

Unravelling *Iguanura* Bl. (Palmae) in Peninsular Malaysia

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Abstract

Based on over four years of field studies, a revision of the palm genus *Iguanura* Bl. in Peninsular Malaysia is presented, listing 16 taxa including seven new species and one new variety.

Preamble: My interest in palms began with the realisation that I knew little about them, whether they were introduced exotics or were local and indigenous or endemic. I decided to learn and investigate firsthand those found within Peninsular Malaysia (initially) and to study them in their natural habitat wherever possible, and also to research on available information in the herbaria with emphasis on the genera *Iguanura*, *Pinanga* and *Areca*. The rediscovery of historical or forgotten species has been both rewarding and exciting, as was the encounter with those that were evidently new. With other team members of the privately sponsored project called Palm Search Malaysia, we were encouraged at an early stage by the fortuitous discovery in N. Perak of a new species, *Areca tunku*, which I published jointly with John Dransfield who had also found the new taxon in Sumatra and in Peninsular Malaysia (see *Principes* 36 (2), 1992: 79-83). The result of the field work begun in 1989 has provided the essential basis for the revision of *Iguanura* within Peninsular Malaysia. As the genus also occurs in other parts of S.E. Asia, the revision will undoubtedly be interim, and will need to be followed up by broader regional studies and comparisons. Nevertheless existing documentation and taxonomic accounts of the Malayan flora require correction, unscrambling or unravelling, in the light of fresh data and of new species and varieties.

Chronology

The genus *Iguanura* was first described by Blume in 1838 based on the specimen he named *I. leucocarpa* which had been collected in Sumatra by Korthals and others. The earliest species found in Peninsular Malaysia was from Penang Island, collected by Porter in 1822 which featured in Wallich's catalogue of 1828, and was published by Martius as *Areca wallichiana* in 1837; it was subsequently reidentified much later in 1883 by J.D. Hooker as *I. wallichiana*. Among other early palms collected in the Malacca area around 1841 was *Slackia geonomaeformis* which Griffith published in 1844; his material had also been seen by Martius who described it as *I. geonomaeformis* Griff. ex Mart. in 1849, placing it under Blume's new genus.

In 1886, Beccari began his monumental publication on Asiatic Palms (Malesia

III) describing his Bornean discoveries, also adding notes on *I. wallichiana*, using Wallich's specimens in the Munich Herbarium. He also claimed a new species, *I. malaccensis*, based on Kehding's collection of 1878 from Klang; which is arguably synonymous with *I. geonomiformis* (as per the revised spelling).

Within the section of Malesia III, dated August 1889, Beccari provided further important accounts based on material supplied by Dr King of Calcutta which had been collected by Kunstler in Perak, and by Father Scortechini, who had died of dysentery in Calcutta in November 1886. The new species published were *I. corniculata* (collected by Kunstler from Selama), *I. bicornis* (by Scortechini from Gunung Ijuk), *I. polymorpha* and its variety *canina* (also by Scortechini, from Perak), as well as numerous taxa from other genera.

In 1892, J.D. Hooker published "Flora of British India", describing Beccari as the precedent co-author for the section on Palmae, incorporating his manuscript data on new *Iguanura* taxa, including *I. wallichiana* v. *major*, *I. wallichiana* v. *minor*, *I. diffusa* (collected by Scortechini from "Gunong Tjok") and *I. parvula* (collected by Scortechini from Perak), hinting however that the last might be a "very small form of *I. polymorpha*".

In 1903, H.N. Ridley cited two new species, *I. ferruginea* and *I. spectabilis*, the latter being the spectacular large entire-leaved form found in the G. Bubu area, which had apparently been preceded by Dr Masters who had exhibited and published it in 1898 as a botanical exotic called *Geonoma Pynaertiana*. However, the syntypes for *I. wallichiana* var. *major* are clearly similar to this, and Masters' species and *I. spectabilis* are consequently reduced to synonyms of the latter. In "Materials for a Flora of the Malay Peninsula" published in 1907, Ridley listed other historical taxa of *Iguanura*, but included *I. diffusa* and *I. parvula* as synonyms of *I. wallichiana*, and *I. brevipes* under *I. polymorpha*. Perplexed by fresh collections of *I. geonomiformis* and the variations in leaf division and inflorescence rachilla, he added to *I. geonomiformis* var. *typica*, *I. geonomiformis* sub. var. *ramosa* and *I. geonomiformis* var. *malaccensis* (which he had cited in 1903). Within this revision these will be treated as forms of *I. geonomiformis*.

The sequel to "Materials" was Ridley's "Flora of the Malay Peninsula", published in 1925, which contained several editorial and textual inconsistencies within the Palmae section, including the description of *Licuala ferruginea* in place of its *Iguanura* namesake (correct in the 1907 publication), as first pointed out by Whitmore (1973 endnote 78).

The syntypes of *I. ferruginea* came from different locations, displaying variations in inflorescence, but Ridley's citation positively identifies characters that are found in *I. polymorpha* Becc. and its var. *canina* in particular. Furriness on which it was distinguished is in fact quite common within the genus and is not necessarily a reliable differentiation for taxonomic purposes.



Plate 1 *I. wallichiana* var. *major*: Watercolour by Charles De Alwis titled "*Iguanura spectabilis* Ridley" (by courtesy of National Parks Board and Singapore Botanic Gardens)



Plate 2 *I. geonomiformis*: Watercolour by Charles De Alwis titled "*Iguanura geonomiformis*"
 (by courtesy of National Parks Board and Singapore Botanic Gardens)

Ridley had also collected a specimen from Ara Kuda in Province Wellesley, Penang, which he labelled "*Pinanga canina* Becc.", probably on account of the fruit shape, although none is on the herbarium sample itself. In 1934, Furtado published this as a new species, *I. arakudensis*, characterised by the broad apical leaflets. Earlier taxonomic attempts to use variations in leaf shape and form as determinants were then undoubtedly part of a learning curve. As the type location has since been turned into rubber and oil palm plantations, the species was deemed extinct (Whitmore 1973), indeed our own field searches have proved abortive. However, other equivalent low-lying terrain in north Malaysia has yielded enough specimens to indicate that Furtado's taxon with its three-branched inflorescence is, like *I. ferruginea*, a form of *I. polymorpha*.

In 1973 Whitmore published "Palms of Malaya", intending it to be a popular guide to the flora, then much misunderstood or unknown. It was a remarkable work, produced apparently in between more serious work and forestry duties. It is still the key introduction and reference for many, and provides a clear overview of the *Iguanura* (and other) taxa. He revives the identity of *I. diffusa*, *I. parvula*, *I. brevipes* and *I. arakudensis* (which he has suggested might be extinct), and reaffirms *I. wallichiana*, *I. geonomiformis*, *I. corniculata*, *I. bicornis* and *I. polymorpha*. In his earlier "Taxonomic Notes" (Principes 1970, Vol. 14: 124) he has contradicted Ridley and held that *I. brevipes* was distinct from *I. polymorpha* on the basis of the crownshaft and its interfoliar as against the infrafoliar inflorescence of the latter. Whitmore however realised and suggested more field specimens were needed for fuller determination of the *I. polymorpha* complex. J.D. Hooker's type for *I. brevipes* collected from Bukit Larut from the same vicinity as *I. bicornis* had no fruit, and its habit, whether solitary or clustering, was not described. Subsequent herbarium specimens described as *I. brevipes* (by Furtado, Whitmore and others) are in my view not at all certain, and are more likely to be *I. polymorpha* or *I. bicornis*.

Whitmore himself and his colleagues collected strenuously and made substantial deposits of palm specimens at the Kepong herbarium; his field coverage and notes have significantly extended postwar botanical investigations. He rediscovered *I. diffusa* in Taman Negara; although it has not been seen in the original type location in Perak, the Pahang form appears to fit the description by Beccari, per J.D. Hooker.

In 1976, Ruth Kiew (née Evans) published the first major revision of the genus, covering the entire known range, including Thailand, Sumatra, Malaya and Borneo (Gardens Bulletin Vol. 28: 191-230). As an extension of her doctoral interest in the genus, the revision itself "was 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". She lists for the region a total of 16 species including four new Bornean ones that she has determined, with further taxa at the rank of subspecies and variety. Later, she added two further new species described from

Sarawak (Kew Bulletin 1978 Vol. 34: 143, 144) with supplementary notes on Malayan taxa also found in Thailand. For Peninsular Malaysia, she reduces the spectrum to four species: *I. bicornis*, *I. corniculata*, *I. polymorpha* and *I. wallichiana*, with two subspecies for the last: *ssp. wallichiana* and *ssp. malaccensis*, each with two or three varieties respectively, totalling eight taxa at various ranks, including two new varieties.

Kiew's revision separates the Malayan taxa on the basis of leaf abscission or marcescence, and of leaflet shape; her "trapezoidal" section lists the first three species mentioned above. She errs however by including *I. arakudensis* within *I. bicornis*, whereas it should be regarded as a form of *I. polymorpha*, under which she includes the *var. canina*, *I. brevipes*, *I. ferruginea* and also, *erroneously*, *I. parvula*. In summary, she places all forms with parallel-sided leaflets, or with entire leaves, within the *I. wallichiana* complex, creating two subspecies, with synonymy as follows:-

- 1.1 *I. wallichiana* (Wall. ex. Mart.) J.D. Hooker *ssp. wallichiana*
var. wallichiana
(synon.: *Areca wallichiana* Wall. ex. Mart., *I. diffusa* Becc., *I. wallichiana*
var. minor Becc. in J.D. Hooker)
- 1.2 *I. wallichiana* *ssp. wallichiana* *var. major* (Becc. in J.D. Hooker) Kiew
(synon.: *I. wallichiana* *var. major* Becc. in J.D. Hooker, *Geonoma*
pynaertiana Masters, *I. spectabilis* Ridley)
- 2.1 *I. wallichiana* *ssp. malaccensis* (Becc.) Kiew *var. malaccensis*
(synon.: *Slackia geonomiformis* Griff., *I. geonomiformis* Griff. ex. Mart.,
I. malaccensis Becc., *I. geonomiformis* *var. malaccensis* (Becc.) Ridley,
I. geonomiformis sub-*var. ramosa* Ridley)
- 2.2 *I. wallichiana* *ssp. malaccensis* *var. humilis* Kiew
- 2.3 *I. wallichiana* *ssp. malaccensis* *var. elatior* Kiew.

Kiew attempted to localise her *I. wallichiana* taxa into an elegant distribution pattern within the map of the Peninsula, which cannot but be outdated by evidence from more collections and further field samplings. For example her *ssp. malaccensis* can be found more northerly well into Perak and Kelantan.

The basis for Kiew's preference for Beccari's *malaccensis* as against the Griffith-Martius *geonomiformis* was that she believed Beccari was first to correctly identify the characteristic spicate inflorescence, whereas Griffith and Martius included "branched" inflorescence - which rendered their earlier accounts synonymous with Martius' own *Areca wallichiana*. However, the illustrations of *I. geonomiformis* within Martius and Griffith (q.v.) are quite indicative and show bi-

furcating and tri-furcating inflorescences, which are usual variations of the spicate form commonly seen. These forms are quite unlike the divaricate, paniculate branching of *I. wallichiana* and its allies.

In addition to herbarium reference and historical research, the field observations and new collections within the Palm Search programme lead to a rather different scenario from Kiew's overview of the *I. wallichiana* complex. Working quite independently, but greatly benefitting from her published work and friendly communications, I propose to revise and update her listing as follows:-

- 1.1 *I. wallichiana* (Wall. ex. Mart.) J.D. Hooker var. *wallichiana*
(synon.: *Areca wallichiana* Wall. ex Mart. *I. wallichiana* var. *minor* Becc. in J.D. Hooker, *I. wallichiana* (Wall. ex. Mart.) J.D. Hooker ssp. *wallichiana* var. *wallichiana*);
- 1.2 *I. wallichiana* var. *major* Becc. in J.D. Hooker
(synon.: *Geonoma pynaertiana* Masters, *I. spectabilis* Ridley, *I. wallichiana* ssp. *wallichiana* var. *major* (Becc. in J.D. Hooker) Kiew);
- 1.3 *I. wallichiana* var. *rosea* C.K. Lim **var. nov.**
- 1.4 *I. diffusa* Becc. ex. J.D. Hooker
- 1.5 *I. asli* C.K. Lim **sp. nov.**
- 1.6 *I. kelantanensis* C.K. Lim **sp. nov.**
- 1.7 *I. piahensis* C.K. Lim **sp. nov.**
- 2.1 *I. geonomiformis* (Griff.) Mart.
(synon.: *Slackia geonomiformis* Griff., *I. malaccensis* Becc., *I. wallichiana* ssp. *malaccensis* var. *malaccensis* (Becc.) Kiew, *I. wallichiana* ssp. *malaccensis* var. *elatior* Kiew)
- 2.2 *I. humilis* (Kiew) C.K. Lim **stat. nov.**
(synon.: *I. wallichiana* ssp. *malaccensis* var. *humilis* Kiew)

It might be mentioned at this juncture that the range of variations and forms within the *wallichiana* and *geonomiformis* groups gives scope for further field investigations. Kiew's var. *elatior* remains tantalising, but seems to be similar to certain other widely distributed forms of *I. geonomiformis*. There are indeed other robust forms of the taxon to be seen in G. Bintang and in Negeri Sembilan: the latter might well be the epicentre on the basis of size. *I. humilis* deserves its new status, as was indeed suggested by Furtado on Corner's specimen: and although other forms of *I. geonomiformis* can have precocious inflorescences at the

acaulescent stage, they are usually clustering, whereas the new taxon is solitary with a short stem. Our field observations reveal certain other “grey” areas between the two groups or within each, but this has been seen mainly in particular locations (Pahang, Kelantan and Terengganu). In the more well-known collecting areas the distinctions seem evident enough to justify maintaining the historical (and convenient) separation of *I. wallichiana* from *I. geonomiformis*.

The field strategy has obviously been to check on or to get close to type locations, and to corroborate against type specimens. *I. wallichiana* (var. *wallichiana*) can still be found on Penang Hill, but in diminishing stands. *I. geonomiformis* is probably extinct at Ayer Panas, but is not uncommon within the Malacca area. *I. diffusa* has yet to be found in the G. Ijok (or G. Hijau?) vicinity, but the Taman Negara form (or its look-alike) is quite accessible and distinctive.

Within the *I. wallichiana* complex, Ridley’s *I. spectabilis* would have been a wonderful name, which would have been subsumed into “*I. pynaertiana*”. However, as mentioned above, they are both synonymous with Beccari’s *I. wallichiana* var. *major*, the distinctive taxon with erect inflorescence and large entire leaves, as seen on G. Bubu. Other forms (eg. *I. wallichiana* var. *minor*) can be readily differentiated from this variety in the field, and are included under *I. wallichiana* var. *wallichiana*.

