

The Genus *Iguanura* Bl. (Palmae)

by

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Summary: A revision of the Malesian genus *Iguanura* Bl. is presented. The genus, which is confined to Thailand, Malaya, Sumatra and Borneo, comprises 16 species, four of which represent new species.

Iguanura is a genus of forest undergrowth palms confined to Borneo, Malaya, Sumatra and Southern Thailand. In Malaya *Iguanura* has a widespread distribution being found in almost every area of lowland forest and occasionally species of *Iguanura* dominate the undergrowth, being found in dense stands.

The botany of Malaya is comparatively well known and *Iguanura* is included in both the floras of J. D. Hooker (1892) and Ridley (1907, 1925), the latter providing a key to Malayan species which tends to cloud rather than clarify the differences between the species. Furthermore in his 1925 edition, the description that Ridley gives for *I. ferruginea* is actually that of *Licuala ferruginea*. Whitmore (1973) has also considered the Malayan members of the genus in his popular book on palms. In contrast, although the species in Borneo are more numerous, they are less well known and no previous composite account or key exists for these species. All in 21 species of *Iguanura* have been described by previous authors — twelve from Malaya, seven from Borneo, one from Sumatra and one dubious species *I. speranskyana* has been described from Brazil.

Iguanura has been regarded as a confusing genus and difficulty has been experienced in identifying taxa in the field with the result that *Iguanura* has remained obscure. Among the Malayan taxa there has been a proliferation of species descriptions based on extreme forms or unsound characters while there has been no systematic study of the species in Borneo since Beccari's time. Detailed study of the genus has resulted in the reduction of nine species (eight from Malaya) and the exclusion of *I. speranskyana* from the genus. Four new species from Borneo are described, bringing the total number of species in the genus to 16.

The genus *Iguanura* is probably not closely related to the other genera of West Malesian arecoid palms and is readily distinguished from the other widespread and common dwarf arecoid palms — *Pinanga*, *Areca* and *Nenga* — and from those with a more restricted distribution — *Rhopaloblaste* and *Gigliolia* — by a combination of the following characters: a praemorse leaf margin, interfoliar inflorescences (except for *I. bicornis*), deeply sunken triads of flowers and the basal position of the stylar remains in the fruit.

Many species of *Iguanura* are most attractive both in habit, varying from palms four metres in height to the minute *I. palmuncula* with leaves the size of a hand, and in possessing red, juicy, drupaceous fruits and delicate foliage. *Iguanura* has

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not been widely introduced into cultivation. It is not difficult to grow from seed and it has been cultivated in the Botanic Gardens of Bogor, Singapore and at the Waterfall Gardens in Penang. There appear to be no records of its being cultivated either in America or Europe except for the exhibition specimen of *I. wallichiana* which was displayed at Ghent in 1898. Seedlings I took to England have thrived in the glass houses at the Cambridge Botanic Gardens. Recently Dransfield distributed a large quantity of seed of *I. macrostachya* from Bogor.

History

The genus was first described by C. L. Blume (1838a) for *Iguanura leucocarpa* which was based on two collections from Sumatra, one collected by Korthals from Padang and the other from Palembang (perhaps collected by Praetorius). In Rumphia (1838b) Blume writes that it was so named "ob aliquam spadice obsessi cum cauda quorundam Amphibiorum, quae ad Genus *Igvanus* pertinent, similitudinem, ei inditum eat". However it is only the immature spadix that appears scaly due to the effect of the raising of the pit bract as the male flowers develop.

Porter first collected in 1822 from Penang what Martius later (1837) described as *Areca wallichiana*, but it was not until 1883 that J. D. Hooker transferred this species to the genus *Iguanura*. From Griffith's collection from Malacca *Slackia geonomaeformis* Griffith was described in 1842 and which Martius transferred to the genus *Iguanura*, thus making *Slackia* synonymous with *Iguanura*.

The first species to be described from Sarawak was *I. remotiflora* which had been collected by Lobb in 1857 and described by Wendland (1859). This was followed by *I. borneensis* described by Scheffer (1876) from a collection by Teysmann from Borneo.

Beccari (1886) described *I. bicornis*, *I. corniculata*, *I. malaccensis* and *I. polymorpha* from the west coast of Malaya and *I. ambigua*, *I. elegans*, *I. macrostachya* and *I. palmuncula* from his own collections from Sarawak. J. D. Hooker (1892) using Beccari's manuscript, described *I. diffusa*, *I. parvula* and *I. wallichiana* var *major* and var *minor* besides a new species, *I. brevipes*. Ridley (1904) described two species from his Malayan collections — *I. ferruginea* and *I. spectabilis* — and one species from Sarawak — *I. sanderiana*, from a collection by Micholitz. Finally in 1934, *I. arakudensis* was described by Furtado and, *I. ridleyana* from Sarawak, described by Beccari, was published posthumously. No recent revision of the genus *Iguanura* has been made.

Iguanura is confined to West Malesia. (Bois, 1899, described *I. speranskyana* from Brazil, but this is probably a geonomoid palm). It is a genus of the undergrowth of primary rain forests and in Malaya is widespread and often abundant. It has no economic value or uses although Burkill (1935, 1966) accords contraceptive ability to *I. wallichiana* based on a note made by Alvin in 1884, after Alvin had been told by an aboriginal community "Anybody don't wished their wife confined, they shall eat this roots and flowers".

Neither the aboriginals nor the Malays have any constant names which distinguish the species of *Iguanura*; all are called "pinang" which includes the forest species of *Areca*, *Pinanga*, *Nenga* and *Iguanura*. There are numerous local names (some, one suspects, are coined on the spot). "Terunoh" or Terunok" has been cited as the native name for *I. wallichiana* subsp. *wallichiana* var. *major* (*I. spectabilis*) although it is used for var. *wallichiana* in Kelantan and Pahang.

Genus

Iguanura Bl.

Iguanura Blume, Bull. Sci. Phys. Nat. Neerl. 1: 66 (1838); in Rumphia. 2: 105 (1843); Endlicher, Genera Plantarum. Suppl. 1, 1752/1: 1372 (1836-40); Meisner, Plantarum Vasc. Gen. 1: 226 (1836-43); Martius, Historia Naturalis Palmarum, 3: 229 (1823-50); Miquel, Flora Indiae Batavae. 3: 43 (1855-59); Scheffer, Ann. Jard. Buit. 1: 141 (1876); Hooker f., in Bentham and Hooker f., Genera Plantarum. 3: 907 (1883); Drude in Engler and Prantl, Nat. Pflanzenfam. 2: 68 (1887); Hooker f., Flora of British India. 6: 415 (1892); Ridley, Materials for Flora of Malay Peninsula. 2: 149 (1907); Flora of Malay Peninsula. 5: 13 (1925); Beccari and Pichi-Sermolli, Webbia 11: 140 (1955). Potztl in Engler's Syllabus Pflanzenfamilien. 2: 585-6 (1964). Whitmore, Palms of Malaya. 62 (1973).

Synonyms. *Slackia* Griffith, Calcutta J. Nat. His. 5: 469 (1845). Palms of British East India. 161 and pl. 163 (1851); Icones Plantarum Asiaticum 3: 162 (1851); Notulae ad Plantas Asiaticas 3: 162 (1851).

Type Species: *Iguanura leucocarpa* Bl.

Description

Small, unarmed, monoecious palms; acaulescent or stem erect to 4 m tall, slender ($\frac{1}{2}$) 1 (3) cm in diameter, with regularly spaced annuli 1-3 cm apart. Solitary or branched from the base and caespitose. Stembase with numerous stilt roots branching copiously at soil level. Crownshaft conspicuous in some species c. 25 cm long and 1.5 cm diameter. Crown of c. 7 leaves. *Leaves* arching out of the crown, bronze-coloured when young becoming rice green then olive green with age. Leaf sheath tubular c. 10-12 cm long with a conspicuous midrib continued into the petiole. In species with crownshaft, leaf abscission occurs and leaf sheath is green and limp; in species with non-abscissing leaves sheath is brown and fibrous and split for c. $\frac{1}{3}$ its length. Petiole c. 15 cm long and $\frac{1}{2}$ cm thick, rounded below, flat or grooved above. Rachis, often covered with brown hairs, tapering to a filiform apex. Lamina c. 30-85 cm long and 30 cm wide, thinly coriaceous, simple with an apical notch in juvenile plants and in some species (except in *I. sanderiana*) or in most species divided into compound reduplicate segments, slightly pendulous, variable in width and number but always with several veins, generally in pairs, the apical pair about twice the width of lower segments. Segments sessile, either parallelogram-shaped with the apical corner elongated and lateral veins parallel or trapezoid with a narrow base widening to the distal margin and with veins diverging from the rachis to the margin. Margin finely dentate, praemorse. Veins prominent, $\frac{1}{2}$ -1 cm apart, abaxial ones often covered with grey or dense brown hairs, *Inflorescence* axillary, inter- or infra-foliar, unbranched or paniculate with upto 15 rachillae c. 10 cm long, the lower rachillae often with second order branching; inflor green, either glabrous and shining or covered by a felt of fawn hairs at the base; either short (c. 4 cm) and below the leaves (*I. bicornis*) or long c. 30 cm and projecting beyond the leaf sheaths (upto 60 cm long in *I. wallichiana* and *I. macrostachya*). Inflor. base narrow, ultimately clasping $\frac{3}{4}$ of stem. *Spathes*, 2, sometimes persistent and papyraceous. Outer spathe c. 6-11 cm long, not extending beyond the leaf sheath, in cross section flattened and wings with a lateral row of teeth. Inner spathe attached c. 1 cm above the outer, longer c. 10-14 (25) cm long and round in cross-section. Inflor. piercing both bracts. 1-3 sterile bracts above the spathes, small (c. 25 mm long), green and ovate. *Floral pits* protandrous, arranged in loose spiral becoming tighter

towards the apex, immature flowers deeply sunk in pit. Pits with bract below and lip above, interior of pit densely covered with long brown hairs, pits widely spaced, c. $\frac{1}{4}$ –1 cm apart. *Flowers* sessile, unisexual and similar with prominent pistillode or staminodes, symmetrical, arranged in triads of 2 male and one female flower with 2 male flowers occupying a distal position to the female; in the distal part of the rachilla with pairs of male flowers only. Flowers rarely seen as triads but developing in succession; mature male I and immature male II; mature male II and immature female; and finally mature female. Male and female flowers similar in appearance, flowers 2–2.5 mm long, conic with a blunt apex or longer, 5 mm, and apex pointed in *I. leucocarpa*, *I. elegans* and *I. macrostachya*. Sepals 3, submerged within the pit, green or brown, cordate, imbricate, 1 x 1 mm, concave, brittle and slightly coriaceous, thinly transparent at the edges, terminating with a row of long simple hairs, inner surface laminate, often split at the apex. Petals 3, projecting beyond the pit, cream and strongly ribbed, fleshy at the base. *Male flowers* partly embedded in the pit, ephemeral, abscising between the petals and sepals. Petals valvate, thick, boat-shaped, closely appressed at the margins. Stamens 6, filaments free, erect 2.5 — 4 mm, inflexed in bud; anthers c. 1.5 — 2 mm, cream; pollen sacs 2, attached laterally, versatile, lobed or unlobed, splitting longitudinally on lateral side. Pistillode c. 7 mm tall, purple, stout, c. 2 mm in diameter, narrowly conical, slightly ridged (where anthers appressed in bud), flask-shaped with domed apex, apex dirty yellow and minutely papillose with raphid cells. Pollen: cream in colour; elliptic monocolpate (rarely tricoto-monocolpate, in *I. wallichiana*) furrow elliptic, exine finely reticulate (Thanikaimoni, 1966). *Female flowers* with stigmas projecting above the petals. Petals and sepals imbricate, increasing in size and thickness from sepals, c. 1.5 mm long, to the petals c. 3 mm long. Sepals thin, slightly coriaceous, brownish green or cream in colour except for some populations of *I. polymorpha* with crimson sepals. Sepals persistent but not falling with the fruit. Petals cream and fleshy. *Staminodes* 6, filaments tapering to a point without anther vestiges, staminodes mostly on opposite side of ovary to the single ovule. Ovary syncarpous, flask-shaped, 3 mm long, slightly asymmetric, bulged on the side of the single ovule. Stigmas 3, massive, sessile and recurved. Ovule hemitropous, pendant, reniform, crassinucellate with vestigial aril. *Fruit* drupaceous, small, 1 — 1.5 cm long and $\frac{1}{2}$ cm diameter, asymmetric with conspicuous basal styler remains, fruit variously shaped: olive-shaped, curved, bigibbous or with elongated apex. Pericarp smooth and fleshy; white, green or pink when unripe, ripening cerise, glistening, sweet and juicy (in all species observed in the field). Endocarp hard and fibrous, inner surface laminate, drying smooth or ribbed with a rounded seed cavity or longitudinally ridged with an angular seed cavity. Endosperm homogeneous, sometimes weakly (*I. polymorpha*, *I. corniculata*) or strongly ruminant (*I. wallichiana*), solid and horny at maturity. Embryo basal. *Germination*: hypogeal with cotyledon enlarging within the fruit, plumule develops through the fruit stalk scar. Plumule with 2 narrowly tubular scale leaves; third leaf with simple lamina, bifid apically, truncate or cuneate at base and margin finely serrate. Successive leaves similar but larger, in most taxa becoming pinnate from the base upwards, first one segment then with a pair of segments and so on.

Species: 16

Distribution: Borneo, Sumatra, Malaya and Thailand. Malaya: *I. corniculata*: Malaya and Thailand: *I. bicornis*; Malaya and Sarawak: *I. polymorpha*; Malaya, Sumatra and Sarawak: *I. wallichiana*; Sumatra: *I. leucocarpa*; Kalimantan: *I. borneensis*, *I. prolifera*; Kalimantan and Sarawak: *I. macrostachya*; Sarawak: *I. ambigua*, *I. elegans*, *I. melinauensis*, *I. minor*, *I. myochodoides*, *I. palmuncula*, *I. remotiflora*, *I. sanderiana*.

