breve connata, intra rugosa. Annulus staminalis minute epipetalus, in filamenta 6 aequalis superne abrupte subulata. Antherae ovales. Grana pollinis alba. Ovarium glabrum carpellis 3, basi liberis, apice in stylo communi 0.4 mm longo connatis. Fructus ad 4 cm diametro, plerumque a carpello uno evolutus aliquando a 2—3 carpellis, c. 150 verrucis humilis suberosis fusco-rufescentibus, ad 2.5 mm altis, tectus. Endocarpium lignosum ad 1 mm crassum. Endospermium osseum ad 2.5 cm diametro, contextu integumentorum suberoso basi penetratus. Embryo lateralis.

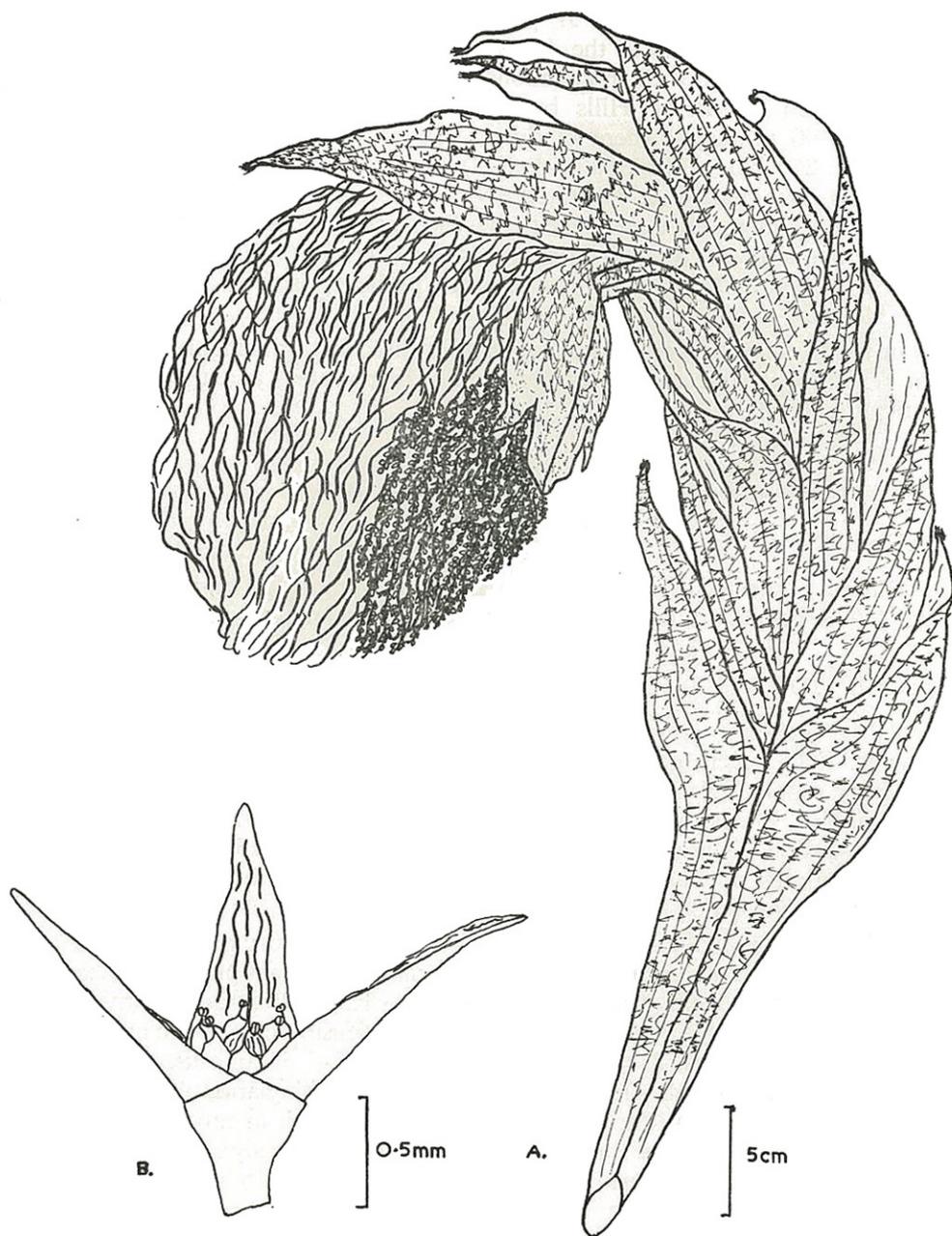


Fig. 4. JOHANNESTEIJSMANNIA MAGNIFICA  
A: inflorescence, B: flower

Malay Peninsula: *Selangor*, in valle humido, Virgin Jungle Reserve Sungei Lalang Forest Reserve, Semenyih, Kajang, in Hill Dipterocarp Forest. J. Dransfield 862, Holotypus, May 1968 (K); et *Negri Sembilan* in monte Bukit Tangga, Seremban, Napier 1903 (SING) et Dransfield (1967); et in monte Gunong Angsi, Corner.

Differing from the other species by the very broad leaves with the lamina covered with white indumentum below, the inflorescence with 5—6 orders of branching, and the flowers with narrow reflexed petals.

Solitary acaulescent palm with procumbent underground stem to 15 cm in diameter. Leaves erect, large and very broad, to 5 m tall, with lamina to 3 m long by 2 m broad, glabrous above, on the lower surface covered with white indumentum except along the costa and at the marginal lobes. Plicae numerous to 20 or more pairs on either side of the costa, with small anastomosing lateral nerves between the plicae. Lower leaf margin armed with short spines (to 1.5 mm) as is the petiole, Petiole with two conspicuous yellow lines. Leaf base fibrous, to 25 cm long, withering to form a brown network of fibres.