I propose to recognise a new variety, *I. wallichiana* var. *rosea*, firmly on its distinctive fruit colour, which is pink from the start, ripening red, as found in two particular locations in Perak and Kelantan. Fruit colour difference as a positive character is also found in the new species to be named *I. asli*, which is quite widespread within *I. geonomiformis* (Kiew’s var. *elatior*) territory, from eastern Johor to Pahang and Terengganu, which similarly has immature pink fruit turning candy pink (rather than cerise red), somewhat rivalling adjacent populations of *Licuala ferruginea* in colour and splendour. The inflorescence is interfoliar, with curled rachillae, and short peduncles within the sheaths.

I.kelantanensis is likely to be more widespread but has so far been seen only in its type locality within the named state. It is acaulescent, and solitary, with variable branching inflorescence, usually having short peduncles.

Another new species, which has so far been seen only in a particular area and is thereby named *I.piahensis*, has a particular distinguishing characteristic that may intrigue the student of dried leaves (as on herbarium sheets) - its fine texture, papery and silky to the touch. Furthermore, the leaf shapes are distinguishable from others of the *wallichiana/geonomiformis* complex; the entire forms are unusually long and parallel-sided. The lobed forms can also be identified, with some comparative practice. Its inflorescence is branching, usually fine and modest, similar to some collections of “*I. wallichiana* var. *minor*”, which however has standard *wallichiana* type leaves.

The rediscovery of Beccari's diminutive *I. parvula* was indeed the providential highlight of our field journeys. Apart from Whitmore's steadfast belief, it had been regarded either as an aberrant or immature aspect of *I. polymorpha* or of *I. wallichiana* (per Ridley). Some strange magnetism led us to stray into its remnant (and threatened) habitat in Kedah, in rather unlikely circumstances, to find among logging debris this highly distinctive clustering palmet, then "new" to us. A month earlier, I had made a series of photographs of Beccari's type specimen without attaching importance to its species status, and was therefore able to make a clear identification. Beccari was indeed so right in his descriptions. Although the type location was elsewhere in neighbouring Perak, it does not seem to have been collected there since. However, I subsequently located a fine specimen in the Singapore Herbarium collected also from Kedah by Haniff (SFN 21104) in 1928, which had been filed under *I. polymorpha* despite Furtado's correct determination.

The other two unmistakable Beccari species are of course *I. bicornis* and *I. corniculata*, which, as might be said, require no introduction - after the full description in Malesia III. The former is relatively common, but has so far not been found other than in Kedah and Perak, and usually on high ground above 500m. Our field observations show a range in size and stature from small clumps not taller than 1m to robust ones reaching over 3m. The largest of the fully ripe bigibbous fruit that we have encountered measure 2cm across, and are luscious and sweet, as all *Iguanura* drupes should be. *I. corniculata* is a different proposition in terms of its survival. Because of the fine type specimens made by King's collector, Kunstler, from Selama, Perak in 1881, it had remained listed as hopefully extant but probably extinct, and as mentioned by Kiew and others, it had not been seen or collected since, ie. within the last 100 years or so. I would be inclined to treat as suspect the specimen collected by Henderson from near Raub, which he himself considered to be *I. ferruginea*. Several forays into the Selama localities have been abortive, and the prospect of discovery there seems dismal as logging and plantation expansion is extensive, especially in the altitude range of 100-150m. I finally found the elusive taxon during the most recent stages of field work - not in Perak, but in its adjacent state - providentially indeed to rediscover *I. corniculata* within Penang boundaries, after failing to resurrect *I. arakudensis*!

Beccari's type specimen of *I. polymorpha* and its var. *canina* were apparently collected on Bukit Larut, which was also the type locality for *I. bicornis* and for J.D. Hooker's *I. brevipes* - all from altitudes above 1000m. Ridley's *I. ferruginea* syntypes were from two locations. Later collections by Ridley and others came from various places, Perak to Kedah and Kelantan; several were from low altitude areas, for example, Furtado's *I. arakudensis*, from Province Wellesley. The cited lectotype for *I. ferruginea* (Fox 10684) had a stout 10-branched inflorescence and is clearly synonymous with *I. polymorpha*. The other syntype seemed different, with 2 rachillae but with the characteristic curved fruit. The taxon is variable in its rachillae, often trident, sometimes with 1 or 2 branches, (suggesting a link with *I.*

corniculata). From our own field collections and other herbarium specimens we have noticed that sterile specimens of *I. bicornis* and *I. polymorpha* have sometimes been confused. Indeed *I. brevipes* might have been based on a *bicornis* specimen. With regard to the inter/intrafoliar distinctions set out by Hooker (and later espoused by Whitmore), Kiew has elucidated on this, pointing out the consequences of variable abscission conditions. Our own observations are on similar lines, as all taxa in the “trapezoidal” group can be seen with inter and/or infrafoliar inflorescence with the obvious conclusion that the peduncle was able to hold laden fruit before or after leaf fall, even if some heavier ones would be more “comfortable” while being interfoliar. Besides, the conditions for abscission would be different for clustering, as from solitary forms of growth.

Returning to the *I. polymorpha* complex, the scenario initially seemed to suggest the existence of 4 taxa: *I. polymorpha* (with ovoid, not curved fruit), *I. polymorpha* var. *canina* (with distinctly curved fruit), and *I. ferruginea/arakudensis* (also with curved fruit) for lower altitude forms (all clustering and not solitary). Although we have not yet seen live populations of *I. polymorpha* or its allies on Bukit Larut, we have observed interesting counterparts on Cameron Highlands, where a range of variation in leaf divisions can be seen. There, within particular colonies, the fruit shapes vary from globose to ovoid and curved, with seeds thicker than for *I. ferruginea* forms. The lowland variant is found all over Perak, Kelantan, Terengganu and Pahang, and is the most commonly encountered form.

Our own relatively recent collections from upper Perak, in the vicinity of Terunok (according to Ridley and Whitmore the local word for *Iguanura*, and perhaps for this particular taxon itself), have broadened our concept of *I. polymorpha*. As against the 2-2.5m clumps that we had seen elsewhere, we were astonished by the robust 3-3.5m stems, with leaves twice as large (as elsewhere) and an amazing variety of inflorescence form, from two to nine branches, the last sub-branching to 16 or more. Some rachillae were over 75cm in length, inclusive of the broad (1.5cm) peduncles, borne infrafoliar or interfoliar. On some rachillae we counted over 95 buds; the immature fruit were typically curved and irregular in its process of distention. The altitude was c.300m., with more colonies likely higher up or lower (now under water level because of damming). The evidence seems incontrovertible that we are faced with a single main taxon of *I. polymorpha*. *I. polymorpha* var. *canina*, *I. brevipes*, *I. ferruginea*, and *I. arakudensis* should thus be regarded as synonyms. Beccari’s taxon is indeed polymorphic.

Again within Perak, we have found two new members of the “trapezoidal” complex, the first solitary in habit identified in 1989, which we then decided to name *I. belumensis*, after its location. Later we came across herbarium specimens of the same or a similar taxon, originating from Bujang Melaka and G. Bubun, labelled as *I. polymorpha*. The other new species is exceedingly rare and highly endangered: over many trips we have yet to find more than ten plants in its only known location. It is a 4m tall, solitary, (occasionally with basal branches) giant

Iguanura, with two forms of leaf divisions, twice as large in size as the sympatric *I. bicornis* neighbours. It is to be called *I. perdana*.

The underlying paradigm behind the Palm Search project has been to seek in the field as widely and repeatedly as possible, in parallel with herbarium research work. Our original purpose was to learn about existing, known taxa and their conditions of endangerment. To alight upon a new species is surely an act of providence, especially in unsuspecting circumstances, but it has undoubtedly given fuller impetus to persistent botanical effort.

The ultimate new taxon among Peninsular *Iguanura* was stumbled upon in a chance sidetrip from a main botanical field expedition. In a sense it is not “new”, in that countless locals and foresters would have known it, and as it happens, a juvenile specimen had been collected and emplaced within the Kew Herbarium, awaiting determination, as we subsequently learnt. The new species to be called *I. mirabilis* is caespitose and has strongly plicate entire leaves and curved fruit, and although unlike the “trapezoidal” members, it also falls within the abscissing group. Affinities with the Sarawak taxa, especially *I. elegans* and *I. sanderiana*, are suggested, but the new taxon is clearly on its own within the genus.

With regard to local names for *Iguanura*, Ridley (1903) had recorded that the striking palm he called *I. spectabilis* was known to the (local) Malays as “Teruno” (Tronoh, Terunoh, Terunok), a name now unfamiliar to most. Griffith earlier noted that the *I. geonomiformis* was called “Pinang Rambeh”, to which Ridley added “Pinang Sapadan”, further noting that “Pinang Pachat”, “Pinang Burong Tikus” and “Pinang K’lasak”, were used for *I. wallichiana*. According to Kiew, the latter is called “Terunok” in Kelantan. In north Perak, along the river, there is a place called Terunoh, probably a village now obscure or vanished under water. In that vicinity, robust forms of *I. polymorpha* abound and it might be conjectured that the word, clearly botanical, applied historically to this particular taxon. Burkill (1935) quotes and extends Ridley’s list, and noted that *I. corniculata* was called “Pinang Angin”. In his reference however, “Terunok” was misprinted as “Termoh”. Many local names might have been ad hoc concoctions. Generally there has been a decline in specificity in knowledge of traditional names for plants. Most understorey palms including the *Iguanura* and the ubiquitous *Pinanga malaiana* (known as “Legong”) are loosely now referred to as “Pinang”. The Temiar (Senoi) folk are however still in command of their botanical names, also for the palms (including rattans) within their traditional domain. They call the *Iguanura wallichiana* alliance “Boq”, but do not use this for the *polymorpha* forms not known to them. With more anthropological research, other aboriginal names will be reidentified, as used by the Semai and others.

Many of the *Iguanura* taxa may be considered endemic to the Peninsula, although territorial boundaries are in fact arbitrary from a botanical point of view; South Thailand, for example, is indeed part of the same bio-domain, unlike Sarawak

and Sabah, which are placed in a separate botanical division, although within the same nation. Knowledge of the confines of a taxon depends on the extent of the collections and will be modified by further field surveys; for example, *I. parvula* and the new species *I. belumensis* may well be found in South Thailand, where *I. polymorpha* and *I. wallichiana* abound.

Our unravelling of *Iguanura* in Peninsular Malaysia is intended to provide a useful framework for a fuller regional taxonomy of the whole genus. Further field work will undoubtedly yield fresh data and refinements or shifts in perceptions, but the next priorities lie in widening the territorial scope to include Thailand and Sumatra, our immediate floristic bio-domain, and then Borneo, in particular Sarawak, where other exciting species of *Iguanura* are to be found, surprisingly different from the Peninsular forms. Contrary to earlier suggestions (Kiew et alia), preliminary observations already suggest that none of the Malayan taxa are to be found in Sarawak.

Iguanura Bl. (Palmae)

Bulletin des Sciences Physiques et Naturelles en NÈerlande 1: 66. 1838.
Type: *I. leucocarpa* Blume; Kiew, *Gdns. Bull.* 28: 191-230; Uhl and Dransfield, *Genera Palmarum*: 421-423. 1987.

Blume first described the genus in 1838 with *I. leucocarpa* collected from Sumatra as his type species. *Slackia* of Griffith, exemplified by *S. geonomiformis* published in 1844 is thus a synonym of the genus. Full citations have been listed in Kiew (1976), and most recently by Uhl and Dransfield (*Genera Palmarum*: 421-423, fig. 133. 1987). These include similar taxonomic accounts, and Uhl and Dransfield have classified the genus within the tribe *Iguanurinae* J.D. Hooker in Bentham and J.D. Hooker, under the sub-family of *Arecoideae*.

The present revision is confined to taxa found in Malaya, and will contribute fresh data on new species and varieties, with more emphasis on field characters and information, but less on herbarium research requiring laboratory and microscope work, eg. on floral, pollen or DNA examinations, which require fuller samplings and remain largely unstudied, giving scope for further inputs.

Blume's type species, *I. leucocarpa*, is of the form with trapezoidal leaflets, ie. similar to the *polymorpha* complex, with cleanly abscising leaves, but the genus now includes other entire-leafed, marcescent forms. It is not certain whether or not *I. leucocarpa* was solitary in habit, but Kiew's account confirms that the fruit was olive-shaped, the inflorescence was spicate, seeds "not ribbed or ridged", the drupes were white in colour (per the epithet, when unripe). So far no Peninsular taxa have these seed features. Presumably from examination of the type specimens at Leiden and Bogor, she noted that the anthers were lobed, a character that she

has recognised and confirmed also for certain Sarawak species (*I. sanderiana*, *I. ambigua* and *I. remotiflora*), and by implication suggesting that all other species had anthers not lobed. This may need to be rechecked with more samplings. It might be suggested however, that anther lobes may tend to crenulate in drying, and therefore examination of fresh material may be essential.

For purposes of this revision I have examined the *Iguanura* collections in Calcutta, Florence, Kepong, Kew and Singapore, and also at UPM, Kuching and Sandakan. Unless otherwise indicated, all specimens quoted have been viewed. This has complemented the substantial field data and our own collections, providing the basis for determinations and for recording distribution of the taxa. Many of the herbarium specimens, both historical and recent, need to be verified; indeed, a major updated checklist correlating specimens in Calcutta, Florence, Kew and Singapore needs to be made, which will also be interesting for botanical history. Pending this, and to avoid perpetuating existing discrepancies, I allude mainly to types and syntypes for the revised taxa and their synonyms, and to limited selected specimens, listed under Reference Collections, including those in the Palm Search Malaysia herbarium (designated here as PSM).

Within its natural habitat, *Iguanura* is arguably the most attractive of understorey palms and is easily recognisable by its leaf shapes and forms, with their distinctive praemorse margins, and the red or bronze flush seen in new leaves. At bifid seedling stages, all taxa are practically identical. With some experience, however, the eophylls and juvenile leaves of the two main groups - the marcescent *wallichiana-geonomiformis* complex and the abscissing trapezoidal alliance - can be differentiated, the latter being darker green and more oblong. *I. mirabilis* is particularly distinct in its discernibly plicate leaves. Historically, botanists have dwelt on leaf divisions, shapes and sizes, petiole lengths etc. as determinants. For most taxa, we must now recognise a wider range of variations. Leaf forms may be entire or divided; the division may conveniently be described as lobed or pinnate. Certain species when mature continue to have undivided bifid leaves, which vary in shape from cuneate to oval and oblong, all with the characteristic apical cleft. They also vary in size from the diminutive 20cm long *I. parvula* to the 2m or longer gigantic blades of *I. wallichiana* var. *major*. Large bifid leaves tend to have short petioles for structural reasons.

Leaf divisions described as lobed, are those split into broad leaflets, with two to five pairs (or more), opposite, alternate or irregular; the leaflets may be spaced closely (with short rachial lengths between) or more distantly. The more common leaf division is the pinnate form with many pairs of narrow parallel-sided leaflets, opposite or alternate, but usually with broader apical leaflets. An extreme form of division can be seen in *I. diffusa*, where uncostate leaflets (including apical ones) have been found. Both for *I. wallichiana* and for *I. geonomiformis* and their allies, the lamina can vary from entire to lobed and pinnate, within the same colony, and sometimes on the same plant.