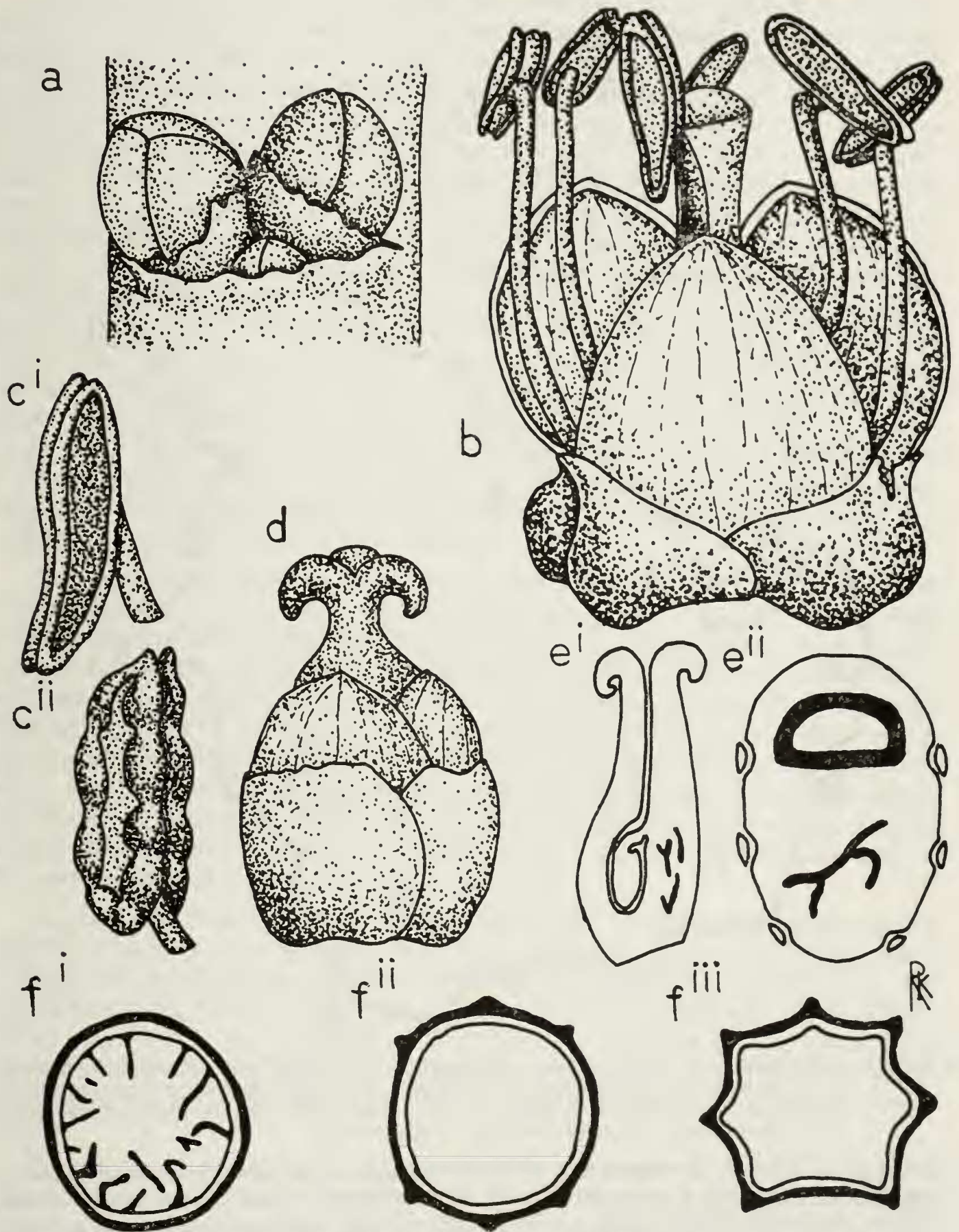


Figure 1. The flower and fruit of *Iguanura*. a. Sunken triad of flowers (*I. wallichiana*) x 4; b. male flower (*I. wallichiana*) x 20; c. stamens x 40 cⁱ unlobed anthers (*I. wallichiana*) cⁱⁱ lobed anthers (*I. remotiflora*); d. female flower (*I. wallichiana*) x 10; e. ovary (*I. wallichiana*) eⁱ LS x 8 eⁱⁱ TS x 20; f. TS of dried fruit x 3 fⁱ unribbed and unridged fruit with ruminant endosperm (*I. wallichiana*) fⁱⁱ ribbed fruit with homogeneous endosperm (*I. myochodoides*) fⁱⁱⁱ ridged fruit with homogeneous endosperm (*I. melinauensis*).

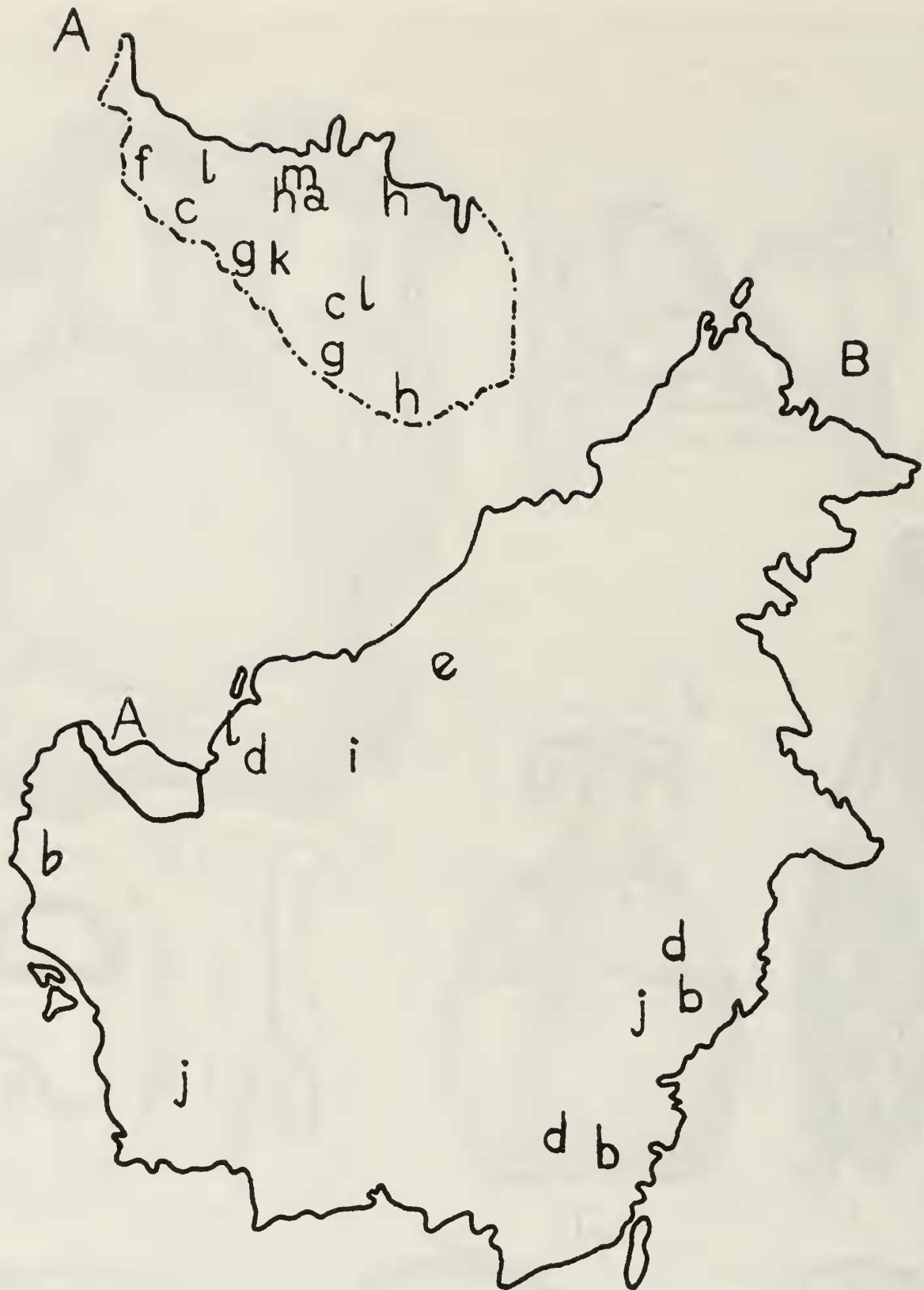


Figure 2. Distribution of *Iguanura* species in Borneo. A. 1st Division Sarawak. B. Borneo. a. *I. ambigua*; b. *I. borneensis*; c. *I. elegans*; d. *I. macrostachya*; e. *I. melinauensis*; f. *I. minor*; g. *I. myochodoides*; h. *I. palmuncula*; i. *I. polymorpha*; j. *I. prolifera*; k. *I. remotiflora*; l. *I. sanderiana*; m. *I. wallichiana*.

Ecology: In Malaya *Iguanura* is a ubiquitous palm in the undergrowth of primary rain forest although it may be absent from ridgetops and forest above about 1300 m, the highest record being 1500 m. It is absent from mangroves and exposed limestone, though *I. polymorpha* and *I. corniculata* have been collected growing in crevices at the base of limestone hills. It frequently dominates the undergrowth, particularly in the vicinity of streambeds and in seasonally swampy areas.

In Borneo (Fig. 2) and Sumatra, *Iguanura* may be common very locally but none of the species is common and widespread. *I. palmuncula* var *lenta* has been collected from shallow peat and *I. melinauensis* from limestone debris. Otherwise *Iguanura* is confined to the undergrowth of the lowland and hill forests.

It has never been recorded from open habitats.

The relationship of the genus *Iguanura* to other Malesian arecoid genera

Other genera of small palms which are common and widespread in Malaya, Sumatra and Borneo are *Pinanga*, *Areca* and *Nenga* which are more closely related to each other than they are to *Iguanura* and from which *Iguanura* is distinguished by its praemorse leaf margin, interfoliate inflorescences (except for *I. bicornis*) and by the basal position of the stylar remains in the fruit. Two other arecoid genera of undergrowth palms are represented by *Rhopaloblaste singaporensis* (Becc.) Hook. f. in Malaya and *Gigliolia* in Sarawak. *Gigliolia subacaulis* Becc superficially resembles *I. elegans* in habit and leaf shape but the leaf margin is serrate rather than praemorse and the flowers of these genera are very different. *Rhopaloblaste* can also be readily distinguished from *Iguanura*, *Rhopaloblaste* possessing narrow leaf segments with a single main vein and its stylar remains occupying an apical position in the fruit. Furthermore, *Iguanura* exhibits several unusual features not seen in the other palms growing in this region, namely the triads of flowers deeply sunken in pits, lobed anthers (Fig. 1) in some species and a wide range of fruit shapes (Fig. 3). In addition *Iguanura* displays several features of leaf anatomy (Kiew 1972 PhD, unpublished) which Tomlinson (1961) records as being unusual in arecoid palms, namely: the possession of epidermal cells with sinuous walls, the possession of different types of hairs, the absence of an adaxial hypodermis and scattered nonvascular fibres in the mesophyll.

The position of *Iguanura* within the arecoid palms has been subject to widely differing opinion. J. D. Hooker (1883) divided the Areceae tribe into 12 subtribes of which Iguanureae was one and included genera from Madagascar, New Guinea and several thorny genera from the Seychelles. Drude (1887) recognised seven subtribes of the Arecinae, *Iguanura* being placed within the Areceae. Beccari and Pichi-Sermolli (1955) provided a detailed conspectus of the arecoid genera of the Old World which they divided into eleven tribes: *Iguanura* was isolated together with a New Guinea genus, *Sommieria*, in the tribe Iguanureae. These two genera are similar in possessing basal stylar remains, a praemorse leaf margin and by lacking thorns. These two genera differed in fruit type: *Iguanura* possessing a drupaceous fruit and *Sommieria* a dry warty one.

Burrett and Potztal (1956) recognized several subtribes but many genera including *Iguanura* were not allied into these subtribes. Satake (1962) produced a system of classification in which *Iguanura* was surprisingly included in the Geonomeae tribe. Potztal (1964) placed *Iguanura* in a monogeneric tribe. Moore (1973) has revised the classification of palms and the largest taxa, the arecoid palms, he subdivides into alliances: *Iguanura* is placed with *Rhopaloblaste* in the Clinostigma alliance and *Pinanga*, *Areca*, *Nenga* and *Gigliolia* fall within the *Areca* alliance.

This lack of concensus about the position of *Iguanura* within the arecoid palms is due to two factors. One factor is that *Iguanura* is not apparently closely related to any palm genus that grows within its geographic range. The other factor is that although common in Malaya, it is a palm that has escaped detailed study until the present time and is little known to many palm taxonomists and to botanic gardens outside South East Asia.

It is difficult to confirm whether *Sommieria* is closely related to *Iguanura* as specimens of this palm are rare and descriptions few, thus for *Sommieria* the position of the inflorescence, whether the leaves are marcescent or absciss and the structure of the ovary are not precisely known. In many respects, the genus

Iguanura appears most closely related to the genus *Linospadix*, a genus from New Guinea and Queensland which has several significant characters in common : the leaf of some species possessing a praemorse margin, interfoliar inflorescences, two spathes, male flowers with six stamens and a conspicuous sterile ovary; female flowers with imbricate petals, six conspicuous staminodes and a single locule in the ovary and a fruit with a fleshy pericarp. It differs in the stylar remains occupying an apical position in the fruit. Some of these characters might reflect a similar degree of advancement e.g. the number of stamens, the number of locules in the ovary and the presence of conspicuous staminodes and pistillodes (Moore, 1973).

Moore (1973) places *Linospadix* in a separate alliance, the *Linospadix* alliance. No diagnoses are given for these new alliances, but Uhl and Moore (1971) provide a description of the ovule characters of the *Linospadix* alliance which agree closely with the anatomy of the ovule of *Iguanura wallichiana* and *I. polymorpha* (Kiew 1972 PhD unpublished). Thus *Iguanura* is similar to *Linospadix* in the triads of flowers being deeply sunken in pits in the rachillae, in the presence of a well developed stigma, in the presence of a triradiate stylar canal, in the ovule being pendant and being attached near the top of the loculus, in the presence of a short, rounded funicular aril and in the outer integument being fused for almost its entire length. The structure of the ovary differs only in the tannin sheath which surrounds the embryo being narrower (2–4 cells thick as opposed to 6–7 cells in *Linospadix*).

The anatomy of the ovule of the Areceae alliance is described and although the Areceae group possess a narrow tannin sheath there are several fundamental differences such as, the ovule is campylotropous being attached basally, the outer integument is separate from the inner integument and the stylar canal is not grooved. The anatomy of the Clinostigma alliance is not mentioned.

Clearly *Iguanura* is not closely related to any palm genus indigenous to Malaya, Sumatra or Borneo and on the basis of evidence presented here, *Iguanura* appears most closely related to *Linospadix* — a genus of palms centred in New Guinea.

The Species of *Iguanura* B1.

The work presented here is based on one year's field work in Malaya and one month's field work in Sarawak, in addition to the study of herbarium specimens. All type specimens have been examined except in the case of *I. speranskyana* for which no type specimen appears to exist, the original brief description being based on a sterile horticultural specimen. A thorough study of the variation between and within populations of the widespread and common Malayan species was made which elucidated the previous confusion created by the proliferation of species based on extreme forms. It was not possible to study variation in populations of the species from Borneo and Sumatra. In most cases the species are rare, local or inaccessible and are represented on average by about five herbarium specimens, some like *I. leucocarpa* are represented by two specimens from which the fruit have been lost. Nor have I seen any of these species in the field. As a result necessary information is sometimes lacking especially for the habit, position of the inflorescences, ripe fruit shape and type of endosperm and field notes are often exiguous. This is particularly disappointing as the majority of the species of this genus are endemic to Borneo. This has resulted in difficulties being encountered in constructing a key to all the species and the one presented here necessarily leans heavily on

herbarium characters. For this reason I have supplied an additional key for the Malayan taxa based on field characters.

As mentioned above several species of *Iguanura* have been described from Malaya which were based on variable characters e.g. *I. ferruginea* was distinguished by the degree of hairiness and colour of the hairs on the under surface of the leaf, *I. diffusa* by its narrow leaf segments and *I. arakudensis* by its simple or scarcely segmented leaf. Study of populations in the field reveals that these are merely unusual forms found within large populations of typical individuals.