Inflorescence axillary, arching out of the pile of dead leaves and other plant debris accumulating in the crown of leaves. Spathes cream at first then becoming brown, 5—6 in number, 25 cm long and 7 cm wide, tubular at the base, inflated above, split down one side, with acute apices, and densely covered in white indumentum. Peduncle tomentose to 80 cm long, 2 cm in diameter, with 5—6 orders of branching. Floriferous branches 500—1,000 in number, to 1.5 mm in diameter and 7 cm long, white, glabrous, and densely covered in flowers. Flowers white and glabrous, acute in bud, solitary or grouped in 2's and 3's, borne on prominent tubercles, each subtended by a minute bract. Calyx short, to 0.5 mm high, fleshy and glabrous, shallowly three-lobed. Petals to 1.5 mm long, narrowly triangular, three times as long as broad, white and fleshy, reflexed, connate at the base into a short tube, and rugose within. Staminal ring minutely epipetalous, abruptly narrowed above into six equal filaments. Anthers oval. Pollen grains white. Ovary glabrous with three carpels, free at the base, connate at the apex into a common style 0.4 mm long. Fruit to 4 cm in diameter, usually developing from one carpel, occasionally from 2—3 carpels, covered by c.150 low, reddish-brown corky warts, to 2.5 mm high. Endocarp woody to 1 mm thick. Endosperm bony to 2.5 cm in diameter, with corky integumental tissue penetrating at the base. Embryo lateral. Malay Peninsula: *Selangor*, in humid valley, Virgin Jungle Reserve, Sungei Lalang Forest Reserve, Semenyih, Kajang, in Hill Dipterocarp Forest. J. Dransfield 862, Holotype, May, 1968 (K); and *Negri Sembilan* on Bukit Tangga, Seremban, Napier 1903 (SING) and J. Dransfield (1967); and on Gunong Angsi, Corner.

#### COLLECTIONS EXAMINED

1 — H. J. NAPIER (1903) Bukit Tangga, Negri Sembilan (SING). 2 — J. DRANSFIELD (1967) Bukit Tangga, Berembun Forest Reserve, Negri Sembilan. 3 — WONG YEW KWAN 95088 (1961) Cpt. 24, Sungei Lalang Forest Reserve, Selangor (KEP). 4 — J. DRANSFIELD (1967) Cpt. 3, Sungei Lalang Forest Reserve, Selangor. 5 — J. DRANSFIELD 862, (1968) Virgin Jungle Reserve, Sungei Lalang Forest Reserve, Selangor.