Leaf sheaths are either fibrous and persistent (i.e. marcescent), or self-peeling and abscising; this differentiation is important, as was well appreciated by Kiew; and obviously has a bearing on the nodal scars on the stems and the internodal dimension. Apart from the entire-leaved *I. parvula* and *I. mirabilis*, others with abscising leaves are those that divide (after the juvenile stage) into trapezoidal leaflets, closely or more widely spaced along the rachis, opposite or alternate, sometimes quite irregular in leaflet widths (as in *I. polymorpha*). The leaflets which flare distally are like butterflies in shape, but there are great variations, sometimes not rhomboid but almost triangular. Again, the leaf divisions may be lobed or pinnate, with two to twelve pairs of leaflets. The apical pair are usually broad and multi-costate; the tip angles can vary from acute to right-angled or obtuse.

Herbarium specimens, being desiccated, usually fail to convey the texture and relative thickness of lamina and other parts observed in the forest. Although there are broad variations, especially between juvenile and older leaves, certain taxa have a distinctive sheen and tactile quality on their leaf surfaces, as with *I. parvula* and *I. piahensis*, where the silky texture can be relied upon for field identification. Prominence of nerves and the leaf fold is also characteristic in the case of *I. mirabilis*, which has other obvious features. Colour is also lost on herbarium sheets, though botanists have tried to describe the hue after drying. Tomentosity and glaucosity are often obscured. Indumentum is usually well preserved, but this character is often variable and found in most taxa, on the sheaths and rachis, leaf nerves and inflorescence.

All *Iguanura* are stilt-rooted. Some are caespitose and clustering, others are solitary, but occasionally with basal branches. Stems vary from the arudinaceous to the robust, eg. *I. parvula* (5mm in diameter, 1m in height) and *I. wallichiana* var. *major* (2cm in diameter, up to 4m or more in height), respectively. Basal branches may produce precocious fruiting at low level, especially when the main stems have been destroyed. Caespitose taxa may also appear to be solitary before basal branching develops (as is often seen in *I. geonomiformis*).

Inflorescences spring from within the leaf sheaths, usually interfoliar, but for abscising forms, they can also develop in an infrafoliar position. The peduncles can be long and extended (sometimes erect, as with *I. wallichiana* var. *major*), or short and enclosed within the sheaths. The inflorescence may be spicate or divaricately paniculate, (varying in robustness from stout and "succulent" to fine and "twiggy"), the latter sometimes branching to second or third orders. The spicate forms (*I. geonomiformis* complex) may split or "furcate" into two to seven parallel tails (sometimes sub-branching), but unlike the paniculate forms, the rachillae are not divaricate (as in *I. wallichiana* and its allies). As a convenient gauge of relative inflorescence size, that of the ubiquitous *I. wallichiana* is often 90cm long (including a 65cm peduncle); and of *I. geonomiformis*, 80cm long.

Floral characteristics include the deeply sunken triads within the rachilla, spirally disposed. Kiew (1976) gives a full account of the details, indicating that "the male and female flowers are uniform throughout the genus, except for the lobing of the anther" (ibid. 199). There are of course variations in sizes and colours of flowers, but these have not been examined within this revision, in the absence of adequate samplings, and also because of our field-based emphasis. Anther lobes have not been observed in Peninsular Malaysian taxa, and is a character more pertinent to those in Borneo, as also the ridged or ribbed seed forms found there. We have also not examined systematically the seed endosperm for the variations in homogeneity, whether ruminant or equable; this can be the subject for further study. For present purposes, fruit shape is adequately indicative, and the basal stylar remains on *Iguanura* fruit is indeed the unmistakable feature of the genus. The fruit develops eccentrically, and may be globose, ovoid, olive-shaped, oblong and bigibbous (*I. bicornis*), or "canine", curved (*I. polymorpha*), and hooked (*I. corniculata*). Fruit sizes vary; those described as large would be near 2cm in diameter, the average being 1.2cm and the small, 8mm.

The pericarp forms like a mould within which the endosperm solidifies relatively later after the drupe assumes its shape. The endocarp then swells to sweet, luscious fullness. It is important to note the fruit colour. Commonly, young fruit is white turning cream or orange, then ripening cerise to crimson red (eventually black). In some taxa the drupes are light green turning yellow to orange and red, as in *I. parvula* and *I. piahensis*. There also appear to be distinct forms that have pink (not white) fruit turning bright candy pink and dark red, consistently seen in particular populations, a determining character which I propose to recognise.

The revised list of 16 taxa has been arranged not alphabetically or chronologically, but by similarity, which I believe to be convenient for ease of comprehension. Its accompanying key is based on simple field characters that facilitate identification, without laboratory equipment. Generally, descriptions, notes on colours, textures etc., are based on live and not on dried specimens. From field surveys of extant *Iguanura* populations, I have also given weight to location and distinctive characters (eg. habit and fruit colour) which are not seen as intermediary forms in other areas. Accurate collection notes on these would be essential for future herbarium identification, and adequate samplings from populations would be desirable.

In summary, the key adopts the following main features and differentiations: leaves marcescent or abscising; habit caespitose or solitary; leaves entire or divided (lobed or pinnate), leaflets parallel-sided or trapezoidal; texture of lamina; inflorescence spicate (splitting or "furcating") or paniculate (branching divaricately, sub-branching); fruit shape globose, ovoid, curved, hooked, or oblong and bigibbous; fruit colour (within location confines).

Revised List of *Iguanura* in Peninsular Malaysia

16 taxa, including seven new species and one new variety, and their synonyms

1. *Iguanura wallichiana* (Wall. ex Mart.) J.D. Hooker var. *wallichiana*
synonyms: *Areca wallichiana* Wall. ex. Mart.
I. wallichiana var. *minor* Becc. in J.D. Hooker
I. wallichiana (Wall.ex.Mart.)J.D.Hooker ssp. *wallichiana*. var.
wallichiana Kiew
2. *Iguanura wallichiana* var. *major* Becc. in J.D. Hooker
synonyms: *Geonoma pynaertiana* Masters
I. spectabilis Ridley
I. wallichiana ssp. *wallichiana*. var. *major* (Becc. in J.D. Hooker)
Kiew **synon. nov.**
3. *Iguanura wallichiana* var. *rosea* C.K. Lim **var. nov.**
4. *Iguanura diffusa* Becc. in J.D. Hooker
5. *Iguanura asli* C.K. Lim **sp. nov.**
6. *Iguanura kelantanensis* C.K. Lim **sp. nov.**
7. *Iguanura piahensis* C.K. Lim **sp. nov.**
8. *Iguanura geonomiformis* (Griff.) Mart.
synonyms: *Slackia geonomiformis* Griff.
I. malaccensis Becc.
I. geonomiformis var. *malaccensis* (Becc.) Ridley
I. geonomiformis sub. var. *ramosa* Ridley
I. wallichiana ssp. *malaccensis* var. *malaccensis* (Becc) Kiew
synon. nov.
I. wallichiana ssp. *malaccensis* var. *elator* Kiew **synon. nov.**
9. *Iguanura humilis* (Kiew) C.K. Lim **stat. nov.**
synonym: *I. wallichiana* ssp. *malaccensis* var. *humilis* Kiew **synon. nov.**
10. *Iguanura parvula* Becc. in J.D. Hooker
11. *Iguanura bicornis* Becc.
12. *Iguanura corniculata* Becc.
13. *Iguanura polymorpha* Becc.
synonyms: *I. polymorpha* var. *canina* Becc.
I. brevipes J.D. Hooker
I. ferruginea Ridley
I. arakudensis Furtado
14. *Iguanura belumensis* C.K. Lim **sp. nov.**
15. *Iguanura perdana* C.K. Lim **sp. nov.**
16. *Iguanura mirabilis* C.K. Lim **sp. nov.**

Key to identification of Peninsular Malaysia taxa of *Iguanura*

1. **Leaves persistent** (marcescent), leaf sheath fibrous 2
1. **Leaves abscissing**, leaf sheath smooth inside 10
2. Inflorescence spicate, or furcating into two to seven 3
2. Inflorescence paniculate, with divaricate branches sometimes to second and third order 4
3. Caespitose (sometimes solitary), stems to 4m: leaves entire, lobed or pinnate **8. *I. geonomiformis***
3. Solitary, stem to 50cm, often covered with roots; leaves entire or pinnate **9. *I. humilis***
4. Solitary 5
4. Caespitose 6
5. Acaulescent; leaves pinnate; inflorescence variable, peduncle often within sheath **6. *I. kelantanensis***
5. Stem to 1m; leaves pinnate; leaflets often uncostate; inflorescence branching to second or third order **4. *I. diffusa***
6. Fruit globose, pink (not white) ripening deep pink or red 7
6. Fruit globose, white, light green, yellow ripening red 8
7. Peduncle short to 15cm, within sheath, rachillae curled **5. *I. asli***
7. Peduncle long to 50cm or more, rachillae divaricate; uncommon **3. *I. wallichiana* var. *rosea***
8. Fruit small to 8mm diameter, light green (not white), cream, orange ripening to red; inflorescence short, rachillae slender; leaves oblong, entire, or lobed, silky texture **7. *I. piahensis***
8. Fruit medium to large, 1cm diameter or more 9

9. Leaves pinnate or entire to 1.3m; inflorescence to 90cm, axillary, spreading; common **1. *I. wallichiana* var. *wallichiana***
9. Leaves usually entire, very large to 2m or more; inflorescence to more than 100cm, erect and robust **2. *I. wallichiana* var. *major***
10. Leaves entire 11
10. Leaves lobed or pinnate, leaflets flaring distally (trapezoidal) 12
11. Leaves small to 30cm, oblong; stems caespitose, arudinaceous, short to 1.2m; peduncle in sheath, fruit globose **10. *I. parvula***
11. Leaves large to 85cm, cuneate, often truncated at apex, strongly plicate; stems caespitose, to 2cm diam., to 3m; inflorescence three to nine branched with purple indumentum; fruit curved **16. *I. mirabilis***
12. Solitary 13
12. Caespitose 14
13. Fruit ovoid or curved; stem 1.5cm diameter, to 3m; leaves to 60cm; inflorescence interfoliar or infrafoliar, paniculate with twiggy branches **14. *I. belumensis***
13. Fruit eccentric with flat top; stem (sometimes with basal branches) 2cm diameter to 4m; leaves to 100cm; inflorescence usually interfoliar, paniculate with succulent branches; very rare **15. *I. perdana***
14. Inflorescence spicate, to 20cm or more; fruit curved, sometimes with a pronounced hook **2. *I. corniculata***
14. Inflorescence branched (rarely spicate, if so less than 10cm); stems to 3m 15
15. Fruit bigibbous, inflorescence with five to seven rachillae; stem to 1cm diameter, chestnut colour; habitat montane **11. *I. bicornis***
15. Fruit ovoid or curved (not hooked); inflorescence variable, three (rarely two or one) to nine rachillae, sometimes sub-branching; stems arudinaceous or robust, not chestnut colour; habitat sea level to montane, distribution widespread **13. *I. polymorpha***



Plate 3 *I. wallichiana* var. *wallichiana*: Leaves in lobed and pinnate forms.



Plate 4 *I. wallichiana* var. *wallichiana*: Characteristic inflorescence, panicle, to 90cm.

1. *Iguanura wallichiana* (Wall. ex Mart.) J.D. Hooker var. *wallichiana*. *Areca wallichiana* Wallich's Catalogue no. 8600 (1828); Martius, Hist. Nat. Palm. 3: 178 (1837); Beccari, Malesia. 3: 100 (1886); J.D. Hooker, 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); Kiew, Gdns. Bull. 28: 216-224 (1976).

Synonyms: *I. wallichiana* var. *minor* Becc. in J.D. Hooker, Fl. Brit. Ind. 6: 416 (1892); *I. wallichiana* (Wall. ex. Mart.) J.D. Hooker ssp. *wallichiana* var. *wallichiana* Kiew **synon. nov.**, Gdns Bull 28: 221 (1976).

This earliest of *Iguanura* taxa collected in Malaya, by Porter in 1822, came from Penang, and from examination of remnant populations on Penang Hill at c. 600m, a good idea of the characteristics of the toptype can be obtained. It grows on hill slopes, along or within rocky streams, and is caespitose (not solitary), clustering in a rather untidy way, with stems up to 2m, and persisting pinnate leaves. The inflorescences extend out from among the leaves, with long peduncles, branching with several divaricate rachillae (usually robust, but sometimes finer). The species is to be differentiated from *I. geonomiformis* mainly by the inflorescence configuration. Although in the latter it is often spicate, forms that fork into many parallel rachillae are also common. The fruit are characteristic of the genus, globular with basal styler remains, and ripening in colour stages from ivory white or light green to cream, then cerise or crimson, eventually black. Eophyll and juvenile leaves are easily identified as of all within the genus, always entire, cuneate or oval, and new leaves which may be entire or lobed are often flushed, reddish or bronze.

From viewing the syntypes of var. *minor* (*King's Collector 454, 7941, 7999*), I concur with Kiew that they are within the range of forms of *I. wallichiana* var. *wallichiana*. As described in J.D. Hooker, with stems up to 30 inches, and leaves simple or pinnatisect, and finer inflorescence and fruit, they represent the smaller variants, with entire or divided leaf forms, which Beccari called "flabelliformis" or "pinnatisect".

The main taxon is variable in stature, with forms that are taller, up to 4m in height, often with dominant stems and basal branches, and thrives at altitudes from lowland to mountain slopes at 1000m. Variations in leaf divisions and leaflet widths can also be observed; entire or lobed forms are not uncommon, but the pinnate with many leaflets are also ubiquitous. The northern populations could be considered typical of the species. Those in Perlis thriving in riverine swamps near limestone outcrops, point to a larger common domain that would include south Thailand.

Distribution: Kedah, Penang, Perak, Perlis.

