APPENDIX 1

A TAXONOMIC COMMENTARY

This commentary outlines the taxonomic decisions that have been taken in reducing the species to the 74 accepted in this guide from the 192 published names from the region. All validly published species (P. example – 155 plus 14 subspecies or varieties), *nomina nuda* (P. example n.n. – 23) and manuscript names ('example' – 95, of which 94 by St. John) are included in the commentary. 66 species are maintained, and eight apparently new taxa are outlined. § signifies a sub-generic name, and §§ a sectional name. Full references to the protologues of species and sub generic ranks are in Appendix 2.

THE GENUS PANDANUS

There are several features of the genus *Pandanus* which make it remarkable. Firstly it belongs to a peculiarly isolated family and order. Although traditionally associated with the palms as the only other major arborescent group of Monocotyledons, the position of the Pandanales remains speculative. Molecular evidence from the rbcL gene is as yet too sparse to help in this regard (Chase et al., 1993). Pandanales and the often associated orders Arecales (Palmae) and Cyclanthales are each clear cut entities without any 'intermediate' species or groups. It is of note that *Nypa* has one of the longest fossil records of any Angiosperm (100 million years), and in the gross morphology of its fruits is not only very un-palm like, but shows many striking similarities to *Pandanus*.

The second major feature of *Pandanus* is the sheer number of species. Previous workers have all agreed that the division of the genus in any way other than the current, informal, sub-genera and sections serves no purpose in its understanding. Although some sections seem eminently natural, others do not. Likewise some sub-genera are without doubt natural (§Acrostigma), while others are probably not (§Kurzia, §Lophostigma – Ben Stone pers. comm.). The use of sections provides all the benefits of practicality, without the philosophical problem of what constitutes a 'good' genus (Stone 1974b). The genus *Pandanus*, with all its archaic features is undoubtedly highly successful, and this success is measured in the fact that as a genus it has remained coherent over almost the entire age of the Angiosperms.

Some species appear to be clear-cut, constant taxa, although this impression is largely on account of the paucity of collections. Others, however, especially the most widespread species are astonishingly variable and appear to have many local forms, which has confounded their taxonomy. Some of the species groups have been treated very conservatively here, partly to remove the confusion of an excessive number of very closely related species, and partly to draw attention to the desire for further investigation of these groups.

TAXONOMIC DIFFICULTIES WITH PANDANUS

At the time of Warburg's revision (1900), only 19 species were known from the region covered by this fieldguide. Collections were few, and the species clear-cut. As collections increased through this century, the taxonomy became confused, and authors struggled to maintain an order that no longer existed (Martelli, St. John). What is needed now are detailed ecological and biological studies of a few species or species groups which can tell us something about breeding populations, variation and consequent evolution of this genus. Work by Ash (1987) and Cox (1990) has shown promising headway in explaining some of the problems in the *P. tectorius* complex (Stone 1975), in terms of its breeding biology, especially the degree to which apomixis (setting seed without pollination) occurs.

The fact that *Pandanus* can set fruit in the absence of pollination was first remarked upon by Kurz in 1869, who noticed that female trees of *P. dubius* growing in the Kebun Raya at Bogor set fruit, even though the nearest male plants were many hundreds of miles away. Ash developed these ideas in terms of populations developing from single phalanges, leading to a strong founder-effect from inbreeding between closely related parents (1987).

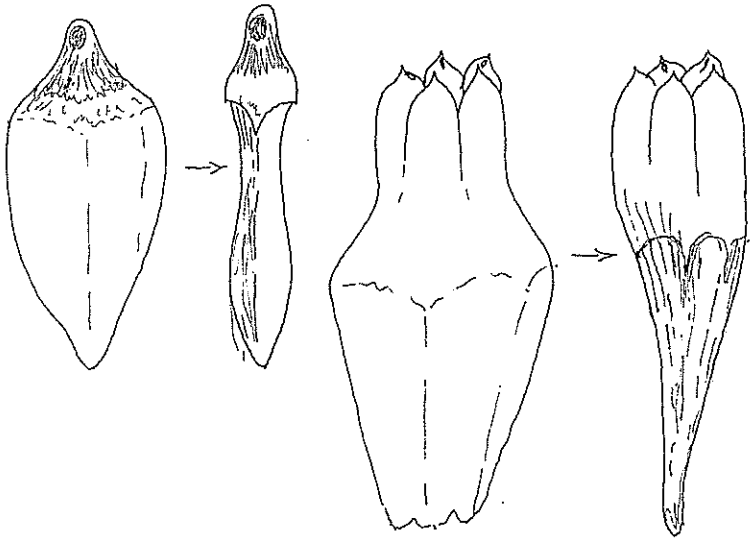
Cox has demonstrated the existence of facultative apomixy (Setting seed without pollination if pollination doesn't occur first) in *P. tectorius* (1990). Thus the genus is well disposed towards developing local clones, explaining much of the complicated variation shown by certain species (Stone 1975).

Although I would be loathe to hold a view point that all species are of similar rank, it is beholden in a generic monograph to maintain a consistent species 'concept' across the entire genus. Thus some species are naturally very variable, others very constant, and yet others distinct, but closely related. Such 'species' should be explicit in a comparative way. For example I have reduced some ten species in §§Dimissistyli, seven in §§Rostellati, thirteen in §§Maysops, six in §§Intraobtutus, and twenty-six in §§Pandanus, since it seems inconsistent to maintain these when compared to the remainder of the genus. Other sections in which too many species are presently recognised include §§Kurzia, §§Liniobtutus and §§Microstigma.

Likewise there is no advantage in dividing *Pandanus* into several genera, since it is clearly a close-knit group of species. Big genera are an intriguing phenomenon worthy of far more attention.

Because all *Pandanus* species 'look' like *Pandanus*, many collectors omit to describe the tree in any detail. The height of the bole, length of the proproots and their relative thickness, and degree of branching appear to be very specific in some species, while in others it remains, as yet, quite unknown. Young plants invariably have much bigger leaves, and unless the age and height of a plant is mentioned it can be unclear what the typical leaf looks like. In many species the juvenile leaves can be as much as three times the size of leaves on a fully-grown tree. The lack of secondary thickening means that the stem diameter is reduced with each branching, and in older, branched trees the diameter of the axes and consequent length of the leaves is considerably reduced.

The developing cephalia and drupes or phalanges are often robust and woody from an early age, thus immature collections may not be obvious, and the cephalia and drupes can appear to be minute versions of 'larger' species. Drying effects on the other hand, can considerably alter the appearance of drupes. Many species have a woody pileus which changes little on drying, but a fleshy mesocarp which can shrink considerably. On account of this a field guide is difficult to produce from herbarium material. Some illustrations in this guide have been prepared from fresh material, whilst the majority are reconstructed from dried material.



A drupe of *P. balenii* A phalange of *P. tectorius*

Examples of fresh and dry fruits of Pandanus

A NOTE ON SOME PANDANOLOGISTS

Otto Warburg (1859–1938) spent nearly 4 years travelling through the Old World tropics. At the time of his revision only 19 species had been collected from New Guinea and the Solomon Islands, and of these 13 are maintained in this guide. His viewpoint on tropical taxonomy was, however, refreshingly modern, and he sunk many species *into P. tectorius*, and recognised distinct varieties only.

Ugolino Martelli (1860–1934) had some rather remarkable views about the Type species concept. He was happy to alter a Type specimen for a previously described species if he felt it did not reflect the 'typical-form' (Stone 1975). His taxonomic style altered radically through his life, initially he followed Warburg's view of a conservative approach to species, but he later became more willing to accept a multi-species concept. Some of his descriptions only occur in the form of a key to species. He named 26 species from the region.

Elmer Merrill (1876–1956) and **Lily Perry** (1895–) were some of the most industrious publishers of material collected by Leonard Brass during the first three Archbold expeditions to New Guinea in the 1930s. Two papers, in 1939 and 1940, added 24 species of *Pandanus* to the New Guinea and Solomon Island floras.

Ryôzô Kanehira (1882–1948) conducted several trips to New Guinea, and described species from the Nabire and Vogelkop regions of Irian Jaya. He described eight new species in two papers in 1940 and 1941. The type material is all deposited at Tokyo. His 1940 paper was a summary of the genus in New Guinea, which then comprised 45 species.

Harold St. John (1892–1991) was, without doubt, the most prolific of Pandanologists, and his major review of the genus begun in 1960 (at the age of 67) comprised regular contributions in a consecutively numbered series. His species concept, however, was of the narrowest kind, and many of his species have been reduced, either here or previously. He has left numerous manuscript names [I have located 94 for the region] on specimens which he clearly intended to assign as types. In view of the fact that these names are now widespread in herbaria, and clearly marked as 'Type Specimen', I have included all those known to me in the taxonomic summary. These *in scheda* names should be regarded as unusable because of possible confusion in the future. In addition there are several references to species in his own, and in Huynh's papers, for which no publication, and sometimes no specimen, has been traced, these *nomina nuda* [I have found 22] are likewise included. Many of St. John's collections at Lae consist solely of a few loose drupes or phalanges and very brief notes.

His accounts have all been published in a consecutively numbered series beginning with the 1960 paper. Later parts appear as photocopied, A4-format booklets, which were privately published out of Honolulu. The last part [Part 51] was published in 1989, and comprises a revision of the species of the Bismarck and Admiralty Islands.

Ben Stone (1933–1994) was the pupil of Harold St. John. However in their later publications the two differ considerably in viewpoint. Stone has produced regional revisions of *Pandanus* in the New Hebrides (1975) and the Solomons (1972b and 1973). In addition he has produced the only recent revision of an entire sub-genus (§Acrostigma, 1978). Other important areas that Stone has covered include the infrageneric classification of *Pandanus* (1974b), the problem of intraspecific variation in *P. tectorius* (1975 & 1982c), and biogeography of the genus in New Guinea (1982a). His most recent publication was a revision of section Maysops in New Guinea (1992). His untimely death in Manila is a great loss to *Pandanus* taxonomy. He regarded *Pandans* as *Big Game of the plant world*, and spent nearly 40 years in dedicated pursuit of their taxonomy.

SUB-GENUS **ACROSTIGMA**

This sub-genus is characterised by the cephalia always having simple, free drupes, a spine-like style, the stigma a groove on the adaxial side, and the lateral pleats of the leaves thorned near the apex. They are stemless shrubs to small-sized trees, most species lack proproots, in others they are short and reduced, with the exception of *P. poronaliva.*

SECTION **ACROSTIGMA**:

SUB-SECTION **ACROSTIGMA**

'akurios'
'guadalcanalius'
'nonos'
'reburrus'
'tark'

* P. adinobotrys (m)
P. angiensis
* P. congregatus
P. ketele
P. lustrorum
* P. poronaliva
* P. pseudosyncarpus
* P. setistylus

SUB-SECTION **DIMISSISTYLI**

'assurgens'
'batavus'
'echinatus'
'eramosus'
'hentyi'
'hohi'
'kalip'
'major'
'malaitensis'
'noviberiensis'
'olivaceous'
'rererivalis'
'rudis'
'rugulosus'
'verruculosus'
'waginaensis'

P. acicularis
P. arcuatus
P. biserratus n.n.
* P.danckelmannianus (m)
P. erinaceus
P. ihuanus
P. jacobsii
P. lictor
P. misimaensis
P. nigridens
P. peekelii
P. stenocarpus

SUB-SECTION **LAUTERBACHIANI**

'badius' 'musaensis' 'sepikensis'

* P. lauterbachii (m)

SUB-SECTION **ROSTELLATI**

'nabirensis'

P. eumekes
P. granulosus
P. humicola
P. inokumae
* P. odoardi
P. papuanus Ridl.
P. pentagonus
* P. permicron
P. rostellatus

SECTION **PSEUDACROSTIGMA**

* P. ornithocephalus

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* Each sub-generic account is preceeded by a listing of all known species names arranged by section. Validly published names appear as P. example, those published as *nomina nuda* as P. example n.n., while unpublished, manuscript names are listed as 'example'. Species accepted in this handbook are asterisked. An (m) after the name indicates that the male plant is also known. For nomenclatural detail see Appendix 2.

Sub-Section ACROSTIGMA.

Infructescence a raceme of 3-9 cephalia.

The members of this sub-section are characterised by a raceme of three or more rounded cephalia. Collections of ***P. adinobotrys*** show great variation in the appearance of these cephalia, much of this appears to be due to the stage of maturity at collection. Thus *P. angiensis* is most probably a synonym of this widespread highland species. The male inflorescence is a raceme of finger-sized spikes. ***Pandanus congregatus*** has a small inflorescence of fewer, different-sized cephalia, in which the terminal one is usually the largest, and the habit of being a freely-branched tree, with the inflorescences usually borne on the short branches. In some individuals the cephalia is solitary (e.g. the Type of *P. lustrorum*). *Pandanus ketele* and *P. lustrorum* are included in *P. congregatus*, as is 'tark', a manuscript name of St. John's, while 'akurios', and 'nonos', further manuscript names of St. John, are included in *P. adinobotrys*.

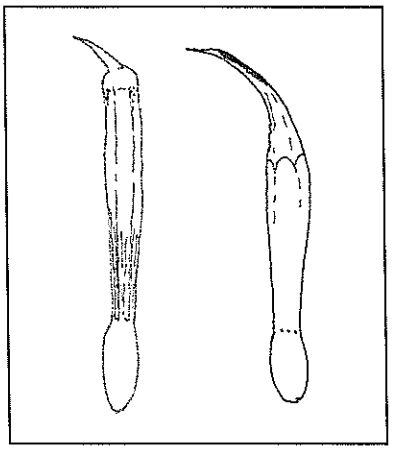
In addition to these two highland species there appear to be two or three distinct lowland species. ***Pandanus pseudosyncarpus*** from Nabire has a very large, compact inflorescence that gives the appearance of being a single cephalium. ***Pandanus setistylus***, the first species to be described in this sub-section, is poorly known (I have seen neither the type, nor the specimen *Clemens 355* attributed to this species by Merrill & Perry). Other collections from Wewak, bearing the name 'reburrus', are a good match for *P. setistylus*, having a very long stylar thorn up to 5 times as long as the drupe. Unlike *P. adinobotrys*, this species is said to be a tall, branching tree with proproots and grows at low elevations on the New Guinea mainland (Morobe, Sepik). ***Pandanus poronaliva*** from the Solomon Islands appears to be very similar in growth form and habitat, and a single plate is provided for these two species. A collection from high altitude on Guadalcanal bears the manuscript name 'guadalcanalius' but is a fair match to *P. poronaliva*.

Sub-Section DIMISSISTYLI

Solitary cephalium with a pileus which abscises from the basal pyrene.

In his review of §Acrostigma, Stone (1978) suggests that far too many species are accepted in this sub-section, and that no clear character combinations allow confident discrimination between species. His suggestion is here taken up, and all eleven species in the subsection are reduced to ***Pandanus danckelmannianus***. I have found a total of sixteen manuscript names of St. John applied to specimens. Although differences occur in drupe size and appearance, these show neither geographical or ecological pattern, nor do they suggest any distinct morphological divisions.

As a variable species with many local forms, *P. danckelmannianus* makes far more sense within the context of the whole genus. Collections I have made near Madang, Finschhafen and in the Eastern Highlands Province of Papua New Guinea, of fully ripened cephalia, in which the styles were already deciduous, were all virtually identical. The surface of the pileus is roughly granular, while the style is brownish yellow and glossy. The stigma runs for the full length of the style and is brown and pulvinate. I suspect the plethora of names is largely accounted for by the maturity of the cephalium upon collection, and consequent artifacts of drying. However *P. stenocarpus* from Manokwari has a rather distinct rounded pileus with an abrupt style, and may represent a distinct species.



Appearance of the drupes in:
P. stenocarpus & *P. danckelmannianus*

The cephalium is borne on a short side branch at the apex of the tree, this bears short, triangular scale-leaves, which become almost circular immediately around the cephalium. Fruiting trees I have seen around Madang often bear a series of three cephalia at different stages of development. At Manokwari I saw a specimen with over eight small cephalia running in a series between two ranks of leaves, this particular tree exhibited the *P. stenocarpus*-type drupes. Like many other species, *P. danckelmannianus* appears capable of fruiting from a height of 1 metre onwards, although the frequency of this is still quite unknown. The abscising style and stigma is unique. The bright red styles fall, often en masse, to reveal the sticky yellow pyrenes, which are attractive to birds, in the Eastern Highlands they are eaten by Manucodes (Debbie Wright and Andy Mack pers. comm.). Around Madang I have also seen the ripe cephalium being visited by various birds. The male inflorescence is known, and comprises a compact raceme of 4 to 5 short spikes with spinous anthers to 1 cm in length.

Sub-Section **LAUTERBACHIANI**

Infructescence a raceme of oblong cephalia.

Pandanus lauterbachii is a clear cut species with no published synonyms. Stone (1978) identifies a north coast form with shorter cephalia (<10 cm) and shorter styles (<4 mm), and a south coast form with longer cephalia (10-14 cm) and longer styles (4-5 mm). These differences seem inconsequential, but as yet collections are poor, and field descriptions inadequate. No synonyms have been described, although there are three manuscript names of St. John's. Stone has equated these to his north coast ('sepikensis') and south coast ('badius') forms (1978). A further name of St. John's 'musaensis' also belongs here. The male inflorescence has exceptionally long anthers, up to 18 mm in length.

Sub-Section **ROSTELLATI**

Small caespitose shrubs with a solitary cephalium.

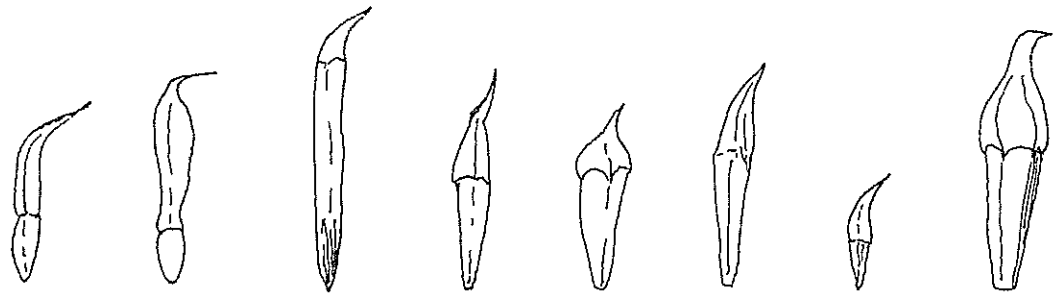
The majority of species in this section cannot be satisfactorily distinguished, and as with §§Dimissistyli there appears to be many local variants of a single species. Most of the species have therefore been reduced to ***Pandanus odoardi***. They are all stemless, or short-trunked, plants with long slender leaves and a globular cephalium of drupes. Ten species have been described, with one manuscript name. *Pandanus papuanus* Ridl. is an invalid name (*P. papuanus* Solms was published 32 years previously), but also appears to belong to this complex, as first suggested by Merrill and Perry (1940).

TABLE 1: Characters of the **type** specimens belonging to sub-section Rostellati

	Trunk(m)	Leaves(cm)	Cephalium(cm)	Drupes(mm)	Locality	Altitude (m)
P. eumekes	1.5	125 x 2	6 x 6	19 x 3	Sorong	60
P. granulosus	?	?	14 x 14	28 x 4	New Ireland	100
P. humicola	0	160 x 3.5	8 x 8	30 x 3	Anggi	1,200
P. inokumae	0	75 x 5	6.5 x 6.5	25 x 4	Nabire-Dalman	600
P. odoardi	0	?	12 x 8	15 x 4	Fly River	?
P. pentagonus	0	183 x 4	7 x 7	25 x 5	Morobe	900
P. permicron	0.1	50 x 1.3	3.2 x 3.2	12 x 5	Nabire-Dalman	600
P. rostellatus	0	130 x 2.5	6 x 6	30 x 5	Central	100

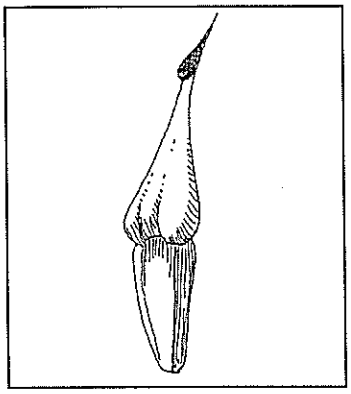
Martelli's original description of *P. odoardi* exists in the form of a key, and is not particularly clear; he describes the inflorescence as 'spicate', but describes only a single, ovoid cephalium. I have seen no specimens which conform to this however. *Pandanus eumekes* differs from all the remaining species in having a very long style, and forming a fairly long trunk. The material of *P. granulosus* consists of a cephalium alone; it may be a young *P. danckelmannianus*. I have not seen the type of *P. humicola*, which has an unusually parallel-sided drupe, more like that of *P. danckelmannianus*. *Pandanus rostellatus* has the most robust drupes.

Pandanus permicron probably represents a valid species, especially since it was collected adjacent to *P. inokumae* on two occasions (Kanehira 1940, 1941), it is minute in all parts, with relatively large drupes for the size of its cephalium when compared to other members of the sub-section.



P. eumekes *P. humicola* *P. odoardi* *P. permicron*
P. granulosus *P. inokumae* *P. pentagonus* *P. rostellatus*

Representative drupes of the species in Section Rostellati



Kalkman 6289 (MAN)

A collection by Kalkman (BW 6289), from near Sorong, undoubtedly belongs to this section, and has a relatively small cephalium with very large drupes to 50 x 10 mm, with a long conical pileus. The remaining species are all much the same in appearance, chiefly differing in the appearance of the drupe, particularly in the length and disposition of the style. Collections of this sub-section are surprisingly few in New Guinea, and virtually every second collection is the type of another species. As with so many *Pandanus* species, further collections are vital before any progress can be made in developing a taxonomy.

An *in scheda* name of Kanehira's – 'nabirensis' – was reduced to *P. inokumae* at the time of the latter's publication. A *nomina nuda* of St. John's – P. biserratus n.n. – was said (St. John 1989) to resemble *P. granulosus*, but from the brief description it pertains better to *P. danckelmannianus*.

Section **PSEUDACROSTIGMA**

Drupes with a flattened apex and hooked style.

Pandanus ornithocephalus is only known from the type, and the only other member of the section is found in Borneo. It is similar to §§Rostellati, being a shrub, with a small solitary cephalium, although the characters of the drupe are distinctive.

SUB-GENUS **KURZIA**

Stone described this sub-genus (1974b) to contain those sections with unilocular drupes with a more or less central, flattened stigma, lacking the pointed or recurved styles of sub-genus Lophostigma. The sections Kurzia and Microstigma are problematic with regard to species and sectional delimitation. §§Paralophostigma is an enigmatic section formerly placed in §Lophostigma (Stone 1974b), but presently included in §Kurzia (Huynh 1976, Stone 1984). Two unrelated species do not fit into the present sectional scheme.