## HABITAT

In all localities visited, *Jt. magnifica* is a plant of steep slopes and ridge-tops except in the Virgin Jungle Reserve, Sungei Lalang Forest Reserve where it also grows at the side of a small river in a very humid valley bottom, alongside *Jt. lanceolata*; in this last locality *Jt. magnifica* occurs in great abundance in the untouched forest, from the valley bottom at 150 m to the ridge-top at 500 m. At Bukit Tangga in Berembun Forest Reserve in Negri Sembilan, *Jt. magnifica* grows in much disturbed, logged forest.

## TAXONOMIC NOTES

As *Jt. magnifica* and *Jt. lanceolata* grow side by side in the Virgin Jungle Reserve (see plate 6) it is possible that hybridization between the two species could take place. As any hybridization experiments would be extremely prolonged, difficult to perform, and dependent on simultaneous flowering, it has only been possible to use indirect evidence to assess the possibility of hybridization taking place. There are no intermediates observable in mature plants; in young plants the presence of white indumentum on the lower leaf surface is always correlated with laminae about  $1\frac{1}{2}$  times as long as broad. Narrower leaves are always glabrous except for scurfy brown scales along the midrib. Narrow leaved adults are always glabrous and always have the inflorescence and fruit characters of *Jt. lanceolata*. These facts suggest that hybridization does not occur.

**Johannesteijsmannia lanceolata** J. Dransfield **sp. nov.**

## DIAGNOSIS

Differt a speciebus ceteris foliis angustis, inflorescentia ramis 3—6, crassis, petalis papillatis.

## DESCRIPTION

Palma solitaria acaulescens, caule subterraneo procumbente ad 15 cm diametro. Folia erecta, plus minusve lanceolata ad 3.5 m alta. Lamina ad 2.4 m longa et 30 cm lata, squamis furfuraceis fuscis infra secus costam et nervos primarios tecta. Plicae numerosae ad 25 utroque costae latere, inter plicas nervulis lateralis anastomosantibus. Margo inferior folii spinis brevibus (ad 1 mm) armatus atque petiolus. Petiolus duobus striis luteis conspicuis notatus. Vagina folii fibrosa ad 25 cm longa marcescens, reticulum fuscum formans.

Inflorescentia axillaris inter petiolos infra cumulum foliorum mortuorum et fragmentorum plantarum aliorum infossa. Spathae primo cremae deinde fuscentes, caducae, 3—4 indumento fusco sparsim tectae, ad 20 cm longae et 2 cm latae, basi tubulosae, non inflatae, apicibus acutis, uno latere fissae. Pedunculus tomentosus ad 25 cm longus, 10 mm diametro, ordine uno ramosus. Rami floriferi 3—6, crassi ad 10 mm diametro et 16 cm longi, pubescentes, arcuati recte. Flores sessiles albi papillosoque, alabastro obtusi, solitarii vel bini vel terni aggregati, unusquisque bracteola minuta subtentus, spiritaliter dispositi. Calyx brevis, 0.3 mm altus, carnosus glaberque, paullo 3—lobatus. Petala ad 1 mm longa, late-triangularia, carnosissima, basi in tube breve connata, extus papillosa, intra apices aliquantum verruculosa. Annulus staminalis minute epipetalus, in filamenta 6 aequalis superne abrupte subulata. Antherae ovoides. Grana pollinis alba. Ovarium glabrum carpellis 3, basi liberis, apice in stylo communi 0.3 mm longo connatis. Fructus ad 3.4 cm diametro, plerumque a carpello uno evolutantes, saepe a 2—3 carpellis, c. 90 verrucis humilibus suberosis fusco-rufescentibus, ad 2.5 mm altis, tectus. Endocarpium lignosum ad 1 mm crassum.