Type: Penang, 1822, *Porter 8600*, (holotype K)

Reference Collections:-

Kedah, Weng, *Furtado* 33070, 33071 K, SING; Cherok Bokbak FR, *Meh* 10100 K; G. Bongsu C.K. *Lim H* 1088 PSM Collection; Mahang, C.K. *Lim H* 11, H 81, H 955, H 976, H 1019, H 1042, H 1046, H 1086, H 1203 PSM Collection; Sintok, C.K. *Lim H* 29 PSM Collection; G. Inas, C.K. *Lim H* 99 PSM Collection; **Penang**, Penang Hill, 1879, *King's Collector* 6002 CAL; *Ridley* 7101, 10344 SING; Bukit Mertajam, C.K. *Lim H* 24 PSM Collection; Bukit Panchor, C.K. *Lim H* 1567 PSM Collection; **Perak**, Gopeng, 1880, *King's Collector* 454 (Type for *I. wallichiana* var. *minor*) FI, K; Batang Padang district, 1885, *Kunstler* 7941 FI, 7941 K, 7999 FI, K; Selama, *King's Collector* 3127 FI, K; Chior FR, *F.S.P. Ng FRI* 5792 KEP, K; Pos Legap, *Gianno E* 326 K; G. Kerbau (Korbu) *Robinson s.n.* K, C.K. *Lim H* 1137, H 1249 PSM Collection; Kg. Sukam, *Avé* 105 K; Bintang Hijau FR, *Everett FRI* 14529 KEP, K; Kenayat, C.K. *Lim H* 44, H 109, H 619 PSM Collection; Banding, C.K. *Lim H* 128 PSM Collection; Sg. Piah, C.K. *Lim H* 396, H 455, H 549, H 1100, H 1108, H 1591 PSM Collection; Pos Salim, C.K. *Lim H* 413, H 418 PSM Collection; Kg. Ijok, C.K. *Lim H* 942, H 1377 PSM Collection; Sg. Bayor, C.K. *Lim H* 956 PSM Collection; Kroh, *Furtado* 33008 K, SING; **Perlis**, Kaki Bukit, C.K. *Lim H* 1607 PSM Collection.

2. *Iguanura wallichiana* var. *major* Becc. in J.D. Hooker, Fl. Brit. Ind. 6: 416 (1892); *Ridley*, Mat. Fl. Mal. Pen. (Monoc) 2: 152 (1907); Fl. Mal. Pen. 5: 14 (1925); Whitmore, Palms of Malaya: 65 (1973); Kiew, Gdns. Bull. 28: 221, 222 (1976).

Synonyms: *Geonoma pynaertiana* Masters, Gdnrs' Chronicle XXIII, 1098: 258 f. 90 (1898); *I. spectabilis* *Ridley*, J. Straits Branch Roy. Asiat. Soc. 41: 40 (1903); Whitmore, Palms of Malaya. 65 (1973); *I. wallichiana* ssp. *wallichiana* var. *major* (Becc.) Kiew **synon. nov.**, Gdns. Bull. 28: 221, 222 (1976).

The variety was first recognised by Beccari as being more robust and having larger entire leaves. The syntypes cited by J.D. Hooker, basing on Beccari's manuscript, were collected between 1880 and 1888, from the Gopeng area: (*King's Collector* Nos. 431, 8227). The collection notes indicated that the fronds were "4-6ft long, sometimes longer". The similarity with *I. spectabilis* is unmistakable, and indeed *Ridley* himself stated that "Some specimens of King's Collection, viz. 431 and 8227, described as the var. *major* Becc. in the Flora of British India are apparently either large forms of *I. geonomaeformis* (sic.) or *I. spectabilis* *Ridley*" (Materials: 152, 1907). By taxonomic precedence, both *Geonoma pynaertiana* and *I. spectabilis* are thus synonyms. Kiew's *I. wallichiana* ssp. *wallichiana* var. *major* also becomes a new synonym within this revision, which dispenses with the subspecies rank by reinstating *I. wallichiana* and *I. geonomiformis*. Her description of the variant is conservative in dimensions, and perhaps *Ridley's* notes on *I. spectabilis* provides a more impressive account. *Ridley* first saw the "superb palm



Plate 5 *I. wallichiana* var. *major*: Leaf large and entire, with erect robust inflorescence.

known to Malays as the Teruno” at Bruas where it had been collected by Curtis, who sent it to Dr Masters. He later saw even more robust specimens on Hermitage Hill, a foothill of G. Bubu from where the early ascents by Swettenham and others were made.

In 1937, Furtado collected specimens from the Gopeng area, which had divided leaves, “5-7ft. long”. The variety is similar to *I. wallichiana* var. *wallichiana*, but has robust stems to 4m, 3cm or more in diameter; the lamina is usually entire (rarely divided), cuneate or oblong, strongly ribbed, to 2m or more in length; characteristically, the inflorescence is ascending erect, thick, paniculate to 8 or more branches; fruit is globose or ovoid, larger (2cm or more) than for *I. wallichiana* var. *wallichiana*, colour in ripening similar; flowers also similar. Common in G. Bubu FR, where according to L.G. Saw, an unusual pinnate form has also been seen.

Distribution: Kedah, Perak.

Type: Perak: Gopeng, *King’s Collector 431* (holotype K, isotype FI)

Reference Collections:-

Kedah, G. Bongsu FR, 1940, *Corner 35837* SING; **Perak**, Gopeng, 1937, *Furtado 33089* SING; Bruas, *Ridley 8403* SING; *C.K. Lim H 1380* KEP; Hermitage Hill, 1892, *Ridley s.n.* (Type for *I. spectabilis*) SING; G. Bubu, 1966, *Whimmore FRI 626* KEP, SING; Keramat Pulai, *C.K. Lim H 1268* KEP; *C.K. Lim H 424, H 1102, H 1141, H 1142, H 1270* PSM Collection.

3. *Iguanura wallichiana* var. *rosea* C.K. Lim var. nov.

A varietate typica fructibus immaturis roseis bene distincta. Typus: Perak: Belukar Semang, 1992, *C.K. Lim H1126* (holotypus KEP)

Caespitose. stem and leaves similar in size and form to *I. wallichiana* var. *wallichiana*, inflorescence also similar, but differs and is distinct in its fruit colour, pink when immature ripening dark pink or red. Two specific colonies, in Perak and Kelantan, were found to display the consistent fruit colour distinction. The drupes are globose or ovoid and similar in size to *I. wallichiana*, and also in the carriage and branching of the inflorescence. Both populations studied over a two-year period are locally abundant, relatively robust, some with stems to 4m in height, with large leaves to 1.5m, pinnate with broad or narrower leaflets. We have so far not encountered intermediaries in colour in other locations, and believe that this character can be used for varietal differentiation.

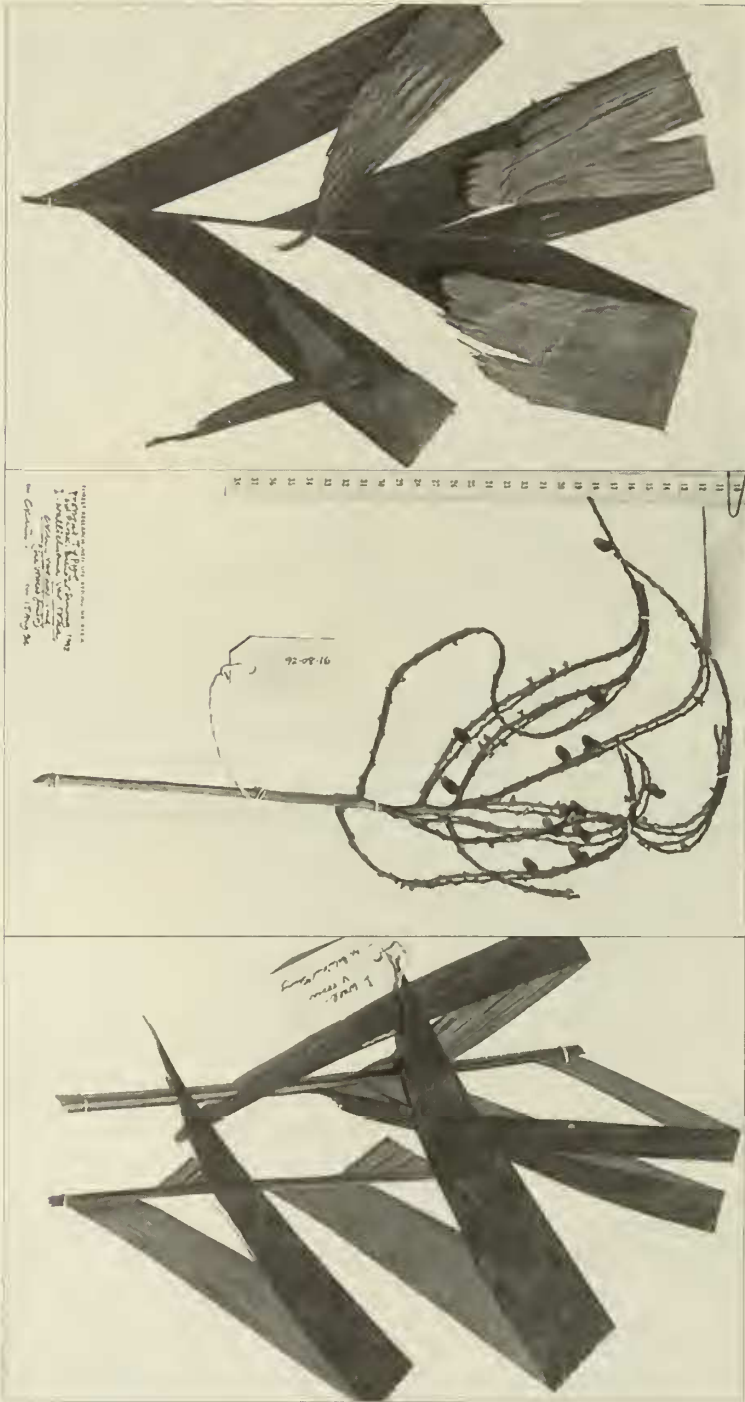


Plate 6 *I. wallichiana* var. *rosea*: Type specimen: Perak: Belukar Semang, 1992, C.K.Lim H1126 (KEP)



Plate 7 *I. wallichiana* var. *rosea*: Inflorescence similar to var. *wallichiana* but with distinctly pink fruit.



Plate 8 *I. asli*: Inflorescence with peduncle within sheath, and curved rachillae, and fruit characteristically candy pink.



Plate 9 *I. diffusa*: Type specimen: Perak: G. Tjok, 1884, Scortechini 1189 (FI) (by courtesy of Erbario Centrale, Florence)



Plate 10 *I. diffusa*: Specimen from Taman Negara: stem solitary, leaves pinnate with narrow leaflets; inflorescence interfoliar

The fruit colour distinction has also been displayed by another new species, *I. asli*. Although the variation had been considered as “minor local differences” within *I. wallichiana* and *I. geonomiformis* by Kiew (1976: 221), the forms she mentioned as seen in Taman Negara and elsewhere with pink immature fruit, might well have been that new species, which has other distinctions in its inflorescence. I believe that further surveys will locate other consistent populations of this taxon.

Distribution: Kelantan, Perak. Habitat: hill forest slopes, at. c. 500m.

Type: Perak: Belukar Semang, 1992, C.K. Lim H 1126 (holotype KEP)

Reference Collections:-

Kelantan, Sg. Pergau, C.K. Lim H 1173 PSM Collection; **Perak**, Belukar Semang, C.K. Lim H 1192, H 1253, H 1413, H 1437, H 1573, H 1574 PSM Collection.

4. *Iguanura diffusa* Becc. in J.D. Hooker, Fl. Brit. Ind. 6: 416 (1892); Ridley, Mat. Fl. Mal. Pen. (Monoc) 2: 152 (1907); Whitmore, Palms of Malaya: 65 (1973); Kiew, Gdns Bull. 28: 221 (1976)

J.D. Hooker’s description (Flora of Br. India, 1892) based on Beccari’s manuscript, noted that this was “one of the largest of the genus, leaves about 3-4ft, very numerous leaflets, narrow, one to one-and-a-half inches, inflorescence filiform, branches eight to ten, branching to second or third orders”. He further admitted that the specimen was imperfect and “may be a luxuriant state of *I. polymorpha*” In fact, the type included a good inflorescence, but too few leaflets, and had an inscription by Scortechini: “*I. polymorpha* var.?” Also in Florence, is another specimen under this name, (presumably accepted by Beccari), collected by Ridley in 1895 from Ara Kuda, which consists of one juvenile leaf and is rather unindicative. In 1907 Ridley himself mentioned the taxon as a variant of *I. wallichiana* (Materials: 152). Since then, many others have tried to match collections to the name, but no specimens have yet been found in or near the type location which may be G. Hijau (Bukit Larut) rather than G. Ijok near Selama. In Kelantan, Henderson found a short-stemmed form which he thought to be *I. diffusa*, which had a six-branched inflorescence, further divided into second and third order, with peduncles shorter than in the type specimen.

In 1968, John Dransfield collected a specimen from Taman Negara (686 KEP), noting that the leaves were 4ft in length, with leaflets very narrow, some unicastate, with short stem to 2ft, with “compound” inflorescence. Whitmore subsequently determined this as *Iguanura diffusa*, and indeed our own field collections in the same area have yielded equivalent samples (eg. H 1542 SING) which have a range of variations in leaflet widths, some totally unicastate, including

(unusually) the apical pair. Furthermore, within the locally common population we saw only solitary plants with stems to 1m, and would put this up as a character in habit, that would further differentiate it from *I. wallichiana*. The inflorescence was interfoliar, some shorter in peduncle than others., finely paniculate, with six to eleven branches, often sub-branching, with fruit similar to *I. wallichiana* in colour and size. The Taman Negara collections appear to fit the original citations, but because of its geographical disjunction from the type location, an element of doubt persists for the field-biased taxonomist, and it remains desirable to find it nearer the type locality.

Distribution: Kelantan, Pahang, Perak. *Habitat:* low hill forests, near river, locally common.

Type: Perak: "G. Tjok", 1884, *Scortechini 1189* (holotype FI)

Reference Collections:-

Kelantan, Bukit Batu Papan, 1935, *Henderson 29501* SING; **Pahang**, Kuala Kenyam, 1968, *J. Dransf 686* KEP; 1993, *C.K. Lim H 1542* SING, PSM Collection.

5. *Iguanura asli* C.K. Lim **sp. nov.**

Fructibus immaturis roseis; a I. wallichiana et geonomiformi inflorescentiae interfoliaceae pedunculo brevi vagina folii occulto, rachillis arcuatis differt. Typus: Pahang; Berkelah FR, 1993, *C.K. Lim H 1539* (holotypus SING)

Caespitose, with dominant stems from 1.5-2.5m, leaves marcescent, divided, similar to *I. geonomiformis*, variable in numbers and leaflet widths; inflorescence branching two to nine, rarely sub-branching, often curled interfoliar, with short tomentose peduncle enclosed in the leaf sheath; fruit globose, 4-8mm, immature pink ripening brilliant candy pink; flowers and seed not examined.

This is indeed a widespread species found from Terengganu to Johor where it might have been taken to be a form of *I. wallichiana* although it is usually within *I. geonomiformis* territory. Indeed the habit and leaf variations are visually more similar to the latter. We later recalled that we had found and photographed examples in other locations, mainly within Johor, which we had assumed to be *I. wallichiana*. There have indeed been earlier collections, and within the Singapore Herbarium, Holttum's specimen (9476) is an example. Kiew's observations on fruit colour variations in her ssp. *malaccensis*, (Kiew 1976: 221) is obviously of this new species. In the Rompin area, the brilliant candy pink fruit often rivals adjacent *Licuala ferruginea* not only in colour, but sometimes in size and robustness of the rachillae and fruit. The inflorescence, although variable, is apparently distinct



Plate 11 *I. asli*: Type specimen: Pahang: Berkelah FR, 1993, C.K.Lim H1539 (SING).