Confusion has been caused by the developmental sequence of the foliage of *Iguanura*. Descriptions of the species are based on adult foliage but Whitmore (1973) illustrates variation of the leaves not with adult leaves but with silhouettes of sterile juvenile plants (see his Fig. 47). In common with many palms, *Iguanura* produces a series of leaves from the simple seedling leaf through a succession of larger leaves exhibiting progressive dissection of the leaf from the base upwards until the adult dissected leaf is produced (Fig. 4: Kiew, 1972) after which further adult leaves produced are similar in the number and width of the leaf segments. Rarely, fertile specimens with simple leaves are found within a population of individuals with segmented leaves. These are smaller plants and are presumably rare individuals which are flowering precociously. In a few areas plants with simple leaves predominate and these populations are considered as varieties.

Another variable character which has generated confusion in the identity of *I. wallichiana* s.l. is the number of rachillae. Extensive field work has revealed that two taxa (*I. wallichiana* with a much branched inflor. and *I. geonomaeformis* with a less branched inflor.) have different but overlapping distributions and these two taxa have been designated subspecies (see below).

Characters that have proved reliable in distinguishing taxa at the species level include the shape of the leaf (Fig. 4 & 5) as opposed to the individual segment shape, position of the inflorescence in relation to the leaves, whether the anthers are lobed or unlobed, fruit shape (Fig. 3) and whether the endocarp is smooth, ribbed or ridged (Fig. 1). The male and female flowers are uniform throughout the genus excepting the lobing of the anther (Fig. 1).

Key for the identification of the species of *Iguanura* Bl.

1. Fruit either curved, oblong and bigibbous or ellipsoidal in shape 2.
2. Fruit curved and endosperm weakly ruminant 3.
3. Fruit narrowly elongate terminating in a pronounced hook, inflorescence unbranched. Malaya 4. *I. corniculata* Becc.
3. Fruit squat and curved, inflorescence branched (rarely unbranched). Malaya and Sarawak 12. *I. polymorpha* Becc.
2. Fruit not curved and endosperm homogeneous 4.
4. Fruit ellipsoidal, endocarp ribbed; peduncle at least 10 cm long; Sarawak 10. *I. myochodoides* Kiew

4. Fruit oblong and bigibbous, endocarp smooth; peduncle extremely short (to 5 cm long). Malaya and Thailand 2. *I. bicornis* Becc.
1. Fruit ovoid (olive-shaped) 5.
5. Endocarp smooth without ribs or ridges, fruit drying smooth 6.
6. Anther not lobed 7.
7. Endosperm deeply ruminant, inflorescence either unbranched or with upto 15 rachillae. Malaya, Sumatra and Sarawak 16. *I. wallichiana* (Mart.) Hook. f.
7. Endosperm homogeneous, inflorescence unbranched. Sarawak 9. *I. minor* Kiew
6. Anther lobed 8.
8. Leaf simple and lamina deeply plicate with apical notch obscure. Sarawak 15. *I. sanderiana* Ridl.
8. Leaf divided into segments, lamina not plicate, apical notch conspicuous 9.
9. Peduncle short (less than 10 cm), inflorescence unbranched. Sumatra 6. *I. leucocarpa* Bl.
9. Peduncle longer (more than 15 cm long), inflorescence unbranched or branched with upto 7 rachillae 10.
10. Peduncle more than 25 cm long, inflorescence unbranched or with upto 6 rachillae. Sarawak 1. *I. ambigua* Becc.
10. Peduncle 15–20 cm long, inflorescence with 5–7 rachillae. Sarawak 14. *I. remotiflora* Wendl.
5. Endocarp ribbed or ridged, fruit drying ribbed or ridged 11.
11. Endocarp ribbed; leaf large (lamina more than 50 cm long) and simple. Sarawak 5. *I. elegans* Becc.
11. Endocarp ridged; leaf divided into segments or simple and less than 50 cm long 12.
12. Peduncle more than 40 cm long 13.
13. Inflorescence unbranched or narrowly 2-branched, flowers large c. 5 mm long, anthers not lobed. Kalimantan and Sarawak 7. *I. macrostachya* Becc.

13. Inflorescence branched with 4-7 rachillae, flower c. 3 mm long, anthers lobed. Sarawak 8. *I. melinauensis* Kiew
12. Peduncle short (upto 25 cm long) 14.
14. Fruit 5-angled with a conspicuous elongated apical beak. Sarawak 11. *I. palmuncula* Becc.
14. Fruit rounded and ridged, not angled 15.
15. Inflorescence with 4-6 rachillae, anther lobed. Kalimantan 3. *I. borneensis* Scheff.
15. Inflorescence unbranched, anthers unlobed. Kalimantan 13. *I. prolifera* Kiew

A field key to the Malayan Taxa of *Iguanura* B1.

1. Leaves with trapezoid segments (leaves rarely simple), leaves abscissing, fruit variously shaped, not olive-shaped, endosperm not deeply ruminant 2.
2. Peduncle short (less than 5 cm long), inflorescence always below the leaves, fruit oblong bigibbous in shape 2. *I. bicornis* Becc.
2. Peduncle long (more than 10 cm), inflorescence among and below the leaves, fruit elongate and curved, not bigibbous in shape 3.
3. Fruit squat and curved, inflorescence branched (rarely unbranched) 12. *I. polymorpha* Becc.
3. Fruit narrowly elongate terminating in a pronounced hook, inflorescence unbranched 4. *I. corniculata* Becc.
1. Leaves with parallel-sided segments, or leaf simple, leaves marcescent, fruit oliveshaped, endosperm deeply ruminant 16. *I. wallichiana* (Mart.) Hook. f.

1. *Iguanura ambigua* Beccari, Malesia 3: 105 (1886).

Stem up to 2.6 m tall. Annuli 3 cm apart. Leaf 40–100 cm long and marcescent. Leaf sheath 12–15 cm. Petiole 10–40 cm long. Lamina 30–60 cm long and 15–18 cm wide, parallel-sided. Veins $\frac{1}{2}$ cm apart. Inflorescence among the leaves. Outer spathe 10 cm, inner 30 cm. Peduncle 15–20 cm long. Inflorescence unbranched or branched with up to 6 rachillae, 10–25 cm long and 2 mm thick. Flowers upto $\frac{1}{2}$ cm apart. Anthers lobed. Fruits (immature, Ridley 11816) with dorsal ridge somewhat extended.

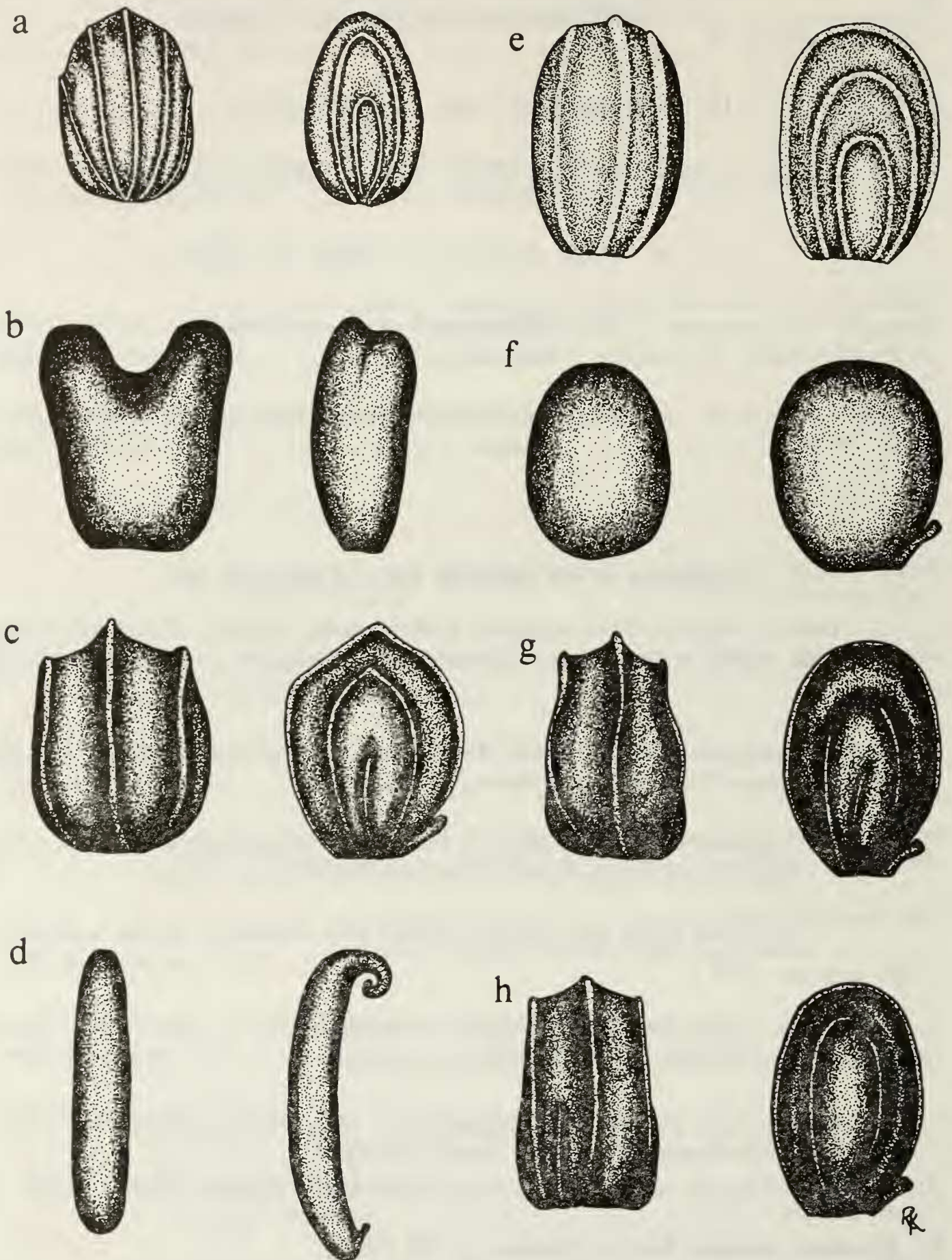


Figure 3. Shapes of the dried fruits of species of *Iguanura*. a. *I. ambigua*; b. *I. bicornis*; c. *I. borneensis*; d. *I. corniculata*; e. *I. elegans*; f. *I. leucocarpa* (after Rumphia); g. *I. melinauensis*; h. *I. macrostachya*.

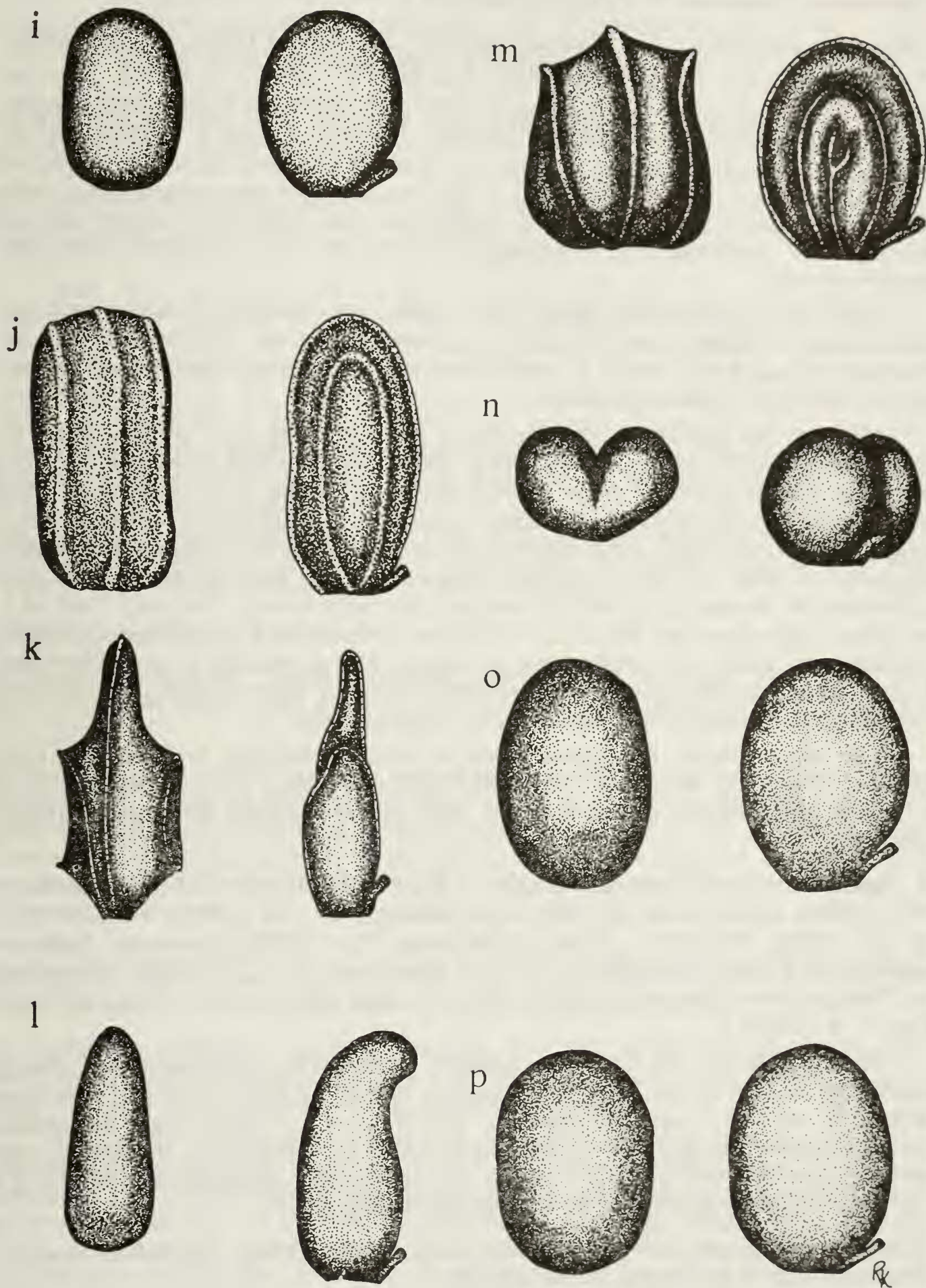


Figure 3. *continued.*

i. *I. minor*; *j.* *I. myochodoides*; *k.* *I. palmuncula*; *l.* *I. polymorpha*; *m.* *I. prolifera*; *n.* *I. remotiflora*; *o.* *I. sanderiana*; *p.* *I. wallichiana*. (left dorsal view; right lateral view).

Distribution : Sarawak, G. Mattang, Kuching.

Collections examined : G. Mattang: *Beccari PB 1308* (Type) FI (!); *Ridley 1903 s.n.* SING (!); *Ridley 11816* SING (!); Sarawak; *Hewitt 35 K* (!).

Notes: Three species of *Iguanura* have been collected from Gunung Mattang in Sarawak — *I. ambigua*, *I. palmuncula* var. *palmuncula* and *I. wallichiana* var. *malaccensis*. Gunung Mattang is close to Kuching and has been the subject of intensive botanical collecting but only a few specimens of these species have been collected (*I. ambigua* was collected by Beccari and Ridley; *I. palmuncula* by Beccari and *I. wallichiana* by Dransfield) which leads to the conclusion that these species are rare.