SECTION **CURVIFOLIA**:		* P. buinensis
		* P. decus-montium (m)
		* P. nemoralis (m)
		* P. paludosus
		P. semidivisus n.n.
SECTION **INVOLUTA**:	'gregorii'	P. involutus
	'kardiakos'	* P. leiophyllus (m)
SECTION **JEANNERETIA**:		P. aruensis
		P. kurzianus
		P. manensis
		* P. polycephalus (m)
		P. rechingerii
SECTION **KURZIA**:		+ P. cominsii
	'matha'	+ P. englerianus
		P. hollrungii
		+ P. latericius
		* P. macgregorii
		+ P. minusculus (m)
		* P. subumbellatus (m)
		* P. species 1
		* P. species 2
SECTION **LEPTOCARPA**:		* P. leptocarpus
SECTION **MARGINATA**:		P. marginatus
	'darbyshire'	* P. meniscostigma
SECTION **MICROSTIGMA**:		* P. conoideus
		P. erythros
		* P. exiguus
		* P. leptocaulis (m)
		P. magnificus
		P. plicatus
		P. ruber
		P. rubrispicatus n.n.
		P. sattelbergensis n.n.
SECTION **PARALOPHOSTIGMA**:		* P. balenii
		* P. clarkei (m)
	'juia'	* P. daymanensis
	'oonopsis'	* P. limbatus
SECTIONS UNNAMED:		* P. navicularis
		* P. species 3

Section CURVIFOLIA

Lanceolate-obovate leaves conspicuously narrowed at their base.

Confined to the Solomon Islands, this section has a very distinct growth form. The slender trees look very un-*Pandanus* like, and resemble the widespread *Cordyline fruticosa* (Agavaceae). The leaves are thin-textured, narrowly oblanceolate in shape, and tend to be transversely crinkled near the apex, whilst at the base they are conspicuously narrowed, broadening again at the very base. The leaf bases are often pinkish in colour.

Two species have solitary cephalia; ***Pandanus buinensis***, with long, slender drupes which have large, flattened stigmas on a constricted style; and ***P. paludosus***, with thicker, shorter drupes with a less marked stigma.

Pandanus nemoralis has a raceme of up to 14 compressed, flattened cephalia of very short, white, drupes. A *nomina nuda* of St. John – P. semidivisus n.n. – was mentioned by Stone (1972b), he regarded this as possibly the female plant to match his ***P. decus-montium*** of which only the male is known. P. semidivisus n.n. has bright red drupes, but is otherwise said to be similar to *P. nemoralis*. At this stage it is difficult to judge the validity of this latter species (it may represent the mature fruit colour) without further material.

Males are only known for the two species with racemose inflorescences. The inflorescence is identical, with the male spikes replacing the cephalia. It is assumed that the male inflorescence in the remaining species will be similar, but this remains to be seen.

Section INVOLUTA

The stigma is table-like, with a narrow neck-like style.

This is another distinct and monotypic section. The section was originally based on *Pandanus involutus*, which is here regarded as synonymous with ***P. leiophyllus***. The species has a characteristic growth habit, with long proproots and short lateral branches. It has a small, ovoid cephalium, and drupes with a hard pileus with a prominent stigma.

Section JEANNERETIA

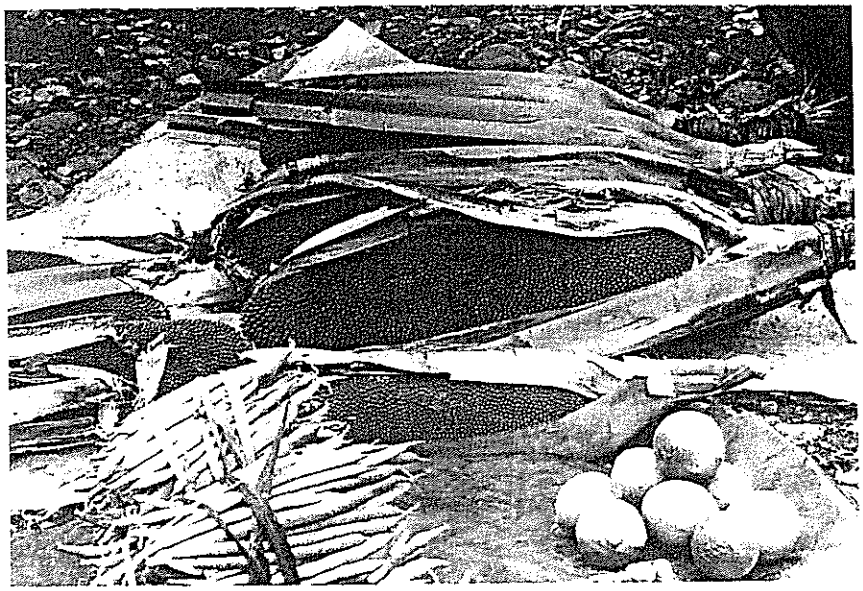
Has a raceme of cephalia borne on short side branches.

The coastal ***Pandanus polycephalus*** is a widespread and constant species. It is a small pandan, and the fruits appear to always be borne on short side branches. The fleshy drupes shrivel on drying, making the appearance quite different from fresh material. The male plant is known, the inflorescence comprising a raceme of short spikes subtended by bracts. Four synonymous names have already been sunk (Stone 1972b, 1974b).

THE '*MARITA*' PANDANS (*BUAH MERAH*) — Sections Kurzia and Microstigma.

Besides '*Karuka*', there is one other widely cultivated and eaten group of Pandans in New Guinea, the '*Maritas*', or '*Buah Merah*'. These can be seen for sale in markets throughout the island as long, bright red or yellow, angular cones enclosed in their long leafy bracts. It is prepared by splitting and coring the entire cephalium. This is then wrapped in leaves and baked in a stone oven, or placed in a bamboo tube and steamed, or more commonly nowadays, boiled in a cooking pot. The solid fat liquefies to become oil, which is expressed by hand, so as to separate the seeds. The resulting sauce is used to enhance the flavour of various starchy foods. Some cultivars, especially those with larger seeds, are eaten whole after cooking, and the seeds spat out after each mouthful.

These oil-pandans are members of sections §§Microstigma and §§Kurzia. They include a number of described species, which probably represent cultivars of two species – *P. conoideus* and *P. macgregorii*. Male plants are unknown for *P. conoideus*, and this may be a consequence of positive selection for female plants, and the destruction of males (Ben Stone pers. comm.). In West Sepik Province this species is said to disappear in regenerating forest after about 20 years (Juillerat 1984). In cases where the seeds of this species have been investigated, they are not viable, the plant being propagated by cuttings, although the diversity of cultivars suggests that viable seed may occur on occasion.



'Marita' fruits on sale at Goroka Market (from Stone 1982a).

Marita is most commonly cultivated between 700 and 2,000 m, although it has also been reported at 2,300 m, and on occasion at sea level. It is either grown singly or more usually in groves. In a given area there are usually numerous cultivars. In some communities as many as 36 cultivars may be recognised (Clarke 1971), although a dozen seems most usual (Hyndman 1984). As a consequence many species have been described, all of which can probably be reduced to the two species, although currently collections are too poor to make any conclusions on the variation norm.

Section **KURZIA**

With a horizontal stigma and a solitary male spike.

This section is characterised by the large, flat stigmas at the apex of the drupe. As in §§Microstigma, the drupe may be surrounded by a thin, oil-rich pericarp, which on maturity is bright red. The cephalium is more cylindrical in this species than it is in *P. conoideus*, which tends to have a somewhat more triangular in section. For the two species of §§Kurzia for which the male is known, the inflorescence is a solitary spike, unlike the remaining species in the sub-genus, which all have racemose male inflorescences.

Pandanus macgregorii is edible, and cooked and used in an identical manner to *P. conoideus*. It appears to be widely cultivated in the Bismark Archipelago, which has led to the selection of numerous varietals. The Maritas show some geographical separation, with *P. conoideus* more common on the New Guinea mainland, particular at higher altitudes, and *P. macgregorii* and its close relatives in the Bismarck Archipelago, Solomon islands, and other island areas such as Milne Bay.

Whilst it could be acknowledged that *P. conoideus* and *P. macgregorii* may be conspecific – *P.conoideus* being the domesticated form – they differ so strikingly in the stigma, that they are, for the time being anyway, left in different sections.

In this handbook I have aligned a number of Bismarck Island species, namely *P. englerianus*, *P. minusculus* and *P. latericius*, all from New Ireland, and *P. cominsii* from the Solomon Islands. These differ from *P. macgregorii* (Fergusson Island) in the smallest of vegetative characters, and although these may be significant on a regional scale (Stone, 1972a), I have not illustrated them here. The variety *P. cominsii* var. *augustus* was distinguished by Stone because of its longer cephalium and shorter drupes. It is uncertain where *P. hollrungii* was collected, but most probably somewhere on north coast Papua New Guinea. It appears to be a further Marita cultivar.

TABLE 2: Characters of the type specimens belonging to Section Kurzia

	Trunk(m)	Leaves(cm)	Cephalium(cm)	Drupes(mm)	Locality	Alt.(m)
P. cominsii	—	20 x 4	50 x 6	12-18 x 4-6	Siota Is.	0
P. englerianus	12	250 x 10	60 x 12	18 x 6	New Ireland	0
P. hollrungii	—	—	35 x 7	13 x 3	New Guinea	0?
P. latericius	10	205 x 4	35 x 9	12 x 3	New Ireland	0
P. macgregorii	—	136 x 4.5	25 x 5	20 x 8	Fergusson Is	?
P. minusculus	6-8	150-265 x 5	23 x 5	12 x 4	New Ireland	0
P. subumbellatus	7-14	200 x ?	20 x 8	15 x 3	Aru Is	0
P. species 1	1.5	150 x 3.5	14.5 x 4.5	13 x 2-3	Arfak Mts	400
P. species 2	3	250 x 7	19 x 11	23 x 4.5	Arfak Mts	300

KEY TO SECTION KURZIA IN SOLOMONS & BISMARCK ISLANDS (Stone 1972a)

1. Cephalia ovoid-ellipsoid, 3-5 x longer than broad .... *P. englerianus*
   Cephalia cylindric, 5-6(8) x longer than broad 2
   2. Cephalia to 50 cm long, cylindric, drupes 12-18 mm long .... *P. cominsii*
      Cephalia to 35 cm long, cylindric, drupes 15-20 mm long .... *P. macgregorii*
      Cephalia to 35 cm long, broader at base, drupes 12-13 mm long 3
      3. Leaf apex acute, marginal teeth 2 mm apart .... *P. minusculus*
         Leaf apex attenuate-acuminate, marginal teeth 4-8 mm apart *P. latericius*

Pandanus subumbellatus is found on the south coast of New Guinea and in the Aru Islands. The cephalium is distinctly oblong-ovoid, tapering evenly to the apex. The drupes have a flattened pileus, with a scarcely raised stigma. The male is known, and comprises a single spike of male flowers over 30 cm long, and 1.5 cm wide, tightly enclosed by narrow yellow bracts. Stone has reported an identical inflorescence for *P. minusculus* in New Ireland (1972b), albeit much smaller at 15 cm in length.

Two apparently undescribed species occur in the Arfak mountains, which appear to conform to this section. **Species 1** is a dwarf species with a minute cylindrical cephalium, while **Species 2**, which grows in the same area, is a larger tree with a much larger, ovoid and angular cephalium. The proproots of Species 2 arise perpendicular to the trunk, in a very characteristic manner.

This section is in need of reappraisal, and molecular systematics will probably be required to determine whether some of these species are horticultural in origin. Likewise members of the *P. conoideus* complex need to be looked at in a similar way. As an important and unique food source in New Guinea, these oil-pandans would repay study.

Section LEPTOCARPA

Drupes slender, matchstick-like.

Pandanus leptocarpus has a large cephalium with many hundreds of matchstick-like drupes. It forms pure stands on the inside curves of river banks in Gulf and Western Province. The habit is unusual, with the sometimes partly decumbent trunks producing many sucker shoots, and forming dense thickets. Besides the sucker shoots the trunk has a characteristic spiral of buds, each with a distinctive cordate outline. The sucker shoot leaves are dark green, and have thorns near the base of the midrib, while the main trunk bears glaucous leaves with unarmed midribs.

Stone (1982a) has pointed out that *P. leptocarpus* is similar in fruit and habitat to *P. helicopus* Kurz, a Malayan species dispersed by turtles which eat the floating drupes, and thus ensure upstream dispersal. No observations have yet been made in New Guinea.

Section MARGINATA

Stigma horse-shoe shaped.

Pandanus meniscostigma is a distinct species with its cylindric cephalium of small drupes with a raised horse-shoe shaped stigma. *Pandanus marginata* is clearly a synonym, as is a manuscript name of St. John's 'darbyshire'. A collection from Cape Vogel in S.E. Papua New Guinea (Brass 21906) has unthorned leaf tips.

Section MICROSTIGMA

Stigmas oblique, male spikes racemose.

Pandanus conoideus is cultivated throughout the Moluccas and New Guinea, and is an oil-pandan like *P. macgregorii.* Plants are propagated by cuttings, although viable seed may be set on occasion. *Pandanus erythros, P. magnificus, P. plicatus, P. ruber,* P. rubrispicatus n.n. and P. sattelbergensis n.n. are probably all cultivars of this same species. As mentioned under §§Kurzia, it could be that this species is conspecific with *P. macgregorii,* representing the domesticated form. The two can be distinguished by the usually larger cephalia of *P. conoideus,* and the drupes have a stigma which is not terminal, but oblique, and the leaf tips which are rounded and acuminate, unlike the tapering to acute apices of *P. macgregorii. Pandanus conoideus* has not been recorded from the wild, while *P. macgregorii* is known from the wild in New Ireland and the Solomon Islands. Cultivation has without doubt selected for greater diversity, and specific delimitations, if they exist, may no longer be discernible.

TABLE 3: Characters of the type specimens of the 'Marita' Pandans in §§Microstigma

	Trunk(m)	Leaves(cm)	Cephalium(cm)	Drupes(mm)	Type Loc.	Alt.(m)
P. conoideus	—	—	—	—	Ambon	0
P. erythros	—	200 x 8	27 x 5	14 x 5	Central	1,000
P. magnificus	—	—	65 x 11	16 x 5	Manus	?
P. plicatus	—	—	20 x 6.3	22 x 4	Central	400
P. ruber	3-5	172 x 10	42 x 10	15 x 4.5	Central	1,450

Two other species belong to this section, by their possession of apical, laterally directed, stigmas. ***Pandanus exiguus***, a small upright plant of swampy sites, it has a small cephalium, and drupes with a prominent, more or less horseshoe-shaped stigma. The drupes have an oily pericarp much like *P. conoideus.*

Pandanus leptocaulis has a raceme of 1-3, small, ellipsoid cephalia with short, blunt drupes. It is a highland species, and widespread from the Owen Stanley ranges to the central mountain ranges of Irian Jaya. In growth form it is similar to *P. exiguus.* Like

P. exiguus it could be equally well placed in §§Marginata on account of its somewhat horseshoe-shaped stigma. A raceme of cephalia is rare in the sub-genus, only being found in §§Curvifolia and §§Jeanneretia.

Section **PARALOPHOSTIGMA**

Drupes connate into 2-4-loculled polydrupes.

This section was originally placed in §Lophostigma when it was described (Stone, 1974b), but later moved to §Kurzia (Stone 1982a, 1984), after the investigations of Huynh (1976) showed that it had many micromorphological characters in common with §§Kurzia and §§Microstigma.

In appearance these species have a characteristically flattened and spreading crown. They tend to be short, unbranched trees with very small proproots. They commence fruiting at a height of a metre or less. The cephalium has a mixtures of solitary and fused drupes, these polydrupes occur as laterally fused rows. The drupes of *P. balenii*, *P. clarkei* and *P. daymanensis* tend to be less commonly fused, except near the base of the cephalium, while those of *P. limbatus* appear to be more frequently fused into phalanges of 2-4 drupes, in which the pileus's are more or less confluent. The endocarp is characteristically short and basal, and apically flat-topped, while the upper mesocarp is soft and fleshy, and on drying shrivels considerably, often leaving an air space immediately above the endocarp.

Pandanus limbatus is a southern species, usually found at greater altitudes than the remaining species, while *P. balenii* and *P. clarkei* are confined to northern New Guinea. *Pandanus limbatus* on Crater Mt. is regularly dispersed by Cassowaries (Debbie Wright and Andy Mack pers. comm.)

Pandanus balenii is characterised by its narrower drupes, and short abrupt pileus. Some collections are recorded as having long-cylindric cephalia (Kanehira 1941), while others have ovoid cephalia similar to *P. limbatus*. Collections from the Sepik Province of Papua New Guinea match the type collection, however material from Waigeo Island, that is otherwise a good fit for this species, has drupes up to twice the length. The pileus is more or less identical in both however. These two drupe forms are illustrated.

Pandanus clarkei is distinguished from *P. balenii* by its larger, fusiform drupes, and from *P. limbatus* by the preponderance of solitary drupes in the smaller cephalium. It was originally distinguished on account of its supposedly unique, oblique leaf tip, this appears, however, to be a regular feature of all the species in this section. The male of this species is known. It comprises a loose raceme of 3-4 spikes, clustered towards the end of a 70 cm long peduncle which bears a series of bright yellow bracts reducing from broad leaf-like blades of 120 x 9 cm through a series of 9 to an ultimate bract of 5 x 0.2 cm. The spikes are up to 33 x 2 cm, triangular in section, and the ultimate pair were fused in their lower quarter. The anthers are about 3 x 1 mm in size, with a small apical lobe, and are sessile on a thickened filament to 3 x 2 mm. These filaments appear to be free, although they are in fact loosely associated in more or less elliptic clusters of 4-6 anthers.

The fourth species, ***P. daymanensis***, is a dwarf species. It has previously been placed in §§Microstigma (St. John 1973) and §§Macrokurzia, which was created for it alone (Stone, 1987). As with *P. balenii* and *P. clarkei*, the drupes are rarely, if at all, fused, and the cephalium is much smaller, with far fewer drupes. The type may well be an immature collection. Other Brass collections from Central Province originally assigned to *P. balenii* (Merrill & Perry 1939) may belong here, but I have not seen the material. A *nomina nuda* of St. John – P. sattelbergensis n.n. – was said to be closely related to *P. daymanensis* (St. John 1973), although it is not clear what specimen St. John intended to attach this name to, since it has been applied to 2 different entities in different herbaria (Ben Stone pers. comm.), and from St. John's description I am inclined to regard it as a further cultivar of *P. conoideus* (§§Microstigma).

Section UNNAMED

Stigma large, apical and, cordate.

Pandanus navicularis is a clear-cut species, with large cordate stigmas, and rounded, acute-tipped leaf apices with toothed lateral pleats. It has only been collected in the south of New Ireland. Stone originally placed the species in section Bryantia (1974a), but reduced this section to §§Microstigma (1974b) later on. The stigma precludes its inclusion in this latter section, and it therefore remains unplaced.

Section UNNAMED

Drupes connate into 3-5-loculled polydrupes.

Species 3 is a large, branching tree with long, spreading proproots and a strikingly ovoid cephalium composed of bright yellow drupes either fused into rows of three, or into small phalanges of up to 5 drupes. Although superficially similar to the polydrupes of section §§Paralophostigma, the quite distinct appearance of the tree, and the internal anatomy of the drupe suggest it is better placed in a separate section. The polydrupes are more symmetrical and even, compared to the less regular polydrupes of section §§Paralophostigma. Andy Mack collected this species at 1,000 metres on Crater Mt. (AM 343) where it is reasonably common, and eaten by Cassowaries.

Whether this species is better placed in sub-genus §Lophostigma is also debatable. These two sub-genera are presently not satisfactory. St. John originally devised just 2 sub-genera within the whole genus: §Pandanus with phalangiate fruits, and §Lophostigma with monodrupaceous fruits (1960). Stone demonstrated the limitations of this arrangement (1968), and proposed eight sub-genera (1974b). §Lophostigma and §Kurzia were distinguished on the basis of fairly subtle stigma characters, the former having an eccentric, usually erect or overtopped stigma, the latter with a centric, usually flattened or plane stigma. Trees of §Lophostigma tend to be larger, often with wide-spreading proproots, while those of §Kurzia tend to be trees of small stature, often with short, slender proproots. Stone was later of the opinion that these two sub-genera are no longer satisfactory, and it is doubtful that they are natural groupings (pers. comm.).

Thus Species 3 is a problematic individual, and it is placed in sub-genus Kurzia without any substantive reasoning other than the outward similarity of the drupe apex and stigma to members of §§Paralophostigma. A further unusual feature of this species is that the midribs are unarmed below, an rare character in the genus.

SUB-GENUS: **LOPHOSTIGMA**

This sub-genus is the most speciose in New Guinea. Originally described as a sub-genus by St. John (1960) to include all species with unilocular drupes, Stone revised the circumscription (1974b) to include other related sections in which the stigma is eccentric and erect, and the style often curved or pointed, and overtopping the stigma.

SECTION **CAULIFLORA**

* P. lamprocephalus (m)

SECTION **KARUKA**

* P. brosimos (m)
* P. iwen
* P. jiulianettii

SECTION **LINIOBTUTUS**

P. boemiensis
P. foveolatus
'gurain' P. hooglandii
'imbricatus' * P. hystrix (m)
P. orculaeformis
* P. penicillus
* P. species 4

SECTION **MAGNICAVERNOSA**

* P. magnicavernosus

SECTION **MAYSOPS**

P. aprilensis
P. auritus n.n.
* P. beccarii (m)
'bidentatus' P. bidrupaceus n.n.
'bukaensis' P. biciliatus
'croceus' St. John P. biformatus
'ebra' * P. castaneus (m)
'helodes' P. cernuifolius (m)
'huntii' P. cernuus n.n.
'karisu' P. clausus
'labratus' * P. concavus
'pia' * P. croceus(m) Stone
'suspensus' P. daulos n.n.
'violaceus' * P. flavicarpus
P. flexibilis n.n.
P. floribundus
P. gogolensis n.n.
P. imbrialis n.n.
P. isis
P. kivi
* P. kosteri (m)
* P. krauelianus (m)
P. luteus
P. maneauensis n.n.
P. microdontus
P. nakanaiensis
P. perryae n.n.
P. reconditus n.n.
* P. roseus
* P. rubellus
* P. spodiophyllus (m)
P. tabbersianus
P. xanthocarpus
P. wauensis n.n.

SECTION **MEGASTIGMA**

'fastosus'

* P. rex
* P. schoddei

SECTION **METAMAYSOPS**

* P. brachyphyllus
* P. galorei

SECTION **PERRYA**

* P. aggregatus
* P. archboldianus
'falcatus' * P. galeatus
* P. vinkii n.n. (= Species 5)
P. viridiruber n.n.
* P. species 6

SECTION **STONEDENDRON**

'deltoideus'

* P. atropurpureus
* P. columbiformis
* P. concinnus
* P. species 7 (m)

SECTION UNCERTAIN

* P. pendulinus (m)

The sub-genus Lophostigma was examined in some detail by Huynh (1976) at the microspcopic level, and by Stone (1974b) at the macroscopic level. The two studies show a high degree of congruence. Huynh's studies (1976) suggest certain reltionships between the sections. The sections §§Maysops, §§Metamaysops and §§Perrya are closely linked by microscopic characters of their leaves, and §§Stonedendron also shows links to these three sections, although this latter section has much in common with §§Lophostigma, a section confined to New Caledonia. §§Magnicavernosa was placed in the sub-genus by Huynh on account of its similarities to §§Megastigma (1976). §§Karuka is somewhat isolated, and could be equally well placed in the sub-genus Kurzia on micromorphological grounds (Huynh 1976), although its overall morphology is decisive in retaining it here (Stone 1974b, 1982a). §§Liniobtutus shows micromorphological similarities to §§Cauliflora (Huynh 1976).