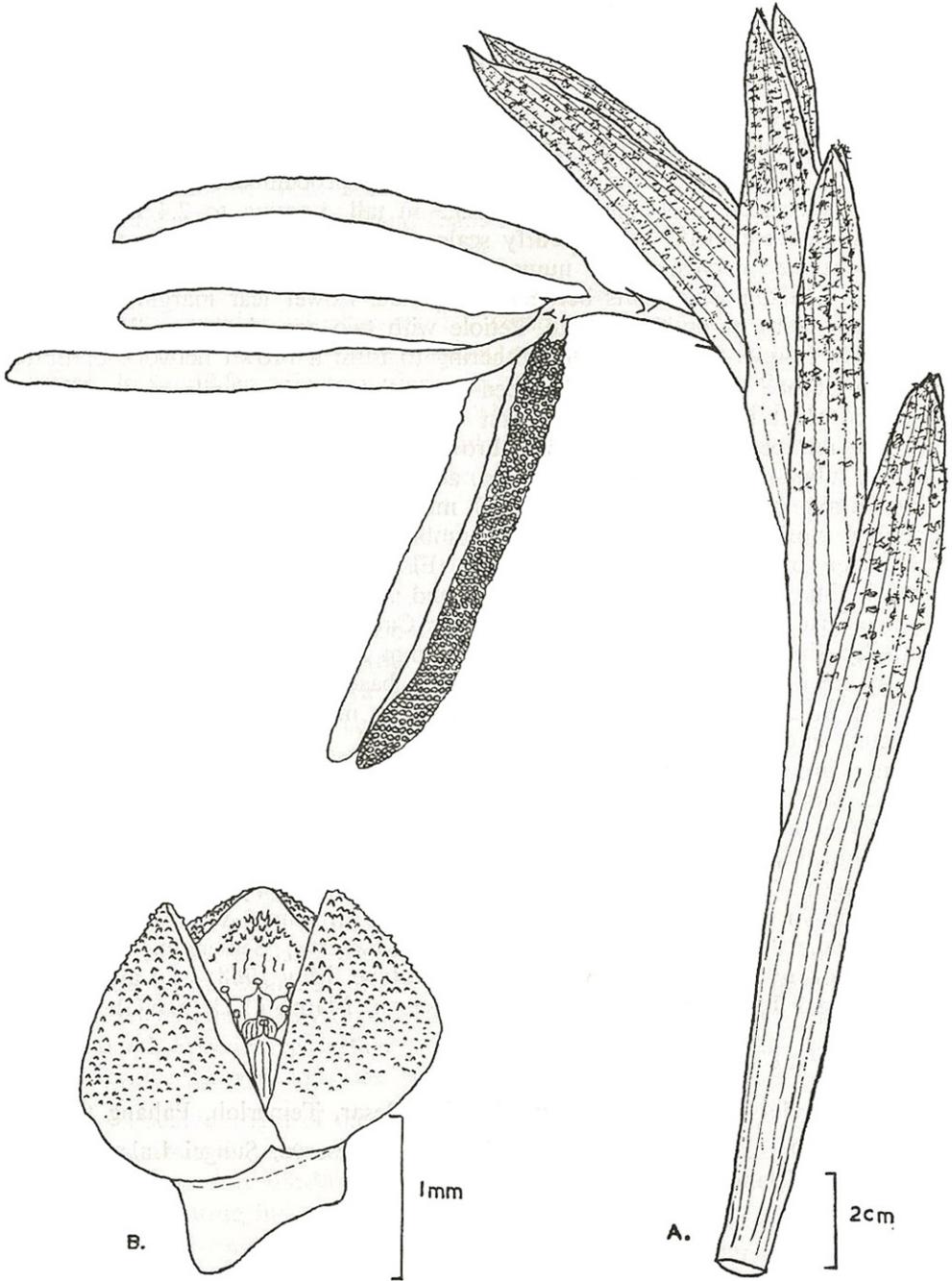


Fig. 5. JOHANNESTEIJSMANNIA LANCEOLATA  
A: inflorescence, B: flower

*Endospermium osseum* ad 2.5 cm diametro, contextu integumentorum suberoso basi penetratus. Embryo lateralis. Malay Peninsula: *Selangor*, in valle humido prope flumen, Virgin Jungle Reserve, Sungei Lalang Forest Reserve, Semenyih, Kajang, in Hill Dipterocarp Forest. J. Dransfield 861, Holotypus, May 1968; (K) et *Pahang*, in Ulu Sungei Tekal Besar, Temerloh, Henderson March 1923 (SING).