There is no doubt that these three species are discrete. *I. palmuncula* var. *palmuncula* is stemless and possesses a remarkable fruit (five-angled with an elongated apical beak), while *I. wallichiana* var. *malaccensis* has unlobed anthers and an unridged olive-shaped fruit.

None of the specimens of *I. ambigua* possesses ripe fruit so that the fruit characters cannot be precisely determined. While it is not likely to be confused with the other species collected from G. Mattang, it is similar to *I. remotiflora* from which it can be separated by characters subject to variation i.e. *I. ambigua* has a longer and narrower leaf, a less branched or unbranched inflorescence and a shorter peduncle; it does not differ in floral characters (both have lobed anthers) and differences in characters of the fruit are not precisely known. The only fruit of *I. ambigua* is immature and that of *I. remotiflora* is represented by a single apparently aberrant fruit where two ovules have developed. I have retained *I. remotiflora* and *I. ambigua* as separate species as the ultimate status of them depends on additional collections of specimens with mature fruit being available.

The other species, *I. elegans*, found at several localities in Sarawak's First Division is unlikely to be confused with either *I. ambigua* or *I. remotiflora* as it possesses large simple leaves and the fruit is olive-shaped and has a ribbed endocarp.

2. *Iguanura bicornis* Beccari, Malesia 3: 188 (1886); Hooker f. Fl. Brit. India 4: 417 (1892); Ridley, Mat. Fl. Mal. Pen. (Monoc) 2: 153 (1907); Fl. Mal. Pen. 5: 16 (1925). Whitmore, Palms of Malaya. 63, (1973). Synonym: *Iguanura arakudensis* Furtado, Reprim nov. Spec. Regni veg. 35: 273 (1934). (described as *Pinanga canina* Beccari in Ridley, Mat. Fl. Mal. Pen. 2: 138 (1907); Fl. Mal. Pen. 5: 6 (1925).)

Plant small, 1–2 m tall, stem smooth, crownshaft conspicuous, leaf sheath abscising cleanly, loose, limp (not fibrous), strongly ribbed. Leaf c. 1.5 m long with 5–8 pairs of trapezoid segments, lateral veins diverging from the midrib towards the margin, glabrous beneath. Inflorescence always below the leaves, with several branches (4) 6 (10). Spathes not persistent. Peduncle short, (1) 2.5 (4) cm. Fruit oblong bigibbous. Endosperm homogeneous.

Distribution: Malaya: Perak, Gunung Inas; Kedah, Weng (abundant locally). Thailand: Kao Keo Range; G. Ma, Betong.

Collections examined: Malaya: Perak, G. Ijuk (Hijau), *Scortechini 1188* (Type) FI (!); Larut Hills, *Kunstler, King's Coll. 6375* FI (!), K (!), Maxwell's Hill, *Wray 695 K* (!); FI (!); Krunei, *Evans 40, 41, 42, 43, 44, 45*, Kedah: G. Lang Weng, *Kiah 35048* SING (!), BO (!), K (!), G. Inas, *Whitmore 4650* KEP (!). Thailand: Kao Keo Range, Songkla, Salut, *Kerr 14520* BM (!), G. Ma, Betong, *Kerr s.n.* BM (!).

Notes: *I. arakudensis* is represented by a single specimen which does not possess any fruits and is regarded as synonymous with *I. bicornis* because it has a short peduncle and because it was distinguished solely by the wide terminal pair of segments and small number of segments. The leaf shape of the specimen of *I. arakudensis* is part of the series of juvenile leaf shapes from the simple seedling leaf to the adult leaf. As in the case of *I. parvula* it represents a precociously flowering specimen and not a distinct taxon.

3. *Iguanura borneensis* Scheffer, *Annls. Jard. bot. Buitenz. 1*: 161 (1876); Winkler, *Engler's Bot. Jahrb.* 48: 89 (1912). Synonym. *I. borneensis* var *australis* Beccari, *Atti Soc. Tosc. Sci. Nat. Pisa Mem.* 44: 172 (1934).

Stem $1\frac{1}{2}$ m tall and 1– $1\frac{1}{2}$ cm thick, smooth, annuli 3 cm apart. Leaf sheath loose, limp (not fibrous), strongly ribbed. "Crownshaft" 25 cm long, leaf abscissing cleanly, petiole 12–37 cm long. Leaf lamina 30–48 cm long and 17–23 cm wide, lamina simple with deep apical notch or divided into c. 4 pairs of distinctly trapezoid segments, the terminal segment pair often forming a rounded apex (Fig. 4). Segments c. 20 cm long and 10 cm wide. Lateral veins 1 cm apart diverging from the midrib to the margin, glabrous below. Inflorescence among or below the leaves. Peduncle stout, 5 mm thick and 12 cm long, only just emerging from the leaf sheaths. Rachillae 4–6, up to 9 cm long, recurved and curled. The pit bract large and elongated into a long point. Male flowers with lobed anthers. Fruit olive-shaped 1 x $\frac{1}{2}$ cm with one central and two lateral ridge on each side. Fruit surface undulate. Endosperm ridged, homogeneous.

Distribution: Borneo, Kalimantan.

Collections examined: Borneo: Landak, *Teysmann 13329* (type) BO (!), FI (!); Batu Babi, *Winkler 2782* FI (!); Lao Djanan, Samarinda, *Kostermans 6479* BO (!).

Notes: Beccari's variety *australis* was distinguished from the typical form by its divided leaf. A leaf of the type specimen of the typical form is also divided and both the varieties have rounded terminal segments compared with other collections. Beccari stated that the fruit of var *australis* is the same as that of *I. elegans*. This is an error as the fruit and endosperm of *I. elegans* is olive-shaped while that of *I. borneensis* is ridged both in the typical form and the specimen of var. *australis*.

This species resembles *I. melinauensis* in fruit shape and from which it can be distinguished by its short peduncle (that of *I. melinauensis* is over 40 cm long) and *I. melinauensis* does not have a conspicuously elongated pit bract.

4. *Iguanura corniculata* Beccari, *Malesia*, 3: 187 (1886); Hooker f. *Fl. Brit. India* 6: 417 (1892); Ridley, *Mat. Fl. Mal. Pen. (Monoc.)* 2: 152 (1907); *Fl. Mal. Pen.* 5: 15 (1925). Whitmore, *Palms of Malaya*. 63 (1973).

Stem small 1–1.3 m tall, bark smooth. Crownshaft conspicuous, leaf abscissing cleanly, leaf sheath loose, limp (not fibrous) and strongly ribbed. Leaf 30 cm long, petiole 10 cm. Lamina divided into 6 pairs of trapezoid segments, segments narrow at proximal end and 3–5 cm wide at distal end, 7–8 cm long, lateral veins diverging from the base and widely spaced, 1.5 cm, at distal margin, glabrous below. Inflorescence unbranched. Peduncle 10 cm long. Fruit 2 cm long with pronounced hook at tip, stylar remains on inside of the curve of the fruit. Endosperm weakly ruminant.

Distribution: Malaya: Perak, Selama; Pahang, Bukit Serdam, Raub.

Collections examined: Malaya: Perak, Selama. *Kunstler, King's Coll 3131* (Type) FI (!), K (!), BM (!); Pahang, Bukit Serdam, limestone hill, Raub, *Henderson 25059* SING (!).

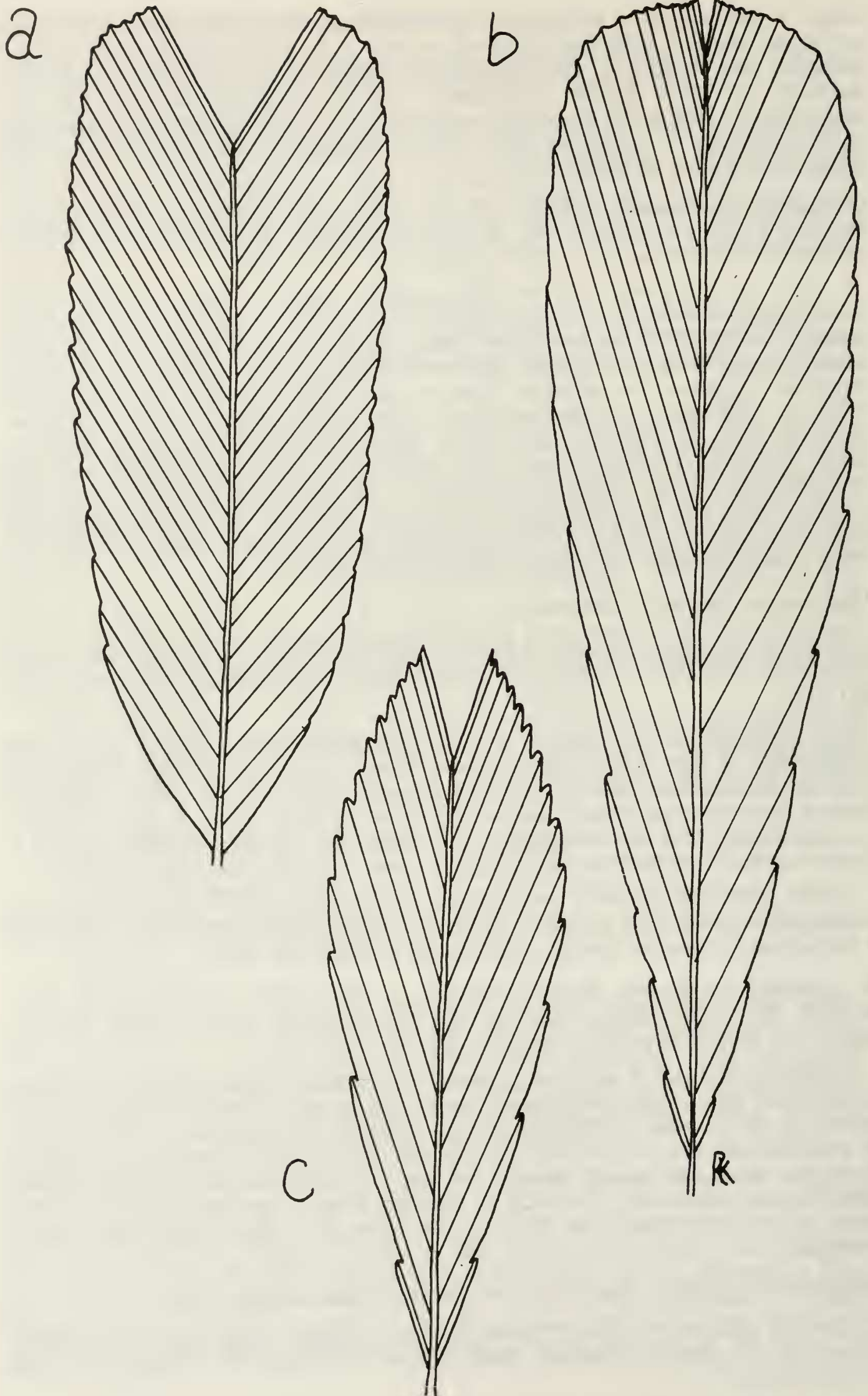


Figure 4. Leaf shapes of *Iguanura borneensis* (a); *I. elegans* (b); and *I. minor*. (c). x 1/6.

Notes: Apart from collections from the type locality, the one other collection, namely *Henderson 25059*, has identical foliage (the leaf segments are particularly narrow at their base and the lateral veins are more widely spaced than those of *I. polymorpha* and *I. bicornis*, which also have trapezoid leaf segments.) Henderson's specimen lacks fruits.

This species must be extremely local as apart from Kunstler's collection from Selama and Henderson's from Raub it has not been collected again although Perak in particular is botanically well known. It is readily recognized by its fruit shape, which compared with that of *I. polymorpha*, is more elongated and only the tip is strongly curved, and, its inflorescence is unbranched (that of *I. polymorpha* is branched but rare individuals possess an unbranched one). *I. leucocarpa* from Sumatra also has an unbranched inflorescence and trapezoid segments but an illustration indicates that *I. leucocarpa* has olive-shaped fruits.

5. *Iguanura elegans* Beccari, Malesia 3: 103 (1886).

Synonym: *I. ridleyana* Beccari, Atti Soc. Tosc. Sci. Nat. Pisa Mem. 44: 173 (1934).

Stem $\frac{1}{2}$ – $1\frac{1}{2}$ cm thick, bark papyraceous when dry. Annuli 2 cm apart. Leaf marcescent, large 60–80 cm long and 17–20 cm wide. Leaf sheath thick, brown and fibrous, 10–13 cm long. Petiole short, 7–11 cm long. Lamina simple, obovate 55–70 cm long, sometimes divided into a few segments at the base, 55–70 cm long and 17–20 cm wide, apex bluntly rounded, sometimes slightly attenuated, with a narrow, shallow ($2\frac{1}{2}$ cm) apical notch. Margin finely serrate. Veins $\frac{3}{4}$ cm apart. Inflorescence unbranched or branched with 2–5 (7) rachillae, always among the leaves. Peduncle 13–16 cm, just projecting above the leaf sheaths. Rachillae 13–20 cm long, curled and recurved. Inner spathe 19 cm long, outer 6 cm. Male flowers large 4–5 mm long. Anthers lobed. Fruit olive-shaped, faintly ribbed with one main dorsal rib, 2 main lateral and 2 shorter lateral ribs, surface rough. Endosperm olive-shaped, not ridged, homogeneous.

Distribution: Sarawak: 1st Division.

Collections examined: Sarawak: Kuching, *Beccari PB 163* (type) FI (!), K (!); Jambusan, *Ridley 12399* K (!), SING (!); Bau, *Ridley s.n.* K (!) SING (!).

Notes: I consider *I. ridleyana* as synonymous with *I. elegans* because it differs only in sometimes having a less branched inflorescence (unbranched or with two rachillae as compared with the 2–5 rachillae of *I. elegans*), which is not a sufficiently reliable character for separating these two taxa at the species level.

Leaves of plants in the Bau population taper more acutely to the base than leaves collected from other localities and in one specimen the leaf is divided into two narrow basal segment pairs and one wide apical pair. The leaf shape is distinctive being rounded at the apex and possessing a shallow apical notch (Fig. 4).

6. *Iguanura leucocarpa* Blume, Rumphia 2, pt 18; 105 and plate 117 (1843); Endlicher, Gen. Plant Suppl. I, 1752/i; 1372 (1836-40); Martius, Hist. Nat. Palm. 3: 317 (1823-50).

Stem $\frac{1}{2}$ cm thick, bark smooth, annuli 2 cm apart. Crownshaft conspicuous, leaf sheath c. 10–12 cm long, abscising cleanly, loose, limp (not fibrous). Petiole 18 cm. Leaf lamina 48 cm long and 20 cm wide, with 4 pairs of trapezoid leaf segments, 2.3 cm wide at midrib and 6–12 cm wide at the margin, main veins diverging from the midrib to the margin, glabrous beneath. Inflorescence unbranched, below the leaves. Inflor. 18 cm long, peduncle 9 cm long, 2 mm thick. Flowers arranged in a tight spiral. Male flowers 4.5 mm long, apex pointed. Anthers lobed. Fruits (from illustrations in Rumphia) olive-shaped, not ribbed nor ridged.

Distribution: Sumatra: Padang and Palembang.

Specimens examined: Sumatra, Padang. *Korthals s.n.* (type) L (!), BO (!).