Section **CAULIFLORA**

Cephalium borne laterally on short deciduous branches.

Pandanus lamprocephalus is the sole member of this section in the region. The inflorescences are borne on lateral branches, although the tree remains vegetatively unbranched. The male plant unknown. Other members of this section are found in Fiji and Vanuatu. The inflorescence of *P. halleorum* Stone (Vanuatu) is paniculate, and Stone regards this species as a relic, sharing inflorescence features with the genus *Sararanga* (Stone, 1975).

Section **KARUKA**

Drupes with a conical pileus.

This section comprises the edible 'Karuka' nuts of the New Guinea highlands. All highlanders distinguish many cultivars of ***Pandanus jiulianettii*** which is not known from the wild, and usually several varieties of the wild *P. brosimos*. ***Pandanus brosimos*** is a taller, less branched tree, with upright leaves and short proproots, while *P. jiulianettii* has longer, broader leaves that tend to be bent. ***Pandanus iwen*** was distinguished by Stone, from but I was unable to locate the type at LAE, the distinction from *P. brosimos* seems slight and it is probable that there is much variation to investigate in this supposedly wild species. *Pandanus iwen* differs in its smaller drupe and habit, with longer, more widespreading proproots than P. brosimos.

Pandanus carrii was described as a relative of the Karukas (St. John 1968), but the material I examined at Kew comprised a phalange of *P. tectorius*. St. John mentions that the duplicate of the type material in the Arnold Arboretum was also a member of §§Pandanus. Either the Kew material is a mixture also, or *P. carrii* is a most unusual species. It is most likely that the material is mixed, and although the description of the drupe suggests it is a member of §§Microstigma or §§Karuka, it is probably better to regard the species as of uncertain status.

'KARUKA'

The section Karuka was named after the New Guinea pidgin name for these trees (Stone 1974a). One species *P. brosimos* is a major feature of the montane forests of New Guinea, not least because it is actively encouraged by the highlanders, representing, as it does, an important food source. In the Upper Kaironk valley (Eastern Highlands, Papua New Guinea), 23 varietal names are recorded (Majnep & Bulmer 1977). Little-branched trees with large leaves, and a marcescent skirt of dead leaves they are often found in extensive groves, and the rustling rattle of their leaves in the drifting mist of a New Guinea ridge top is one of the most memorable sights and sounds of the Highland forests.

In most highland valleys there are a dozen or more cultivars of *P. jiulianettii*. Although the cephalium is smaller than the 'wild' *P. brosimos*, the individual drupes are larger, and have a thinner shell which can be cracked with the teeth, they develop and ripen in about half the time, and produce two, or rarely three, crops in a year, compared to the single crop of

the wild Karukas (*P. brosimos* and *P. iwen*). *Pandanus jiulianettii* trees are both smaller and begin fruiting at a younger age than the wild Karukas, and they are probably parthenogenic (Rose 1982).

Pandanus jiulianettii may be a cultivated form of *P. brosimos*, and the variation seen in domestic and wild 'species' today may be an artifact of nearly 20,000 years of human intervention. *Pandanus iwen* was collected for the first time in 1981, and even though the Wopkaimin people recognise three 'wild' species; 'Kaun' (*P. brosimos*), 'Iwen' (*P. iwen*) and 'Mimkan' (Hyndman 1984), the last named has yet to be collected. Although common and widespread, collections of Karukas are few, and have invariably been made by Ethnographers. *Pandanus iwen* is said to dominate the Star Mountains of PNG (Hyndman 1984), but only one collection has been made, and no doubt big advances in the taxonomy of this section could be made with further ethnological collections.

The Karuka season appears to vary for different areas – Southern Highlands: June, Central Highlands: Dec-March, Schrader Mts: Jan, Finnisterre Mts: Jan. Furthermore it is not every year that a crop of any significance occurs, and studies suggest that there is probably only a heavy crop every 3 years or more (Rose 1982). There is evidence to suggest that drought may be the most important trigger in bringing about mass-flowering of the Karukas (Mike Bourke, pers. comm.). The Karukas at Teptep (Finnisterre Mts) are said not to have fruited from 1982 till 1992 (Kocher Schmidt, 1991). The last recorded widespread drought (with highland frosts) in New Guinea was 1982. Two consecutive dry years, 1990 and 1991, in Teptep may have triggered the most recent fruiting. Likewise the heavy crop recorded by Rose (1982) for 1977 followed a dry period in 1976.

The drupes of the Karukas are either eaten fresh or roasted. In most valleys, large quantities of nuts are smoke-dried in the roofs of the houses, to preserve them after the short season (2-3 months). An interesting phenomenon known as "Karuka madness" occurs in some areas of the highlands when the Karuka's first become ripe. It has been suggested that the presence of Dimethyltriptamine, in the nuts may be responsible for this (Hyndman 1984). The potential for agronomic studies of the Karukas was investigated by Stone (1982b).

One of the large tree-dwelling rodents in New Guinea – *Anisomys imitator* – is reported as being of importance in dispersing Karukas in two independent publications (Majnep & Bulmer 1990, Kocher Schmid 1991). According to tradition in both areas (The Schrader Mts. and Finnisterre Mts respectively) this large rodent cleans the husk from the nuts of *Pandanus brosimos*, *P. jiulianettii* and *P. antaresensis* and places them in an underground store. It is then said to bury the kernels after they have begun to germinate. It is possible that the rat rejects the germinating seeds from its store, giving the impression of a deliberate act. Whatever, this is a fascinating piece of folklore, confirmed in independent areas of Papua New Guinea. Andy Mack and Debbie Wright similarly report that undetermined rats remove the *Pandanus* seeds from Cassowary droppings, and transport them over short distances.

Section **LINIOBTUTUS**

Fusiform polydrupes with clustered stigmas.

This section is characterised by long, thick, and spreading proproots, and a rounded cephalium of polydrupes. The stigmas are crowded at the apex of the polydrupe, and barely distinguishable – in most cases it is necessary to slice the polydrupe at its centre to determine the number of locules. The polydrupes are glaucous-green at the apex and red or pink below and may also be pinkish where they are hidden below bracts. In some species, or at least specimens (?), they are clearly arranged in vertical rows (Brass 7007).

The position of this section remains enigmatic. Both Kanehira and Merrill & Perry placed the section in sub-genus Hombronia. Stone (1974b and 1982a) placed it in sub-genus Lophostigma, but in a 1984 paper he moved it to sub-genus Pandanus without comment.

Huynh has concluded from micromorphological evidence that it is best placed in §§Lophostigma (Huynh 1976). An interesting observation is that the polydrupes are often arranged in distinct vertical rows, such an arrangement is seen in *Pandanus dubius* (§Hombronia). The overall appearance of the plants in this section, with their broad leaves and large, thick proproots is also shared with *P. dubius*.

Pandanus hystrix is characterised by its dorso-ventrally flattened polydrupes with 4-7 locules. From Brass's description it is clearly a bizarre plant; the short branching stem is held in a reclining position 12-14 metres above the ground on enormously developed, spreading proproots (Brass 7007). Photographs of the cephalium show the polydrupes arranged in strikingly vertical rows. *Pandanus hooglandii* is probably a synonym, as is *P. orculaeformis*, which is appears to be an immature specimen with an undeveloped fruit.

Pandanus penicillus has more or less round-sectioned polydrupes, with 3-7 locules. The ripe fruits have a deliciously aromatic smell, and are dispersed by Cassowaries on Crater Mt. (Debbie Wright and Andy Mack pers. comm.). the species has proproots which appear high on the plant, often descending from 8 or 10 metres above ground level. A consequence of this is that the main trunk is able to increase in diameter at a considerable height, giving the tree a characteristic tappering trunk. *Pandanus foveolatus* is probably a synonym, as is *Pandanus boemiensis*, probably representing a very young *P. penicillus*. Two manuscript names of St. John – 'gurain' and 'imbricatus' – probably also belong here.

A collection from Western Province (Foreman & Katik NGF 48469) has small polydrupes not unlike a minute *P. penicillus*, but these differ in having at least 12 locules, versus the 2-6 locules of *P. boemiensis* or *P. penicillus*, furthermore it has a much smaller number of drupes in its cephalium, and it may represent an undescribed species (**Species 4**).

Section MAGNICAVERNOSA

has 1-3 loculed drupes with cordate stigmas.

Pandanus magnicavernosus is a unique species with no apparent affinities. The drupes may be 1 to 3-loculed, with conical styles with apical stigmas. Formerly placed in sub-genus *Pandanus* (Stone 1974), Huynh (1976) showed that many features favoured its transfer to sub-genus Lophostigma.

Section MAYSOPS (1)

Cephalia resembling an ear of maize, with flat-topped drupes.

This must be one of the most distinctive, and natural, sections in New Guinea, and the species are common constituents of many lowland forests. It is a remarkably uniform section, and species delimitations are difficult. The species are listed in Table 4, the recognised species are printed in bold, followed by their synonyms, as recognised in this guide, in alphabetical order. Stone has recently revised this section (1992), and the species he recognises in the region are preceeded by an asterisk. Many species are still known by only one or a few specimens.

Pandanus beccarii is a species of low to medium altitudes from the south side of mainland New Guinea. The proproots are more erect, and drop straight to the ground, forming a tight cone one to two metres tall at the base of the trunk. The cephalium is large, with upwards of 12,000 individual drupes. The apices of the drupes are dark brown and concave, and from their centre arises a bony, yellow, flat-topped style with an acutely pointed stigma to one side. The style contrasts noticeably with the dark-topped drupe, while below, the drupe flesh is a bright red. I have not seen all the type specimens of the species I have included in *P. beccarii* here. The types of *P. cernuifolius* and *P. xanthocarpus* are both immature specimens. *Pandanus aprilensis, P. clausus, P. floribundus, P. microdontus*, and P. perryae n.n. are also regarded as synonyms.

TABLE 4: Characters of the type specimens of species belonging to Section Maysops

		Trunk (m)	Leaves(cm)	Cephalium(cm)	Drupes(mm)	Type Loc.	Alt.(m)
*	**P. beccarii**	–	**300 x 9**	**30 x 11**	**14 x 4**	**Aru**	**0**
	P. aprilensis	–	250 x 11.2	32 x 8	23 x 6	Sepik	50
*	P. cernuifolius	4	160 x 5.3	8 x 4	16 x 3	Central	500
	P. clausus	–	200 x 7.5	32 x 10	27 x 6.5	Morobe	1,000
	P. floribundus	14	300 x 8	45 x 14	20 x 5	Western	100
*	P. microdontus	4	300 x 8	25 x 8.5	20 x 4	Western	0
*	P. xanthocarpus	7	170 x 8	22 x 11	30 x 3	Western	40
*	**P. castaneus**	8	**280 x 7**	**23 x 7**	**20 x 9**	**East. Hghs.**	**1,370**
	P. luteus	12	180 x 7	35 x 10.5	15 x 6.5	Goodenough	1,600
*	**P. concavus**	14	**190 x 7**	**47 x 8**	**15 x 7**	**Star Mts. IJ.**	**1,500**
*	**P. croceus**	15	**300 x 10**	**41 x 13**	**13 x 5**	**Manus**	**0-500**
*	**P. kosteri**	1.7	**100 x 5**	**6.5 x 3.5**	**15 x 5**	**Kebar, IJ.**	**950**
*	**P. krauelianus**	–	**? x 3.8**	**20 x 8**	**17 x 5**	**Finschhafen**	**0**
	P. biciliatus	10	174 x 5.5	42 x 8	16 x 4.8	Woodlark	100
	P. biformatus	10	150 x 4.5	23 x 7.5	23 x 6	Milne Bay	200
	P. isis	–	200 x 5	30 x 15	21 x 6	New Ireland	0
	P. kivi	7	180 x 4	20 x 7	17 x 5	Central	100
	P. nakanaiensis	5	190 x 3.3	8.5 x 3.4	14 x 4	New Britain	0
*	P. tabbersianus	5	300 x 6	40 x 10	21 x 5	Manokwari	30
*	**P. spodiophyllus**	20	**210 x 6**	**28 x 11**	**30 x 12**	**New Britain**	**100**
*	**P. flavicarpus**	15	**300 x 13**	**50 x 15**	**23 x 5**	**Santa Ysabe**	**10**
*	**P. roseus**	15	**190 x 11**	**28 x 12**	**30 x 7**	**New Georgia**	**0**
*	**P. rubellus**	15	**230 x 6.5**	**30 x 12**	**25 x 6**	**Buka**	**0**

Species in bold as recognised in this guide, followed by their synonyms in alpha order.
* = Species recognised as valid by Stone (1992). N.B. Stone also regarded *P. amboinensis* as being found in New Guinea, and with this species he synonymised *P. luteus* and *P. biciliatus*.

Pandanus castaneus is a distinctive species occurring in the northern mountain ranges and foothills, from the Cycloop mountains in the west, to Milne Bay in the east. It is a slender tree, characterised by its small proproots, and an uncrowded crown of leaves. Similar in appearance to ***P. krauelianus*** it differs in its more slender, taller trunk, slightly broader, and not glaucous leaves, less crowded foliage crowns, most of the inflorescence bracts are shorter than the cephalium, which tends to be smaller, and salmon pink to orange-red in colour. The male spikes are also much shorter than those of *P. krauelianus*. P. daulos n.n., *P. luteus* and P. maneauensis n.n., are regarded as synonymous.

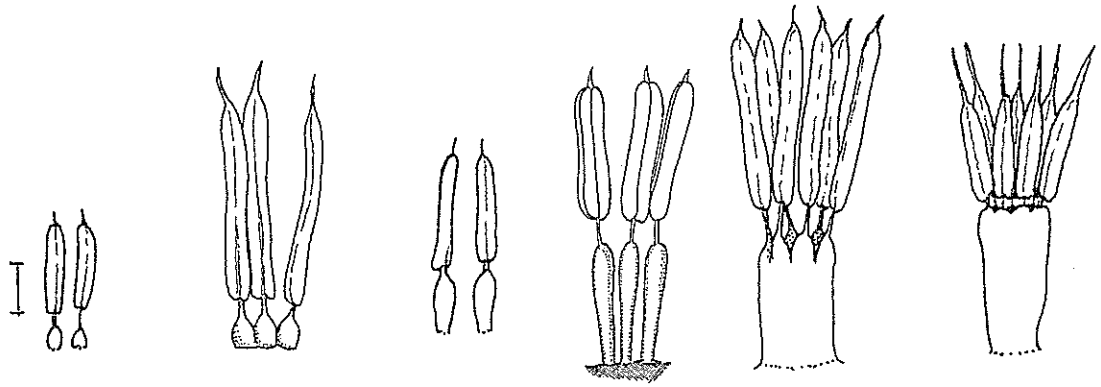
Pandanus concavus is a high altitude species. It appears to have a fairly discrete distribution on the southern flanks of the central ranges of New Guinea. It is similar in many respects to *P. beccarii*, differing in its shorter drupes and longer proproots, although otherwise the distinction is not clearcut. The male is unknown.

Pandanus croceus is geographically isolated on Manus Island, and is morphologically distinct, being a broad-leafed species with a large cephalium with relatively small drupes. The male is known.

Pandanus kosteri is minute in all its parts, with small leaves and a small cephalium. The drupes are red, and the male inflorescence, like the female cephalium, has red bracts. The type specimen has also been cited for the invalidly published P. cernuus n.n. It is found in the Vogelkop region of Irian Jaya, coincidentally the range of several other 'miniature' pandans – *P. ornithocephalus, P. permicron* and Species 1.

Pandanus krauelianus is a widespread species of low altitudes occurring throughout New Guinea and the Bismarck Archipelago. The proproots are few and tend to spread widely from the base. The leaves are narrow and a glaucous grey-green in colour. The

cephalium is almost smooth, in that the style is barely raised, if not somewhat sunken into the flat-topped drupes. The drupes are yellow, orange or pink. This species is found along the north coast of New Guinea and in the Bismarck Archipelago, from sea level up to 1,500 m. The male has been collected on several occasions. The species included under *P. krauelianus* here are morphologically all very close. My only doubts are with *P. kivi*, which is geographically somewhat out of place, although there are several other collections from Western Province which match the combination of narrow leaves and scarcely raised stigmas. *Pandanus tabbersianus* is also placed here with reservation, since I have not seen the type. Ben Stone (1992) regards this as a legitimate species, although having visited Manokwari I believe the type may be an unbranched *P. krauelianus*, with a consequently broader leaf and larger cephalium. P. auritus n.n., *P. biciliatus*, P. bidrupaceus n.n., *P. biformatus*, P. flexibilis n.n., P. gogolensis n.n., P. imbrialis n.n., *P. isis*, *P. kivi*, *P. nakanaiensis*, P. reconditus n.n., *P. tabbersianus* and P. wauensis n.n. are all regarded as synonyms. Manuscript names of St. John which also match this species include 'bidentatus', 'ebra', 'huntii', 'karisu', 'pia', 'suspensus' and 'violaceus'.



P. beccarii P. castaneus P. spodiophyllus P. croceus P. krauelianus P. kosteri

Male phalanges of some of the species in Section Maysops

Pandanus spodiophyllus is confined to the Gazelle Peninsula of New Britain, it has several distinct features, including silvery undersides to the leaves, and the large drupes with an angular, prismatic pileus with small, unvisored stigma. It is like a more robust form of *P. krauelianus* (Stone, 1972b). The male is known. It is eaten by people in the area in which it occurs, although it is not recorded as to whether it is highly regarded. Certainly other species of §§Maysops have also been recorded as edible (Hyndman 1984), although they can also cause irritation of the mouth, and are probably only eaten during famine periods.

Pandanus flavicarpus, P. roseus and ***P. rubellus*** are distinct Solomon Island entities, unfortunately represented by far too few specimens. *Pandanus roseus* is only known by the type collection from Rendova Island. Like *P. croceus* of Manus island they are large trees with broad leaves, and may represent island forms of a widespread species. Collections from near Lae (including 'labratus') match *P. rubellus*. It may be that these species are better considered as being conspecific or at least contiguous with *P. beccarii*, a species otherwise confined to the south of New Guinea, with which they share many vegetative features. Manuscript names include 'croceus' sensu St. John, 'helodes' and 'bukaensis'. There is a single male collection of a §§Maysops from Kolombangara Island, but it cannot be confidently assigned to one of these species (Stone 1972b).

Section MAYSOPS (2) — according to Stone (1992)

Ben Stone's revision is the most recent publication on New Guinea *Pandanus* and it seems appropriate to include a summary here. Ben Stone worked on the genus for some thirty years, and he saw and collected more of the species in this section than I have, in addition he has viewed all the types, which I have not done.

1a. Small shrubs to c.1.5 m tall. Cephalium small, oblong-ellipsoid, c. 6.5 x 3.5 cm. Drupes red, 15 x 4-5 mm. Leaf midrib proximally unarmed. Apex of blade broadly acute. Leaf margins with small equal prickles. **1. P. kosteri**

b. Arborescent shrubs or trees mostly 2-12(-16)m tall. Cephalium ellipsoid-oblong or narrowly ovoid-cylindric, mostly 15-50 cm long. Drupes variously coloured (yellow, orange, red, pink, rarely purplish), mostly 12-30 mm long. Leaf midrib proximally usually prickly. Apex of blade often somewhat acuminate. Leaf margins with equal or sometimes unequal prickles when unequal, sometimes with larger and smaller ones alternating). 2

2a. Drupes slender, elongate, 30-32 mm long, 3-4 mm wide. Stigmatic turret raised c.1 mm above the pilear rim; pileus 3-4 mm high. Leaves large, 7.5-8 cm wide. Fruit orange to yellow. **2 .P. xanthocarpus**

b. Drupes mostly shorter and proportionately broader, usually (12-)15-29 mm long. Stigmatic turret raised or at the same level as, or lower than, the pilear rim. Pileus usually somewhat wider than long. 3

3a. Leaf margins with rather widely spaced prickles, these not or not very much increasingly crowded toward the base, and mostly equal. Leaves rather large (?this seems to be an error), often 7 cm wide or more . 4

b. Leaf margins near base and apex with increasingly more crowded prickles, these often unequal, larger and smaller ones alternating. Leaves small to large. 6

4a. Leaves not over 5.5 cm wide, usually about 150 cm long. Drupes orange-brown, at least 16 mm long (immature **5. P. cernuifolius**

b. Leaves mostly 7-11 cm wide. 5

5a. Drupes pink, 20 x 4 mm, the pileus slightly concave. Cephalium c.25 cm long, 8.5 cm wide. Leaves c.275-300 cm long, 6.8-8.5 cm wide. **3. P. microdontus**

b. Drupes red, 20-25(-27) x 4-6 mm, the pileus with convex turret. Cephalium c.32-45 cm long, (7-) 11-14 cm wide. Leaves usually 300-400 cm long, 7-11.2 cm wide. **4. P. beccarii**

6a. Ripe fruits yellow, the pericarp yellow throughout (not orange or red, not bicoloured). Stylar visor usually 3-more-toothed (rarely only 2-toothed), usually evidently excentric. Drupe apex slightly . 7

b. Ripe fruit purplish to red, vermilion, orange, or pink. Stylar visor 1- or 2-toothed (rarely more), sometimes deltoid, often situated on a subcentral rounded turret. 10

7a. Drupes 12-13 mm long, 4-5 mm wide. Cephalium 28-41 cm. Style flattened, visor 2-toothed. Leaves large, 200-400 cm long, 7-12 cm wide. **6. P. croceus**

b. Drupes longer. Cephalium somewhat shorter. Leaves smaller, up to 5-6 cm. 8

8a. Leaves slender, usually 2-4 cm wide, very glaucous beneath. Cephalium rather short ovoid, 10-20(-25) cm long, broadest near base. Drupes (15-)19-22(-24) mm long; style usually 3 or more-toothed. **7. P. krauelianus**

b. Leaves mostly 5-8 cm wide. Cephalium to about 30 cm long, mostly ellipsoid. Drupes 13-30 mm long. 9

9a. Leaves 5-6 cm wide. Drupes 20-30 mm long. Stylar visor usually 3-toothed. **8. P. tabbersianus**

b. Leaves 5.5-7.5 cm wide. Drupes 13-16 mm long. **9. P. amboinensis**

10a. Drupes short truncate, 14-15.5 mm long. Cephalium elongate, 38-48 cm long. Leaves c.200 cm long 7 cm wide. **10. P. concavus**

b. Drupes longer, 17-25 mm long. Cephalium 19-45 cm long, ovoid sub-cylindric. Leaves 5-10 cm wide. 11

11a. Drupes 17-20 mm long. Cephalium short-ovoid ellipsoid, 19-23 cm long. Leaves 5-7 cm wide. **11. P. castaneus**

b. Drupes 20-25(-27)mm long. Cephalium ovoid sub-cylindric, 32-45 cm long. Leaves 200-400 cm long, 7-11.2 cm wide. **4. P. beccarii**

1a. Ripe drupes pink; stylar turret above rim of pileus; ventral pleats of leaf apex with few scattered teeth or sometimes unarmed. **14. P. roseus**
b. Ripe drupes red or yellow; stylar turret usually surrounded by a pilear rim, sometimes lower than this rim. 2
2a. Drupes completely dark red; leaf apex acute, not or scarcely acuminate; ventral pleats of leaf apex with numerous, though not crowded, teeth. **15. P. rubellus**
b. Drupes all yellow except brown apex; leaf apex slender attenuate **16. P. spodiophyllus**
c. Drupes with vermilion pileus, yellow base; leaf apex somewhat acuminate; ventral pleats with few or no teeth. **13. P. flavicarpus**

ONLY AUSTRALIAN SPECIES **12. P. zea**

TABLE 5: §§MAYSOPS according to Stone (1992)

1. P. kosteri* (P. cernuus n.n.) Vogelkop, Irian Jaya.
2. P. xanthocarpus (P. maneauensis n.n.): Western & Milne Bay Prov., PNG.
3. P. microdontus: Western, PNG.
4. P. beccarii* (P. aprilensis; P. clausus; P. floribundus; P. daulos n.n.; P. perryae n.n.): Aru Is; Western, Gulf, Sepik, Morobe, Milne Bay, PNG.
5. P. cernuifolius: Jayapura, IJ; Central, PNG.
6. P. croceus*: Manus, PNG.
7. P. krauelianus* (P. flexibilis n.n.; P. nakanaiensis; 'bidentatus'; 'reconditus'; P. wauensis n.n.): Madang, Morobe, New Britain, Western, Western Highlands, Central, PNG.
8. P. tabbersianus (P. biformatus; P. imbrialis n.n.; P. kivi; 'auritus'; 'bidrupaceus'; 'suspensus')
9. P. amboinensis (P. biciliatus; P. luteus; 'ebra': Manokwari, IJ; Milne Bay, PNG.
10. P. concavus*: Merauke, IJ; Western, South Highlands, PNG.
11. P. castaneus*: Western Highlands, Eastern Highlands, PNG.
(12. P. zea: Australia).
13. P. flavicarpus* ('helodes'): Santa Ysabel, Solomons.
14. P. roseus*: Rendova, Solomons.
15. P. rubellus* ('bukaensis'): Bougainville Is; Guadalcanal, Solomons.
16. P. spodiophyllus*: New Britain, PNG.