Differs from the other species by the narrow leaves, the inflorescence with 3 — 6 thick branches and the flowers with papillate petals.

Solitary acaulescent palm, with subterranean procumbent stem to 15 cm diameter. Leaves erect,  $\pm$  lanceolate, to 3.5 m tall. Lamina to 2.4 m long and 30 cm wide covered with brown scurfy scales on the underside, along the midrib and the primary nerves. Plicae numerous to 25 along each side of the costa, with small anastomosing veins between the plicae. Lower leaf margin with short spines (to 1 mm) as on the petiole. Petiole with two conspicuous yellow stripes. Leaf sheath fibrous to 25 cm long, withering to form a brown network of fibres.

Inflorescence axillary buried between the petioles under a pile of dead leaves and other plant debris. Spathes at first cream, then turning brown, caducous, 3 — 4 in number, sparsely clothed in brown indumentum, to 20 cm long and 2 cm wide, tubular at the base, not inflated, acute at the apex, split down one side. Peduncle tomentose to 25 cm long, 10 mm in diameter, with one order of branching. Floriferous branches 3 — 6 in number, thick, to 16 cm long and 10 mm in diameter, pubescent, curved or straight. Flowers sessile, white and papillate, obtuse in bud, solitary or grouped in 2's and 3's, each subtended by a minute bracteole, arranged in a spiral on the branch. Calyx short 0.3 mm high, glabrous and fleshy, shallowly three-lobed. Petals to 1 mm long, broadly triangular, fleshy, and very thick, connate into a short tube at the base, papillose without, somewhat verrucose within towards the apex. Staminal ring minutely epipetalous, abruptly contracted into six equal filaments. Anthers oval. Pollen grains white. Ovary glabrous, carpels three, free at the base, connate at the apex to form a common style 0.3 mm long. Fruit to 3.4 cm in diameter, usually developing from one carpel, often developing from two or three, covered with c.90 low corky warts, reddish-brown in colour, to 2.5 mm high. Endocarp woody to 1 mm thick. Endosperm bony to 2.5 cm in diameter, penetrated at the base by corky integumental tissue. Embryo lateral. Malay Peninsula: *Selangor* in humid valley by the river, Virgin Jungle Reserve, Sungei Lalang Forest Reserve, Semenyih, Kajang, in Hill Dipterocarp Forest. J. Dransfield 861, Holotype, May 1968: (K) and *Pahang* in Ulu Sungei Tekal Besar, Temerloh; Henderson, March 1923 (SING).

#### COLLECTIONS EXAMINED

- 1 — Henderson (1923) Ulu Sungei Tekal Besar, Temerloh, Pahang (SING).
- 2 — J. Dransfield 861 (1968) Virgin Jungle Reserve, Sungei Lalang Forest Reserve, Selangor (K).

#### HABITAT

In Sungei Lalang Virgin Jungle Reserve, *Jt. lanceolata* is known from the steep banks of a forest river in a deep humid valley; growing with *Jt. magnifica*. Despite the proximity of the river, *Jt. lanceolata* grows on well drained soils and not in the low swampy ground at the bends in the river. The population of *Jt. lanceolata* was probably once greater — further down the valley scattered individuals occur growing in logged forest near the river.

## The Geography of *Johannesteijsmannia*

*Johannesteijsmannia* is confined to North Sumatra, the Malay Peninsula, and West Borneo, with one widespread species *Jt. altifrons*, and three species endemic to the Malay Peninsula. The concentration of species in the Malay Peninsula may be a reflection of the more intensive fieldwork carried out in Malaya; there are, for example, as far as is known, no post 1940 specimens of *Jt. altifrons* from Sumatra, and the possibility of new species of the genus occurring in Sumatra cannot be ruled out. *Jt. altifrons*, however, in Sarawak appears to be genuinely rare, and Forest Staff and Ibans in Brunei did not know of the existence of this very conspicuous and useful palm.