Plate 12 *I. kelantanensis*: Type specimen: Pahang: Gua Musang, 1992, L.G.Saw FR137607 (KEP)



Plate 13 *I. kelantanensis*: Stemless and solitary, with interfoliar inflorescence.

from the other taxa, usually curled among the leaf petioles, with the peduncles mainly enclosed within the leaf sheath.

The inspiration for the name arose out of encountering the aboriginal groups living near to the first fruiting populations that we saw; it was also determined within the Year of the Indigenous (Orang Asli) Peoples.

Distribution: Johor, Pahang, Terengganu; not rare, in low hill forests, riverine swamp.

Type: Pahang: Berkelah FR, 1993, *C.K. Lim, H 1539* (holotype SING)

Reference Collections:-

Johor, Kluang, 1922, *Holtum* 9476 SING; Kahang, *C.K. Lim H 1523* PSM Collection; Jamari, *C.K. Lim H 1401* PSM Collection; *H 1524* SING; **Pahang**, Kedaik, 1991, *C.K. Lim H 1000* PSM Collection; *H 1041* KEP; Lesong FR, *Samsuri 433* SING; Balok 1994, *C.K. Lim H 1599* PSM Collection; Gambang, 1992, *C.K. Lim H 1229* PSM Collection.

6. *Iguanura kelantanensis* C.K. Lim **sp. nov.**

I. wallichiana affinis sed habitu solitario acaulescenti differt. *Typus:* Kelantan: Gua Musang, 1992, *L.G. Saw FRI 37607* (holotypus KEP)

Differing from caespitose *I. wallichiana* by being solitary, acaulescent (sometimes with short stems to 10cm), leaves marcescent, pinnate to 20 pairs of leaflets, often bicostate, inflorescence branching among petioles, peduncles short or longer (varying by 20cm or more), rachillae six to nine, curled or not; often branching to second order, fruit as for *I. wallichiana*, white ripening red.

To the east of the Main Range, in Pahang and Kelantan, there appear to be considerable variation in the forms within the *I. wallichiana/geonomiformis* complex, especially in the branching of the inflorescence. While surveying this area, we first encountered this stemless, solitary *Iguanura*, which had also been collected by L.G. Saw of FRIM, whose specimen we have chosen as Type. Subsequent collections display wide variability in leaflet width and divisions, and also in size and form of rachillae. I would like to credit Saw with the perception of acaulescence as a distinguishing character, until then not observed in the genus, and quite unlike the short-stemmed forms of *I. geonomiformis*. So far the taxon has only been found in one area, and thus it will be named after the state of Kelantan. In an adjacent forest, Henderson had collected a specimen (20301) identified as *I. diffusa* (q.v.), which has similar inflorescence, and there may be a relationship between the two taxa.

Distribution: Kelantan; habitat: hill forests c. 300m

Type: Kelantan: Gua Musang, 1992. L.G. Saw FRI 37607 (holotype KEP)

Reference Collections:-

Kelantan, Gua Musang, 1991, C.K. Lim H 984, 1992, H 1261 PSM Collection.

7. *Iguanura piahensis* C.K. Lim sp. nov.

I. wallichiana affinis sed lamina oblongata integra vel lobata, glabra, papyracea, laeve sericea differt. Typus: Perak, Piah FR, 1992, C.K. Lim H 1266 (holotypus KEP).

Caespitose, clustering, stems to 2m, leaves marcescent, sometimes entire, usually divided into two or more pairs of lobes but closely spaced along rachis, lamina oblong or elliptical, glabrous, texture papery, smooth and silky to the touch; inflorescence fine and sparsely paniculate four to seven branches or more, with fruit slightly smaller (c. 6mm in diameter) than *I. wallichiana*, usually light green, turning cream to yellow, ripening red.

This is yet another species found so far only in a limited location, where there are contiguous populations of the more gregarious and common *I. wallichiana*. It is an elegant taxon that can quickly be identified once one "gets one's eye in", especially when the oblong entire forms are encountered. Another useful field indicator is the feel of the relatively thin lamina: the nerves are fine and unobtrusive and give rise to the smooth and silky glabrous sheen. Young or juvenile leaves of other taxa can be similar, especially within the *I. polymorpha* alliance, and conversely some old leaves of the new taxon could be coarser. Fruit colours, in the more evidently yellow-cream (not white) stage are reminiscent of *I. parvula* Becc. (q.v.)

Certain herbarium specimens labelled *I. wallichiana* var. *minor* display similar inflorescence, but differ in leaf shape. The specimen collected in 1889 by Wray (3628, K) from an unknown location in Perak, is an example that I consider to be this new taxon. Its name is based on the type location which is one of the home districts of the Temiar tribe.

Distribution: Perak. Habitat: Hill forest 300m alt. Locally not rare.

Type: Perak: Piah FR., 1992, C.K. Lim H.1266 (holotype KEP)

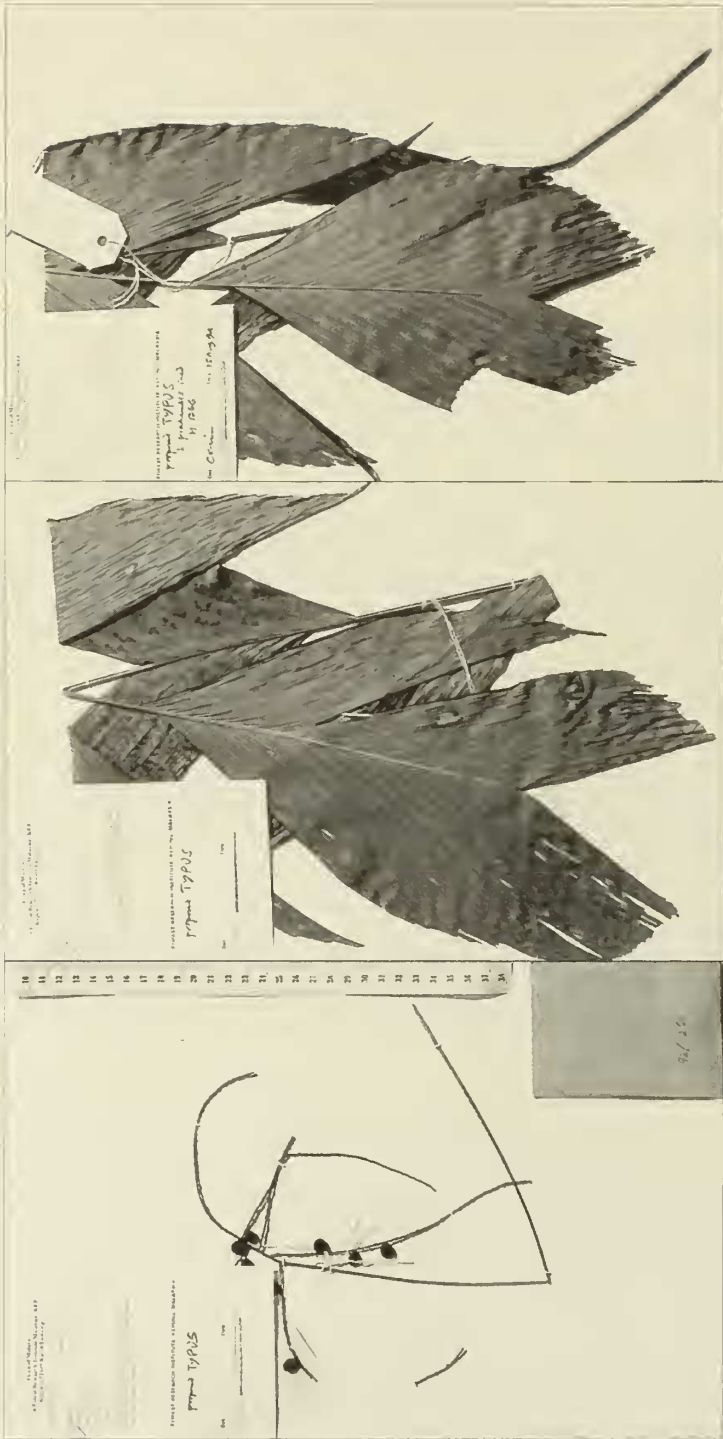


Plate 14 *L. piahensis*: Type specimen: Perak: Piah FR, 1992, C.K.Lim H1266 (KEP)

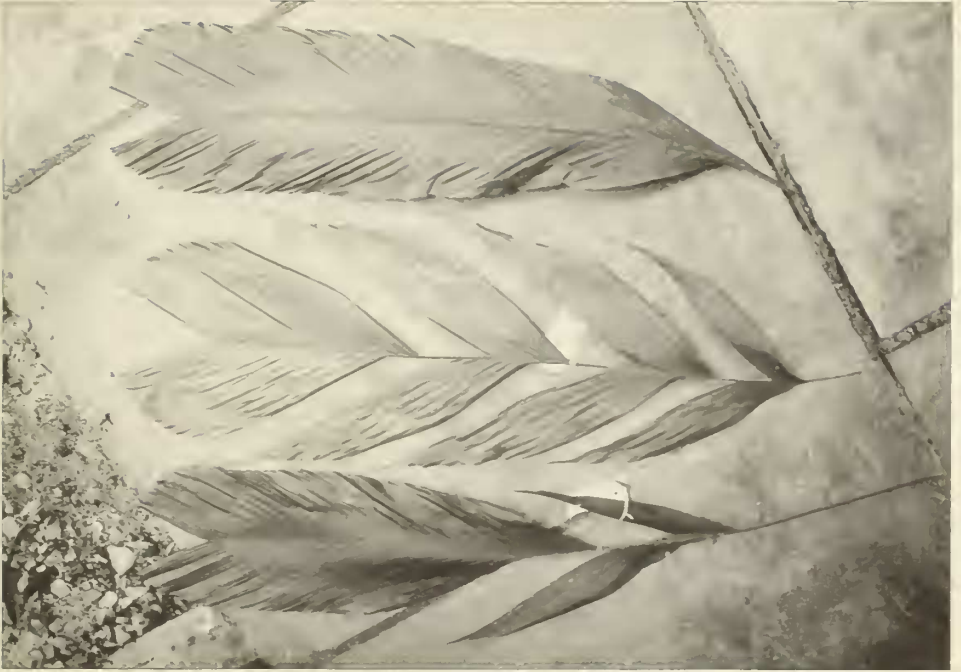


Plate 15 *I. piahensis*: Leaves silky textured, sometimes undivided, oblong.



Plate 16 *I. piahensis*: Inflorescence with seven rachillae and fruit to 8mm diameter.

Reference Collections:-

Perak, 1889, *Wray* 3628 K; Piah FR, 1992; *C.K. Lim* H 454, 1991, H 587, H 1099, 1992, H 1172, H 1202, H 1266, 1993, H 1357 PSM Collection.

8. *Iguanura geonomiformis* (Griff.) Mart., *Hist. Nat. Palm.* 3: 229 (1837-1850) and pl. 178 (1894); *Slackia geonomaeformis* Griffith, *Calcutta J. Nat. Hist.* 5: 469 (1845); *Palms of British East India*, (1850); *Miquel Fl. Ind. Bat.* 3: 44 (1855); J.D. Hooker *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); ; Kiew, *Principes* 16: 3-10 (1972); *Gdns Bull.* 28: 216 (1976).

Synon.: *I. malaccensis* Becc., *Malesia* 3: 102 (1886); J.D. Hooker, *Fl. Brit. Ind.* 6: 416 (1892); Whitmore, *Palms of Malaya*: 114 (1973); *I. geonomiformis* var. *malaccensis* (Becc.) Ridley, *Mat. Fl. Mal. Pen. (Monoc)* 2: 150 (1907), *Fl. Mal. Pen.* 5: 14 (1925); *I. geonomiformis* sub. var. *ramosa* Ridley, *Mat. Fl. Mal. Pen.* 2: 151 (1907); *I. wallichiana* ssp. *malaccensis* var. *malaccensis*. (Becc.) Kiew **syn. nov.**, *Gdns Bull.* 28: 220 (1976); *I. wallichiana* ssp. *malaccensis* var. *elatior* Kiew **syn. nov.**, *Gdns Bull.* 28: 224 (1976).

The reasons for reinstating *I. geonomiformis* have been explained (which includes the *I. wallichiana* ssp. *malaccensis* propositions of Kiew). Griffith's description and illustration (*Palms of Brit. Ind.*, 1850: 162, tab. 234) bear out the characteristics as found in Ayer Panas, Malacca, the bifurcating spadix being common. Martius using the same collection contributed to some confusion by his citation: "... spadice saepe simpliciter ramoso". Incidentally, he also clouded his description of *Areca wallichiana*, by noting: "spadicibus simpliciter valde ramosis", but described it elsewhere as having 10-15 branching inflorescences. As with *I. wallichiana*, which is still extant in its type location, the populations of *I. geonomiformis* in and around Malacca can still be referred to.

I. geonomiformis has very much the habit of *I. wallichiana* - caespitose, clustering often with dominant stems up to 4m, leaves marcescent entire or pinnate, some with narrow leaflets, sometimes divaricate; the long, stout and tomentose inflorescence is often spicate but may fork into parallel tails, sometimes varying in numbers on the same plant. The fruit is similar to its relative, although in colour it is often white rather than green, before maturing red. The individuals in Negri Sembilan are particularly large in stature and fruit size. The taxon has also often been seen in a solitary form, where basal branching had not yet developed.