* = Recognised in this guide.

Section **MEGASTIGMA**

Drupes very large with a horizontal or oblique stigma.

Pandanus rex has only been collected once in Gulf Province from low altitude. Ben Stone spent several days searching for this species in the type locality without success. This enigmatic rarity shown by many *Pandanus* species may be merely a consequence of sporadic flowering and fruiting. I have often seen sterile plants that are common in an area of forest, but which I have been unable to identify. It is probable that many new species are still to be collected, even in otherwise well visited and collected areas. One other member of this section occurs in the region, ***P. schoddei***, which comes from high altitudes on Bougainville. A third species *P. patina* is found on Ponape in the Pacific. The species in this section are unmistakable with their giant drupes.

Section **METAMAYSOPS**

Similar to §§Maysops, but with poly-loculed drupes.

Pandanus brachyphyllus and ***P. galorei*** do not appear to be particularly similar, either in their overall appearance or in their stigma arrangement. Microscopic characters, however, suggest that they are closely related (Huynh 1976). The two species are clear-cut entities, although the former has only been collected once and the latter twice.

Section **PERRYA**

Cephalia long, cylindrical, drupes flat-topped with a laterally facing stigma.

The species in this section are mostly found in mid-montane forests. They are distinguished from §§Stonedendron only by the degree to which their drupe apices taper. They are also close to members of §§Maysops, but differ in the longer drupes in which the seed is borne near the base. The cephalia are long and cylindrical and totally enclosed by bracts. Architecturally the section is fairly uniform, all the species being tall, slender trees with a little-branched crown, and with few, slender proproots near the base.

Pandanus aggregatus and ***P. archboldianus*** have the longest drupes, well over 5 cm long. Those of the latter species are somewhat more robust, with a flat-topped or rounded pileus. *Pandanus aggregatus* grows in clusters, from whence it gains its name, it grows at lower altitudes than *P. archboldianus*, which is a widespread species found throughout the highlands of Papua New Guinea. The drupes of *P. archboldianus* are often connate in the lower parts, forming ribbons or clusters of drupes which fall from the cephalium en masse. Debbie Wright reports that the clear yellow sap released by this fruit when it is cut, causes fingers to itch and burn. She further records that the fruits of *P. archboldianus* are the only ones which are not shredded by rats, however, they are avidly swallowed by the Cassowary.

A *nomina nuda* published by Huynh, P. viridiruber n.n., probably refers to *P. archboldianus*. In Mt.Gahavisuka National Park (PNG) there is a well correlated group of one male and 2 female trees at the lake. Although I have seen the half rotted remains of the male inflorescence (in December 1992), I have not yet succeeded in collecting a fresh specimen. This would be the first male collection for the section. The male tree is unbranched, but of an equal height to the severally-branched female, I cannot determine if this was just the first time the male had flowered, or whether it is a fixed architectural difference.

Pandanus galeatus and **Species 5** have smaller drupes. Each species is known by just a single collection. In some respects they are similar, although the seed of Species 5 is somewhat larger, and not so basal as that of *P. galeatus*. The cephalium of Species 5 is strongly triangular in section, although this is a feature common amongst *Pandanus* cephalia, and may not be significant, since that of *P. galeatus* is not fully known. *Pandanus galeatus* is said to have thick, erect, crowded proproots, while those of Species 5 are said to be slender and spreading. *Pandanus galeatus* is said to be plentiful in forested gullies on Goodenough Island, while Species 5 was collected in an open marshy place in the Minj valley (Western Highlands, Papua New Guinea). St. John has affixed the name 'vinkii' to the specimen of Species 5, and this was then invalidly published by Huynh (1976).

I have collected a further undescribed species (**Species 6**) from near Amboin in the Sepik, which appears to pertain to this section. The drupes have a broad, flat, prismatic tip, with a small, sharply hooded stigma to one side. Like *P. archboldianus* the lateral pleats are toothed near the apex. This may be the species referred to as 'falcatus' on a drawing at LAE, but for which no herbarium material has been traced.

Section STONEDENDRON

Cephalia ovoid, drupes with a conical or rounded pileus, style hooded, pointed.

This section was described by Huynh (1976), to include the New Guinea members of the former section Lophostigma, the remainder all being New Caledonian. This move was first suggested by Stone (1974), and confirmed by Huynh's microscopic studies.

The species have much shorter cephalia than §§Perrya, and these are only about half enclosed by bracts. The apex of the drupes is more conical, and gradually tapers into the narrow style which is bent abruptly towards the apex of the cephalium, and the stigma is somewhat more hooded than those of §§Perrya. The drupes of this section tend to be flattened from side to side rather than dorso-ventrally as in §§Perrya. The trees of this section share long, spreading proproots, and the drupes have a blackish-purple pileus, and are red or yellow below.

TABLE 6: Characters of the type specimens belonging to Section Stonedendron

	Leaves(cm)	Cephalium(cm)	Drupes(mm)	Locality	Alt.(m)
P. atropurpureus	300 x 10	43 x 20	45 x 7	Bernhard Camp	850
P. columbiformis	220 x 7.5	33 x 20	70 x 15	Vailala River	100
P. concinnus	160 x 4	16 x 14	43 x 4	Bernhard Camp	1,800
Species 7	200 x 5	9 x 6	22 x 6	New Britain	1,500

Cephalium and drupe size and shape are sufficient to distinguish the three species; ***Pandanus atropurpureus***, ***P. columbiformis*** and ***P. concinnus***. An undescribed species (**Species 7**) from New Britain belongs to this section. It has a relatively small cephalia, but these have the characteristic long, woody, conical pileus of the section. St. John's 'deltoideus' from Sorong is probably a specimen of *P. atropurpureus*.

Section UNCERTAIN

One of the more enigmatic New Guinea *Pandanus* species is ***P. pendulinus***. Unlike all other species it is only known from a single male collection. As current *Pandanus* taxonomy rests largely upon the Infructescence (and in many species the male is still not known) this makes the species difficult, if not impossible, to place at present. Dioecy in speciose genera is invariably complicated by the difficulty in matching male and female plants. Martelli originally assigned it to sub-genus Acrostigma (1929), while Stone and Huynh (1983) regarded it as belonging to an as yet undescribed section within sub-genus Lophostigma, based upon microscopic characters of the leaves, and structure of the anthers. Stone has searched in vain for this species in the type locality.

This sub-genus is characterised by multi-loculed phalanges with separate ascending styles. It is one of the most widespread sub-genera, encompassing almost the entire range of the genus. The greatest diversity of sections is found in New Guinea.

SECTION **ATHROSTIGMA**

P. capitellatus
* P. calathiphorus

SECTION **AUSTROKEURA**

* P. brassii

(P. carrii ? – see §Lophostigma: §§Karuka)

'furvus'
'graminatilis'
'gyraleos'
'libratus'
'listrotos'
'mulleolus'
'paucifrugifer'
'rufus'

SECTION **EXCAVATA**

* P. antaresensis (m)
'akara'
P. bowersae
P. isan n.n.

SECTION **FAGERLINDIA**

* P. dolichopodus
'amphikephalos'
* P. kaernbachii
'confertus'
P. scabribracteatus
'magdaliaris'
P. turbinatus n.n.
'semiplantus'
* P. species 8
'woodlarkensis'

SECTION **INTRAOBTUTUS**

P. biakensis
* P. kajewskii
'aranbit'
P. lamekotensis
'dimboe'
P. mussauensis
'habenaceous'
* P. papuanus
'wasso'
P. parkinsonii
'zomoi'
P. pistillaris (m)
P. pseudopapuanus

SECTION **PANDANUS**

'aktinoides'
'angustior'
'bana'
'bicinversus'
'binconvexus'
'bunganaensis'
'cuneiformis'
'dimidisphaericus'
floridanus'
'giyoensis'
'glaucus'
'glomeris'
'kyrtos'
'laeensis'
'levatus'
'magnus'
'porcorum'
'profundior'
'rendovaensis'
'rostratellus'
'subconvexus'
'subtruncatus'
'tenuis'
'tertianus'
'testeyt'
'thermifonteus'
'tritos'
'tulagiensis'
'ubericarpelatus'
'uliginosus'
'ysabelensis'
P. alatus
P. alifer
P. baptistii
P. bismarkensis
P. calostigma
P. gazelleensis
P. glaphyros
P. humilior
P. kaviengensis
P. lacustris
P. lamekotensis
P. longissimus
P. marinus
P. navigatorum
P. neomecklenburgensis
P. novibritannicus
P. novohibernicus
P. odoratissimus
P. pedunculatus
P. polyacris
P. quadrifidus
P. rabaulensis
P. rennellensis
*P. tectorius (m)
P. upolensis
P. vogelensis
P. yuleensis

SECTION UNNAMED

* P. solomonensis

Section **ATHROSTIGMA**

Phalanges with rounded apex and crowded stigmas.

Pandanus calathiphorus is a distinctive species with its large terminal crown, smaller lateral crowns and long-pedunculate cephalium. Stone mentions that the apical-ventral pleats of the leaves tend to be more spiny on the left-hand side (1973). This probably varies between sympodia (vegetative growth between inflorescences or branches) and is a regular feature of many species (see 'The Pandanus Plant' in Introduction). Stone (1973) reduced *P. capitellatus* to synonymy.

Section **AUSTROKEURA**

Phalanges angular, furrowed, bark spiny.

Pandanus brassii is the only species of this section in New Guinea. It could be regarded as conspecific with the Australian species *P. solms-laubachii*. Without a critical revision of the Australian taxa, however, it is probably best to maintain the name *P. brassii* for this entity. In Australia this section is a great deal more speciose, with over 30 published names representing c. 6 taxa (Ben Stone, pers. comm.)

From §§Pandanus the section is told by a combination of characters: The main trunk is densely beset with upturned adventitious roots; the proproots are short and dense; the leaves are stiffer, and tend not to be as flexible as those *of P. tectorius*; the phalanges are a brownish-red colour when ripe, and tend to be more diamond-shaped, being widest in the middle, with the carpel tips crowded at the apex, while those of *P. tectorius* tend to be more or less parallel-sided, or wedge-shaped. Ecologically *P. tectorius* is a maritime species, while *P. brassii* is a species of inland savanna, although in New Guinea the former is also often to be found in savanna areas up to 500 m altitude. Stone has discussed the distinction (1982c), and the possibility of §§Austrokeura being derived from a tetraploid §§Pandanus.

Pandanus carrii is a problematic species. As discussed under §Lophostigma, §§Karuka, the original description and drawings match this latter section, but some of the material appears to be of *P. brassii* also.

Section **EXCAVATA**

Phalanges with a narrow, concave apex.

Pandanus antaresensis is a clear-cut species. It is a very large tree, and is widespread in the New Guinea Highlands. Stone has already synonymised *P. bowersae* (1974a), and a nomina nuda, P. isan n.n. (St. John 1974), probably also pertains to this species. The seeds are edible, and the broken phalanges are common in archeological excavations in the highlands, although today they are rarely eaten. Trees in excess of 30 m tall, with trunks to one metre in diameter have been reported (Robert Johns, pers. comm.). The large rodent *Anisomys imitator* is said to be an important dispersal agent of this species (Majnep & Bulmer 1990, Kocher Schmidt 1992).

Section **FAGERLINDIA**

Infructescence a spike of1-12 cephalia.

The type of ***Pandanus kaernbachii*** consisted of a phalange only, without leaf material, and has since been destroyed at Berlin. The drawing in Warburg (1900), however, is a convincing match to extant material from New Guinea. A *nomina nuda* of St. John's P. turbinatus n.n. no doubt belongs here also. *Pandanus scabribracteatus* is probably a synonym of *P. kaernbachii*.

Pandanus dolichopodus is a distinct species which has a raceme of up to 12 cylindrical cephalia. Unlike *P. kaernbachii* this is an inland species, usually found above 700 metres.

An undescribed species from Woodlark island (**Species 8**) is said to have 'several' fruit heads, these are small, ovoid cephalia with drupe-like phalanges, each with a cluster of 2-3 stigmas at their apex. The material is sparse, and does not fit convincingly into this section, however, without further information or collections I have decided to place it here for the time being, since this is the only section with other racemose inflorescences of phalanges.

Section **INTRAOBTUTUS**

Cephalium solitary, phalanges flat-topped, stigmas facing a focal carpel on the adaxial face.

This section is characterised by the way the stigmas all face a 'focal' carpel, which usually lies on the edge of the phalange. Previously St. John created a further section §§Lateriobtutus (1961), for those species in which the focal carpel, or line of carpels was shorter than the other carpels. This distinction breaks down within a cephalium however (Stone 1974b).

Seven names have been used in New Guinea to describe what I believe, with reservations, to be the single, variable ***Pandanus papuanus***. *Pandanus papuanus* is found in coastal and hill forest up to 1,000 m. It is also found in degraded woodland and savanna areas around Lae, Madang, and Jayapura although it is unclear if this is a relic from forest or whether the species is naturally at home in such habitats. The phalanges are wedge-shaped, being parallel-sided from one view, but markedly triangular from the perpendicular viewpoint. Each phalange is composed of 6 to 10 carpels, of which 1, rarely 2, are totally surrounded by the others. The phalanges of *P. lamekotensis* are undoubtedly very immature, while other collections vary in size from 8 x 3.5 to 13 x 5 cm. On Crater mountain this species is dispersed by Cassowaries (Debbie Wright and Andy Mack pers. comm.).

Material I have examined from the Sepik, suggests that there may be several entities, if not species. In one form the trunk and proproots are much larger, the latter reaching up to 10 metres in length and 20 cm thick, and producing a thick gelatinous exudate (Franck Gerald, pers. comm.). The cephalia of this form are often borne in 2's or 3's at the stem apices, and the phalange apices are less distinct than in the more typical form. The second form tends to be found at greater altitudes, and away from swampy sites. In some collections the style apices are very angular, while in others they are more rounded, unfortunately this character shows no correlation to other features. Some individuals have persistent, acuminate bracts covering the cephalium, while in others they rot quickly. The taxonomic problem can only be solved with comparable series of collections from several localities. The type of *P. lamekotensis* is a mixed collection with *P. kaernbachii* (Ben Stone, pers. comm.).

Pandanus kajewskii is only known by a few loose phalanges, but no leaf material or description of the tree. The phalanges are distinct with their 10-16 carpels, each with a tapering, conical pileus.

Section **PANDANUS**

Phalange pilei separate, stigmas all face inwards.

A walk on any beach in the Pacific Ocean will produce an enormous variety of ***Pandanus tectorius*** phalanges. This has led some workers to generate a huge plethora of names (i.e. Martelli and St. John). Cox has demonstrated that this species is facultatively apomictic (1985) – that is, if not fertilised, carpels will still develop to form viable seeds. In the Marshall Islands alone, some 300+ cultivars are recognised (Stone 1976). In New Guinea the cultivation of this species is less usual, and only occurs in the Milne Bay region, in particular on the Trobriand Islands (Osia Gideon pers. comm.). I have no information on its cultivation in the Solomons or Bismarck Islands.

For differences from *P. brassii* see under §§Austrokeura. The phalange apices tend to be green when ripe, although below they are often yellow or orange, while those of *P. brassii* tend to be orange-red throughout.

Ash (1987) has made the observation that a single phalange of *P. tectorius* may give rise to up to 12 plants from the separate seeds. These have a juvenile growth form which travels laterally before entering an erect phase prior to flowering, thus spreading the plants away from a crowded origin. The effect of having multiple seeds in a single dispersal unit is very significant to a dioecious, wide ranging, coastal species. A single propagule will produce a population of plants in which the chances of having both males and females is high. Being borne of the same parent, this 'founder' population is closely related and by virtue of their common origin, and hence close proximity, sexual reproduction will tend to be greatest between siblings, leading to the rapid development of local forms (Stone 1976). Pandanologists such as Martelli, Kanehira and St. John have multiplied this species into an unnecessary array of names. Warburg (1900) and Stone (1975) favour the maintenance of the single species *P. tectorius* and the recognition of variants.

Mike Hopkins (pers. comm.) has also pointed out to me how many of these phalanges have clearly been parasitised by wasps – 1 to 2 emergence holes being found on virtually every phalange. He suggests that the structure of the phalange may be of significance in protecting the more central seed from destruction.

The phalanges can be sucked for the flavoursome juice at their bases, while other cultivars are used in cooking in many Polynesian societies. Ash (1987) reports them as being bat dispersed in Fiji, and suggests that land crabs may be significant in moving phalanges.

Section UNNAMED

Pandanus solomonensis is another enigmatic species. It may have links to sub-genus Rykia – the overall appearance of the tree and poly-loculed drupe being not unlike *P. dubius*.

SUB-GENUS: **RYKIA**

Section **HOMBRONIA**

Phalange with a single straight row of flattened stigmas.

The only species, ***Pandanus dubius***, is constant through its range, in marked contrast to the other common coastal species *P. tectorius*. Although the two species appear capable of existing in the same habitat, they are nowhere found co-extensively. *Pandanus dubius* is more common on coral rock, or other rocky shorelines, while *P. tectorius* dominates in sandy beaches and in coastal grasslands. Compared to the latter species the phalange of *P. dubius* has few (2-4), relatively large seeds. This may make the seedlings of *P. dubius* more capable of establishing themselves on the less hospitable rocky substrate, while those of
P. tectorius, being far smaller, are only capable of establishment on soil less prone to dessication.

Pandanus compressus Mart. from the Solomon Islands is doubtfully distinct, its only specific feature being the much flatter phalanges. *Pandanus tetrodon* (Gaudich.) Balf.f. is recorded from the Solomon islands by Merrill and L. M. Perry (1939), but this is also conspecific with *P. dubius* (Stone 1975). Stone has distinguished the variety compressus to account for these collections (1975).

There are a number of cultivated Pandans which do not flower. These are often characterised by variegated leaves, or in one case by the aromatic leaves. The taxonomy of these species is far from certain, most were described as horticultural species, and fertile material is lacking.

Stone has proposed a collection from New Georgia as a neotype for *P. baptistii*, since it was a fruiting specimen, and the species was without a type. The phalanges of this specimen are a good match to *P. tectorius*, and it seems likely that the origin of this particular variegated plant was from that species. It is not certain, however, that all cultivated plants with unthorned, variegated leaves belong together. It is of note that the specimen from which Stone collected the neotype was unusual in that it had a single, unvariegated branch, with all-green leaves, on which the fruit was borne. It could be that variegated plants lack the energy threshold for fruiting. Ash (1987) found that female trees of *P. tectorius* in Fiji allocated up to 45% of their annual productivity to reproduction, while physiological studies at the Christensen Research Institute by Cath Lovelock have shown that the photosynthetic ability of a variegated leaf is directly proportional to the area of green tissue. In view of the high allocation of energy to reproduction, it seems that these cultivars are therefore physiologically sterile.

Cultivated plants in the region, can be keyed out, and assigned to species as follows:

1a.	Leaves not variegated	2
b.	Leaves variegated	3
2a.	Leaves unscented	***P. augustianus***
b.	Leaves scented	***P. amaryllifolius***
3a.	Leaves unarmed on margin	***P. baptistii***
b.	Leaves thorned on margins	4
4a.	Leaf apex filiform, margin thorn tips ±brown-purple	***P. variegatus***
b.	Leaf apex acute, thorns green to yellow throughout	***P. veitchii***

TABLE 7: Horticultural species and their presumed origins

P. baptistii	New Britain
P. variegatus	Australia/Polynesia
P. veitchii	Polynesia
P. amaryllifolius	Ambon
P. augustianus	Papuasia

APPENDIX 2

LIST OF PANDANUS NAMES FROM NEW GUINEA AND THE SOLOMONS

Recognised species are in bold type; *synonyms* are in italics; invalid names are in roman type (*nomina nuda*); manuscript (*in scheda*) names are in inverted commas, they are not preceded by the generic name since they have never been published (they are followed by 'MS. Spec.'), the herbarium labels to which these names have been attached is given. Sub-generic classifications are in capitals: § signifies a sub-genus, while §§ signifies a section or sub-section. **Page XX** refer to page numbers in this guide.

P. acicularis (DIMISSISTYLI) H.St.John, Pac. Sci. 27 (1) (1973) 44. Type: Clemens 8578 (B), Sattelberg, MOROBE (= P. danckelmannianus).