Notes: The type specimen was collected by Korthals from Padang and is cited in Rumphia. Palembang was also cited as a locality but I have not been able to locate this specimen. Korthals never visited Palembang; van Steenis (pers. comm.) suggests that Praetorius might have collected it. No other specimen of *I. leucocarpa* appears to exist which suggests that it has not been collected since Blume's time. The type specimen does not now have any fruits but the illustration in Rumphia shows them as being olive-shaped. The type description for the genus records that the flowers are hermaphrodite, this error is probably due to observations being based on the male flowers which possess a large pistillode similar externally to the ovary of the female flower.

Several species of *Iguanura* besides *I. leucocarpa* possess trapezoid leaf segments viz. the Malayan *I. polymorpha*, *I. corniculata* and *I. bicornis* and the Bornean *I. borneensis*, of these only *I. corniculata* has an unbranched inflorescence but it differs in possessing strongly hooked fruits, a shorter leaf, more pairs of segments and the male flower has a blunt apex.

7. *Iguanura macrostachya* Beccari, Malesia 3: 101 (1886).

Stem c. 2 m tall and 1–1½ cm thick, bark papyraceous when dry. Annuli 1–2 cm apart. Leaf marcescent, about 10 leaves in the crown. Leaf sheath thick and fibrous, 15 cm long. Petiole long, 20–25 cm. Lamina 40–60 cm long and 19–23 cm wide, with upto 10 pairs of parallel-sided leaf segments. Inflorescence unbranched, sometimes narrowly two branched, always among the leaves. Outer spathe 7–10 cm long, inner 25–35 cm long. Inflorescence exceptionally long, 90–130 cm of which peduncle is 58–60 cm long. Male flowers large, 5 mm long with pointed apex in bud. Anthers unlobed. Fruits olive-shaped, ridged with one dorsal and two lateral ridges on each side. Endosperm ridged, homogeneous.

Distribution: Borneo: Sarawak — Jakarran, Kuching; Kalimantan Kutei Nature Reserve.

Collections examined: Sarawak: *Beccari PB 3851* (type) FI (!); Kalimantan: *Endert 5210* BO (!), SING (!); *Dransfield 1568* BO (!); Cultivated at Bogor Botanic Gardens no. 340 BO (!).

Notes: This species is distinctive, possessing an exceptionally long inflorescence which is usually unbranched and bears large male flowers. Its local populations have a wide distribution throughout Borneo (Fig. 2).

8. *Iguanura melinauensis* Kiew sp. nov.

Palma humilis: caulis ½–1½ m altus, cortice laeve. Annuli 2–2½ cm distantes. Vagina folii 9–14 cm longa. Petiolus brevis 7–12 cm longus. Lamina 30–65 cm longa, 12–16 cm lata, in 2–5 paribus segmentorum divisa. Margines segmentorum parallelae, sed angulo apicale distale elongato. Segmenta terminalia lata: nervi ½–¾ cm distantes. Inflorescentia inter-vel infra-foliata. Spatha externa ad 20 cm longa, spatha interna 25–30 cm longa. Pedunculus 42–53 cm longus. Rachillae 4–7, rectae, 10–20 cm longae, 1–2 mm latae, 45° divergentes. Flores ½–¾ cm distantes. Antherae lobatae. Fructus olivaeformis crista centrale cristis duobus utrinque. Endospermium homogeneum cristis ad cristam endocarpii congruentibus.

Typus: *Chew 487*, Melinau, Sarawak, Holotypus (SING).

Stem ½–1½ m tall. Bark smooth. Annuli 2–2½ cm apart. Crownshaft 22–30 cm long. Leaf sheath 9–14 cm long. Petiole short, 7–12 cm long. Lamina 30–65 cm long and 12–16 cm wide, divided into 2–5 pairs of segments. Segments parallel-

sided but with apical distal corner elongate. Terminal segment pair wide, often $\frac{1}{3}$ – $\frac{1}{2}$ as long as whole laminal region. Veins $\frac{1}{2}$ – $\frac{3}{4}$ cm apart. Inflorescence among or below the leaves. Outer spathe 20 cm long, inner 25–30 cm long. Peduncle 42–53 cm long. Rachillae 4–7, straight, 10–20 cm long and 1–2 mm thick, diverging at 45°. Flowers $\frac{1}{2}$ – $\frac{1}{4}$ cm apart. Anthers lobed. Fruit olive-shaped with central ridge and two lateral ridges on either side. Endosperm homogeneous and with ridges corresponding to the endocarp.

Distribution: Sarawak: Melinau district, 4th Division.

Collections examined: Melinau 4th Division Melinau Gorge. Chew 487 SING holotype (!), SARF (!); Anderson and Keng K 81 SARF (!); G. Api, Chai S 30057 K (!).

Notes: All collections are from a single locality — Melinau and in the Melinau Gorge it is recorded living on limestone debris as well as on alluvial soil. The complete collections indicate that the Melinau population is probably extensive enough to allow selection of plants in both flower and fruit.

This species is recognised by its narrow leaves with a large pair of terminal segments, by its long peduncle and its fine and diverging rachillae, its ridged fruit and ridged endosperm. The species epithet refers to its locality, Melinau.

9. *Iguanura minor* Kiew sp. nov.

Palma humilis, caulis ad 4 m altus, $\frac{3}{4}$ –1 cm diametro. Annuli $1\frac{1}{2}$ cm distantes. Vagina folii ad 10 cm longa. Folia marcescentia. Petiolus 4–10 cm longus. Lamina indivisa 30–40 cm longa, 12–14 cm lata; vel in 2–3 (7) paribus segmentarum parallelilaterum apicis elongatis divisa. Inflorescentia interfolia, simplex 30–50 cm longa in toto, pedunculo 15–30 cm longo. Spatha interior 14 cm longa. Flos masculus antheris lobatis. Fructus olivaeformis nec porcatus nec striatus.

Typus: Foxworthy 242, Gunung Pueh, Sarawak. Holotypus (FI).

Stem up to 4 m tall, $\frac{3}{4}$ –1 cm thick. Annuli $1\frac{1}{2}$ cm apart. Crownshaft c. 10 cm long. Leaves marcescent. Petiole 4–10 cm long. Lamina simple 30–40 cm long and narrow, 12–14 cm wide or divided into 2–3 (7) pairs of narrow, parallel-sided segments each with an elongated apex. Inflorescence among the leaves, unbranched, total length, 30–50 cm of which 15–30 cm is the peduncle. Inner spathe 14 cm long. Male flower with anthers lobed. Fruit olive-shaped, not ridged nor ribbed.

Distribution: Sarawak, G. Pueh, 1st Division.

Collections examined: Sarawak, G. Pueh. Foxworthy 242 FI (!) 241 FI (!); Purseglove P 4748 K (!); at 4500' Clemens 20474 K (!).

Notes: This species has been collected from a single locality, Gunung Pueh in Sarawak. It is a slender palm with particularly small and narrow simple leaves (Foxworthy 241) while the dissected leaved plant possesses long and narrow leaf segments; the inflorescence is unbranched — for reason of the small leaves and inflorescence it has been named *I. minor*.

It is closely related to *I. wallichiana* in possessing parallel-sided leaf segments, unlobed anthers and an olive-shaped fruit without ribs or ridges on the endocarp. *I. wallichiana* var *malaccensis* in addition possesses unbranched inflorescences and has been collected from G. Mattang (Dransfield 768). *I. minor* is distinguished from *I. wallichiana* by the leaf shape — *I. minor* has a simple leaf which is particularly narrow, and has a deeply toothed margin at the apex (Fig. 4) and both simple and dissected leaves have a narrow apical notch.

This single population at G. Pueh might be analagous to the populations of *I. wallichiana* subsp. *malaccensis* with distinctive leafshapes at Gunung Belumut and Kemaman in Malaya which are regarded as varieties of the large and variable Malayan population. Since information about variation within the Sarawak population of *Iguanura* is not available I have described the Gunung Pueh population as a separate species.

10. ***Iguanura myochodoides* Kiew sp. nov.**

Palma humilis; caulis c. 0.6 m altus, 7.5 mm crassus. Annuli 1–3 cm distantes, vaginae coronae 26 cm longa. Folia abscissa. Vagina folii 9–11 cm longa. Petiolus 11–13 cm longus. Lamina 26–37 cm longa, 13–18 cm lata in 2–3 paribus segmentorum latium paralleli laterum divisa. Inflorescentia interfolia. Pedunculus 13–20 cm longus, rectus, 1–2 mm diametro; rachiallae 4–6, curtae ex axe vix divergentes. Flos masculus antheris lobatis. Fructus ellipsoideus 1.5 cm longus, 0.7 cm latus, porca unica centrale, porca duobus lateralibus.

Typus: *Clemens 20541*, Gunung Tieng, Sarawak. Holotypus (SARF).

Stem c. 0.6 m tall, $\frac{3}{4}$ cm thick. Annuli 1–3 cm apart. Crownshaft 26 cm long. Leaves abscissing. Leaf sheath 9–11 cm long. Petiole 11–13 cm long. Lamina 26–37 cm long and 13–18 cm wide, divided into 2–3 pairs of wide parallel-sided segments. Inflorescence among the leaves. Peduncle long, 13–20 cm and straight and 1–2 mm thick with a few, 4–6, short c. 7–9 cm, rachillae which scarcely diverge from the main axis. Male flowers with lobed anthers. Fruit ellipsoidal, longer (1.5 cm) than wide (0.7 cm) with one central rib and with a lateral one on either side.

Typus: *Clemens 20541*, Gunung Tieng, Sarawak. Holotypus (SARF).

Distribution: Sarawak, Kuching 1st Division.

Collections examined: Sarawak: Kuching, G. Tieng, *Clemens 20541* SARF (!) : (isotype) K (!). G. Penrissen, *Jacobs 5024* K (!) SARF (!).

Notes: This species is distinct from others in possessing an erect inflor. with narrowly divergent short rachillae and by its fruits. Most species of *Iguanura* have an olive-shaped fruit or those that are elongate in shape are either bigibbous (*I. bicornis*) or curved (*I. polymorpha*, *I. corniculata*) but *I. myochodoides* takes its name from its peculiar fruit shape which is that of a giant mouse dropping.

11. ***Iguanura palmuncula* Beccari, Malesia 3: 106 (1886).**

A dwarf palm or with stem to 3 m tall. Leaf sheath fibrous, 7 cm long. Leaves marcescent, small and simple, or large and dissected, the larger segments being trapezoid. Inflorescence among or below the leaves, branched. Male flowers with lobed anthers. Fruit dorsiventrally flattened with dorsal ridge extending into a long projecting beak (6 mm long) at the apex. Four prominent lateral ridges form shoulders on opposite sides of the dorsal ridge, two at the apex and two at the base. Endosperm homogeneous.

Distribution: Sarawak, 1st Division.

Notes: This species is distinguished by its peculiar fruit with a long apical beak. Although other species have a dorsal ridge, it is never elongated to such an extent at the apex and furthermore the fruits of other species possess an additional lateral ridge on either side which runs parallel to the dorsal main ridge (Fig. 3).

The two varieties differ only in size and dissection of the leaf; they do not differ in significant characters such as fruit shape, branching and position of the inflorescence.

Var *palmuncula*

Synonym: *I. palmuncula* var. *angustisecta* Beccari, Malesia 3: 107 (1886)

Stem concealed within the persistent leaf sheaths, 6–10 cm long. Annuli crowded. Leaf c. 40 cm long, petiole 8–9 cm; lamina 30 cm long and 15 cm wide, either divided into 2–4 pairs of segments or simple and oval-rounded in shape with a deep apical notch. Inflorescence branched among the leaves, short, just emerging from the leaf sheaths. Peduncle 8 cm. Rachillae 2–6, 10 cm long, 1 mm thick. Flowers to $\frac{1}{2}$ cm apart.

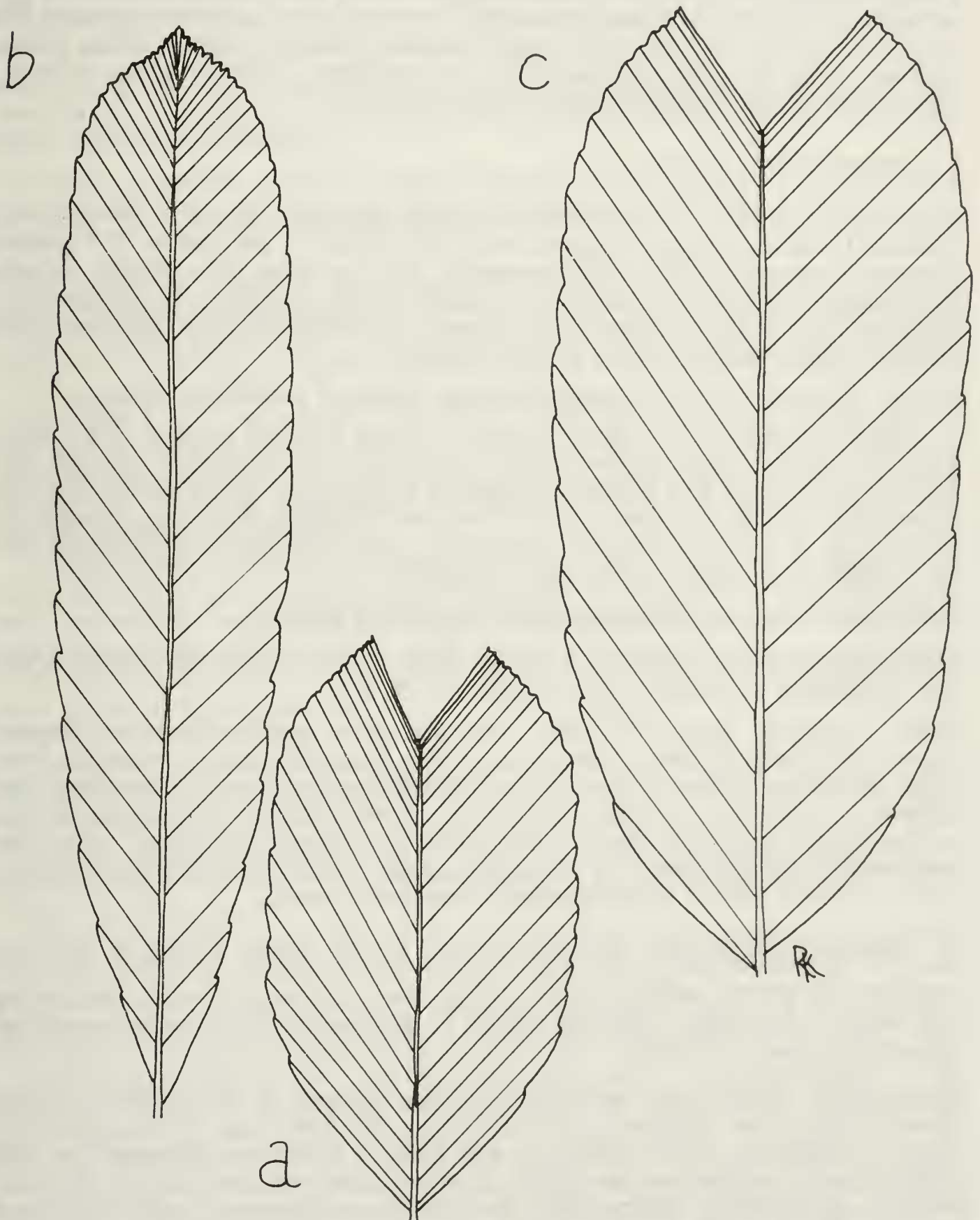


Figure 5. Leaf shapes of *Iguanura palmuncula* var. *palmuncula* (a); *I. sanderiana* (b); and *I. wallichiana* (c) x 1/6.