J.D. Hooker had listed the synonymous *I. malaccensis* Becc. as a "closely allied" species; its type was collected by Kehding in Klang, where the main taxon is common. Likewise most of the collections cited by Ridley for his varieties came from the southern part of the Peninsula, including Singapore. The species is by no

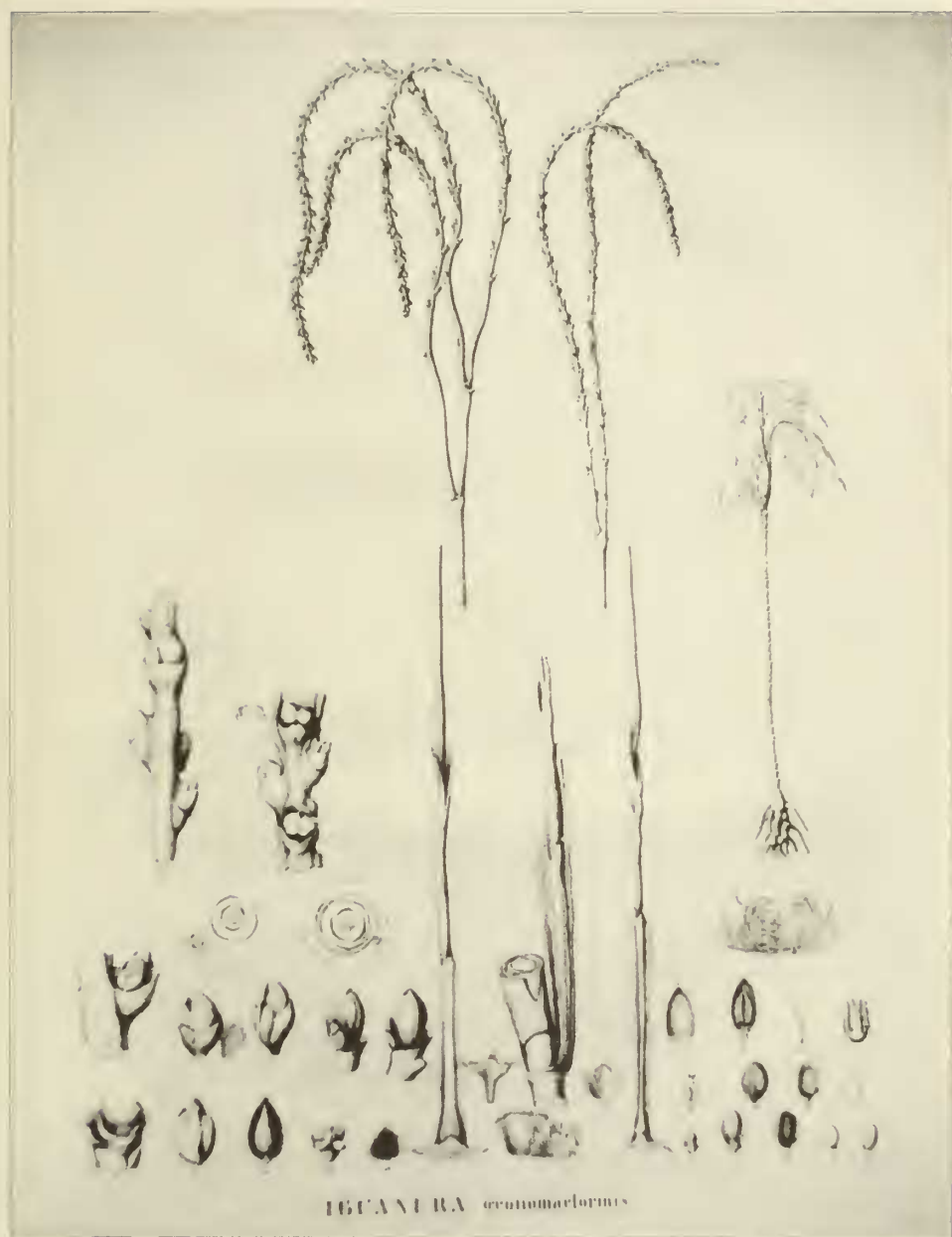


Plate 17 *I. geonomiformis*: Drawing showing furcating inflorescence; (Tab. 178, Martius, *Historia Naturalis Palmarum* Vol. 3. 1837-1850).

means confined to the south, and has been collected on Larut and Bujang Melaka in Perak and on the eastern side of the Main Range, north to Kelantan, where curious forms present scope for further study.

The vast collection in the Singapore herbarium displays the wide range of inflorescence divisions, from the thick robust spikes, often forking up to two or three, to the "ramose" form, with seven or more tails, sometimes forking again to second order. Ridley and others devised new appellations to cope, including var. *malaccensis*, sub. var. *ramosa*, and "var. *spectabilis*" (unpublished). The lamina of *I. geonomiformis* varies from entire to lobed and narrowly pinnate, as with *I. wallichiana*. Certain historical specimens of *I. wallichiana* var. *minor*, eg. King's Collector 7996 from Batang Padang, Perak, might well be similar to the form of *I. geonomiformis* as found on Bujang Melaka.

To describe the larger entire leaf form as found around Belumut, Kiew published her var. *elatiior*, which I include within the main taxon. In the same vicinity, pinnate forms are also found. Similar variations with entire leaves can be seen on Bujang Melaka in Perak, and near Jerantut, Pahang. In other locations, eg. at G. Panti, precocious flowering acaulescent individuals have been seen, but these are usually caespitose, and may well be basal branches of a mature plant where the dominant stems have been destroyed. So far we have not encountered variants of *I. geonomiformis* with pink fruit, such as those of *I. asli*. There may well be other variants to be described especially from Kelantan, Pahang and elsewhere, which will require more field collections and samplings of populations.

Distribution: Johor, Kelantan, Malacca, Negeri Sembilan, Pahang, Perak, Selangor.

Type: Malacca, Ayer Panas, *Griffith 6406, 6407* (holotype K)

Reference Collections:-

Johor, Mawai, 1934, *Corner 2900I*, K, SING; G. Blumut, *Holttum 10299* (Type for *I. wallichiana* ssp. *malaccensis* var. *elatiior*) SING; F.S.P. Ng 98021, KEP; Gemas, 1966, *Palmer 814* SING; Mt. Ophir, 1888, *Hullett 751* SING; *Ridley 3141* SING; G. Panti, 1892, *Ridley s.n.* SING; C.K. Lim H 259, H 260, H 914, H1198 PSM Collection; Linggiu, C.K. Lim H 923, H 1023, H 1024, H 1342, H 1345, H 1528 PSM Collection; Ulu Sedili, C.K. Lim H 925; Labis, C.K. Lim H 1520 PSM Collection; Lenggong, C.K. Lim H 931, H 1073, H 1590 PSM Collection; **Malacca**, Ayer Panas, 1891, *Hervey s.n.* SING; 1893, *Ridley 1583, 1618* SING; Lubok Kedondong, 1892, *Ridley s.n.* SING; **Negeri Sembilan**, Perhentian Tinggi, 1890, *Ridley s.n.* (Type for *I. geonomiformis* sub. var. *ramosa*) SING; Kuala Klawang, C.K. Lim H 468, H 492, H 1334 PSM Collection; G. Angsi, C.K. Lim H 998 PSM Collection; Bukit Tampin, 1894, *Ridley 1891* FI, SING; G. Angsi, 1904, *Ridley 11968* FI, SING; **Pahang**, Tahan Woods, 1891, *Ridley s.n.* SING; Temerloh, 1913, *Murdoch 174* SING; Kuala Lipis, 1924, *Burkill & Hauiff 17188* SING; Kuala

Tembeling, 1928, *Holttum* 20538 SING; Sg. Tahan, 1967, *Palmer* 12, 13 SING; Tembeling, 1929, *Henderson* 21874 SING; Fraser's Hill, 1929, *Holttum* 21535 SING; Sg. Yu, *Hardial & Noor* 84 K. SING; Taman Negara, *Loy FRI* 17254 KEP; K. Temerloh, *Hanid* 10596 K; Kuala Tenok, *Ridley* 3138 FI, SING; Pulau Tawar, *Ridley* 3514 FI; Aur Guar, *C.K. Lim* H 982, H 983, H 1258, H 1479 PSM Collection; Stong *C.K. Lim* H 986 PSM Collection; Taman Negara *C.K. Lim* H 1541 PSM Collection; Jerantut, *C.K. Lim* H 1256, H 1477 PSM Collection; **Perak**, Larut, 1881, *King's Collector* 1869 CAL. K; 1882, *King's Collector* 2994 CAL. FI, K; 1949, *Sinclair & Kiah* 38783 SING; Ulu Bubong, 1886, *King's Collector* 10270. CAL. K; *Scortechini* 502 FI; Bujang Melaka, *C.K. Lim* H 1423 PSM Collection; **Selangor**, Klang, 1878, *Kehding* 108 (Type for *I. malaccensis* Becc.) FI; Kuala Lumpur, 1889, *Ridley s.n.* SING; Petaling, 1889, *Ridley s.n.* SING; Rawang, 1894, *Ridley s.n.* SING; Ginting Peras, 1896, *Ridley* 7887 SING; Semangko Pass, *Ridley s.n.* SING; Bukit Kutu, 1896, *Ridley* 7889 SING; Ulu Langat, 1912, *Kloss s.n.* K; Genting, 1917, *Ridley et alia s.n.* K; Gombak, *Croat* 53311 K; Sg. Lallang, *C.K. Lim* H 1373 PSM Collection; Awana *C.K. Lim* H 1535, H 1550 PSM Collection; **Singapore**, 1890, *Ridley* 3140 FI, SING; 1891, *Ridley* 1664 SING; 3139 FI, SING.

9. *Iguanura humilis* (Kiew) C.K. Lim stat. nov.

Synon.: *I. wallichiana* ssp. *malaccensis* var. *humilis* Kiew syn. nov.: Gdns Bull. 28: 223, 224 (1976)

I propose to elevate in rank this solitary, short-stemmed relative of *I. geonomiformis* with the upward growing roots, as well described by Kiew who provided a full account of her new variety. The leaves are however, more variable than as identified and illustrated; other specimens from the type location also include those that are pinnate. The inflorescence is spicate, and erect; characteristically, the fruit is globose, white in colour, ripening red. It is interesting that Furtado, who viewed Corner's specimen, had also noted that it might be a new species. It is common and widespread in Terengganu and is possibly also found in bordering Pahang. It could however be confused with short or stunted forms of *I. geonomiformis* which have been seen to flower in acaulescence, as in G. Pantii which are usually caespitose, whereas *I. humilis* is distinctly solitary in habit, and mostly not taller than 75cm. In parts of Taman Negara, and in northwest Pahang, however, solitary forms of *I. geonomiformis* may be seen, but these may well be intermediate variants that may relate with *I. humilis*. Although undivided leaves are usual especially in the Ulu Setiu area, *I. humilis* is also often seen with broad pinnate leaves. The ascending growth of the roots may be correlated with the swampy habitat, and there may well be upland individuals without this feature.

Distribution: Kelantan, Pahang, Terengganu.

Type: Terengganu, Ulu Bendong, 1935, *Corner* 30095, (holotype SING, isotype K)

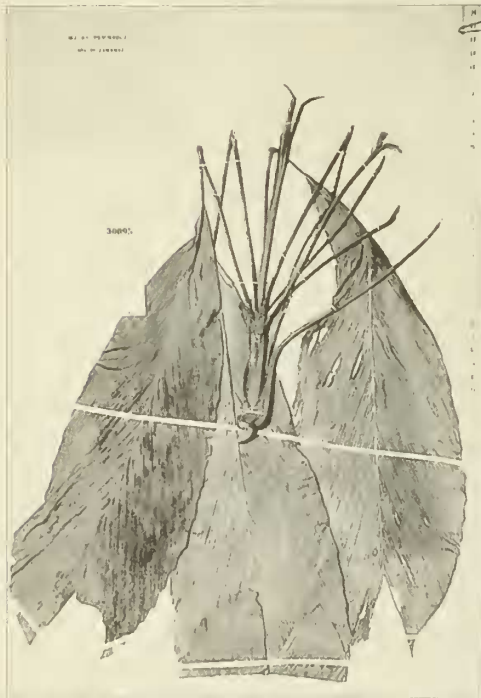
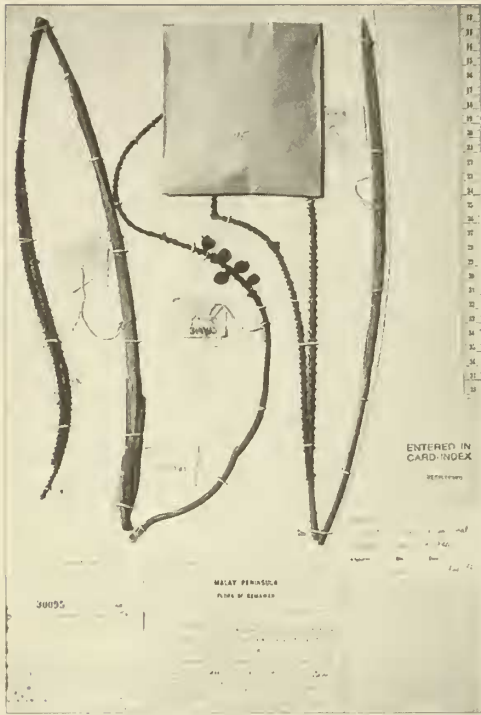


Plate 18 *I. humilis*: Type specimen: Terengganu: Ulu Bendong, 1935, Corner 30095 (SING)



Plate 19 *I. humilis*: Short-stemmed, with entire (or pinnate) leaves, and spicate inflorescence.

Reference Collections:-

Kelantan, Gua Panjang, 1927, *Henderson 19502* SING; **Terengganu**, Ulu Ayam, *Corner 30258* SING; *30259* SING; *30260* SING; Bukit Kajang *Corner 30237* SING; Ulu Setiu 1977, *J. Drans 5156* K; *C.K. Lim H1451* KEP; *H 1518* SING; *C.K. Lim H 1299, H 1325, H 1369, H 1542* PSM Collection; Sg. Kemaman, *C.K. Lim H 1491* PSM Collection.

10. *Iguanura parvula* Becc. in J.D. Hooker, *Flora of British India* 6: 417 (1892); Ridley *Mat. Fl. Mal. Pen (Monoc)* 2: 152 (1907); Whitmore, *Palms of Malaya*: 63 (1973); Kiew, *Gdns Bull.* 28: 212 (1976)

From Beccari's manuscript, J.D. Hooker's description is pertinent: "Leaves small, oblong, tip forked, margin undulate; spadix filiform, sparingly branched, peduncle about as long as the petiole more than half embraced by the spathes". He further noted that the leaves were 8"-10" by 3", which is typical, although the undulate margin might be the result of drying and is not as evident in the live plants. He also added that it might be "possibly a very small form of *I. polymorpha*" (as annotated by Scortechini), leading others to this assumption. Ridley, however, erroneously considered it (and also *I. diffusa*) a form of *I. wallichiana* (*Materials*: 152, 1907)

The taxon is the most diminutive of the genus, caespitose, with arundinaceous, sinuous stems which often sprout aerial branches. The leaves are entire (so far no divided forms have been seen) and could be mistaken for young entire leaves of the other taxa in the *I. polymorpha* complex, but they are held stiffly at right angles to the sheath and distinctive in texture. The inflorescence has been accurately described by Beccari. The peduncles are indeed mainly enclosed, but are frequently exposed by early abscission, and become infrafoliar. The fruit is globose, smaller than *I. wallichiana*, ripening from light green, cream, yellow (not white) to red.

The aptly named species has been ignored or misunderstood partly because there was only one historical specimen (in Florence); the evidence in Kew consisted only of a drawing of the holotype, which is nevertheless a fine sketch.

The type location in Perak is not known, but Furtado recognised the species as distinct in 1933, when he correctly determined a fine specimen in the Singapore Herbarium (*SFN 21104*) collected from the Kedah-Perak border by Haniff in 1928. No other collections appear to have been made until our recent finds in Kedah, now deposited at KEP, K and SING, which are from one specific area on forested hill slopes at 200m unfortunately threatened by re-logging activities. We have also encountered rare individuals of this species at 1000m alt. in a logged remnant forest in the G. Bintang Forest Reserve. These then are its residual known distributions.