§ACROSTIGMA (Kurz) B.C.Stone, Bot. Jahrb. 94 (1974) 521. Basionym: §§ACROSTIGMA Kurz, J. Bot. Brit. For. 5 (1867) 100. Type sp.: P. affinis Kurz.

§§ACROSTIGMA subsect. DIMISSISTYLLI (§ACROSTIGMA) B.C.Stone, Fed. Mus. J. n. s. 1a (1967) 119. Type sp.: P. danckelmannianus K. Schum.

§§ ACROSTIGMA subsect. LAUTERBACHIANI (§ACROSTIGMA) B.C.Stone, Fed. Mus. J. 23 (1978) 24. Type sp.: P. lauterbachii K. Schum. & Warb.

§§ACROSTIGMA subsect. ROSTELLATI (§ACROSTIGMA) B.C.Stone, Fed. Mus. J. 23 (1978) 43. Type sp.: P. rostellatus Merr. & L.M.Perry.

P. adinobotrys (ACROSTIGMA) Merr. & L.M.Perry, J. Arn. Arb. 21 (1940) 175. Type: Brass 12077 (A), Bernhard Camp, JAYAPURA. **Page 22**

P. aggregatus (PERRYA) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 176. Type: Brass 6974 (A), Palmer R., WESTERN. **Page 74**

'akara' (EXCAVATA) H.St.John, MS. Spec.: St. John 26203 (K), 8/1/58, Kuminakora No. 1., 2 m S of Aiyura, EASTERN HIGHLANDS (= P. antaresensis).

'aktinoides' (PANDANUS) H.St.John, MS. Spec.: St. John 26128 (K), 1/12/57, Lemon Is, Dore Bay, MANOKWARI (= P. tectorius).

'akurios' (ACROSTIGMA) H.St.John, MS. Spec.: St. John 26207 (LAE), Aiyura, EASTERN HIGHLANDS (= P. adinobotrys).

P. alatus (PANDANUS) H.St.John, Pac. Sci. 27 (1) (1973) 83. Type: Brass 27735 (L, A, US), Sudest Is., MILNE BAY (= P. tectorius).

P. alifer (PANDANUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 29. Type: Stone 2633a (BISH), Kavieng, NEW IRELAND (= P. tectorius).

P. amaryllifolius (Horticultural) Roxb., Hort. Beng. 71; Fl. Ind. iii. 743. ex Ambon. **Page 127**

P. amboinensis (MAYSOPS) Warb., Pflanzenr. Heft. 3(IV. 9) (1900) 83. Type: De Vriese 171 (L), Amboina, MOLUCCAS.

'amphikephalos' (FAGERLINDIA) H.St.John, MS. Spec.: St. John 26100 (K), 24/11/57, Lio Is., Sele Strait, SORONG (= P. kaernbachii).

P. angiensis (ACROSTIGMA) Kaneh., Bot. Mag. Tokyo 55 (1941) 304. Type: Kanehira & Hatusima 13974 (FU), Angi, MANOKWARI (= P. adinobotrys).

'angustior' (PANDANUS) H.St.John, MS. Spec.: Stone 2535 (K), 11/11/57, Tulagi Is., FLORIDA (= P. tectorius).

P. antaresensis (EXCAVATA) H.St.John, Pac. Sci. 27 (1) (1973) 58. Type: Kalkman 4367 (L, A, BM), Mt. Antares, MERAUKE. **Page 88**

P. aprilensis (MAYSOPS) H.St.John, Pac. Sci. 27 (1) (1973) 62. Type: Ledermann 8756 (B), April R, SEPIK (= P. becarrii).

'aranbit' (INTRAOBTUTUS) H.St.John, MS. Spec.: St. John 26175 (K), Wewak, SEPIK (= P. papuanus).

P. archboldianus (PERRYA) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 176. Type: Brass 5366 (A) Mafalu, CENTRAL. **Page 75**

P. arcuatus (DIMISSISTYLI) H.St.John, Pac. Sci. 27 (1) (1973) 47. Type: Brass 24045 (K, A), Kwagira River, MILNE BAY (= P. danckelmannianus).

P. aruensis (JEANNERETIA) Martelli, Webbia 4(1) (1913) 6, 41. Type: Beccari 488 (FI), Soron, ARU ISLAND (= P. polycephalus).

'assurgens' (DIMISSISTYLI) H.St.John, MS. Spec.: St. John 26132 (LAE), Warossor. (= P. danckelmannianus).

§§ATHROSTIGMA (§PANDANUS) B.C.Stone, Bot. Jahrb. 94 (1974) 518. Type sp.: P. luzonensis Merr.

P. atropurpureus (STONEDENDRON) Merr. & L.M.Perry, J. Arn. Arb. 21 (1940) 173. Type: Brass 13648 (A), Bernhard Camp, JAYAPURA. **Page 79**

P. augustianus (Horticultural) L. Linden & Rodigas, in Illustr. Hortic. xxxiii. (1886) 157, t. 612. ex New Guinea.

P. auritus n.n. (MAYSOPS) H.St.John ex Huynh (nom. nud.), Bot. Jahrb. Syst. 97 (1976) 93. Spec.: Brass 27272 (A, PNH), Agamoia, Fergusson Is, MILNE BAY (= P. krauelianus).

§§AUSTROKEURA = §§PANDANUS subsect. AUSTROKEURA B.C.Stone.

'badius' (LAUTERBACHIANI) H.St.John, MS. Spec.: St. John 26231 (K,LAE), 26/1/58, Brown R. Rd., 20 m NW of Port Moresby, CENTRAL (= P. lauterbachii).

P. balenii (PARALOPHOSTIGMA) Martelli, Webbia 2 (1907) 432. Type: Balen (Herb. Mart. No. 3), Windesi, GEELVINK BAY. **Page 46**

P. bana n.n. (PANDANUS) H.St.John (nom. nud.), Rev. Gen. Pandanus, part 51 (1989) 32. Spec.: ?, SAN CRISTOBAL(= P. tectorius).

'bana var. bana' (PANDANUS) H.St.John, MS. Spec.: Stone 2544 (K), 16/11/57, Bungana Is., Floria Grp., FLORIDA (= P. tectorius).

P. bana var. inermis n.n. (PANDANUS) (Merr. & L.M.Perry) H.St.John (nom. nud.), Rev. Gen. Pandanus, part 51 (1989) 32. Spec.: ?, SAN CRISTOBAL(= P. tectorius).

P. baptistii (PANDANUS) Hort., Hortic. Belg. 19 (1893) 166. Type: Stone 2562 (BISH), Gizo Is. [neotype], NEW GEORGIA (= P. tectorius).

'batavus' (DIMISSISTYLI) H.St.John, MS. Spec.: Brass 8873 (LAE), Jayapura, JAYAPURA (= P. danckelmannianus).

P. beccarii (MAYSOPS) Solms, Ann. Jard. Bot. Buitenz. 3 (1883) 97. Type: Beccari 4/1873 (FI), ARU. **Page 62**

P. biakensis (INTRAOBTUTUS) H.St.John, Pac. Sci. XIV (1960) 231. Type: St. John 26142 (BISH), BIAK (= P. papuanus).

P. biciliatus (MAYSOPS) H.St.John, Pac. Sci. 27 (1) (1973) 64. Type: Brass 28746 (K, L, US), Kulumadu, Woodlark Is, MILNE BAY (= P. krauelianus).

'biconvexus' (PANDANUS) H.St.John, MS. Spec.: St. John 26114 (K), 29/11/57, Cape Memori, 2. 5 km E of Manokwari, MANOKWARI (= P. tectorius).

'bidentatus' (MAYSOPS) H.St.John, MS. Spec.: Brass 7518 (A,LAE), 8/1936, Lake Daviumbu, WESTERN (= P. krauelianus).

P. bidrupaceus (MAYSOPS) H.St.John, MS. Spec.: Brass 28120 (PNH), Rambuso, Sudest Is, MILNE BAY (= P. krauelianus).

P. biformatus (MAYSOPS) H.St.John, Pac. Sci. 27 (1) (1973) 67. Type: Brass 23765 (K,L,LAE), Gwairu R., MILNE BAY (= P. krauelianus).

P. biserratus n.n. (DIMISSISTYLI) H.St.John (nom. nud.), Rev. Gen. Pandanus, part 51 (1989) 2. Spec.: ?, SANTA YSABEL (= P. ?danckelmannianus).

P. bismarkensis (PANDANUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 30. Type: Koie & Olsen 1494 (C), Mussau Is., NEW IRELAND (= P. tectorius).

P. boemiensis (LINIOBTUTUS) Kaneh., Bot. Mag. Tokyo 55 (1941) 303. Type: Kanehira & Hatusima 12682 (FU?), Boemi, GEELVINK BAY (= P. penicillus).

P. bowersae (EXCAVATA) H.St.John, Contr. Herb. Aust. 3 (1974) 1. Type: Bowers 201 (BISH), Kaugel Valley, WESTERN HIGHLANDS (= P. antaresensis).

P. brachyphyllus (METAMAYSOPS) Merr. & L.M.Perry, J. Arn. Arb. 21 (1940) 170. Type: Brass 12255 (A), Bernhard Camp, JAYAPURA. **Page 72**

P. brassii (AUSTROKEURA) Martelli, J. Arn. Arb. 10 (1929) 139. Type: Brass 1604 (A), Domara R., CENTRAL. **Page 87**

P. brosimos (KARUKA) Merr. & L.M.Perry, J. Arn. Arb. 21 (1940) 171. Type: Brass 12698 (A), Bernhard Camp, JAYAPURA. **Page 55**

§§BRYANTIA (Webb in Gaudich.) Warb. Pflanzenr. iv. 9 (1900) 68. Basionym: Genus BRYANTIA Webb in Gaudich. Bot. Voy. Bonite, t. 20 (1843). Type sp.: Bryantia butyrophora Webb in Gaudich. Kurz. (=§§MICROSTIGMA in New Guinea).

P. buinensis (CURVIFOLIA) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 173. Type: Kajewski 2303 (A), BOUGAINVILLE. **Page 32**

'bukaensis' (MAYSOPS) H.St.John, MS. Spec.: Stone 2565 (K), 3/12/57, Buka, BOUGAINVILLE (= P. rubellus).

'bunganaensis' (PANDANUS) H.St.John, MS. Spec.: Stone 2545 (LAE), 16/11/57, Bungara Is., FLORIDA (= P. tectorius).

P. calathiphorus (ATHROSTIGMA) (Gaudich. ex Hombron) Balfour, in Martelli, Webbia 4(1) (1913) 9. Type: Plate in D'Urville Voy. Pol Sud sur l'Astrolabe. SOLOMONS. **Page 86**

P. calostigma (PANDANUS) Martelli, Webbia 2 (1907) 428. Type: MacFarlane s. n. 1905 (H. Mart. No. 6), Tubuai, POLYNESIA (= P. tectorius).

P. calostigma var. *tenaruensis* (PANDANUS) B.C.Stone, Mal. J. Sci. 2(A) (1973) 62. Type: Stone 2270 (BISH, LAE), Tenaru River, GUADALCANAL (= P. tectorius).

P. capitellatus (ATHROSTIGMA) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 160. Type: Brass 3414, Tatamba, SANTA YSABEL (= P. calathiphorus).

P. carrii (AUSTROKEURA) H.St.John, Pac. Sci. XXII (1968) 514. Type: Carr 12274 (BM), Koitaki, CENTRAL (= P. brassii).

P. castaneus (MAYSOPS) H.St.John & B.C.Stone, Melanesian Plant Studies I (1965) 5. Type: Brass 32277 (US), Kassam Pass, EASTERN HIGHLANDS. **Page 63**

§§CAULIFLORA (§LOPHOSTIGMA) B.C.Stone, Mal. J. Sci 1(A) (1972) 124. Type sp.: P. lamprocephalus Merr. & L.M.Perry.

P. cernuifolius (MAYSOPS) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 180. Type: Brass 3916 (A) Dieni, CENTRAL (= P. beccarii).

P. cernuus n.n. (MAYSOPS) H.St.John ex Huynh (nom. nud.), Bot. Jahrb. Syst. 97 (1976) 92. Spec.: Koster BW 13646 (L), Wondiwoi Mts, Wandammen, GEELVINK BAY (= P. kosteri).

P. clarkei (PARALOPHOSTIGMA) B.C.Stone, Contr. Herb. Aust. 4 (1974) 17. Type: Clarke 108 (KLU), Schrader Mts., MADANG. **Page 47**

P. clausus (MAYSOPS) H.St.John, Pac. Sci. 27 (1) (1973) 69. Type: Clemens 171 (B,L), Sattelberg, MOROBE (= P. concavus).

P. columbiformis (STONEDENDRON) B.C.Stone, Contr. Herb. Aust. 4 (1974) 8. Type: Stone 10131 (LAE), Vailala, CENTRAL. **Page 80**

P. cominsii (KURZIA) Hemsley, Hook. f. Icon. 27 (1900) t. 265. Type: Rev. Comins 363 (K), Siota. FLORIDA. **Page 37**

P. cominsii var. *augustus* (KURZIA) B.C.Stone, Mal. J. Sci. 1(A) (1972) 109. Type: Stone 2496 (BISH), 17/10/57, Vulavu-Thathaje Trail., nr. Vulavu, SANTA YSABEL.

P. compressus (HOMBRONIA) Martelli, Webbia 1 (1905) 363. Type: Guppy s. n. (K), SOLOMONS (= P. dubius).

P. concavus (MAYSOPS) H.St.John, Pac. Sci. 27 (1) (1973) 71. Type: Kalkman 4416 (L, A, BM), Mt. Antares, MERAUKE. **Page 64**

P. concinnus (STONEDENDRON) Merr. & L.M.Perry, J. Arn. Arb. 21 (1940) 172. Type: Brass 12074 (A), Bernhard Camp, JAYAPURA. **Page 81**

'confertus' (FAGERLINDIA) H.St.John, MS. Spec.: St. John 26099 (K), 24/11/57, Sio Is., Sele Strait, SORONG (= P. kaernbachii).

P. congregatus (ACROSTIGMA) H.St.John, Pac. Sci. 27 (1) (1973) 49. Type: Ledermann 11117 (B), Hunstein Mts., SEPIK. **Page 23**

P. conoideus (MICROSTIGMA) Lamk., Encycl. 1 (1785) 372. Type: Rumph. Amb. 4. P. 149, t. 79, AMBON. **Page 43**

P. croceus (MAYSOPS) B.C.Stone, Contr. Herb. Aust. 4 (1974) 23. Type: Stone 10290 (LAE), MANUS. **Page 65**

'croceus' (MAYSOPS) H.St.John, MS. Spec.: Whitmore 6283 (K), 2/8/65, Warahito valley, SOLOMONS (= P. flavicarpus).

'cuneiformis' (PANDANUS) H.St.John, MS. Spec.: Stone 2232 (K), 5/9/57, Pwele Is, NE coast, BOUGAINVILLE (= P. tectorius).

§§CURVIFOLIA (§KURZIA) B.C.Stone, Melan. Pl. Stud. I (1965) 5. Type sp.: P. nemoralis Merr. & L.M.Perry.

P. danckelmannianus (DIMISSISTYLI) K. Schum., K. Schum. & Holl. Fl. Kais. Wilhlm. (1889) 18. Type: Hollrung 280 (B+) Finschhafen, MOROBE. **Page 26**

'darbyshire' (MARGINATA) H.St.John, MS. Spec.: Darbyshire 693 (K,LAE), Kairuku S/D, CENTRAL (= P. meniscostigma).

P. daulos n.n. (MAYSOPS) H.St.John ex Huynh (nom. nud.), Bot. Jahrb. Syst. 97 (1976) 93. Spec.: Brass 24639 (A,L,LAE), E. Slopes, Goodenough Island, MILNE BAY (= P. krauelianus).

P. daymanensis (PARALOPHOSTIGMA) H.St.John, Pac. Sci. 27 (1) (1973) 79. Type: Brass 23459 (K, A), Mt. Dayman, MILNE BAY. **Page 48**

P. decus-montium (CURVIFOLIA) B.C.Stone, Proc. Biol. Soc. Wash. 82 (1969) 439. Type: Whitmore BSIP 1836 (BSIP, LAE, SING), Mt. Austen, Guadalcanal, SOLOMONS. **Page 33**

'deltoideus' (STONEDENDRON) H.St.John, MS. Spec.: St. John 26112 (K), 27/11/57, Roefei Stream, 1 km N of Sorong, SORONG (= P. atropurpureus?).

'dimboe' (INTRAOBTUTUS) H.St.John, MS. Spec.: St. John 26171 (K), 23/12/57, Mouth of Laho R., Humbolt bay, JAYAPURA (= P. papuanus).

'dimidisphaericus' (PANDANUS) H.St.John, MS. Spec.: Stone 2583 (?), 19/12/57, OpP. Sohano Is., Buka, BOUGAINVILLE (= P. tectorius).

P. dolichopodus (FAGERLINDIA) Merr. & L.M.Perry, J. Arn. Arb. 21 (1940) 169. Type: Brass 13439 (A), Bernhard Camp, JAYAPURA. **Page 89**

P. dubius (HOMBRONIA) Spreng., Syst. Veg. 3 (11826) 897. Type: Rumphius, Hort. Amb. t. 80 (1743), AMBON. **Page 96**

'ebra' (MAYSOPS) H.St.John, MS. Spec.: St. John 26116 (K), 29/11/57, 5km E of Manokwari, MANOKWARI (= P. krauelianus).

'echinatus' (DIMISSISTYLI) H.St.John, MS. Spec.: Whitmore RSS 6089 (K,LAE), 14/7/65, 5 m inland NW GUADALCANAL (= P. danckelmannianus).

P. englerianus (KURZIA) Martelli, Bot. Jahrb. 49 (1912) 65. Type: Penloup 5 (Martelli); Peekel 91 (B), Naumann (B), NEW IRELAND. **Page 37**

'eramosus' (DIMISSISTYLI) H.St.John, MS. Spec.: Brass 23512 (LAE), 7/53, Mt. Dayman, MILNE BAY (= P. danckelmannianus).

P. erinaceus (DIMISSISTYLI) B.C.Stone, Melanesian Plant Studies I (1965) 1. Type: Stone 2578 (BISH), Buka, BOUGAINVILLE (= P. danckelmannianus).

P. erythros (MICROSTIGMA) H.St.John, Pac. Sci. XXII (1968) 515. Type: Carr 15922 (BM), Isuarava, CENTRAL (= P. conoideus).

P. eumekes (ROSTELLATI) H.St.John ex B.C.Stone, Feb. Mus. J. 23 (1978) 43. Type: van Royen 3343 (L), SORONG (= P. odoardi).

§§EXCAVATA (§PANDANUS) B.C.Stone, Contr. Herb. Aust. 4 (1974) 31. Type sp.: P. antaresensis H.St.John.

P. exiguus (MICROSTIGMA) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 170. Type: Brass 7070 (A), Palmer River, WESTERN. **Page 44**

§§FAGERLINDIA (§PANDANUS) B.C.Stone, Bot. Jahrb. 94 (1974) 518. Type sp.: P. kaernbachii Warb.

'falcatus' (PERRYA?) B.C.Stone, MS. Spec.: drawing at Lae by Terry Nolan.

'fastosus' (MEGASTIGMA) B.C.Stone, MS. Spec.: Craven & Schodde 347 (CANB, LAE), Lake Loloru, BOUGAINVILLE (= P. schoddei).

P. flavicarpus (MAYSOPS) B.C.Stone, Melanesian Plant Studies I (1966) 1. Type: Stone 2478 (BISH), SANTA YSABEL. **Page 66**

P. flexibilis n.n. (MAYSOPS) H.St.John ex Huynh (nom. nud.), Bot. Jahrb. Syst. 97 (1976) 93. Spec.: Brass 32315 (A), Lowe's ford, Kassam-Water Rice Rd, MOROBE (= P. krauelianus).

P. floribundus (MAYSOPS) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 181. Type: Brass 6975 (A), Palmer River, WESTERN (= P. beccarii).

'floridanus' (PANDANUS) H.St.John, MS. Spec.: Stone 2542 (K), Siota, FLORIDA IS. (= P. tectorius).

P. foveolatus (LINIOBTUTUS) Kaneh., Bot. Mag. Tokyo 55 (1941) 300. Type: Kanehira & Hatusima 12199 (FU), Dalman, NABIRE (= P. penicillus).

'furvus' (AUSTROKEURA) H.St.John, MS. Spec.: St. John 26155 (K), 16/12/57, Joberi, 6 km S of Merauke, MERAUKE (= P. brassii).

P. galeatus (PERRYA) H.St.John, Pac. Sci. 27 (1) (1973) 74. Type: Brass 24885 (K, A), Goodenough Is., MILNE BAY. **Page 76**

P. galorei (METAMAYSOPS) B.C.Stone, Contr. Herb. Aust. 4 (1974) 21. Type: Ridsdale & Galore NGF 33192 (LAE), Okwalimkan, WESTERN. **Page 73**

P. gazelleensis (PANDANUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 31. Type: Stone 2589 (BISH), 11/12/57, Gazelle peninsula, NEW BRITAIN (= P. tectorius).

'giyoensis' (PANDANUS) H.St.John, MS. Spec.: Stone 2546 (K), 19/11/57, Giyo Is., NEW GEORGIA (= P. tectorius).

P. glaphyros (PANDANUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 33. Type: Parkinson 7 (FI), S. Coast, NEW IRELAND (= P. tectorius).

P. glaucus n.n. (PANDANUS) H.St.John (nom. nud.), Pac. Sci. 27 (1973) 86. Spec.: Brass 21778 (LAE), 1/4/53, Menapi, Cape Vogel, MILNE BAY (= P. tectorius).

'glomeris' (PANDANUS) H.St.John, MS. Spec.: St. John 26129 (K), 3/12/57, Warossiri, 60 km S of Manokwari, MANOKWARI (= P. tectorius).

P. gogolensis n.n. (MAYSOPS) H.St.John (nom. nud.), Pac. Sci. 27 (1) (1973) 69. Spec.: Lauterbach 862 (?), Gogol R., MADANG (= P. krauelianus).

'graminatilis' (AUSTROKEURA) H.St.John, MS. Spec.: St. John 26147a (K), 11/12/57, Mopa, 12km SE of Merauke, MERAUKE (= P. brassii).

P. granulosus (ROSTELLATI) St. John, Rev. Gen. Pandanus, part 51 (1989) 1. Type: Gressitt 2745 (BISH), Kait River, NEW IRELAND (= P. odoardi).

'gregorii' (INVOLUTA) H.St.John, MS. Spec.: F. v. M. (K), 1888, Lousiades Arch, MILNE BAY (= P. leiophyllus).

'guadalcanalius' (ACROSTIGMA) H.St.John, MS. Spec.: Corner RSS 82 (K), 20/10/65, Tambalusu, GUADALCANAL (= P. poronaliva).