Distribution: Sarawak, G. Mattang, Kuching.

Collections examined: Sarawak, G. Mattang, *Beccari PB 3957* (type) FI (!);

Notes: Beccari (1904) described how he found this species on Gunung Mattang:— "Here, too, I collected specimens of the largest known *Calamus* and of the diminutive *Iguanura palmuncula*, which is probably the smallest of known palms. Its four or five fronds which constitute the entire plant, and are about the size of a man's hand, are borne at the summit of a stem a few inches high and of the thickness of a goose-quill." He described two varieties: one has simple leaves ("forma typica") and the other has dissected leaves (var *angustisecta*). The type collections of those two varieties have the same collecting number suggesting that they are from the same population and the dissected leaved specimen shows a series of leaves from the scarcely dissected to the completely dissected leaves so that I regard these plants as belonging to a single taxon.

Var **magna** Kiew var. nov.

Caulis ad 3 m altus, 1 cm diametro. Annuli aggregati vel ad 3 cm distantes. Petiolus 15–25 cm longus. Lamina 30–50 cm longa, 13 cm lata in 3–5 paribus segmentis trapezoideis divisa. Inflorescentia inter vel infra folia. Spatha exterior 7 cm longa, interior 19 cm longa. Pedunculus 20–25 cm longus, 3 mm diametro. Rachillae 7–18, 8–13 cm longae, 1 mm crassae. Rachillae inferiores late divaricatae, rachillis ordinis secundis. Flores $\frac{1}{2}$ –1 cm distantes.

Typus: *Anderson S 15319*, Gunung Gaharu, Sarawak. Holotypus (SARF).

Plant tall, stem to 3 m and 1 cm thick. Annuli crowded or up to 3 cm apart. Petiole 15–25 cm long. Lamina 30–50 cm long and 13 cm wide, divided into 3–5 pairs of more or less trapezoid segments. Inflorescence either among or below leaves. Outer spathe 7 cm long, inner 19 cm long. Peduncle 20–25 cm, 3 mm thick. Rachillae 7–10, 8–13 cm long and 1 mm thick. Lower rachillae widely spread with second order branching. Flowers $\frac{1}{2}$ –1 cm apart.

Distribution: Sarawak, Gunung Gaharu and Telok Sabang.

Collections examined: Sarawak: Kuching, Telok Sabang, *Anderson S 12246* SARF (!); G. Gaharu, *Anderson S 15319* SARF (!), K (!).

Notes: Anderson discovered plants with the same peculiar fruits at Gunung Gaharu and Telok Sabang. These plants differ from the typical variety in being taller, possessing larger leaves and a secondarily branched inflorescence, this difference in size is so marked that I have accorded them varietal rank as var. *magna*. Anderson reports (pers. comm.) that the plants he collected came from small and local populations. At Telok Sabang this variety was growing in shallow peat — the only species to be recorded from shallow peat.

12. ***Iguanura polymorpha*** Beccari, Malesia. 3: 189 (1886); Hooker f., Fl. Brit.

India 6: 417 (1892); Ridley, Mat. Fl. Mal. Pen. (Monoc). 2: 152 (1907); Fl. Mal. Pen. 5: 15 (1925); Martelli, Nuovo G. bot. ital 42: 52 (1935). Whitmore, Palms of Malaya. 64 (1973).

Synonyms: *I. polymorpha* var *canina* Beccari, Malesia. 3: 189 (1886); Ridley, Mat. Fl. Mal. Pen. (Monoc). 2: 152 (1907); Fl. Mal. Pen. 5: 15 (1925); *I. brevipes* Hooker f. Fl. Brit. India 6: 416 (1892); Whitmore, Principes 14: 124 (1970); Palms of Malaya 63 (1973). *I. parvula* Beccari, in Hook. f. Fl. Brit. India 6: 417 (1892), Ridley Mat. Fl. Mal. Pen. (Monoc) 2: 152 (1907). *I. ferruginea* Ridley, J. Straits Branch Roy. Asiat. Soc. 41: 40 (1904); Mat. Fl. Mal. Pen. (Monoc) 2: 152 (1907).

Stem 1–3 m tall, bark smooth. Annuli (1) $2\frac{1}{2}$ (5) cm apart. Leaf abscising. Leaf sheath loose, limp (not fibrous), strongly ribbed, 11–12 cm long. Petiole (6) 13 (22) cm long. Lamina (26) 42 (69) cm long and (12) 20 (31) cm wide. Leaf dissected with (2) 5 (6) pairs of trapezoid leaf segments, each with the lateral veins diverging from the midrib to the margin, glabrous beneath. Lamina rarely simple and then oblong with the base cuneate. Inflorescence branched (rarely unbranched), inflorescence either among or below the leaves, infructescence generally below the leaves. Peduncle (7) 12 (19) cm long. Rachillae (1) 5 (10) and (6) $11\frac{1}{2}$ (19) cm long. Spathes persistent. Outer spathe (4) 9 (16) cm long, inner (7) 12 (20) cm. Male flower with unlobed anthers. Fruit elongate, diameter largest at the centre weakly or strongly curved. Stylar remains either on the inner or outer side of curve. Endosperm weakly ruminant.

Distribution: Malaya — widespread in the north; northwards from Maxwell's Hill, Perak on the west coast and Gunong Tebu, Trengganu on the east coast. Sarawak: Bukit Mersing, Tau Range.

Collections examined: Malaya: Perak, *Scortechini* 3186 (type) Fl (!) and about 50 specimens from herbaria and 30 of my own. Sarawak: Bukit Mersing, Tau Range, *Purseglove* P 5278 L (!) SING (!).

Notes: Although called *I. polymorpha* there is little variation in the vegetative form of this species. Simple leaved forms are exceptionally rare, for example there is only a single specimen of the simple leaved form *I. parvula*. *I. parvula* has a simple leaf longer than the early juvenile ones of *I. polymorpha* though identical in shape and not differing in any other character and is therefore considered as synonymous with *I. polymorpha*. Whitmore (1973) considers *I. parvula* an extreme form of *I. wallichiana*, however, this is an error for the simple leaf of *I. wallichiana* never has the oblong shape of the simple leaf of *I. polymorpha* (Plate 4, a & b). In addition Whitmore has labelled in his Fig. 8c the leaf segment of *I. polymorpha* as *Korthalsia rigida*.

The criterion of whether a taxon possesses a crownshaft or not has caused confusion within the genus, particularly in regard to the status of *I. brevipes*. The term "crownshaft" was coined by Bailey (1933) and he defined it in 1943 as: "The apparent extension of the trunk or main caudex above the spadices and on the top of which rests the head of leaves well marked in *Roystonea* and *Euterpe*. This shaft is not a woody caudex, however, but is composed of long sheathing leaf bases and the enclosed long terminal bud".

In Bailey's sense this crownshaft is seen in those arecoid palms where the leaves absciss and by leaf fall the inflorescence is exposed. The inflorescence in this case is relatively short. Palms considered not to have a crownshaft are those in which the leaves are marcescent and the inflorescence is generally long and projects beyond the leaves e.g. *Linospadix* or in a few instances the inflorescence is short and breaks through the decaying leaf base as in *Pinanga simplicifrons*.

This distinction is not absolute and the presence of a crownshaft can depend purely on the timing of leaf fall in relation to inflorescence development. The complete range can be seen within *Iguanura*. Thus *I. bicornis* has a conspicuous crownshaft — the leaves absciss cleanly to reveal the short inflorescence which was previously completely enclosed within the tubular leaf sheath of the fallen leaf. *I. wallichiana* represents the other extreme where there is no crownshaft — the leaves are marcescent and as the leaf sheath is fibrous they remain rotting on the plant for several years, the inflorescence has a long peduncle and projects beyond the leaf sheaths and is always found among the leaves. In *I. polymorpha* the intermediate situation is seen — the inflorescences have long peduncles and project beyond the leaf sheaths; however the leaves absciss and since fruit development is a long process taking about six months it may happen that during this period the supporting leaf abscisses so that the infructescence is below the leaf sheaths

and the plant can then be said to have a crownshaft in Bailey's sense. From field observations and from the examination of numerous herbarium specimens the picture emerges of the great majority of inflorescences being found among the leaves and most of the infructescences being found below the leaves and in any large population of *I. polymorpha* this process can be seen on a single plant where there is a series of inflorescences from the young inflorescences among the leaves to the infructescences below the leaves.

Hooker f. (1892) made this same distinction of "spadix infrafoliar" and "spadix interfoliar" in separating the taxa of *Iguanura* — *I. brevipes* he distinguished from *I. polymorpha* solely on the former having interfoliar inflorescences and the latter having infrafoliar inflorescences. The character "infrafoliar inflorescence" being equivalent to the taxon possessing a crownshaft. Thus the presence or absence of a crownshaft in *I. polymorpha* (and the synonymous *I. brevipes*) depends only on the age of the inflorescence and the time at which the lowest leaf abscisses and does not as Whitmore (1973) suggests "reflect a considerable difference in the growth processes of the stem apex"

I. ferruginea was distinguished by its acutely curved fruits (though the specimens identified by Ridley are not more curved than those of *I. polymorpha* and do not have the pronounced hook of *I. corniculata*) and dense hairs — neither of these characters is a reliable taxonomic character and fall within the variation seen within a single population of *I. polymorpha* and *I. ferruginea* is therefore reduced to synonymy. The description of *I. ferruginea* in Ridley (1925) is that of *Licuala ferruginea*.

13. *Iguanura prolifera* Kiew sp. nov.

Caulis 1.5 crassus. Vagina folii crassa, fibrosa c. 10 cm longa. Folia marcescentia. Petiolus 12–24 cm longus. Lamina 25–45 cm longa, 17–19 cm lata indivisa, vel pare apicale segmentorum latorum et 1–2 paribus infinis angustorum. Inflorescentia inter folia, simplex, 25–35 cm longa, pedunculos 15–25 cm longo. Flos masculus antheris non lobatis. Fructus oblongus porca unica dorsale, porcis duobus lateralibus.

Typus: *Hallier 1759*, Gunung Kenepai, Borneo. Holotypus (L).

Stem 1½ cm thick. Leaf sheath thick, fibrous c. 10 cm long. Leaves marcescent. Petiole 12–24 cm long. Lamina 25–45 cm long and 17–19 cm wide, simple or with a wide apical pair of leaf segments and 1–2 narrow pairs of basal parallel-sided segments. Inflorescence among the leaves, unbranched, 25–35 cm long of which peduncle is 15–25 cm long. Male flowers with unlobed anthers. Fruits oblong, ridged with one dorsal and two lateral ridges.

Distribution: Borneo.

Collections examined: Borneo: G. Kenepai, *Hallier 1759* L (!); Muara Muntai on S. Bongan, Kutei. *Meijer 503*.

Notes: This species is recognised by its unbranched inflorescence and oblong, ridged fruits and is distinguished from *I. leucocarpa* and *I. corniculata*, which have unbranched inflorescences, by their trapezoid leaf segments and their fruit shapes, and from *I. wallichiana* var *malaccensis* with parallel-sided leaf segments by its olive-shaped fruits.

Hallier's collection was determined by Beccari as "*I. macrostachya* var *prolifera*". His variety had a simple leaf or a scarcely segmented one compared with the typical variety with leaves with about 10 segments. Although *I. prolifera* and *I. macrostachya* both have an unbranched inflorescence, they differ in the length of the inflorescence and the shape of the fruit: *I. macrostachya* always has

a long inflorescence, and the fruits are olive-shaped and ridged while *I. prolifera* possesses a shorter inflorescence (about half the length of that of *I. macrostachya*) and the fruit which is oblong in shape has an additional lateral ridge on either side of the main ridge (fig. 3), I have elevated Beccari's varietal name "*prolifera*" to the species level.

14. **Iguanura remotiflora** Wendland Bot. Ztg. 17: 63 (1859).

Stem $\frac{1}{2}$ – $1\frac{1}{2}$ m tall. Leaf divided into 3 pairs of wide segments, parallel-sided but with apical corner elongated. Petiole c. 15 cm long, lamina 37–44 cm long and 17–19 cm wide. Inflorescence branched, thin, 1 mm thick. Outer spathe $10\frac{1}{2}$ cm long, inner 22 cm long. Peduncle 28–50 cm long. Rachillae 5–7, 15–22 cm long, and at right angles to the main axis. Flowers $\frac{1}{2}$ –1 cm apart. Male flowers with anthers lobed. Fruit globose (2-lobed in Ridley's collection) and neither ridged nor ribbed.

Distribution: Sarawak: 1st Division.

Collection examined: Sarawak, 1st Div. Lobb s.n. (1857) (type) K (!); Bau, Ridley 11815 SING (!).

Notes: The two collections match exactly on vegetative and inflorescence characters. The lamina is broad compared to its length and is divided into a few wide segments; the inflorescence, both peduncle and rachillae, is unusually thin and the rachillae are held at right angles to the main axis. The flowers are not exceptionally wide apart — several other species e.g. *I. palmuncula* have equally widely-spaced flowers but the effect is exaggerated by the thinness of the rachillae of *I. remotiflora*.

The fruit on Lobb's specimen is immature while that on Ridley's, besides being immature, is also a rare aberrant fruit where the two ovules have developed to produce a two-lobed fruit: the immature fruits show neither ribs nor ridges.

I. remotiflora resembles *I. wallichiana* in possessing parallel-sided leaf segments and an inflorescence, which although unusually thin, falls within the range of variation seen in Malayan specimens. It differs in possessing lobed anthers. In many aspects it is most similar to *I. ambigua* (see *I. ambigua*) but neither species is represented by specimens with mature fruits.

15. **Iguanura sanderiana** Ridley, Gdnrs' Chron. 35: 50 (1904).

Stem 1– $1\frac{1}{2}$ cm thick, bark papyraceous when dry. Annuli 1–2 cm apart. Leaf marcescent. Leaf sheath thick and fibrous, 9–20 cm long. Petiole short, 3–8 cm long. Lamina simple, large, 30–85 cm long and narrow 9–16 cm wide, apex acuminate. Lamina deeply and closely plicate, lateral veins c. $\frac{1}{2}$ cm apart, apical notch obscured by overlapping pleats. Margin finely serrate. Lateral veins abaxially covered by brown hairs. Inflorescence usually branched, sometimes unbranched, always among the leaves. Inner spathe 15–36 cm long. Peduncle short 10–13 cm long or sometimes up to 57 cm long, stout 3 mm thick. Rachillae 2–3, 9–18 (40) cm long, flowers $\frac{1}{2}$ –1 cm apart. Male flowers 2 mm long, anthers lobed. Fruit olive-shaped, neither ridged nor ribbed. Endosperm homogeneous.

Distribution: Sarawak: 1st Division.