Plate 20 *I. parvula*: Type specimen: Perak: c1886, Scortechini s.n. (FI) (by courtesy of Erbario Centrale Florence)

Distribution: Perak, Kedah.

Type: Perak: c. 1886, *Scortechini s.n.* (holotype FI).

Reference Collections:-

Kedah, Kuala Ketang, 1928, *Haniff 2H104* SING; G. Inas, 1991, *C.K. Lim H 962* SING; *H 975, H 1016, H 1077, 1992, C.K. Lim H 1123* PSM Collection.

11. *Iguanura bicornis* Becc., Malesia III: 188 (1889), J.D. Hooker, 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); Kiew, Gdns Bull 28: 204 (1976)

In 1889, Beccari was stimulated by fresh collections sent to him by Dr King from Calcutta, made by Kunstler and by the late Father Scortechini. The species named *I. bicornis* was one of the New Asiatic Palms he listed, citing two specimens: the one Scortechini collected at c. 1300m from G. Ijuk (more correctly G. Hijau which is adjacent to Bukit Larut), and the other by Kunstler (6375) also from Bukit Larut. His description highlights the unique fruit tipped by “two obtuse unequal bosses” (per J.D. Hooker), which is also described as bigibbous. The fruit shape varies from oblong to broad and square; ripening from light green to yellow and brilliant cherry red.

The palmlet is caespitose, clustering often with numerous basal branches, stems to 2-5m and up to 3-5m (in recently observed robust populations), 6-8mm in diameter, usually chestnut brown in colour. The leaf sheath is green, abscising, leaves entire when young, pinnate with two to eight pairs of trapezoidal leaflets, flaring distally, varying in the angle of the apical tips, from less than 30 degrees to more than 90 degrees, typical and similar within the *polymorpha* complex. The leaves appear to abscise more readily than others in the complex, giving rise to the smooth stems, and to the infrafoliar position of the inflorescence, which nevertheless usually forms within the sheath, as characteristic in that genus.

The taxon in fruit is especially distinctive, and appears to thrive and is quite abundant in mountain forests usually above 400m to 1500m alt. (it has not been seen in lowlands), from Bukit Larut northwards to Belum Forest Reserve, Gerik, also common in Kedah; Weng, and in S. Thailand. Kiew incorrectly included within this taxon the lowland *I. arakudensis* Furtado (which was based on a specimen misidentified by Ridley as *Pinanga canina* Becc.), whereas it is indubitably a form of *I. polymorpha*.

Distribution: Kedah, Perak.

Type: Perak: G. Ijuk, 1886, *Scortechini H188*, (holotype FI)



Plate 21 *I. bicornis*: Inflorescence with bigibbous fruit, trapezoidal leaflets



Plate 22 *I. bicornis*: Variations in leaf form



Plate 23 *I. bicornis* (top), *I. polymorpha* (left) and *I. mirabilis* (right): Fruit and seeds.

Reference Collections:-

Kedah, G. Lang, *Kiah 35048* K, SING; G. Inas, *Whitmore 4650* KEP; Bukit Palong, C.K. Lim *H 1505, H 1558* PSM Collection; **Perak**, Larut, *King's Collector 6375* CAL. FI, K, SING; *Wray 695* FI; *Scortechini s.n.* FI; C.K. Lim *H 1391, H 1096* PSM Collection; Kenayat, C.K. Lim *H 53, H 58, H 110, H 115, H 117, H 120, H 617, H 792* PSM Collection; Belum FR, C.K. Lim *H 610, H 612, H 1482* PSM Collection; Bintang Hijau, C.K. Lim *H 719, H 754, H 779, H 1043, H 1387* PSM Collection; Belukar Semang, C.K. Lim *H 1124, H 1127, H 1252, H 1365* PSM Collection.

12. *Iguanura corniculata* Becc., Malesia III: 187 (1889), J.D. Hooker 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); Kiew, Gdns Bull 28: 204 (1976)

The original specimens from the Selama area are so distinctive that this, the first of the new *Iguanura* Beccari described in 1889, has retained pride of place in all taxonomic accounts although it had not been collected until recently, and had been deemed extinct, especially as its type location (at 100-170m alt.) has largely been cleared for plantations. Fortunately, our recent field trips have yielded a newly discovered population, not in Perak but in adjacent Penang, at low altitudes.

As inferred by Whitmore (1973) and Kiew (1976), it is very much a member of the *I. polymorpha* alliance. It is caespitose, and is distinguished by its long spicate inflorescences (22cm in the type specimen), and fruit more pronouncedly hooked than the narrowest forms in *I. polymorpha*. The recent collections from Penang, however, have fruit more similar to *I. polymorpha*, where the hook is less pronounced. The plant is smaller, up to 2m in height, with finer trapezoidal leaflets. It should be noted that some forms of *I. polymorpha* may be similarly diminutive, as at Merapoh, where individuals with spicate but shorter inflorescence can occasionally be found, clearly a variation among those predominantly with two or three branches. The flowers of the two taxa are observably different in size, those of *I. corniculata* being half to two-thirds as large, and having sepals tinged red at the tips.

So far, the known distribution seems limited to near the Perak-Penang boundary. The collection by Henderson from Pahang, which he labelled as *I. ferruginea*, may need to be corroborated, especially as *I. polymorpha* forms with one to three rachillae have been seen in that state and also elsewhere. Furtado had determined it to be *I. corniculata* on the basis of leaflet shape, and may have introduced (from Kew?) the hooked fruit and leaflet cuttings now in the sachets on the specimen. Yet another fresh lead might be provided by a recent collection in 1990 by Kiew and Anthonysamy (*RK 2908*, UPM) from the Nenggiri area in Kelantan; the specimen, classified as *I. polymorpha*, has spicate inflorescence, but



Plate 24 *I. corniculata*: Type specimen: Perak: Selama, Kunstler (King's Collector) 3131 (FI) (by courtesy of Erbario Centrale, Florence).



Plate 25 *I. corniculata*: Fruit and seeds



Plate 26 *I. corniculata*: Dwarf clustering palm with long spicate inflorescence; specimen from Penang.

unfortunately, no fruit were collected or described. *I. corniculata* remains one of the rarest endemic species, requiring the fullest conservation measures.

Distribution: Pahang, Perak, Penang.

Type: Perak: Selama, 1882, *Kunstler (King's Collector) 3131*, Holotype FI, isotypes CAL, K.

Reference Collections:-

Pahang, Raub, 1931, *Henderson 2509* SING: **Penang**, Seberang Prai, C.K. *Lim H 1626* PSM Collection; *H 1672* KEP.

13. *Iguanura polymorpha* Becc., Malesia III: 189 (1889), J.D. Hooker, Fl. Brit. India 6: 417 (1892); Ridley, Mat. Fl. Mal. Pen. (Monoc.) 2: 152 (1907); Fl. Mal. Pen. 5: 15 (1925); Whitmore, *Principes 14*: 124 (1970), Palms of Malaya: 64 (1973); Kiew, Gdns Bull 28: 212 (1976)

Synonyms: *I. polymorpha* var. *canina* Beccari. Malesia 3: 190 (1886); *I. brevipes* J.D. Hooker, Fl. Brit. India 6: 416 (1892); *I. ferruginea* Ridley, J. Straits Branch Roy. Asiat. Soc. 41: 40 (1903); Mat. Fl. Mal. Pen. (Monoc) 2: 152 (1907); *I. arakudensis* Furtado, Reprium nov. Spec. Regni veg. 35: 273 (1934).

Like the others with abscising, pinnate, leaves and trapezoidal leaflets, this caespitose taxon is indeed appropriately named, with a range of forms that has given rise to three other proposed species and one variety, now reduced to synonymy. From extensive field observations, the variations in leaf division, forms and apical tip angles, are typical of the whole complex (including *I. bicornis* etc.)

Beccari's description of the new species and its variety *canina* (*Scortechini* sn., FI) were based on specimens collected by Scortechini, but the type locations in Perak are not certain. We would infer that they came from relatively high altitudes (c. 1200+m), probably from Bukit Larut. Our reexamination of Beccari's concept of the taxon has been based on equivalent populations from Cameron Highlands, some with sinuous stems and leaves irregularly pinnate with broad and narrow leaflets on the same leaf, a feature which initially seemed distinctive, not often seen in herbarium samples. Contiguous and intermixed forms can also be observed with a range of fruit shapes - ovoid, elliptic (but not curved) to the lightly curved "tooth" (canine) form. The fruit ripens from white to pink and red. The rachillae vary in number from three to nine, within both forms and are not as clearly different as suggested by Beccari and others

The *Iguanura brevipes* of J.D. Hooker was also collected from above 1200m at Bukit Larut, where *I. bicornis* and *I. polymorpha* are also found. The holotype



Plate 27 *I. polymorpha*: Type specimen: Perak: c1886, Scortechini 318b (FI) (by courtesy of Erbario Centrale, Florence)



Plate 28 *I. polymorpha*: Inflorescence with ripe fruit.

(Kunstler 2029, K) had no fruit, but had flowers which, as described, are indistinguishable from the others in the complex. The spadix, with three to four branches, were indeed interfoliar, but it is not certain if any remnant infrafoliar ones had fallen off. The leaf sheath forming the crownshaft were certainly of the abscissing type, and although Hooker referred to the slender stem, he did not indicate whether the taxon was solitary or caespitose, but noted that it was 2-5m in height. Amongst abscissing *Iguanura* taxa, the inflorescences can be within or below the sheaths, sometimes both; leaf fall varies with moisture conditions and persistence of the nodal grip of the peduncle, and the size and weight of the inflorescence would also have a bearing. The mixed conditions can often be seen in the field. Practically all the subsequent herbarium specimens we have seen labelled as *I. brevipes* could fit within *I. polymorpha* - and some within *I. bicornis* (one actually had its typical fruit!).

By the time Ridley published Flora of the Malay Peninsula in 1925, he had overlooked many editorial errors and credited his *I. ferruginea* to Beccari, also providing it with the description of its Licuala namesake in the same volume! When he first published the new taxon in 1903, he noted that it had the habit of *I. polymorpha*, and distinguished it on the basis of its “stouter inflorescence on a longer peduncle and covered with red wool, the larger flowers, and curved cylindric fruit”. His syntypes were from “Thaiping Hills common from 2000ft upwards” (Fox 10684, and Ridley s.n.) and from Bujang Melaka (Curtis 3164). In “Materials” (1907) he characterised the inflorescence as being stout and having nine to eleven branches, sometimes branched again, and re-emphasised the furry indumentum. In effect by citing the characteristics of his 1891 specimen, he rendered it synonymous within *I. polymorpha*. Indumentum on rachillae and leaf parts is, however, not uncommon for all *Iguanura* taxa.

The other syntypes displayed inflorescences with two or three rachillae, and curved seeds. This is a form that is common and widespread, and is found in many parts of Perak, Kedah, Kelantan, Terengganu and Pahang, mainly at lower altitudes. *I. arakudensis* Furtado is almost certainly of this form; its type was based on Ridley’s misidentification of “*Pinanga canina*” (Ridley 7027), which had broad apical leaflets and immature three-branched inflorescence. It would have been tempting to erect a distinct taxon, at least at varietal rank, for *I. ferruginea* based on the trident inflorescence and the curved seeds which are more slender than in var. *canina* samples. It is now evident that curved and ovoid fruit can be found within the same taxon, with the “canine” shapes more common. As observed by Beccari and others, the drupes form eccentrically from the basal stylar remains which can be on the concave or the convex side. Inflorescence branching and size are also variable. This was further resolved by the collection of fresh specimens (from north. Perak) from taller, clustering, robust forms with stems up to 3.5m, larger leaves (72cm x 40cm), and gigantic inflorescences, variable from three or four to nine branches, sub-branching sometimes to 16. The longest rachillae measured over 78cm, including a peduncle of 33cm (vide. C.K. Lim H 1671).



Plate 29 *I. polymorpha*: Robust form with two to nine branched inflorescence; specimen from Belum, Upper Perak.



Plate 30 *I. polymorpha*: Leaflets variable, inflorescence with ovoid or curved fruit.

In summary, the concept of the aptly named *I. polymorpha* would include a wide range of variations. Its habitat ranges from sea level to 1500m or more. In habit it is always caespitose, stilt rooted, with fine or stout stems, 1m to 3.5m in height, leaves always abscising, trapezoidal, variable in divisions, leaflet widths and apical tip angles, with short or long peduncles and inflorescences fine or stout, with or without ferruginous indumentum, with three (rarely one or two) to nine branches, sometimes branching to second order with up to 18 or more branches, with fruit ovoid to curved, ripening from white to pink and red.

Distribution: Kelantan, Pahang, Perak, Terengganu:

Type: Perak, c. 1886, *Scortechini 318b*, (holotype FI)

Reference Collections:-

Kelantan, Sg. Bring, 1990, *Kiew 2808* UPM; Kota Bharu, *Gwynne-Vaughan 560* CAL, K; Sg. Kerteh, *Nur 12052* K, SING; Jeli FR, *Chelliah FR1 6528* KEP, K; 1911, *Anderson 165, 173* SING; 1899, *Fox 162, 10684* SING; *Burkill & Haniff 12715* SING; *Barnard CF 29* SING; Ulu Sat, *C.K. Lim H 1164, 1509* PSM Collection; Sg. Mekong *C.K. Lim H 1302* KEP; Lojing, *C.K. Lim H 1247, H 1264, H 1347, H 1630* PSM Collection; **Pahang**, Sg. Gasoh, *Jaamar 28264* SING; Merapoh, *C.K. Lim H 1543* PSM, *H 1576* PSM Collection; **Penang**, Ara Kuda, *Ridley 7027* (Type for *I. arakudensis*) SING; **Perak**, *Scortechini s.n.* (Type for *I. polymorpha* var. *canina*), FI; Taiping Hills, 1881, *King's Collector 2029* (Type for *I. brevipes*) K; 1891, *Ridley s.n.* (Type for *I. ferruginea*) SING; Larut, 1899, *Fox 10684* SING; *Ridley 3157* FI, SING; *Wray 714* FI, *Ridley 11405* CAL, SING; *Curtis 2078* SING; G. Batu Puteh, *Wray 396* SING; Bujang Melaka, *Curtis 3164* (Syntype *I. ferruginea*) SING; *Ridley 9803* FI, SING; Tapah, *Avé 132* K; Tambun, *Burkill 6299* SING; Padang Rengas, *Burkill & Haniff 13577* SING; Kati, *C.K. Lim H 1109, H 1202* PSM Collection; Nenering *C.K. Lim H 1411* PSM Collection; Belum FR, *C.K. Lim H 1132* PSM Collection; *C.K. Lim H 1671* KEP, K; Kroh, *Furtado s.n.* SING; **Terengganu**, Kg. Tok Dor *C.K. Lim H 1156, H 1440* PSM Collection; Dungun, *C.K. Lim H 1169* PSM Collection; G. Tebu FR, *Sinclair & Kiah 40821* K, SING; *C.K. Lim H 1416* PSM Collection; Besut, *J. Drans. 6504* K; Sg. Tong FR, *Meijer & Yong, KEP 94780* KEP, K,

14. *Iguanura belumensis* C.K. Lim sp. nov.