'gurain' (LINIOBTUTUS) H.St.John, MS. Spec.: St. John 26177, 26/12/57, Siuri, 5 m W of Wewak, SEPIK (= P. penicillus).

'gyraleos' (AUSTROKEURA) H.St.John, MS. Spec.: St. John 26156 (K), 16/12/57, Joberi, 6 km S of Merauke, MERAUKE (= P. brassii).

'habenaceous' (INTRAOBTUTUS) H.St.John, MS. Spec.: St. John 26226 (K), 23/1/58, Garaina, MOROBE (= P. papuanus).

'helodes' (MAYSOPS) H.St.John, MS. Spec.: Stone 2478 (K), 14/10/57, 1/2 w Sesedo, SANTA YSABEL (= P. krauelianus).

'hentyi' (DIMISSISTYLI) H.St.John, MS. Spec.: Henty NGF 11581 (LAE), Oomsis, MOROBE (= P. danckelmannianus).

'hohi' (DIMISSISTYLI) H.St.John, MS. Spec.: St. John 26134 (LAE), Andei, MANOKWARI (= P. danckelmannianus).

P. hollrungii (KURZIA) Warb., Pflanzenr. Heft III, IV. 9 (1900) 71. Type: Hollrung (B), German New Guinea, PNG (= P. macgregorii).

§§HOMBRONIA (§RYKIA) (Gaudich.) Warb., Pflzr. iv. (1900) 9. Type sp.: P. dubius Spreng.

P. hooglandii (LINIOBTUTUS) H.St.John, Pac. Sci. 27 (1) (1973) 56. Type: Hoogland 3658 (K, A, LAE), Gwaiari, NORTHERN (= P. hystrix).

P. humicola (ROSTELLATI) Kaneh., Bot. Mag. Tokyo 55 (1941) 305. Type: Kanehira & Hatusima 13500 (FU), Angi, MANOKWARI (= P. odoardi).

P. humilior (PANDANUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 34. Type: Stone 2633 (BISH), 17/1/58, 40 m S of Kavieng, NEW IRELAND (= P. tectorius).

'huntii' (MAYSOPS) H.St.John, MS. Spec.: Hunt RSS 2980 (K), 1/11/65, Mt. Popomanatseu, GUADALCANAL (= P. krauelianus).

P. hystrix (LINIOBTUTUS) Martelli, Bull. Soc. Bot. Ital. (1904) 300. Type: D'Albertis (FI?), Fly R., WESTERN. **Page 58**

P. ihuanus (ROSTELLATI) Martelli, J. Arn. Arb. 10 (1929) 141. Type: Brass 978 (A), Vailala R., CENTRAL (= P. odoardi).

P. imbrialis n.n. (MAYSOPS) H.St.John ex Huynh (nom. nud.), Bot. Jahrb. Syst. 97 (1976) 93. Spec.: Brass 5655 (A,LAE), Kubuna, CENTRAL (= P. krauelianus).

'imbricatus' (LINIOBTUTUS) H.St.John, MS. Spec.: St. John 26110 (LAE), 26/11/57, SORONG (= P. penicillus).

P. inokumae (ROSTELLATI) Kaneh., Bot. Mag. Tokyo 54 (1940) 255. Type: Inokumae 574 (FU), NABIRE (= P. odoardi).

§§INTRAOBTUTUS (§PANDANUS) H.St.John, Pac. Sci. 14 (1960) 229. Type sp.: P. parkinsonii Martelli.

§§INVOLUTA (§KURZIA) H.St.John, Pac. Sci. 22 (1968) 532. Type sp.: P. involutus H.St.John.

P. involutus (INVOLUTA) H.St.John, Pac. Sci. XXII (1968) 532. Type: Brass 28366 (K), Abaleti, Rossel Is, MILNE BAY (= P. leiophyllus).

P. isan n.n. (EXCAVATA) H.St.John (nom. nud.), Contr. Herb. Aust. 3 (1974) 3. (= P. antaresensis).

P. isis (MAYSOPS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 17. Type: Peekel 450 (B,FI) Namatanai, NEW IRELAND (= P. krauelianus).

P. iwen (KARUKA) B.C.Stone, Economic Botany 38, 3 (1984) 305. Type: Donoghue 2 (LAE, KLU), Ok Tedi, WESTERN. **Page 56**

P. jacobsii (DIMISSISTYLI) B.C.Stone, Gard. Bull. Singapore 36(2)(1984) 210. Type: Jacobs 9281 (L), Waro, 20 km SSW Lake Kutubu. SOUTHERN HIGHLANDS (= P. danckelmannianus).

§§JEANNERETIA (§KURZIA) (Gaudich.) B.C.Stone, Micronesica 3 (1967) 108. Type sp.: P. polycephalus Lam.

P. jiulianettii (KARUKA) Martelli, Webbia 2 (1907) 433. Type: Giulianetti and English s. n. 1897 (K), CENTRAL. **Page 57**

'juia' (PARALOPHOSTIGMA) H.St.John, MS. Spec.: St. John 26178 (LAE), 28/12/57, Wewak, SEPIK (= P. clarkeii).

P. kaernbachii (FAGERLINDIA) Warb., Pflanzenr. Heft III, IV. 9 (1900) 49. Type: Kaernbach (B?). **Page 90**

P. kajewskii (INTRAOBTUTUS) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 165. Type: Kajewski 1757 (A), Kupei, BOUGAINVILLE. **Page 92**

'kalip' (DIMISSISTYLI) H.St.John, MS. Spec.: St. John 26102 (LAE), 24/11/57, Lio Is, Sele Strait, SORONG (= P. danckelmannianus).

'kardiakos' (INVOLUTA) H.St.John, MS. Spec.: St. John 26160 (K), 17/12/57, Tandjung Poetoes, 15km up Merauke River, MERAUKE (= P. leiophyllus).

'karisu' (MAYSOPS) H.St.John, MS. Spec.: St. John 26141 (K), Mendusiri, Biak Is, 24km E of Mokmeri, BIAK (= P. krauelianus).

§§KARUKA (§LOPHOSTIGMA) B.C.Stone, Contr. Herb. Aust. 4 (1974) 11. Type sp.: P. brosimos Merr. & L.M.Perry.

P. kaviengensis (PANDANUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 35. Type: St. John 2641 (BISH), 15/1/58, 30m SE of Kavieng, NEW IRELAND (= P. tectorius).

P. ketele (ACROSTIGMA) B.C.Stone, J. Arn. Arb. 64 (1983) 312. Type: Stone & Rose 15005 (KLU,K), 6/9/81, Itipu village, Tari, SOUTHERN HIGHLANDS (= P. congregatus).

P. kivi (MAYSOPS) Martelli, J. Arn. Arb. 10 (1929) 140. Type: Brass 1557 (A), Mori R., CENTRAL (= P. krauelianus).

'kopiagoensis' (INTRAOBTUTUS) H.St.John, MS. Spec.: Vandenburgh & Galore 42064 (LAE), 8/11/68, 3 miles from Kopiago on Paga Hill Rd., SOUTHERN HIGHLANDS (= P. papuanus).

P. kosteri (MAYSOPS) B.C.Stone, Blumea 32(2) (1987) 435. Type: Koster BW 6852 (L), Kebar, Sanopi, GEELVINK BAY. **Page 67**

P. krauelianus (MAYSOPS) K. Schum., K. Schum. & Holl. Fl. Kais. Wilhlm. (1889) 17. Type: Hollrung 164 (B?), Kollua bay, Finschhafen, MOROBE. **Page 68**

§KURZIA B.C.Stone, Bot. Jahrb. 94 (1974) 501. Type sp.: P. cominsii Hemsley.

§§KURZIA (§KURZIA) B.C.Stone, Bot. Jahrb. 94 (1974) 503. Type sp.: P. cominsii Hemsley.

P. kurzianus (JEANNERETIA) Solms, Linnaea XLII (1878-79) 4. Type: Naumann, Bougainville. (= P. polycephalus).

'kyrtos' (PANDANUS) H.St.John, MS. Spec.: Stone 2536 (K), 10/11/57, Tulagi Is. FLORIDA (= P. tectorius).

'labratus' (MAYSOPS) H.St.John, MS. Spec.: St. John 26193 (LAE), 4/1/58, Lae Bot. Gdns., MOROBE (= P. rubellus).

P. lacustris (PANDANUS) H.St.John, Nat. Hist. Rennel Is. 8 (1980) 7. Type: Elbert s. n. 9/1957 (BISH), RENNEL (= P. tectorius).

'laeensis' (PANDANUS) H.St.John, MS. Spec.: St. John 26196 (K), 4/1/58, Lae, MOROBE (= P. tectorius).

P. lamekotensis (PANDANUS) Makgf., Notizbl. Konigl. Bot. Gart. Berlin 10 (1927) 112. Type: Peekel 917 (B), Lamekot, NEW IRELAND (= P. papuanus + kaernbachii).

P. lamprocephalus (CAULIFLORA) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 181. Type: Brass 2878 (A, BISH), SAN CRISTOBAL. **Page 54**

P. latericius (KURZIA) B.C.Stone, Melanesian Plant Studies I (1965) 2. Type: Stone 2637 (BISH), Kavieng, NEW IRELAND. **Page 37**

§§LATERIOBTUTUS (§PANDANUS) H.St.John, Pac. Sci. 14 (1960) 229. Type sp.: P. biakensis St. John. (=§§INTRAOBTUTUS).

P. lauterbachii (LAUTERBACHIANI) K. Schum. & Warb., in Warb., Pflanzenr. Heft III, IV. 9 (1900) 81. Type: Lauterbach 863 (B), Gogol, MADANG. **Page 27**

P. leiophyllus (INVOLUTA) Martelli, Webbia 4(1) (1913) 21, 4. Type: Balen (Herb. Mart. No. 2), Windesi, GEELVINK BAY. **Page 35**

§§LEPTOCARPA (§KURZIA) Huynh & B.C.Stone, Bot. Jahrb. 98 (1977) 219. Type sp.: P. leptocarpus Martelli.

P. leptocarpus (LEPTOCARPA) Martelli, Webbia 4(1) (1913) 21. Type: Herb. Utrecht IRIAN JAYA. **Page 41**

P. leptocaulis (MICROSTIGMA) Merr. & L.M.Perry, J. Arn. Arb. 21 (1940) 172. Type: Brass 13280, 13328 (A), Bernhard camp, JAYAPURA. **Page 45**

'levatus' (PANDANUS) H.St.John, MS. Spec.: St. John 26135 (K), 5/12/57, Maripi beach, MANOKWARI (= P. tectorius).

'libratus' (AUSTROKEURA) H.St.John, MS. Spec.: St. John 26146 (K), 11/12/57, 10 km SE of Merauke, MERAUKE (= P. brassii).

P. lictor (DIMISSISTYLI) B.C.Stone, Melanesian Plant Studies I (1965) 2. Type: Stone 2614 (BISH), Warangoi, Gazelle Peninsula, NEW BRITAIN (= P. danckelmannianus).

P. limbatus (PARALOPHOSTIGMA) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 168. Type: Brass 7228 (A), Palmer R., WESTERN. **Page 49**

§§LINIOBTUTUS (§LOPHOSTIGMA) H.St.John, Pac. Sci. 27 (1973) 56. Type sp.: P. hooglandii H.St.John.

'listrotos' (AUSTROKEURA) H.St.John, MS. Spec.: St. John 26147 (K), 11/12/57, Mopa, 12 km SE of Merauke, MERAUKE (= P. brassii).

P. longissimus (PANDANUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 36. Type: Stone 2619 (BISH), Rabaul, NEW BRITAIN (= P. tectorius).

§LOPHOSTIGMA (Brongn.) H.St.John, Pac. Sci. 14 (1960) 226. Basionym: (as section of genus Bryantia) LOPHOSTIGMA Brongniart Ann. Sci. Nat. Bot. Ser. VI,1 (1875) 287. Type sp.: P. viscidus (Brongn.) Solms.

P. lustrorum (ROSTELLATI) B.C.Stone, J. Arn. Arb. 64 (1983) 313. Type: Womersley & Waikabu (KLU, LAE,L,BRI) Telefomin, SEPIK (= P. congregatus).

P. luteus (MAYSOPS) H.St.John, Pac. Sci. 27 (1) (1973) 77. Type: Brass 24732 (K), Goodenough Is., MILNE BAY (= P. concavus).

P. macgregorii (KURZIA) F. Muell. ex Solms, Bot. Zeit. 47 (1889) 511?. Type: Macgregor (B), Fergusson Island, MILNE BAY. **Page 37**

§§MACROKURZIA (§KURZIA) B.C.Stone, Blumea 32(2) (1987) 439. Type sp.: P. daymanensis H.St.John. (=§§PARALOPHOSTIGMA).

§§MAGNICAVERNOSA (§LOPHOSTIGMA) Huynh, Bot. Jahrb. Syst. 97 (1976) 102. Type sp.: P. magnicavernosus H.St.John.

'magdaliaris' (FAGERLINDIA) H.St.John, MS. Spec.: St. John 26109 (K), 25/11/57, 1 km N of Melanoe, SORONG (= P. dolichopodus).

P. magnicavernosus (MAGNICAVERNOSA) H.St.John, Pacif. Sci. 15 (1961) 587. Type: Brass 3120 (BRI), SAN CRISTOBAL. **Page 61**

P. magnificus (MICROSTIGMA) Martelli, Bot. Jahrb. 49 (1912) 66. Type: Kraemer s. n. (B), MANUS (= P. conoideus).

'magnus' (PANDANUS) H.St.John, MS. Spec.: St. John 26122 (K), 29/11/57, Amban beach, MANOKWARI (= P. tectorius).

'major' (DIMISSISTYLI) H.St.John, MS. Spec.: St. John 26120 (LAE), 30/11/57, Amban, MANOKWARI (= P. danckelmannianus).

'malaitensis' (DIMISSISTYLI) H.St.John, MS. Spec.: Stone 2304 (K). MALAITA (= P. danckelmannianus).

P. maneauensis n.n. (MAYSOPS) H.St.John ex Huynh (nom. nud.), Bot. Jahrb. Syst. 97 (1976) 93. Spec.: Brass 23461 (A), Mt. Dayman, Maneau range, MILNE BAY (= P. beccarii).

P. manensis (JEANNERETIA) Martelli, Webbia 4(1a) (1913) 22, 4. Type: Warburg 21005 (B), Man Is., NEW IRELAND (= P. polycephalus).

§§MARGINATA (§KURZIA) H.St.John, Pac. Sci. 22 (1968) 520. Type sp.: P. marginatus H.St.John.

P. marginatus (MARGINATA) H.St.John, Pac. Sci. XXII (1968) 520. Type: Brass 24406 (K, A), Goodenough Is, MILNE BAY (= P. meniscostigma).

P. marinus (PANDANUS) H.St.John, Pac. Sci. 27 (1) (1973) 87. Type: Darbyshire & Hoogland 7859 (BM, BISH, G, L), Aitape, SEPIK (= P. tectorius).

'matha' (KURZIA) H.St.John, MS. Spec.: Stone 2496 (LAE), 17/10/57, Vularu-Thathaje trail, SANTA YSABEL (= P. macgregorii).

§§MAYSOPS (§LOPHOSTIGMA) H.St.John, Pac. Sci. 14 (1960) 227. Type sp.: P. zea H.St.John.

§§MEGASTIGMA (§LOPHOSTIGMA) B.C.Stone, Contr. Herb. Aust. 4 (1974) 26. Type sp.: P. rex B.C.Stone.

P. meniscostigma (MARGINATA) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 171. Type: Brass 3650 (A), Laloki R., CENTRAL. **Page 42**

§§METAMAYSOPS (§LOPHOSTIGMA) B.C.Stone, Contr. Herb. Aust. 4 (1974) 21. Type sp.: P. brachyphyllus Merr. & L.M.Perry.

P. microdontus (MAYSOPS) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 177. Type: Brass 7695 (A), Lake Daviumbu, WESTERN (= P. beccarii).

§§MICROSTIGMA (§KURZIA) Kurz, J. Bot. 5 (1867) 105. Type sp.: P. conoideus Lam. Synonyms: §§SUSSEA and §§BRYANTIA.

P. minusculus (KURZIA) B.C.Stone, Melanesian Plant Studies I (1965) 3. Type: Stone 2627 (BISH), 14/1/58, SE of Kavieng, NEW IRELAND. **Page 37**

P. misimaensis (DIMISSISTYLI) H.St.John ex B.C.Stone, Fed. Mus. J. 23 (1978) 54. Type: Brass 27401 (L,LAE), Mt. Sisa, Misima Is, MILNE BAY (= P. danckelmannianus).

'mulleolus' (AUSTROKEURA) H.St.John, MS. Spec.: St. John 26148 (K), 11/12/57, Mopa, 12 km SE of Merauke, MERAUKE (= P. brassii).

'musaensis' (LAUTERBACHIANI) H.St.John, MS. Spec.: Hoogland 4214 (LAE), Musa River, Tufi, MILNE BAY (= P. lauterbachii).

P. mussauensis (INTRAOBTUTUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 10. Type: Koie & Sandermann Olsen 1770 (C), 1/2/62, Mussau Is., NEW IRELAND (= P. papuanus).

'nabirensis' (ROSTELLATI) Kaneh., Bot. Mag. Tokyo 54 (1940) 255. in synon. P. inokumae Kanehira, Spec.: Inokumae 574 (FU), NABIRE (= P. odoardi).

P. nakanaiensis (MAYSOPS) B.C.Stone, Melanesian Plant Studies I (1966) 2. Type: Floyd 6440 (LAE), Nakanai, NEW BRITAIN (= P. krauelianus).

P. navicularis (UNNAMED) B.C.Stone, Contr. Herb. Aust. 4 (1974) 26. Type: Lelean NGF 46147 (LAE), Namatanai, NEW IRELAND. **Page 50**

P. navigatorum var. *elbertii* (PANDANUS) B.C.Stone, Mal. J. Sci. 2(A) (1973) 64. Type: Elbert s. n. (BISH), RENNEL (= P. tectorius).

P. nemoralis (CURVIFOLIA) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 169. Type: Brass 3279 (A), FLORIDA. **Page 33**

P. neomecklenburgensis (PANDANUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 38. Type: Stone 2624 (BISH), Kulube Pltn., NEW IRELAND (= P. tectorius).

P. nigridens (DIMISSISTYLI) B.C.Stone, Melanesian Plant Studies I (1966) 1. Type: Stone 2304 (BISH), MALAITA (= P. danckelmannianus).

'nonos' (ACROSTIGMA) H.St.John, MS. Spec.: Flenley ANU 2267 (LAE), 28/12/64, Wabag, WESTERN HIGHLANDS (= P. adinobotrys).

'normanbyensis' (MARGINATA) H.St.John, MS. Spec.: Brass 25571 (K), 23/4/56, Waikaiuna bay, Normanby Island, MILNE BAY (= P. meniscostigma).

'noviberiensis' (DIMISSISTYLI) H.St.John, MS. Spec.: Corner RSS 1203 (K), 3/9/65, Kolombangara, NEW GEORGIA (= P. danckelmannianus).

P. novibritannicus (PANDANUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 39. Type: Stone 2593 (BISH), 12/12/57, 1/2 m inland from Matupi harbour, Rabaul, NEW BRITAIN (= P. tectorius).

P. novohibernicus (PANDANUS) Martelli, Webbia 4(1) (1913) 25. Type: Peekel (Herb. Mart.), NEW IRELAND (= P. tectorius).

P. novohibernicus var. *contractus* (PANDANUS) B.C.Stone, Mal. J. Sci. 2(A) (1973) 65. Type: Stone 2544 (BISH), 16/11/57, Bungana Is., FLORIDA (= P. tectorius).

P. novohibernicus var. *inermis* (PANDANUS) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 162. Type: Brass 2664 (A, BISH), 16/8/32, Waimamura, SAN CRISTOBAL (= P. tectorius).

P. novohibernicus var. *leptomeris* (PANDANUS) B.C.Stone, Mal. J. Sci. 2(A) (1973) 66. Type: Stone 2523 (BISH), 10/11/57, Tulagi Is., FLORIDA (= P. tectorius).

P. novohibernicus var. *praeacutus* (PANDANUS) B.C.Stone, Mal. J. Sci. 2(A) (1973) 66. Type: Stone 2583 (BISH), 19/12/57, OpP. Sohano Is., Buka, BOUGAINVILLE (= P. tectorius).

P. *novohibernicus* var. *pseudoturritus* (PANDANUS) B.C.Stone, Mal. J. Sci. 2(A) (1973) 67. Type: Stone 2542 (BISH), 14/11/57, Siota, FLORIDA (= P. tectorius).

P. odoardi (ROSTELLATI) Martelli, Bull. Soc. Bot. Ital. (1904) 304. Type: D'Albertis (FI), Fly River, WESTERN. **Page 28**

P. odoratissimus (PANDANUS) L. f., Suppl. (1781) 424. Type: ?, (= P. tectorius).

'olivaceous' (DIMISSISTYLI) H.St.John, MS. Spec.: Stone 2578 (LAE), 9/12/57, Buka Is. BOUGAINVILLE (= P. danckelmannianus).

'oonopsis' (PARALOPHOSTIGMA) H.St.John, MS. Spec.: St. John 26186 (LAE), 1/1/58, Angoram, SEPIK (= P. clarkeii).

P. orculaeformis (LINIOBTUTUS) Kaneh., Bot. Mag. Tokyo 54 (1940) 251. Type: Inokumae 537 (FU), Senen, NABIRE (= P. hystrix).

P. ornithocephalus (PSEUDACROSTIGMA) H.St.John ex B.C.Stone, Feb. Mus. J. 23 (1978) 64. Type: Versteegh BW 7474 (L, LAE), Teminaboean, SORONG. **Page 30**

P. paludosus (CURVIFOLIA) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 172. Type: Brass 3375 (A), SANTA YSABEL. **Page 34**

§PANDANUS B.C.Stone, Bot. Jahrb. 94 (1974) 512. Basionym: Genus PANDANUS Stickm., Linn. Amoen. Acad. Herb. Amb. (1754) 17. Type sp.: P. tectorius Park. ex Z.

§PANDANUS H.St.John, Pac. Sci. 14 (1960) 228. Type sect.: §§Pandanus.

§§PANDANUS subsect. AUSTROKEURA (§PANDANUS) B.C.Stone, Bot. Jahrb. 94 (1974) 517. Type sp.: P. solms-laubachii F. Muell.

§§PANDANUS subsect. PANDANUS (§PANDANUS) B.C.Stone, Bot. Jahrb. 94 (1974) 516. Type sp.: P. odoratissimus L. f.

§§PANDANUS = §§PANDANUS subsect. PANDANUS B.C.Stone.

P. papuanus (INTRAOBTUTUS) Solms, Ann. Jard. Bot. Buitenz. 3 (1883) 93. Type: Beccari, 6/1873, Lutor, ARU. **Page 93**

P. papuanus (ROSTELLATI) Ridl., Trans. Linn. Soc. II. Bot. 9 (1916) 237. Type: Kloss s.n. (BM) MIMIKA (= P. odoardi).

§§PARALOPHOSTIGMA (§KURZIA) B.C.Stone, Contr. Herb. Aust. 4 (1974) 17. Type sp.: P. limbatus Merr. & L.M.Perry.