Collections examined: Sarawak: Lundu River, Micholitz 11849 (type) K (!); Forest Reserve, Kuching, Brunig nos. 5, 20, 22, 30. SING (!); Bako National Park, Brunig nos. 4, 31, 34 SING (!).

Notes: The leaf is particularly distinctive (Fig. 5), the deep plications and the lack of apical notch do not occur in other *Iguanura* species: it rather resembles the leaf of *Gigliola subacaulis* from which it can readily be distinguished by the inflorescence, flowers and fruits, and in the lobing of the leaf margin which in

I. sanderiana is truly praemorse and in *G. subacaulis* corresponds to the ribbing of the leaf.

From Brunig's collections this species appears to be locally abundant.

16. ***Iguanura wallichiana*** (Wall. ex Mart) Hook. f. *Areca wallichiana* Wallich's Catalogue no. 8600 (1828); Martius, Hist. Nat. Palm. 3: 178 (1837); Endlicher, Gen. Plant. Suppl. 1. (1841); Kunth, Enumeratio Plantarum. 3: 186 (1841); Miquel, Fl. Ind. Bat. 3: 15 (1855). *Iguanura wallichiana* (Mart) Hook. f. in B. and H. f. Gen. Pl. 3: 908 (1883); Beccari, Malesia. 3: 100 (1886); Hook. f, Fl. Brit. Ind. 6: 416 (1892); Ridley, Mat. Fl. Mal. Pen. (Monoc) 2: 151 (1907); Fl. Mal. Pen. 5: 14 (1925); Whitmore, Palms of Malaya. 65 (1973). *Iguanura geonomaeformis* Griff ex. Mart. Hist. Nat. Hist. Palm. 3: 229 (1838) and pl. 178 (1894); Miquel, Fl. Ind. Bat. 3: 44 (1855); Hooker f. Fl. Brit. Ind., 6: 415 (1892); Ridley, Mat. Fl. Pen. (Monoc) 2: 150 (1907); Fl. Mal. Pen. 5: 13 (1925); Martelli, Nuovo G. bot. ital. 42: 52 (1935); Whitmore, Palms of Malaya. 63 (1973). *Slackia geonomiformis* Griffith Calcutta J. Nat. Hist. 5: 469 (1845); Palms of Brit. E. Ind. 162 and pl. 245 (1851); Icones Plantarum Asiaticum 3: 162 and pl. 243 (1851); Notulae ad plantas Asiaticas 3: 163 and Pl. 243 (1851). *Slackia insignis* Griffith, J. Travels in Assam, Burma, Affghanistan and the neighbouring countries 2: 187 no. 977 (1847).

Solitary or in clumps (except in var. *humilis* where solitary). Stem usually 2 m tall and upto 3.5 m or acaulescent, to 1 m tall in the dwarf variety (var. *humilis*) and upto 4 m in tall varieties (var. *major* and var. *elatior*) Stem ($\frac{1}{2}$) $1\frac{1}{2}$ (3) cm thick. Bark brown squamous, papracous when dry. Annuli c. 1–2 cm apart. Leaves 8–10 in the crown (upto 14). Leaf medium-sized c. 50–70 cm long and c. 20–40 cm wide. Leaf simple or pinnate, not abscissing but decaying on the stem. Leaf sheath thick, brown and fibrous. Petiole c. 20–50 cm long. Lamina with abaxial veins covered by brown hairs. Pinnate leaf usually with 5–6 segment pairs and upto 20 narrow segments. Segments parallelogram-shaped with veins parallel to one another and at right angles to the margin. Rarely opposite but frequently with equal numbers on either side of the midrib. Terminal segments ending bluntly, upto twice as wide as the lower segments and forming a deep cleft between them. Lower segments with apical corner elongated.

Spathes short, remaining within the leaf sheaths. Inflorescence long, 20–50 cm (upto 100 cm in subsp. *wallichiana*), always among the leaves and projecting beyond them. Inflorescence branched or unbranched. Peduncle long, upto 90 cm, spongy, sometimes glistening green, portion among the leaves sometimes covered with a felt of grey or brown hairs. Male flowers c. 2–2½ mm long, anthers unlobed.

Fruits olive shaped, $1\frac{1}{4}$ x $\frac{3}{4}$ cm (upto 2 x 1 cm in var. *major*); white, ripening sweet, fleshy, translucent and cerise. Dried fruit neither ribbed or ridged but surface undulate. Endosperm deeply ruminant.

Type specimen: *Porter, Wallich Cat. 8600* (K) Penang, Malaya.

Distribution: Malaya, common and widespread. Sumatra and Sarawak.

Taxa: Two subspecies (subspecies *wallichiana* and subsp. *malaccensis*) and five varieties, two in subsp. *wallichiana* (var. *wallichiana* and var. *major*) and three in subsp. *malaccensis* (var. *malaccensis*, var. *humilis* and var. *elatior*).

Malay name: There is no Malay name which is consistently used throughout Malaya for this common forest palm. The name "terunok" is used in Kelantan for var. *wallichiana* and at G. Bubu, Perak, for var. *major*.

Notes: *Iguanura wallichiana* is distinguished at once from all other Malayan species by the shape of the leaf segments and the persistent, fibrous leaf sheaths — even the seedling can be recognised by its distinctive lamina shape with a deep apical cleft and brown hairs on the abaxial veins (Plate 4b).

I. wallichiana is a variable species both in the degree of inflorescence branching and the division of the lamina which has led to the description of several species which are here reduced to *I. wallichiana*. *I. geonomaeformis* Griff. ex. Mart. and *I. malaccensis* Becc. were both based on variation in the number of branches of the inflorescence and *I. diffusa* Becc. and *I. spectabilis* Ridl. were based on variation of lamina dissection. Neither of these characters is sufficiently precise to divide this taxon into species but rather represents a continuum of variation. However, I have used them for distinguishing taxa at the subspecific level, based not only on differences in inflorescence branching but also on ecological differences and distinct, though over-lapping, geographic distribution. Five varieties are recognised based on geographic distribution (Fig. 6) and whether the lamina is dissected or not.



Figure 6. Distribution of the subspecies and varieties of *Iguanura wallichiana* in Malaya.

In Malaya, the degree of branching of the inflorescence is not a reliable character because there is a complete continuum from the unbranched inflorescence to one with upto eight or occasionally 16 branches, although one form tends to predominate in a local population. Branching does not alter with age.

For example, of a sample of 100 plants of this species (50 from different localities in the northern part of Malaya and 50 from different localities in the south of Malaya), the majority from northern Malaya had four or eight (sometimes with upto 16) branches to the inflorescence though a few had inflorescences with only two or three branches; in the sample from southern Malaya, the majority of plants had unbranched inflorescences and about $\frac{1}{5}$ had bifurcating inflorescences. In Pahang, in central Malaya where the distributions of these two taxa overlap, occasional plants were found with several inflorescences on the same plant, some inflorescences unbranched and some with upto four branches.

Inflorescence branching is therefore not a valid criterion for erecting species. However two subspecies are recognised by differences in inflorescence branching and by distinct though overlapping geographic distribution. Thus subspecies *wallichiana* has branched inflorescences, a northern distribution and a wider ecological range and subspecies *malaccensis* has unbranched or sometimes bifurcating inflorescences, a southern distribution and a narrow ecological range, being confined to wet areas.

The subspecies have been so named because the species epithet *wallichiana* predates *geonomaeformis* for a taxon with branched inflorescences. Martius (1837) described *Areca wallichiana* as possessing "spadicibus simpliciter valde ramosis", and Griffith (1845) described *Slackia geonomiformis* as possessing an inflorescence "generally dichotomous, sometimes ramosely branched". In 1838, Martius published a description of *Iguanura geonomaeformis* Griff. ex. Mart. stating that "spadice saepe simpliciter ramosa" and an illustration of the plant shows two inflorescences, one with two branches and the other with three branches. This description was based on Griffith's specimen and description, although Martius' publication predates Griffith's. J.D. Hooker (1892) also did not make any distinction between these two taxa for inflorescence branching describing both as having either simple or branched inflorescences.

However Ridley (1907) made these two taxa apparently distinct by describing *I. geonomaeformis* as having a simple inflorescence or an inflorescence with two or three branches as opposed to *I. wallichiana* which he described as having about eight branches. Whitmore (1973) follows Ridley in this, describing *I. wallichiana* as having "several (to 10) widely-diverging spikes, sometimes branching" and *I. geonomaeformis* as having "simple spikes . . . , occasionally with a few narrowly diverging branches".

In 1886 Beccari described a new species, *I. malaccensis*, with unbranched inflorescences and I have used this name at a subspecific level for the taxon with unbranched or bifurcating inflorescences. This predates Ridley's re-interpretation of the concept of *I. geonomaeformis*, which in Griffith's original sense is synonymous with Martius' description of *Areca wallichiana*.

Within each subspecies I have recognised varieties where simple leaved plants are predominant in certain localities. There are three varieties in subspecies *malaccensis*: var *malaccensis*, widespread in southern Malaya and with pinnate leaves; var *humilis* in Kemaman with simple leaves and a dwarf habit, and var *elatior* at G. Blumut with simple leaves and a tall habit. There are two varieties in subspecies *wallichiana*: var *wallichiana*, widespread in northern Malaya with pinnate leaves and var. *major* at G. Bubu with simple leaves and a tall habit.

The genetic status of these taxa is not known — it is unknown whether the varieties are interfertile or whether the two subspecies are interfertile where their distribution overlaps.

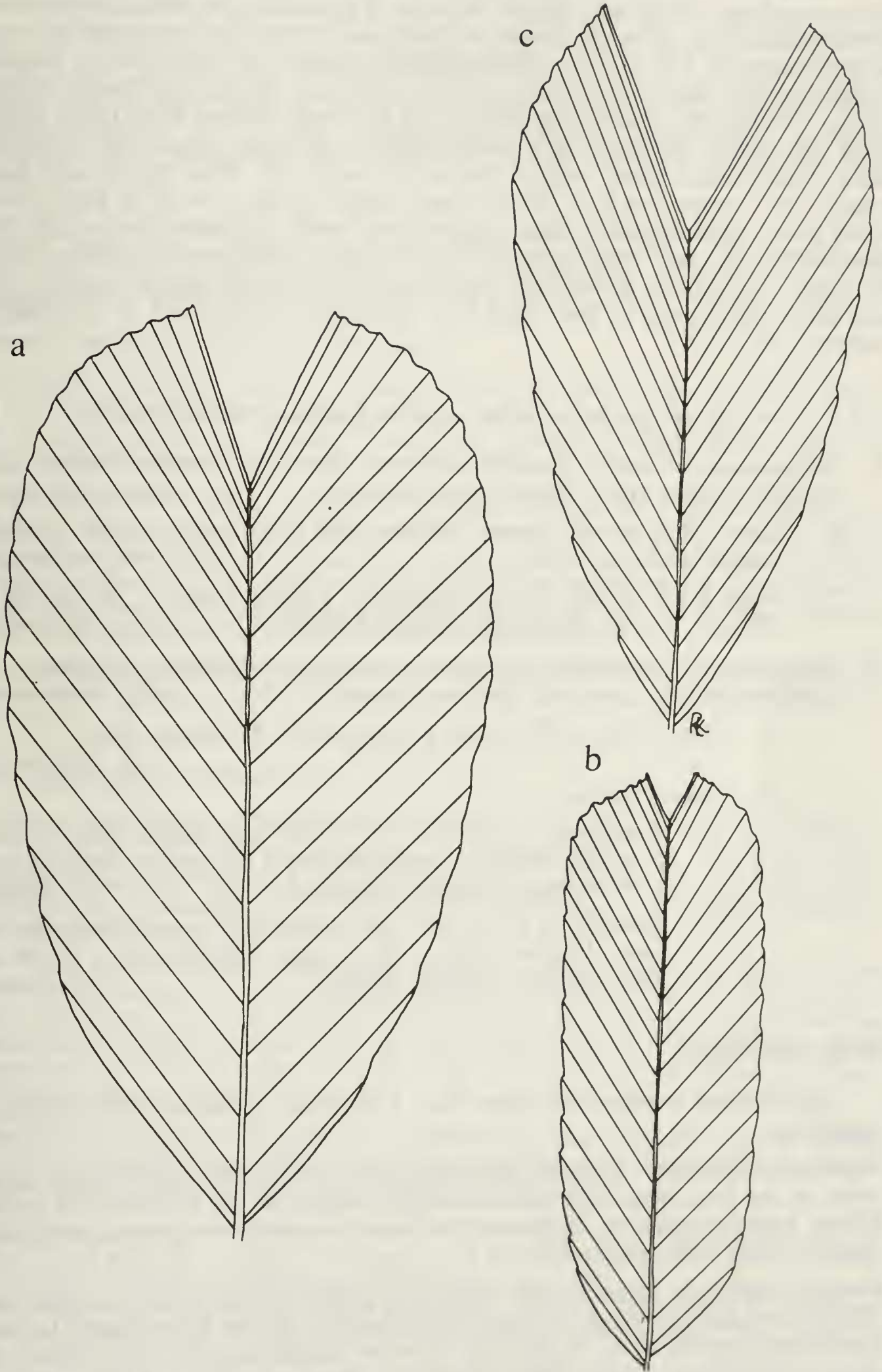


Figure 7. Leaf shapes of *Iguanura wallichiana*. x 1/6. a subspecies *wallichiana* var. *major*; b. subspecies *malaccensis* var. *humilis*; c. subspecies *malaccensis* var. *elatior*.

There may be found rarely and scattered randomly among populations of the pinnate varieties, plants with simple leaves as if immature, yet with inflorescences. These plants have no trunk or only a small one (c. 50 cm) compared with the average height of 1.2 m for the fertile pinnate varieties. The leaves too are smaller, suggesting that these simple-leaved forms are young plants precociously fertile among a completely pinnate population. It is unknown whether these plants would show the normal succession of juvenile leaves to the adult pinnate leaf (observations of this nature would require five to ten years) but fertile plants have been found with a succession from older juvenile simple leaves to more or less pinnate adult leaves, indicating that these simple forms would probably develop into the pinnate form in time. This contrasts with the other simple-leaved varieties which not only predominate in number over pinnate varieties in specific localities but also differ significantly in leaf shape from the simple juvenile leaf of the pinnate varieties (fig. 7.).

Key to the infraspecific taxa of *Iguanura wallichiana*.

- I. Inflorescence branched, generally with more than four branches. Sumatra and northern Malaya (from Fraser's Hill northwards) subsp. *wallichiana*
 2. Stem 1.5–2 m tall. Leaves pinnate with 3–10 segment pairs. Lamina narrow c. 24 cm wide var. *wallichiana*
 22. Stem 2–2.5 m tall. Leaves undivided. Lamina broad c. 40 cm wide. Malaya: Gunong Bubu and Kledang Siong F. R. var. *major*
- II. Inflorescence unbranched, sometimes narrowly bifurcating. Sarawak and Southern Malaya (south of Genting Simpah) subsp. *malaccensis*
 3. Stem 1.5–2 m tall. Leaves pinnate with 3–20 segment pairs var. *malaccensis*
 33. Leaves simple.
 4. Acaulescent or stem to 0.3 m tall, leaf sheaths often covered by a mass of roots. Lamina narrow c. 15 cm wide. Inflorescence c. 40 cm long. Malaya: Kemaman var. *humilis*
 44. Stem 0.3 to 1.5 m tall. Leaf sheaths not covered by a mass of roots. Lamina broad c. 30 cm wide. Inflorescence c. 55–90 cm long. Malaya: Gunong Blumut var. *elatior*

Subsp. *wallichiana*

Inflorescence usually with more than 4 branches, sometimes with secondary branching.