It seems most reasonable, however, to suppose that the centre of diversity of the genus coincides with present day centre of distribution — i.e. the uplands of Selangor, Negri Sembilan and Pahang, where three of the four species grow together. In late Mesozoic time this area was somewhere near the centre of the Sundaland mass (van Bemmelen 1949, Umbgrove 1949), and this area together with West Sarawak, East Sumatra, Banka and Billiton, has remained above sea level until the Pleistocene marine incursions (Umbgrove l.c.) when it seems probable (extrapolation from Malaya) that much of Banka and Billiton and of lowland East Sumatra would have been submerged during the maximum sea level of 80 m (Walker 1954). It is the area of Sundaland now represented by Malaya and Borneo which probably remained as land through the Pleistocene, that harbours the greatest concentration of species in the palm genera *Licuala*, *Calamus*, *Daemonorops*, and *Korthalsia*. (the number of species of *Licuala* on New Guinea exceeds the number in Malaya and Borneo individually, but if Malaya/Borneo is treated as one land mass, i.e. part of Sundaland, then the total exceeds that of the land mass of New Guinea and its outlying islands).

The limited distribution of the genus can be explained in two main ways: (1) the genus is an ancient one and survives as a relatively unsuccessful form in the area of its diversity as a relic of Coryphoid evolution, (2) the genus has relatively recently evolved and has not yet spread to areas outside its area of origin. That *Johannesteijsmannia* has many characters in common with *Licuala* but is in many ways more primitive than *Licuala* (e.g. leaf and inflorescence structure) suggests it is probably more ancient than the successful widespread genus *Licuala*. It therefore seems more likely that *Johannesteijsmannia* is an ancient genus surviving in Sundaland. Speculating further I would suggest an origin during the Mesozoic from primitive Coryphoid stock.

If a Mesozoic origin of the genus in the Malay Peninsula is assumed then the spread away from the centre could have occurred any time during the late Mesozoic and the Tertiary. Any pre-Miocene invasion of Sumatra would probably have been destroyed by marine incursions, for much of Sumatra was submerged during the Miocene (Umbgrove 1949). Only one species at the present day, *Jt. altifrons*, has spread out of the proposed centre of diversity, and is therefore to be regarded as the most successful and adaptable species. *Jt. altifrons* probably reached Sumatra during the Pliocene, and was then cut off from the Malayan populations by the appearance of the Straits of Malacca. *Jt. altifrons* could have reached Sarawak any time before Borneo was separated from the Malay Peninsula during the Pleistocene, but the very local occurrence of the species in West Sarawak suggests

that the invasion of Borneo is relatively recent, (e.g. in the Pliocene corresponding with the proposed time of spread into Sumatra). *Jt. altifrons*, although it has reached Sarawak, is absent from Pulau Tioman (Pahang), Penang and the Anamba and Natuna Islands; the absence may be due to chance extinctions if the palm ever colonized these islands or else it was unable for some reason to reach the islands.

The distribution of *Jt. altifrons* within the Malay Peninsula is disjunct and it seems reasonable to suppose that *Jt. altifrons* was at one time widespread over the whole area; this may have coincided with the proposed period of active expansion which resulted in the colonization of Sumatra and Borneo. The disjunction of the range of distribution has resulted in slight vicarious evolution; the isolated populations have diverged slightly from each other. In Perak, populations on the Bubu Range and Gunung Kledang have diverged further and reached a degree of divergence where it is convenient to regard them as a distinct species, *Jt. perakensis*. The evolution and distribution of *Jt. lanceolata* and *Jt. magnifica* cannot be explained by vicariism (as Croizat 1968 would explain the speciation of *Ficus* — refuted by Corner 1969); the two species occur alongside *Jt. altifrons* in the one Forest Reserve in Selangor, apparently with the same ecological requirements. It is most reasonable to regard *Jt. lanceolata* and *Jt. magnifica* as relatively unsuccessful early products of form making within the genus which have survived near the centre of diversity without having spread. (*Jt. lanceolata* has reached central Pahang from the proposed centre of diversity).

The dispersal powers of *Jt. altifrons* appears to be very limited — seedlings are rare, — and the distribution of the whole genus suggests plants of very limited dispersal powers at the present day, surviving as relics in the centre of massing of the Asiatic coryphoid palms, as do *Liberbaileya gracilis* and *Maxburretia rupicola* (Furtado 1941).

#### Acknowledgements

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