P. parkinsonii (INTRAOBTUTUS) Martelli, Webbia 4 (1) (1913) 27, 4. Type: Parkinson s. n. 1905 (Herb. Mart.), Raul Is, BISMARCK ARCH (= P. papuanus).

P. parkinsonii var. *kukuwai* (INTRAOBTUTUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 12. Type: Stone 2616 (BISH), 14/12/57, Toma, Gazelle peninsula, NEW BRITAIN (= P. papuanus).

'paucifrugifer' (AUSTROKEURA) H.St.John, MS. Spec.: St. John 26149 (K), 11/12/57, Mopa, 12 km SE of Merauke, MERAUKE (= P. brassii).

P. pedunculatus (PANDANUS) R. Br., Prodr. (1810) 341. Type: Description only AUSTRALIA (= P. tectorius).

P. pedunculatus var. *insularis* (PANDANUS) B.C.Stone, Mal. J. Sci. 2(A) (1973) 67. Type: Stone 2536 (BISH), Tulagi Is. FLORIDA (= P. tectorius).

P. pedunculatus var. *malagunensis* (PANDANUS) B.C.Stone, Mal. J. Sci. 2(A) (1973) 68. Type: Stone 2619 (BISH), Malaguna-Taliligap Rd., NEW BRITAIN (= P. tectorius).

P. pedunculatus var. *rendovensis* (PANDANUS) B.C.Stone, Mal. J. Sci. 2(A) (1973) 68. Type: B.C.Stone 2560 (BISH), Rendova Is., NEW GEORGIA (= P. tectorius).

P. peekelii (DIMISSISTYLI) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 4. Type: Peekel 435 (FI), Namatanai, NEW IRELAND (= P. danckelmannianus).

P. pendulinus (Uncertain ?LOPHOSTIGMA) Martelli, J. Arn. Arb. 10 (1929) 142. Type: Brass 1053 (A), Ihu, Vailala R., CENTRAL. **Page 83**

P. penicillus (LINIOBTUTUS) Martelli, Bull. Soc. Bot. Ital. (1904) 299. Type: d'Albertis (FI?), Fly R., WESTERN. **Page 59**

P. pentagonus (ROSTELLATI) H.St.John, Pac. Sci. 27 (1) (1973) 50. Type: Clemens 1537 (BR, L), Wareo, MOROBE (= P. odoardi).

P. permicron (ROSTELLATI) Kaneh., Bot. Mag. Tokyo 54 (1940) 258. Type: Inokumae 603 (FU), NABIRE. **Page 29**

§§PERRYA (§LOPHOSTIGMA) B.C.Stone, Contr. Herb. Aust. 4 (1974) 19. Type sp.: P. archboldinaus Merr. & L.M.Perry.

P. perryae n.n. (MAYSOPS) H.St.John ex Huynh (nom. nud.), Bot. Jahrb. Syst. 97 (1976) 92. Spec.: Brass 5283 (FI, BRI), Mafulu, CENTRAL (= P. beccarii).

'pia' (MAYSOPS) H.St.John, MS. Spec.: St. John 26168 (K), 22/12/57, Nettar, N coast Lake Sentani, JAYAPURA (= P. krauelianus).

P. pistillaris (INTRAOBTUTUS) Martelli, Bot. Jahrb. 49 (1912) 64. Type: Peekel 209 (B), Namatani, NEW IRELAND (= P. papuanus).

P. plicatus (MICROSTIGMA) H.St.John, Pac. Sci. XXII (1968) 517. Type: Carr 12590 (BM), Koitaki, CENTRAL (= P. conoideus).

P. polyacris (PANDANUS) Martelli, Webbia 4(2) (1914) 27, 4. Type: Lauterbach 275 (B+), NEW BRITAIN (= P. tectorius).

P. polyacris var. *malaitensis* (PANDANUS) B.C.Stone, Mal. J. Sci. 2(A) (1973) 69. Type: Stone 2458 (BISH) N. of Auki, MALAITA (= P. tectorius).

'polyacris var. helios' (PANDANUS) H.St.John, MS. Spec.: Stone 2460 (K), 1957, Auki, MALAITA (= P. tectorius).

P. polycephalus (JEANNERETIA) Lamk., Encycl. 1 (1785) 372. Type: Rumph. Amb. 4. P. 143. t. 76 AMBON. **Page 36**

'porcorum' (PANDANUS) H.St.John, MS. Spec.: St. John 26130 (K), 3/12/57, Warossir. 60 km S of Manokwari, MANOKWARI (= P. tectorius).

P. poronaliva (ACROSTIGMA) B.C.Stone, Melanesian Plant Studies I (1966) 1. Type: Stone 2468 (BISH), SANTA YSABEL. **Page 24**

'profundior' (PANDANUS) H.St.John, MS. Spec.: St. John 26176 (K), 26/12/57, Wirui, 1 km S of Wewak, SEPIK (= P. tectorius).

§§PSEUDACROSTIGMA (§ACROSTIGMA) B.C.Stone, Fed. Mus. J. n. s. 13 (1968) 146. Type sp.: P. platystigma Martelli.

P. pseudopapuanus (INTRAOBTUTUS) Martelli, Webbia 4(1) (1913) 28, 4. Type: Lauterbach s. n. (B), German New Guinea (= P. papuanus).

P. pseudosyncarpus (ACROSTIGMA) Kaneh., Bot. Mag. Tokyo 54 (1940) 258. Type: Inokumae 636 (FU), NABIRE. **Page 25**

P. quadrifidus (PANDANUS) B.C.Stone, Melanesian Plant Studies I (1966) 3. Type: Stone 2555 (BISH), Ganongga Island, NEW GEORGIA (= P. tectorius).

P. rabaulensis (PANDANUS) H.St.John, Rev. Gen. Pandanus, part 51 (1989) 42. Type: Stone 2595 (BISH), Matupi harbour, Rabaul, NEW BRITAIN (= P. tectorius).

'reburrus' (ACROSTIGMA) H.St.John, MS. Spec.: St. John 26181a (K), 29/12/57, Kuranon, 18 m W of Wewak, SEPIK (= P. setistylus).

P. rechingerii (JEANNERETIA) Martelli, Webbia 4(1a) (1913) 29, 4. Type: Rechinger 4385, 4998 (H. Rech.), Jeta, Buka, BOUGAINVILLE (= P. polycephalus).

P. reconditus n.n. (MAYSOPS) H.St.John ex Huynh (nom. nud.), Bot. Jahrb. Syst. 97 (1976) 93. Spec.: Brass 29252 (A), Oomsis, MOROBE (= P. krauelianus).

'rendovaensis' (PANDANUS) H.St.John, MS. Spec.: Stone 2561 (K), 26/11/57, Rendova Is., NEW GEORGIA (= P. tectorius).

P. rennellensis (PANDANUS) H.St.John, Nat. Hist. Rennel Is. 8 (1980) 9. Type: Dissing 2861b (C) RENNEL (= P. tectorius).

'rererivalis' (DIMISSISTYLI) H.St.John, MS. Spec.: ?, Solomons (= P. danckelmannianus).

P. rex (MEGASTIGMA) B.C.Stone, Contr. Herb. Aust. 4 (1974) 28. Type: Pullen 6595 (LAE), Vailala R., CENTRAL. **Page 70**

P. roseus (MAYSOPS) B.C.Stone, Melanesian Plant Studies II (1966) 1. Type: Stone 2559 (BISH), Rendova Is., NEW GEORGIA. **Page 66**

P. rostellatus (ROSTELLATI) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 182. Type: Brass 5675 (NY), Kubuna, CENTRAL (= P. odoardi).

'rostratellus' (PANDANUS) H.St.John, MS. Spec.: Stone 2270 (LAE), 15/9/57, 1/2 m E of Henderson Field, GUADALCANAL (= P. tectorius).

P. rubellus (MAYSOPS) B.C.Stone, Melanesian Plant Studies I (1966) 2. Type: Stone 2565 (BISH), Buka Is., BOUGAINVILLE. **Page 66**

P. ruber (MICROSTIGMA) H.St.John, Pac. Sci. XV (1961) 579. Type: Brass 5463 (BRI), Bella Vista, CENTRAL (= P. conoideus).

P. rubrispicatus n.n. (MICROSTIGMA) H.St.John (nom. nud.), Pac. Sci. 22 (1968) 519. (= P. conoideus).

'rudis' (DIMISSISTYLI) H.St.John, MS. Spec.: ?, Solomons (= P. danckelmannianus).

'rufus' (AUSTROKEURA) H.St.John, MS. Spec.: St. John 26150 (K), 12/12/57, Koembe. MERAUKE (= P. brassii).

'rugulosus' (DIMISSISTYLI) H.St.John, MS. Spec.: St. John 26188 (LAE) Angoram, SEPIK (= P. danckelmannianus)

§RYKIA (De Vriese) B.C.Stone, Bot. Jahrb. 94 (1974) 489. Basionym: Genus RYKIA De Vriese, Tuinbouw Fl. 1 (1854) 161. Type sp.: P. furcatus Roxb.

P. sattelbergensis n.n. (MICROSTIGMA) H.St.John (nom. nud.), Pac. Sci. 35 (1973) 81. (= P. daymanensis or conoideus).

P. scabribracteatus (FAGERLINDIA) Martelli, J. Arn. Arb. 10 (1929) 139. Type: Brass 987 (A), Vailala R., CENTRAL (= P. kaernbachii).

P. schoddei (MEGASTIGMA) H.St.John, Contr. Herb. Aust. 3 (1974) 5. Type: Craven & Schodde 347 (CANB, LAE), Lake Loloru., BOUGAINVILLE. **Page 71**

P. semidivisus n.n. (CURVIFOLIA) H.St.John ex B.C.Stone (nom. nud.), Mal. J. Sc. 1(A) (1972) 114. Spec.: Whitmore BSIP 881 (BSIP, LAE), 29/11/62, Vangunu, SE Coast, NEW GEORGIA (= P. decus-montium).

'semiplantus' (FAGERLINDIA) H.St.John, MS. Spec.: St. John 26094 (K), 22/11/57, 7 km S of Sorong, SORONG (= P. kaernbachii).

'sepikensis' (LAUTERBACHIANI) H.St.John, MS. Spec.: Millar & Dockerill NGF 35188 (LAE), 29/7/67, Arafundi R, SEPIK (= P. lauterbachii).

P. setistylus (ACROSTIGMA) Warb., Pflanzenr. Heft III, IV. 9 (1900) 81. Type: Hollrung 175, Lauterbach 2505 (B), Finschaffen, MOROBE. **Page 24**

P. solms-laubachii (AUSTROKEURA) F. Muell., Bot. Zeit. 45 (1887) 218. Type: Persich, Endeavor River, AUSTRALIA. **Page 124**

P. solomonensis (UNNAMED) B.C.Stone, Melanesian Plant Studies I (1966) 3. Type: Stone 2303 (BISH), Malaita Is., MALAITA. **Page 95**

P. species 1 (KURZIA). Spec.: Jebb 1017, 18/9/92, Ransiki River, 14 km NW of Ransiki, MANOKWARI. **Page 39**

P. species 2 (KURZIA). Spec.: Jebb 1018, 18/9/92, Ransiki River, 14 km NW of Ransiki, MANOKWARI. **Page 40**

P. species 3 (UNNAMED). Spec.: Mack 343 (LAE), Crater Mt., EASTERN HIGHLANDS. **Page 51**

P. species 4 (LINIOBTUTUS). Spec.: Foreman & Katik NGF 48469 (LAE), Kiunga WESTERN. **Page 60**

P. species 5 (PERRYA). Spec.: Vink 16448 (LAE), Agie, Minj Valley, WESTERN HIGHLANDS. **Page 77**

P. species 6 (PERRYA). Spec.: Jebb 949, Karawari SEPIK. **Page 78**

P. species 7 (STONEDENDRON). Spec.: Croft & Katik NGF 13130 (LAE) Mt. Sule, NEW BRITAIN. **Page 82**

P. species 8 (FAGERLINDIA). Spec.: Brass 28672 (LAE), 8/11/56, Lauani Creek, Woodlark Is, MILNE BAY. **Page 91**

P. spodiophyllus (MAYSOPS) B.C.Stone, Melanesian Plant Studies I (1966) 2. Type: Stone 2617 (BISH), Warangoi river, NEW BRITAIN. **Page 69**

P. stenocarpus (DIMISSISTYLI) Solms, Ann. Jard. Bot. Buitenz. 3 (1883) 91. Type: Beccari 7/1875, Arfak Mts., MANOKWARI (= P. danckelmannianus).

§§STONEDENDRON (§LOPHOSTIGMA) Huynh, Bot. Jahrb. Syst. 97 (1976) 91. Type sp.: P. concinnus Merr. & L.M.Perry.

'subconvexus' (PANDANUS) H.St.John, MS. Spec.: Stone 2585 (K), 9/12/57, OpP. Sohano Is., Buka, BOUGAINVILLE (= P. tectorius).

'subtruncatus' (PANDANUS) H.St.John, MS. Spec.: Stone 2584 (K), 9/12/57, Lua village, Buka, BOUGAINVILLE (= P. tectorius).

P. subumbellatus (KURZIA) Becc., in Solms-Laubach, Ann. Jard. Bot. Buitenz. 3 (1883) 96. Type: Beccari sn., ARU. **Page 38**

'suspensus' (MAYSOPS) H.St.John, MS. Spec.: St. John 26183 (K), 29/12/57, Awain, 15km W of Wewak, SEPIK (= P. krauelianus).

§§SUSSEA Warb. Pflanzenr. IV,9 (1900) 44 (=§§MICROSTIGMA in New Guinea).

P. tabbersianus (MAYSOPS) Rendle in L. S. Gibbs, Phytogeog. & Fl. of the Arfak Mts. 198. Type: Gibbs 6213 (BM), track to Amban, MANOKWARI (= P. krauelianus).

'tark' (ACROSTIGMA) H.St.John, MS. Spec.: Flenley ANU 2527 (LAE), Laiagam, WESTERN HIGHLANDS (= P. congregatus).

P. tectorius (PANDANUS) Parkinson, J. Voy. S. Seas 1773. Type: Description only., TAHITI. **Page 94**

P. tectorius var. *novoguineensis* (PANDANUS) Martelli, Webbia 4(1) (1913) 34, 4. Type: Warburg 21006 (B) Hatzfeldthafen, MADANG (= P. tectorius).

'tenuis' (PANDANUS) H.St.John, MS. Spec.: St. John 26136 (K), 5/12/57, Maripi beach, MANOKWARI (= P. tectorius).

'tertianus' (PANDANUS) H.St.John, MS. Spec.: Stone 2560 (K), 27/11/57, Rendova Is., NEW GEORGIA (= P. tectorius).

'testeyt' (PANDANUS) H.St.John, MS. Spec.: St. John 26121 (K), 30/11/57, Ambon beach, MANOKWARI (= P. tectorius).

'thermifonteus' (PANDANUS) H.St.John, MS. Spec.: Brass 25979 (K), 26/5/56, Iamelele No. 1., Fergusson Is, MILNE BAY (= P. tectorius).

'tritos' (PANDANUS) H.St.John, MS. Spec.: Stone 2569 (K), 5/12/57, Buka Is., BOUGAINVILLE (= P. tectorius).

P. tulagiensis n.n. (PANDANUS) H.St.John (nom. nud.), Rev. Gen. Pandanus, part 51 (1989) 33. Spec.: Stone 2523 (K), 10/11/57, Tulagi Is., FLORIDA (= P. tectorius).

P. turbinatus n.n. (FAGERLINDIA) H.St.John (nom. nud.), Rev. Gen. Pandanus, part 51 (1989) 6. Spec.: Brass 8139 (A), Sturt Is., Lower Fly, WESTERN (= P. kaernbachii).

'ubericarpelatus' (PANDANUS) H.St.John, MS. Spec.: St. John 26126 (K), 1/12/57, Lemon Is, Dore Bay, MANOKWARI (= P. tectorius).

'uliginosus' (PANDANUS) H.St.John, MS. Spec.: Stone 2458 (K), 30/9/57, Anki SwamP. MALAITA (= P. tectorius).

P. upolensis (PANDANUS) Martelli, Bish. Mus. Occ. PaP. 10(13) (1934) 15. Type: ex SAMOA (= P. tectorius).

P. variegatus (Horticultural) Miq., Anal. Bot. Ind. ii. 28.

P. veitchi (Horticultural) Hort., Cf. Gard. Chron. (1868) 349; Hort. ex Dalliere, Pl. Ornament. i. 28 (1873), ex Pacific.

'verruculosus' (DIMISSISTYLI) H.St.John, MS. (= P. danckelmannianus).

P. vinkii n.n. (PERRYA) H.St.John ex Huynh (nom. nud.), Bot. Jahrb. Syst. 97 (1976) 94. Spec.: Vink 16448 (K,LAE), Agie, Minj Valley, WESTERN HIGHLANDS (= P. species 5).

'violaceus' (MAYSOPS) H.St.John, MS. Spec.: H.St.John 26144 (LAE), 9/12/57, Jendidari, 20 km W of Mokmeri, BIAK (= P. krauelianus).

P. viridiruber n.n. (PERRYA) H.St.John ex Huynh (nom. nud.), Bot. Jahrb. Syst. 97 (1976) 95. Spec.: Clemens s. n. (L), MOROBE (= P. archboldianus).

P. vogelensis (PANDANUS) H.St.John, Pac. Sci. 27 (1) (1973) 89. Type: Brass 21778 (K), Cape Vogel, MILNE BAY (= P. tectorius).

'waginaensis' (DIMISSISTYLI) H.St.John, MS. Spec.: Whitmore BSIP 5524 (LAE), 19/3/64, Wagina Is. CHOISEUL (= P. danckelmannianus).

'wasso' (INTRAOBTUTUS) H.St.John, MS. Spec.: St. John 26159 (K), 17/12/57, Tandjung Poetoes, 15 km up Merauke R., MERAUKE (= P. papuanus).

P. wauensis (MAYSOPS) H.St.John ex Huynh (nom. nud.), Bot. Jahrb. Syst. 97 (1976) 93. Spec.: Womersley NGF 24963 (LAE), N. slope Watut valley, Wau, MOROBE (= P. krauelianus).

'woodlarkensis' (FAGERLINDIA) H.St.John, MS. Spec.: Brass 28672 (K,LAE), 8/11/56, Lauani Creek, Woodlark Is, MILNE BAY (= P. species 8).

P. xanthocarpus (MAYSOPS) Merr. & L.M.Perry, J. Arn. Arb. 20 (1939) 179. Type: Brass 8487 (A), Wassi Kussa R., WESTERN (= P. beccarii).

'ysabelensis' (PANDANUS) H.St.John, MS. Spec.: Hunt RSS 2680 (K), 21/9/65, Cockatoo anchorage, SANTA YSABEL (= P. tectorius).

P. yuleensis (PANDANUS) H.St.John, Pac. Sci. XV (1961) 583. Type: Womersley & Simmonds 5099 (BRI), Yule Is., CENTRAL (= P. tectorius).

'zomoi' (INTRAOBTUTUS) H.St.John, MS. Spec.: St. John 26219 (K), 18/1/58, Bulolo, MOROBE (= P. papuanus).

APPENDIX 3

LISTING OF SPECIES BY ALTITUDE AND HABITAT

This appendix lists species by altitude and habitat, so as to provide a means of narrowing down a search for an identification of a specimen.
Abbreviations: NC: Confined to north coast New Guinea; SC: Confined to south coast New Guinea; Sol.: Confined to Solomon Islands, including Bougainville; Bism.: Confined to Bismarck Archipelago.

Sea-level to 500 metres

BEACH VEGETATION
P. dubius, P. kaernbachii, P. polycephalus, P. solomonensis (Sol.), P. species 8, P. tectorius.

MANGROVE SWAMPS
P. calathiphorus (Sol.), P. kaernbachii, P. krauelianus, P. polycephalus, P. poronaliva (Sol.), P. setistylus (NC), P. species 8, P. tectorius.

SWAMP FOREST
P. atropurpureus, P. columbiformis (SC), P. exiguus (SC), P. hystrix (NC), P. kaernbachii, P. lauterbachii, P. leiophyllus, P. nemoralis (Sol.), P. penicillus, P. setistylus (Sol.).

LOWLAND, WELL DRAINED FOREST
P. aggregatus (SC), P. balenii (NC), P. beccarii, P. buinensis (Sol.), P. castaneus (NC), P. calathiphorus (Sol.), P. clarkei (NC), P. conoideus (cultivated), P. croceus (Bism.), P. danckelmannianus, P. decus-montium (Sol.), P. flavicarpus (Sol.), P. krauelianus, P. lamprocephalus (Sol.) P. leiophyllus, P. limbatus (SC), P. macgregorii, P. magnicavernosus (Sol.), P. meniscostigma, P. navicularis (Bism.), P. odoardi, P. ornithocephalus, P. paludosus (Sol.), P. papuanus, P. permicron, P. poronaliva (Sol.), P. pseudosyncarpus (NC), P. rex (SC), P. roseus (Sol.), P. rubellus (Sol.), P. setistylus (NC), P. species 1, P. species 2, P. species 4 (SC), P. spodiophyllus (Bism.), P. subumbellatus (SC).

RIVERINE ASSOCIATIONS
P. balenii (NC), P. clarkei (NC), P. hystrix (NC), P. lauterbachii, P. leiophyllus, P. leptocarpus, P. pendulinus (SC), P. species 6 (NC).

FOREST ON LIMESTONE
P. navicularis (Bism.), P. ornithocephalus, P. species 1, P. species 2.

SAVANNAH GRASSLANDS
P. brassii (SC), P. papuanus, P. pendulinus (SC), P. tectorius.

CULTIVATED
P. amaryllifolius, P. conoideus, P. macgregorii, P. solomonensis (Sol.).

Over 500 m, and up to 1,000 m.

FOREST
P. atropurpureus, P. beccarii, P. castaneus, P. conoideus (cultivated), P. danckelmannianus, P. daymanensis, P. dolichopodus, P. kajewskii (Sol.), P. kosteri, P. lamprocephalus (Sol.), P. limbatus, P. odoardi, P. permicron, P. penicillus, P. poronaliva (Sol.), P. species 3.

FOREST ON LIMESTONE
P. navicularis.

CULTIVATED
P. conoideus.

Over 1,000 m and up to 1,500 m

FOREST
P. adinobotrys, P. antaresensis, P. archboldianus, P. beccarii, P. castaneus, P. concavus, P. congregatus, P. galorei, P. kajewskii (Sol.), P. kosteri, P. leptocaulis, P. limbatus, P. odoardi, P. papuanus, P. penicillus, P. species 3, P. species 7 (Bism.)
CULTIVATED
P. conoideus.