I. polymorphae affinis sed habitu solitario, inflorescentis rachillis 10-14, distincta. Typus: Perak, Belum FR, 1992, *C.K. Lim H 1281* (holotypus KEP).

Solitary, stilt-rooted, stem grey or brown, erect to 4m or more, to 1.5cm diam., leaves abscising, nine or more in crown, pinnate three to five pairs leaflets, trapezoidal (size and variations similar to *I. polymorpha*), leaf sheath brown, internode 1-1.4cm, inflorescence often numerous, inter or infrafoliar, finely



Plate 31 *I. belumensis*: Solitary, with infrafoliar, multi-branched inflorescence.

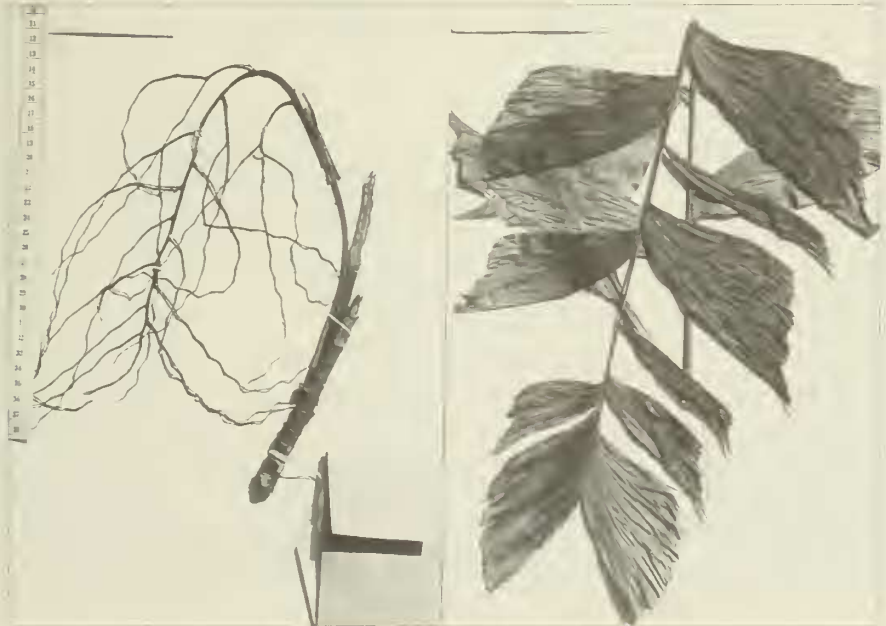


Plate 32 *I. belumensis*: Type specimen: Perak: Belum FR. 1992, C.K.Lim H1281 (KEP)



Plate 33 *I. perdana*: Inflorescence interfoliar, with rachillae thick and long.

paniculate with many branches, 10-14, often sub-branching, usually profuse in flower or fruit; fruit ovoid (also known to be curved), white, pink tinged, ripening red; seed not ridged.

Found on hill forest slopes at alt. c. 800m, not seen on lower locations, its solitary habit and more robust erect stem sets it apart, as does the profuse inflorescence (though sometimes sparse in poor soil conditions), flowering from 1m to 4m or more. Not uncommon but endangered by logging along the E.W. Highway, it has so far been encountered only in isolation from other *Iguanura* taxa, although *I. bicornis*, *I. wallichiana* and *I. geonomiformis* have been seen at similar altitude. In the Belum FR, other sympatric palm species include *Pinanga subintegra* var., *P. simplicifrons*, *P. perakensis*, *P. malaiana*, *Nenga macrocarpa* and *Johannesteijsmannia altifrons*. In that area, visited over four years, *I. polymorpha* has not been found at this altitude, although to the east and west, at lower levels, that taxon abounds, and also to the north (probably extending into Thailand), where robust colonies of the clustering relative are dominant.

On G. Bubu, a specimen collected in 1972 at 1000m (*Evans 722*, UPM) displayed curved fruit, but in another (*FSP Ng FRI 6134*) they were ovoid. Like others, the fine specimen with robust stems from Bujang Melaka (*Shah 3369*) was thought to be *I. polymorpha*. The epithet *belunensis* was chosen for the locality in which we found it in 1989, and used (ined.), for purposes of herbarium depositions; the choice becomes especially appropriate in the light of more recent national conservation efforts in the type area.

Distribution: Perak.

Type: Perak: Belum FR, 1992, *C.K. Lim H 1281* (holotype KEP)

Reference Collections:-

Perak, Bujang Melaka, 1975, *Mohd. Shah 3369* SING; G. Bubu, 1966, *Whitmore FRI 633* KEP, SING; *F.S.P. Ng FRI 6134* KEP; *Evans 722* UPM; Belum FR, *C.K. Lim H 64, H 122, H 531, H 606, H 621, H 787, H 800, H 991, H 1128, H 1153, H 1163, H 1195, H 1243, H 1277, H 1306, H 1438, H 1466, H 1468, H 1472* PSM Collection.

15. *Iguanura perdana* C.K. Lim sp. nov.

Affinis I. bicorni sed habitu solitario raro caespitoso; elatior, erecta ad 4.5m, laninis majoribus inflorescentiis robustis fructa non bicorni, excentrico apico plano bene distincta. Typus: Perak: Kroh, 1992, *C.K. Lim, H 1125* (holotypus KEP)

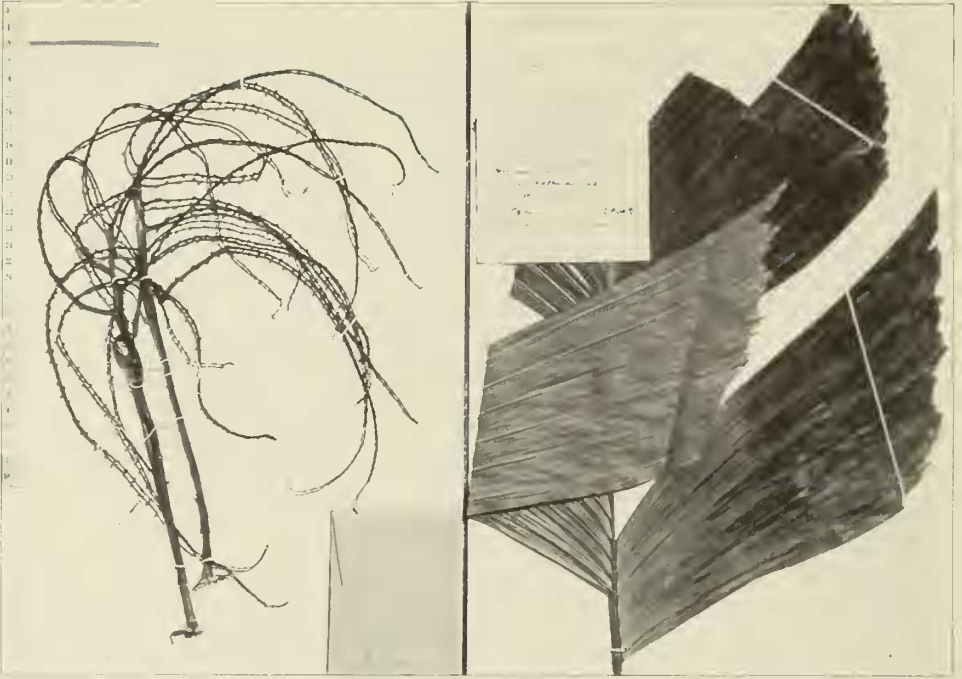


Plate 34 *I. perdana*: Type specimen: Perak: Kroh, 1992, C.K.Lim H1125 (KEP)

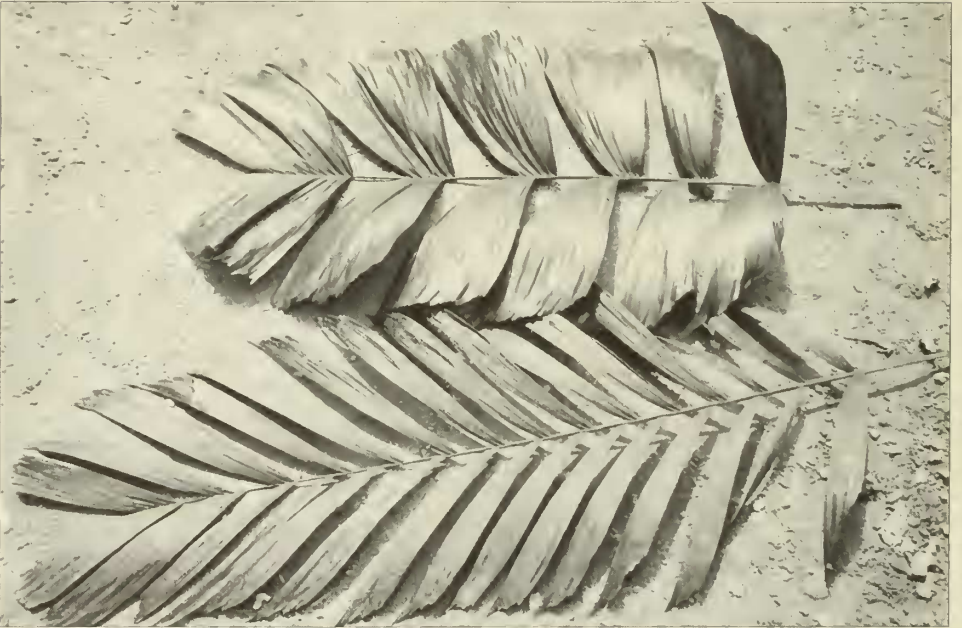


Plate 35 *I. perdana*: Leaves large to 100cm, pinnate forms with trapezoidal or parallel-sided leaflets.

Usually solitary, rarely with basal branches, stilt-rooted. stem greyish brown, erect, 1.8cm diam., robust, erect, to 4.5m; internodes 4-5cm, leaves abscising, large 100cm x 50cm, pinnate with two forms of leaflets, few (six pairs) broadly flaring distally or numerous (15-17 pairs) narrowly parallel-sided, petiole 20cm, leaf sheath 29cm, green with brown indumentum; often persisting in inflorescence thereby remaining interfoliar, rachillae stout, succulent, nine to ten branches, to 45cm long with 30cm peduncle; flowers widely spaced, relatively large; fruit (only one seen to date), unripe yellow, pink, like *bicornis* but eccentric, with flat top, not two-lobed.

This tantalising taxon needs to be described and recorded even if somewhat incompletely, in view of its rarity; we have only found less than ten plants in one threatened locality. Although it is within a Forest Reserve, adjacent felling and land schemes may affect its survival. It grows sympatrically, with the common *I. bicornis* and the new *I. wallichiana* var. *rosea*. The very large leaves are a third to twice the size of the adjacent *I. bicornis*, usually trapezoidal, but another pinnate form has been seen with parallel-sided leaflets. The inflorescences are signally different, lingering (perhaps because of size) among the leaf sheaths, which are of the abscising type, leaving clean scars, but are more fibrous, and appear to persist in support of the stout but gangling rachillae. The unique fruit collected was somewhat like a dirty tooth, irregular but not bigibbous. This sampling is incomplete, but other characteristics set this taxon apart not only from *I. bicornis* and *I. polymorpha* but also from *I. belumensis*.

The population is certainly not sterile, as seedlings and the one tantalisingly solitary fruit collected prove. It is indeed an imposing erect taxon, and the epithet, which means prime (in Malay), alludes at attributes which a leader *primus inter pares*, should have.

Distribution: Perak; damp hill slopes, alt. 500m.

Type: Perak: Kroh, 1992, C.K. Lim H 1125, (holotype KEP)

Reference Collections:-

Perak, Kroh, H 1507 SING; C.K. Lim H 1254, H 1366, H 1412, H 1572 PSM Collection.

16. *Iguanura mirabilis* C.K. Lim sp. nov.

A ceteris speciebus malaysianis foliis integris valde plicatis, pedunculo brevi, fructibus curvatis differt. Typus: Terengganu: Ulu Setiu, 1993, C.K. Lim H 1448 (holotypus KEP).



Plate 36 *I. mirabilis*: Type specimen: Terengganu: Ulu Setiu. 1993, C.K.Lim H1448 (KEP)



Plate 37 *I. mirabilis*: Rachillae (three to nine branched) with purple indumentum; fruit curved.

Caespitose, stilt-rooted, with basal branches, dominant stems to 3m, 1-2cm diam., internodes 2-3cm, leaves eight to ten at crown, held stiffly with short petioles 3cm or less, abscissing, entire, lamina strongly plicate, 85cm x 28cm, with deep (23cm) apical cleft, often with blunt truncated apical edges sometimes attenuated: leaf sheath 14cm; inflorescence among or below sheath, stout, horizontal or erect, with purple indumentum, 5 or more branches sometimes sub-branching, rachillae to 15cm or more, 4-6mm thick peduncle up to 10cm, 10mm x 5mm, often within sheath; buds prominent pink, with red indumentum, male flowers large 5mm wide when open, with pinkish sepals not examined in detail. Fruit curved (like *I. polymorpha*, also in size), white, ripening cherry red; seed not ridged.

This is indeed a spectacular new species, quite unlike any others within the genus in Peninsular Malaysia. The plicate leaves are stiff, with deep apical clefts, and often blunt at the top edges (oar-shaped), sometimes with extended tips. The leaves absciss cleanly and are entire. The taxon is clearly distinct from the *polymorpha* complex, although the curved fruit resemble those of *I. polymorpha*, and has been placed (together with *I. parvula*) for convenience with the trapezoidal leaflet members, under the abscissing group.

A small specimen with inflorescence had been collected earlier from the same area but remained unidentified at Kew (*J. Dransfield 5145*); but no other collections had previously been deposited in KEP or SING. In Sarawak, two species (*I. sanderiana* and *I. elegans*) may seem to have affinities, their leaves also being plicate and entire (although lobed forms have recently been found with variable apical clefts); however, these are solitary in habit, and the inflorescence and fruit are quite different, globose, with seeds that are ribbed or ridged, features not observed in Peninsular taxa of *Iguanura*. The new species has been a wonderful culmination for this stage of our palm studies, and the name *I. mirabilis* is surely appropriate.

Distribution: Terengganu, where it is limited but not uncommon in particular flood-prone swamp forests, sharing the habitat with *I. humilis*.

Type: Terengganu: Ulu Setiu, 1993, C.K. Lim H 1448 (holotype KEP)

Reference Collections:-

Terengganu, Ulu Setiu, *J. Dransfield 5145* K: *H 1518* SING: C.K. Lim *H 1300*, *H 1379* KEP; *H 1326*, *H 1418*, *H 1474*, *H 1475* PSM Collection.



Plate 38 *I. mirabilis*: Caespitose, leaves entire, strongly plicate.

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