Distribution: Malaya: common and widespread at and from Fraser's Hill northwards in the main range and north of Sungei Dungan on the east coast. In central Pahang mixed populations of this subspecies and subspecies *malaccensis* are found. Sumatra: East coast and Jambi.

Ecology: This is a common and widespread palm and unlike subsp. *malaccensis* it is not restricted to damp or wet areas (though it is also found there) but will form large populations on slopes. It is, however, absent from dry ridges where the bertam, *Eugeissona tristis*, often dominates. With selective logging practises it becomes restricted to areas near streams which suffer less disturbance.

Var **wallichiana**

Generally 1–2 m tall, upto 3.5 m. Leaves usually with (3) 5 (8) leaf segment pairs and with upto 17 in some populations, rarely simple and then acaulescent. Lamina (34) 68 (133) cm long and (18) 27 (40) cm wide. Lamina of simple leaves (39) 52 (64) cm long and (22) 23 (40) cm wide, apex rounded, sides parallel, cuneate at the base. Inflorescence branches (2) 6 (16). Peduncle 11–40 cm upto 100 cm long, branches (15) 22 (45) cm long. Floral pits deep. Fruit $1\frac{1}{4} \times \frac{3}{4}$ cm.

Synonym: *Iguanura diffusa* Beccari, Malesia 3: 123 (1886); Hooker f. Fl. Brit. Ind. 6: 416 (1892); Ridley, Mat. Fl. Fl. Mal. Pen. (Monoc) 2: 152 (1907); Fl. Mal. Pen. 5: 14 (1925). Whitmore, Palms of Malaya. 65 (1973). *Iguanura wallichiana* var *minor* Beccari ex Hook. f. Fl. Brit. Ind. 6: 416 (1892).

Distribution: as for subspecies *wallichiana*.

Collections examined: Malaya: Penang, *Porter Wallich's Cat. no. 8600* (type) K (!); Singapore* *Lobb s. n. K* (!); also about 100 specimens from herbaria and 50 of my own collection. Sumatra: East Coast, Batang Serangan, *Beumee 481, 482 BO* (!) Jambi, Kampung Penetai, *Dransfield 2623. BO* (!).

Notes: Minor local differences include the pink immature fruit colour (rather than the usual white colour) in the National Park population, a variant colour it shares with subsp. *malaccensis* at this locality. Another conspicuous local form is found in populations in South Kemaman and north east Pahang, where the inflorescence is particularly thin and has secondary branching as compared with the less branched and stouter inflorescences of the main range population.

Smaller plants of this variety have been described as var. *minor* and plants with leaves with numerous narrow segment pairs have been described as *I. diffusa* by Beccari.

Var. **major** Becc. ex Hook. f.

Iguanura wallichiana var *major* Becc. ex Hook. f., Fl. Brit. Ind., 6: 416 (1892).

Synonym: *Geonoma pynaetiana* Masters, Gdnrs' Chron. 23: 258 f. 98 (1898) *Iguanura spectabilis* Ridley, J. Straits Branch Roy. Asiat. Soc. 41: 40 (1904); Mat. Fl. Mal. Pen. (Monoc) 2: 151 (1907); Fl. Mal. Pen. 5: 14 (1907). Whitmore, Palms of Malaya. 65 (1973).

Stem 1.5–2.5 m tall. Leaf simple, frequently glabrous or with sparse brown hairs on the abaxial veins. Lamina undivided and broad; (63) 75 (103) cm long and (32) 38 (45) cm wide; rounded at the apex and tapering gradually to the base. Main veins on upper surface (26) 33 (37). Petiole short c. 15 cm. Inflorescence branches 5–8, c. 25 cm long, peduncle 55–80 cm long, glabrous glisteningly green. Floral pits shallow. Fruits 2 x 1 cm.

Distribution: Malaya: Common at G. Bubu and Kuala Kangsar (formally known as the Larut Hills) also known from Gopeng, although it has not been collected there recently. Sumatra: East Coast, Palembang and Batang.

Collections examined: Malaya: Gopeng, *King's Coll 431* (type) L (!) K (!), *King's Coll 8827* K (!) BM (!); *King's coll 8227* K (!) Fl (!) : Bruas, *Ridley 8403* BM (!) SING (!); Hermitage Hill, *Ridley s.n. SING* (!); G. Bubu *Symington 30743* KEP (!) and several other collections from G. Bubu and K. Kangsar. Sumatra: Palembang, *Grashof 643* BO (!); Batang, *Jochems 3191, 3193* BO (!).

* Thos. Lobb ... "collected also dried plants which were sold in sets after determination, often bear incorrect localities. It is thought that the majority of the Malayan plants were got in Penang" (Burkill, 1927).

Notes: This variety was discovered early in the botanical exploration of Malaya being relatively accessible on the west coast from Penang and was avidly taken into cultivation by Victorian society which appreciated lush foliage — thus it was introduced into Europe by Curtis at the Ghent Exhibition where it was described by Masters (1898) as “strikingly handsome”. This exhibition plant was sterile and was named *Geonoma pynaertiana*. Ridley (1907) later described this taxon as *Iguanura spectabilis*. However, Beccari's earlier variety (Hooker f. 1894), var *major*, included pinnate and simple forms and these were described as larger than *I. wallichiana*. In fact the pinnate forms in this population are not as large as var *major* but the leaflets are wider and closer together than typical plants of var. *wallichiana* but as the range of the pinnate forms is large these can easily be accommodated in the concept of var. *wallichiana*. It is not known whether these two varieties are inter-fertile. Whitmore (1973) considers this taxon a variant of *I. wallichiana*.

This taxon comprises the largest plants of *Iguanura* growing in Malaya and it is interesting to note that *Johannesteijsmannia perakensis* which is the only trunked member of its genus, is also found on these hills, Gunong Kledang and G. Bubu fide Dransfield (1972).

Subsp. **malaccensis** (Becc) Kiew stat nov

Iguanura malaccensis Beccari, Malesia. 3: 102 (1886); Hooker f., Fl. Brit. Ind. 6: 416 (1892), Whitmore, Palms of Malaya. 114, (1973).

Synonyms: *Iguanura geonomaeformis* var. *malaccensis* (Becc) Ridl. Mat. Fl. Mal. Pen. (Monoc) 2: 150 (1907); Fl. Mal. Pen. 5: 14 (1925). *Iguanura geonomaeformis* var. *ramosa* Ridl., Mat. Fl. Mal. Pen. 2: 151 (1907); Fl. Mal. Pen. 5: 14 (1907).

Inflorescence usually unbranched with about a fifth of the collections examined with narrowly bifurcating inflorescences. Fruit 1 x $\frac{3}{4}$ cm.

Distribution: Malaya: widespread and common south of the Genting Simpah in the main range and south of Kemaman in the east coast. Sarawak: G. Mattang 1st Division.

Ecology: This subspecies appears to be strictly limited in its habitat, as suggested by the fact that dense populations dominating the undergrowth beside streams will cease abruptly not far from the streams where there is no apparent competition from other plants in the undergrowth layer. It is tolerant of waterlogging and plants are often found growing in shallow water near the banks of streams or pools. I have seen seedlings growing in areas seasonally flooded to a depth of about 5 cm, a depth which would almost submerge them. Their distribution is particularly conspicuous in their confinement to damp flushes in forests at low altitudes and their absence elsewhere.

Notes: I have recognised three varieties: one with pinnate leaves and two new varieties with simple leaves, both with a very local distribution, one taller than the pinnate variety and the other smaller.

Var **malaccensis**

Generally 1–2 m tall, upto 3.5 m. Leaves commonly with (3) 5 (7) segment pairs, less commonly with numerous segments (9) 13 (21), rarely simple and then on acaulescent plants to 0.5 m tall. Lamina (42) 69 (98) cm long and (11) 24 (40) cm wide. Lamina of simple leaves (17) 47 (67) cm long and (13) 20 (26) cm wide, apex rounded, sides parallel and cuneate at the base. Peduncle 20–50 cm long, floral pits in distal (10) 33 (65) cm of inflorescence.

Distribution: as for subspecies *malaccensis*.

Collections examined: Keheding (1878) Klang (type) K (!) Fl (!). About 150 Malayan specimens from herbaria and about 30 of my own collection.

Sarawak: G. Mattang *Dransfield* 768.

Notes: Beccari (1886) distinguished *I. malaccensis* by the unbranched inflorescence. This is the first description which distinguishes a taxon with unbranched inflorescences from those with branched ones i.e. *I. wallichiana* and *I. geonomaeformis*. However the situation became confused when *I. geonomaeformis* was used by Ridley to describe the unbranched taxon, while *I. malaccensis* was reduced to the varietal level and was distinguished from the "typical" variety only by being more tomentose. The situation is further confused by Whitmore (1973) who mistakenly described *I. malaccensis* as "one of the branched forms".

In accordance with Griffith's original sense, *I. geonomaeformis* is treated as synonymous with *I. wallichiana* so that *I. malaccensis* is the correct name for the taxon with unbranched inflorescences. I have used it in a slightly wider sense by including plants which have both simple and bifurcating inflorescences on the same plant. A problem then arises about Ridley's *I. geonomaeformis* var *ramosa* which he described as having two or three branches. After consideration, I have reduced this to synonymy with var *malaccensis* as all the plants cited by Ridley have a southern distribution. However plants with one, two, three or four-branched inflorescences on the same plant are rare and form less than 2% of the populations I examined.

Var **humilis** Kiew var. nov.

Palma humilis solitaria saepe acaulescentia, vel caule breve 10 cm — 1 m alto, 2 cm crasso. Annuli aggregati ad 2.5 mm distantes. Plantae caulescentiae radicibus gralliformibus. Vagina folii ramis radicum gralli formium tecta. Folium indivisum 8–10 in corona. Lamina anguste — oblonga, base cuneate, apice rotundata, margine leviter serrato. Petiolus 30 cm longus. Lamina (46) 50 (55) cm longus, (13) 15 (20) cm latus, nervis lateralibus (21) 23 (26). Inflorescentia c. 42 cm longa, c. 17 cm florifera. Inflorescentia indumento aurantiaco tecta. Spatha exterior c. 10 cm longa, interior c. 20 cm longa, indumentum dense tecta. Foveae conspicuae, bracteolo magna.

Typus: *Corner* 30095 Ulu Bendong, Malaya. Holotypus (SING).

Solitary, often acaulescent or with short trunk 10 cm to 1 m tall. Stem stout c. 2 cm thick. Annuli crowded, upto $\frac{1}{4}$ cm apart. In plants with a stem, stilt roots at stem base give rise above to a mat of thin branched roots covering the leaf sheaths. Leaf simple, 8–10 leaves in the crown. Lamina narrowly oblong, gradually cuneate at base, rounded above. Margin shallowly serrate. Petiole c. 30 cm long. Lamina (46) 50 (55) cm long and (13) 15 (20) cm wide. Lateral veins (21) 23 (26). Inflorescence c. 42 cm long, c. 17 cm bearing floral pits. Inflorescence covered by wiry ginger hairs. Outer spathe c. 10 cm long, inner c. 20 cm long. Spathes covered by a felt of fluff. Pits conspicuous with large covering bract.

Distribution: Malaya: Kemaman.

Collections examined: Ulu Bendong, *Corner* 30095 SING (!); L (!); *Corner* s.n. BO (!), SING (!) BM (!); Ulu Ayam, *Corner* 30258 SING (!); 30259 SING (!); 30260 SING (!); Bukit Kajang, *Corner* s.n. SING (!); *Kiew* 4, 5, 8, 12, 13, 14, 15, 16.

Notes: Var *humilis* is distinguished from the sporadic simple-leaved forms by the narrower leaf (fig. 7) and by the peculiar mass of branched roots at the base of the trunk. These arise from the stilt roots and are unusual in that they appear to be negatively geotropic, growing upwards and forming a network round the leaf sheaths where detritus collects and into which the roots appear to penetrate. Occasional pinnate forms are found in the local populations of var *humilis* which are both smaller in stature and in length of leaf than the average var *malaccensis* and possess the mat of roots covering the leaf sheaths characteristic of the Kemaman population.

This variety is the smallest palm in Malaya and rivals *I. palmuncula* var *palmuncula* in Sarawak. It is fertile when acaulescent and can have rounded leaves only about 5 cm in width and length and an unbranched inflorescence about 10 cm long. It is smaller than the early juvenile simple-leaved forms of the other taxa of this species.

Var **elator** Kiew var. nov.

Caulis 50–350 cm altus. Folia indivisa (36) 57 (72) cm longa, (24) 30 (36) cm lata. Lamina fissura apicale profunda, (19 cm), base acute contracta (interdum parallelilatera). Nervi laterales (18) 29 (35) interdum glabri, saepe indumento aurantiaco longo. Inflorescentia 55–90 cm longa, indumento filimetallico simile tecta, floribus 25–45 cm tecta. Spatha exterior 14 cm longa, interior 28 cm.

Typus: *Holttum* 10299 Gunung Belumut, Malaya. Holotypus (SING).

Stem $\frac{1}{2}$ – $3\frac{1}{2}$ m tall. Leaves simple (36) 57 (72) cm long and (24) 30 (36) cm wide. Lamina with deep apical notch (19 cm), base tapering acutely (occasionally with parallel sides) towards the apex. Lateral veins (18) 29 (35), sometimes glabrous frequently with dense long ginger hairs beneath. Inflorescence 55–90 cm long, covered by wiry hairs, flowers covering 25–45 cm. Outer spathe 14 cm, inner spathe 28 cm.

Distribution: Malaya: G. Blumut, Johore.

Collections examined: Johore: North side G. Blumut, *Holttum* 10299 SING (!); Kluang Forest Reserve, *Ng* 98021 KEP (!), *Dransfield* 817 KEP (!), *Kochummen* 2841 KEP (!); *Whitmore* 3850 KEP (!) *Evans* 103, 107, 108, 109, 110 (!).

Notes: This variety grows in populations together with the pinnate variety var *malaccensis*, over which var *elator* slightly predominates in number. The pinnate plants are indistinguishable from the general Malayan population of var *malaccensis*. Var *elator* eventually grows much taller than these and has leaves differing in shape from the general populations' simple-leaved forms (fig. 7) by being abruptly cuneate at the base and having a particularly deep apical cleft.

The first reference to this variety is Dransfield (1969). He points out its similarity to the population of var *major* at Gunung Bubu in Perak; however they are distinct in inflorescence branching — var. *elator* has a simple inflorescence and falls within the range of subsp. *malaccensis* while var *major* has a branched inflorescence and falls within the range of variation of subsp. *wallichiana*. Leaf size and shape also show differences (fig. 7).

Species Excludenda

Iguanura speranskyana Bois, J. Hort. Soc. France 665 (1899). Martelli, Nuovo Giornale Botanico Itali 42: 52 (1935).

There is no type specimen for this plant and the sole description is: "Palmier originaire du Brésil, à port de *Geonoma*, acaule, à feuilles rouges dans le jeune âge."

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