Over 1,500 m

FOREST
P. adinobotrys, P. antaresensis, P. archboldianus, P. brachyphyllus, P. brosimos, P. concavus, P. concinnus, P. congregatus, P. galeatus, P. galorei, P. iwen, P. leptocaulis, P. schoddei (Sol.).
SWAMP GRASSLAND
P. species 5.
CULTIVATED
P. conoideus, P. jiulianettii.

CULTIVATED SPECIES

P. amaryllifolius (0), P. conoideus (0-2,000 m), P. macgregorii (0-200 m), P. solomonensis (0-100 m) [For leaves only], P. jiulianettii (1,500-2,800 m).

ORNAMENTALS

P. variegatus (0?), P. baptistii (0?), P. veitchii (0?), P. augustianus (0?).

EDIBLE, WILD COLLECTED SPECIES

P. antaresensis (1,500-2,500 m), P. brosimos (1,800-3,300 m), P. dubius (0-10 m), P. iwen (1,500-2,500 m), P. limbatus (100-1,050 m), P. macgregorii (0-200m), P. spodiophyllus (200-300 m).

APPENDIX 4

BIBLIOGRAPHY

The bibliography has been divided into two parts. The literature cited in the text and appendices (the majority of taxonomic references are contained in Appendix 2, and are not repeated here) is placed first, and this is followed by a second listing compiled by R. M. Bourke of the Australian National University which lists all the known references to edible *Pandanus* species in New Guinea. An asterisk indicates that the paper is briefly summarised in Appendix 5.

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APPENDIX 4: contd.

AN INCOMPLETE BIBLIOGRAPHY OF EDIBLE *PANDANUS* IN PNG
PREPARED BY R.M.BOURKE - 1991
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APPENDIX 5

A CONDENSATION OF SELECTED PUBLICATIONS ON *PANDANUS*

Some of these references are difficult to obtain, and I decided it would be of use to field workers to have access to condensed versions of these various papers on the biogeography and utilisation of *Pandanus* in New Guinea.

Stone, B. C., 1982. New Guinea Pandanaceae: Ecology and Biogeography in Biogeography and Ecology of New Guinea. Monogr. Biol. 42: 401-436. Junk.

New Guinea is part of the "core" region where all three genera of Pandanaceae occur. These three genera - *Freycinetia*, *Pandanus* and *Sararanga* - are morphologically distinct, with no 'intermediate' species.

Sararanga is represented by one species in New Guinea, the other occurs in the Philippines. This genus is regarded as the most primitive within the family, with its complex inflorescence, trichomes of stellate hairs, quadrifarious phyllotaxy and absence of proproots. There are probably 66 species of *Pandanus* in the island of New Guinea itself, of which probably 50 are endemics. *Freycinetia* is a genus of about 180 species, with 50-56 species in New Guinea, of which 40 are endemic.

For both these latter genera, Stone lists the biogeographic and ecological status of each of the species. In addition a table of the sub-genera and sections of *Pandanus* is also given, although not all the species included in the first enumeration are listed in the latter.

Sararanga appears to only be capable of surviving and growing in transitional successional communities. In parts of the Solomons it can form pure stands, although these do not appear to be self-sustaining. [Note: I have seen *S.sinuosa* growing in wet gullies both inside and outside forest on the Cycloop mountains around Lake Sentani and Jayapura]. A detailed discussion of species with wide ecological amplitudes, cultivated species, and species with narrow ecological limits is given. In addition the approximate distribution of *Pandanus* and *Freycinetia* in different forest types is given.

A summary of the biogeographic status of the genera is given. For *Pandanus* New Guinea has no endemic subgenera, but 10 endemic sections or sub-sections. Sub-genus Lophostigma has 5 endemic sections, the remaining 2 sections are more widespread, for the other subgenera the proportions are: Kurzia 3:2; *Pandanus* 1:4; Acrostigma 1:3. In terms of species *Pandanus* shows 80% endemism.

Freycinetia shows a similar degree of species endemism (71%). Of the 12 sections of this genus occurring in New Guinea, however, none are endemic.

Stone, B. C., 1982. Agronomic Study of Karuka: Proposal scheme for an Agronomic Study of *Pandanus julianettii* (sic) and *Pandanus brosimos*, the Karuka nut trees of Papua New Guinea. Unpubl. report prepared for the Dept. of Primary Industry, Division of Agriculture, PNG. 26pp.

This report outlines the knowledge of the Karukas, their distribution, utilisation, and suggests a research program into their current and future agronomic potential. The Karuka Nut Agronomic Study should provide the basis for a gradual long-term improvement in the scientific understanding of the crop, and use this knowledge as the basis for a program of practical steps to improve it, to widen the scope of use, distribute the products more widely and, if possible, extend the season.

Growth pattern. Woody monocots are very predictable in growth form, the number of branches, and hence number of terminal inflorescences is generally an accurate age of a tree, moreover the productivity of a tree is dependent upon the total number of branches.

Clonal cultivars. The majority (?all) cultivated *P.jiulianettii* are grown from short side branches which arise near the base of adult plants. Proproots may also be used for propagation, when removed with a segment of stem.

Leaves. There are 24 "kinds" of leaves (seedling, juvenile, adolescent, unbranched adult, branched adult, senescent X prophyll, scale leaf, transitional leaf, normal leaf, transitional bract, bract) and when used for identification, it is important that comparable leaves are used.

Flowering. Flowering is terminal on a stem, and the stem continues through activation of an (or two or three) axillary bud(s). The first branching point does not appear to flower in the Karukas.

Male Flowers. Pollen is as yet unknown for the Karukas. Male flowers in some species appear to be produced more frequently than female flowers (every year vs. every 2nd year).

Female Flowers. Unlike the male flower, the female flower remains erect for much longer. How long the stigmas are receptive is unknown. Whether seeds are produced apomictically is unknown. The degree of parthenocarpy (fruit set without seeds) is also unknown.

Fruit development. The Karuka season varies in different localities, and in size from year to year. Biennial production appears to be the norm.

Distribution. The upper and lower limits appear to be 10,500' to 6,000'. P.brosimos occurs at higher altitudes, and P.jiulianettii at lower altitudes, at 8,500' to 9,000' the two species may occur together. The latter species has yet to be found in the `wild'. One collection of P.jiulianettii with fruit was made at 4,160', there may therefore be scope for applied research into lowering the altitudinal limit of Karuka.

Specimens. *P. brosimos* - 16 collections known, from 5 localities. *P. jiulianettii* - 9 collections from 9 localities.

A key for distinguishing the Karukas from wild *Pandanus* species is given.

Objectives of the Research Programme.

1: i) Individual tree productivity. ii) data from informants. iii) Numbers of trees owned and used by villagers. iv) Numbers of villages/human populations utilising Karukas, and to what extent and importance.
2: Comparative studies of the productivity of the two species.
3: Nutritional quality of Karukas.
4: Storage.

Other research goals would be a reproductive and genetic study, an investigation of pathogens, and physiological studies on fertilisation and husbandry.

ROSE, C., 1982. Preliminary observations on the *Pandanus* nut (*Pandanus jiulianettii*). In R.Bourke and V.Kesavan, eds., Proc. of the Second Papua New Guinea Food Crops Conference, Dept. Primary Industry, Port Moresby.

Pandanus jiulianettii is parthenogenetic and dioecious. Compared to the wild species *P. brosimos* it is more richly branched, has longer, less erect leaves, and larger, weaker drupes. It is cultivated extensively in the highlands of Papua New Guinea above 1,700 m and is an important subsistence crop.

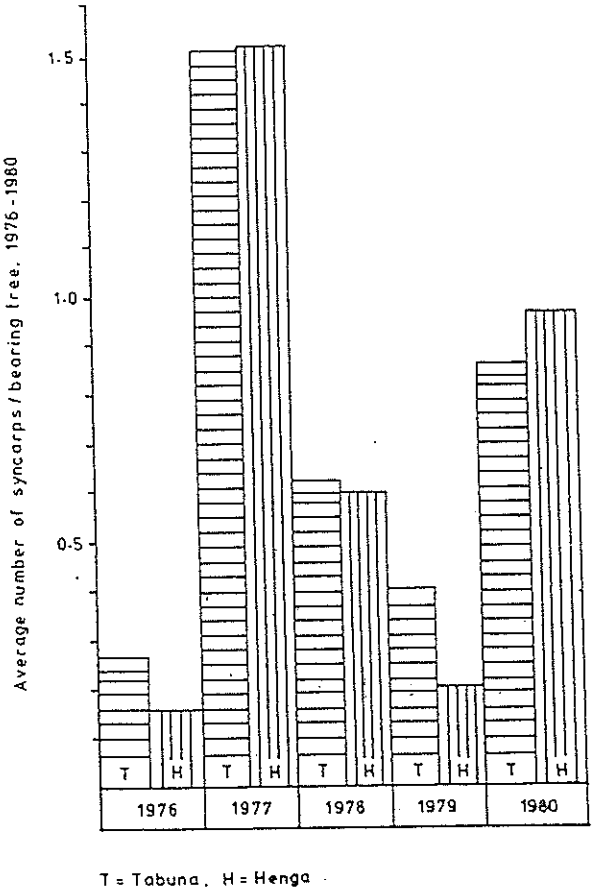
A study of yields was initiated in 1976 in Tari, Southern Highlands. Approximately 1,200 trees were monitored, the number of syncarps produced was recorded over 4 years. Seventeen different varieties were identified. Two varieties, Tabuna and Henga, accounted for 50% and 24% of the survey population respectively and approximately 70% of these trees fruited during the period 1976 to 1980.

There were two 'seasons' in 1979 and 1980 (no months given). 1977 was an exceptional year, with up to 1.5 syncarps being produced per tree. In 1978 the trees averaged 0.5 syncarps per tree, and this increased to approximately one syncarp per bearing tree by 1980. The number of syncarps harvested during the five year period was positively and significantly related to the number of leaf clusters growing on the trees (r=0.956**).

The yearly production of the two main varieties suggests that the trees are triennial, i.e. they bear heavily every three years. However, this pattern will depend largely on climate and soil fertility.

Approximately 8% of the syncarp (as harvested) was available as dried edible nut. Chemical analysis of the nuts indicated levels of crude protein, ether extract and nitrogen free extract as 13.6%, 35.6% and 30.4% of dry matter respectively for Tabuna. The mesocarp contained 8.5% crude protein.

Average yields per bearing tree per annum for two varieties, Tabuna and Henga, at two locations, 1976 to 1980



MONRO, G., Essays on *Pandanus*, No.1. Review of Edible *Pandanus* in Papua New Guinea. Unpubl. report from Dept. of Primary Industry, H.A.E.S.,Tambul, W.H.P.

A description of the species *P. brosimos*, *P. jiulianettii* and *P. conoideus* is given. All three species are capable of being parthenocarpic, although males are known.

P. conoideus is propagated naturally by the production of suckers on aerial roots of mature trees. Male trees are generally cut down. Cuttings are made either from the root suckers, or more usually from whole branches, which are planted diagonally with 50% of the stem below ground level. This latter method results in faster maturing plants. Altitudinal limits are given as: absolute minimum, 0 m; usual minimum, 0 m; usual maximum, 1,650 m; absolute maximum, 1,940 m (R.Bourke pers.comm.). It seems most common between 1,300 and 1,500 m. It is restricted to moist soils, and prefers moderately shaded areas. Many varieties are recognised. Fruit production is seasonal (December to February) and may be as short as 2-4 weeks. The fruit takes c.3 months to mature, once mature it goes rancid quickly and cannot be stored. The whole cephalium is cooked and the pulp of mesocarp and seeds scrapped and squeezed to extract the 'Marita sauce'. This sauce is used as a flavouring.

Composition Analysis of Marita fruits					
Water	Protein	Fat	Carbohydrate	Fibre	Ash
64.7%	2.5%	9.1%	9.1%	12.4%	2.2%

P. brosimos is a wild tree, and is generally not planted or propagated by man. Seedlings are protected and encouraged however. The trees are otherwise not tended in any way. Altitudinal limits are given as Absolute minimum, 2,300m; Usual minimum, 2,500m; Usual maximum, 3,100m; Absolute maximum, 3,300m; preferred range 2,600-2,700m.

P. jiulianettii may be propagated by seed or by cuttings, the latter method again producing a more rapidly maturing tree (4-5 years versus 8-10 years from seed. It is grown in open or shaded environments, but not in the forest. Altitudinal limits are given as Absolute minimum, 1,650m; Usual minimum, 1,800m; Usual maximum, 2,500m; Absolute maximum, 2,700m; preferred range 2,100-2,400m.

The two Karukas are easily told apart. Varietal differences of the latter are usually slight, and chiefly involve fruit characteristics. Male flowers of *P. jiulianettii* are not common, since the male trees are usually cut down. In some valleys only very few varieties are credited with having males. During a heavy harvest the nuts of this species are full and fertile. In seasons of moderate or small harvest, many of the nuts are empty, with more mesocarp being produced. Male flowers are reported as more common during heavy seasons. Monro suspects that the pollen of *P. brosimos* is capable of fertilising the female flowers of *P. jiulianettii*. Flowering to fruiting takes about 4 months in *P.jiulianettii*, and 6 months in *P. brosimos*.

The Karuka season in the PNG highlands is usually between December and March, corresponding with the wet season. During a light season fruits are produced irregularly through this period. In a heavy season most of the fruits of *P. jiulianettii* will be harvested in 1 week, and the bulk of the P.brosimos over 2-3 weeks.

Karuka nuts do not store well, and will last only 1-2 days after harvesting. Several storage methods are employed. In Enga and the Eastern Highlands the nuts are smoked and dried. In the Enga the nuts are removed from the shells and tightly wrapped in *Pandanus* leaves. In the Eastern Highlands the nuts are hung inside their shells. In the Southern Highlands the nuts are dried only lightly before being hung in the corners of the house. Stored Enga nuts are reported to last 4 years. In Southern and Eastern Highlands the nuts can be stored up to 1 year.

HYNDMAN, D.C. 1984. Ethnobotany of Wopkaimin *Pandanus*: Significant Papua New Guinea Plant Resource. Economic Botany 38(3): 287-303.

The Wopkaimin live at the headwaters of the Ok Tedi in the Star and Hindenburg mountains. This paper details the names, taxonomy, cultural and nutritional use of 12 species of Pandanus by these people. They divide Pandanus into the nut bearers (sal), with large pyrenes, and the remainder (aim) in which the individual pyrenes are small. These categories are not equivalent to the pidgin terms Karuka and marita. Sal combines the wild and domesticated `Karukas', as well as wild species, which may or may not be edible. P. iwen was discovered and first collected during the course of this work. In addition the Wopkaiman also distinguish a further `wild karuka' mimkan, which was not collected by Hyndman, and may prove to be a further new species.

	SAL			AIM	
Wild Karukas:	IWEN:		Cultivated Maritas:	KAIEP	
	iwen	P. iwen		12 named cvs.	P.conoideus
	kaun	P. brosimos			
	mimkan	P.sp?	Others:	sel	P.adinobotrys
Cult. Karukas:	AMSAL:			waprom	P.concavus
	18 named cvs.	P. jiulianettii		get	P.dolichopodus
				faket	P.castaneus

Others:

aian	P.antaresensis
gol	P.galorei
kulom	P.foveolatus
tum	P.limbatus

WILD KARUKAS: *P. brosimos* produces the most favoured of all the Karuka nuts. It is found in wetter sites and at higher altitudes that *P. iwen*. It fruits once a year, the cephalia taking some 6 months to ripen, being ready in about June onwards. A ripe cephalia weighs upwards of 10 Kg. Only men can harvest the wild nuts, although they can be eaten by anybody. The wild Karuka season is indicated by the flowering of the tanket shrub - *Cordyline fruticosa.*

P. iwen is most prevalent in the drier portions of the Hindenburg Plateau. It is the next most favoured species of Karuka nut. It differs from *P. brosimos* in a more oval shaped cephalium, shorter leaves and longer proproots.

P. sp. (mimkan) is the shortest of the wild Karukas. It is found in the wettest portions of the Hindenburg Plateau, and is transitional into mossy forest. The nuts of this variety are the smallest of the wild Karukas. The leaves are short, and the proproots are long, as in *P. iwen*, and arch dramatically down to the ground.

'Karuka madness' is a phenomenon recorded from several areas of the highlands. It is thought that the presence of Dimethyltryptamine (DMT) in the nuts of wild collected Karukas induces this hysterical atoxic state. However to date there has been no detailed examination of the causes or factors involved in this phenomenon, nor whether it is truly related to Karukas or not.

CULTIVATED KARUKAS: *P. jiulianettii* is propagated as cuttings in mixed varietal groves at 1,500-2,000 m. The trees take 7-8 yrs to mature, and continue to bear fruits for 60 yrs. Only men are allowed to plant and tend these trees. Each man owns several groves. The ripe cephalia require 2-3 months to ripen, reaching 5 kg in weight. Two crops of cephalia are produced a year, although they bear most abundantly in May and June. 18 cultivars were named.

OTHER SAL: The four remaining wild species fruit continuously through the year, and two are occasionally eaten by people. Cassowaries, Palm cockatoos and tree rats (*Uromys*) are regarded as the main feeders upon these fruits. The fallen phalanges of *P. antaresensis* are cracked open for the several seeds within. The tree is never climbed, because it is both tall and covered with spines, while those of *P. limbatus* are, and this is the only species that women are permitted to climb in order to harvest the ripened fruit.

P. antaresensis is utilised as an important medicinal plant in the treatment of headache, diarrhoea and breathing difficulties. Prop roots, bark and drupe shells are used in this regard. Its leaves provide one of the most important thatching materials. *P. galorei* is used for house construction, its proproots are split and used as walling, while its main trunk is split open and flattened out for flooring.

CULTIVATED MARITA: *P. conoideus* is also cultivated in groves, but these lie between 700-1,300 m. There are 12 varieties, only one is yellow, the remainder are all red. The cephalia take about 4-6 months to ripen. Although available throughout the year, they are

most abundant in January and February. As with *P. jiulianettii* the trees are cultivated by cuttings, and tended by men only. Certain cultivars can only be consumed by adult men.

OTHER AIM: Of the wild species of aim only *P. castaneus* is sometimes used in a similar manner to marita, being cooked for its oil. It is not commonly eaten however, as it can irritate the mouth. *P. adinobotrys* is believed, ritually, to be the source of male blood, fibres from its leaves are used in traditional head-dresses for men. *P. castaneus* is considered to be the source of female blood.

APPENDIX 6

LISTING OF SPECIMENS EXAMINED

d'Albertis s.n. (peni), s.n. (hyst), s.n. (odoa) - Argent 1058 (peni) - Ash ANU 20414 (bros), 20415 (bros).

Balen H.M.No.2. (leio), No.3. (bale) - Barrett NGF 10203 (arch) - Beccari (macg), (becc), (papu), (danc), 488 (poly) - Beguin 1812, 2314 (ambo) - Bowers 36, 37 (bros), 194, 195 (jiul), 201 (anta), 206 (bros), 207 (jiul), 208, 211, 228 (bros), 709, 712, 713, 730, 765, 766, 767 (anta) - Brass 978 (odoa), 986 (laut), 987 (kaer), 1053 (pend), 1164 (lcar), 1557 (?), 1604 (bras), 2552 (poly), 2600 (macg), 2664 (tect), 2786 (dubi), 2837 (tect), 2878 (lamp), 2918 (decu), 2942 (poly), 2994 (tect), 3120 (magn), 3175, 3275 (poly), 3279 (nemo), 3342 (danc), 3375 (palu), 3414 (cala), 3489 (nemo), 3493 (macg), 3650 (meni), 3851 (?), 3916 (becc), 3924 (odoa), 3948, 3955 (daym), 5283 (?), 5345 (danc), 5366 (arch), 5461 (jiul), 5463 (cono), 5655 (?), 5675 (odoa), 5791, 5792 (laut), 5847 (papu), 5892 (laut), 5893 (kaer), 5933 (bras), 5942 (becc), 6255, 6407 (tect), 6764 (krau), 6829 (laut), 6974 (aggr), 6975 (becc), 7007 (hyst), 7070 (exig), 7071 (papu), 7118 (subu), 7190 (odoa), 7228 (limb), 7518 (krau), 7636 (leio), 7695 (becc), 7758 (papu), 7861 (danc), 7931 (bras), 8052 (leio), 8136, 8138 (laut), 8139 (kaer), 8208 (leio), 8487 (becc), 8617 (leio), 8648 (tect), 8873 (danc), 8981 (macg), 12074 (cnci), 12077 (adin), 12255 (brac), 12698 (bros), 12805 (danc), 12874 (peni), 12875 (?), 13280, 13328 (lcau), 13439 (doli), 13620 (odoa), 13621 (atro), 13631 (danc), 13648 (atro), 13827 (peni), 14096 (laut), 21778 (tect), 21906 (meni), 23191 (cast), 23459 (daym), 23461 (cast), 23512 (danc), 23765 (krau), 24045 (danc), 24406 (meni), 24639, 24732 (cast), 24885 (gale), 25446 (krau), 25571 (meni), 25979 (tect), 27272 (krau), 27401 (danc), 27735 (tect), 28120 (krau), 28366 (leio), 28672 (sp.8), 28746, 29252 (krau), 30521 (bros), 31390 (adin), 31611 (arch), 32277 (cast), 32315 (krau) - Brown 242 (poly).

Cabalion 2593 (macg) - Carr 11443, 11444 (tect), 11600 (laut), 12274 (bras), 12590 (subu), 13236 (adin), 15922 (cono) - Clarke 34 (cono), Clarke 108 (clar), ANU 9606 (krau) - Clemens 10568-A (krau), 171 (?), 355 (seti), 445 (cono), 861, 1128, 1537 (odoa), 8578, 11370 (danc) - Clunie LAE 63073 (danc) - Comins (solo), (tect), 34 (macg), 208 (poly), 215 (?), 363 (macg) - Coode & Katik NGF 29984 (odoa) - Corner RSS 18 (decu), 43 (lamp), 82 (poro), 116 (rube), 1203 (danc), 2277 (decu), 2715 (?), 2747 (macg), 2748 (solo), 2778 (nemo), 2866 (danc) - Craig 17 (limb), 24 (adin), 29 (anta) - Craven & Schodde 310 (danc), 347 (scho), 470 (tect), 540 (buin), 1005 (adin) - Croft NGF 24045 (danc), 34607 (jiul), 34979, 60528 (bros), 68281 (danc), 70159 (?), LAE 71058, 71059 (cast), & Katik NGF 13180, 13181 (sp.7), & Vinas LAE 61299 (tect), LAE 61301 (lcar), LAE 61307 (laut).

Darbyshire 684 (bras), 693 (meni), 799, 831 (bras), & Hoogland 7859 (tect), 8068 (peni) - de Beer BSIP 6781 (poly) - De Vriese 171 (ambo) - Dennis BSIP 4623 (macg) - Dissing 2861b (tect) - Djamhari 503 (poly) - Docters van Leeuwen 10572 (?) - Donoghue 2 (iwen), 3 (bros), 6 (galo), 8 (adin), 10 (anta), 11 (conc), 12 (peni), 14 (doli), 16 (conc), 18 (limb).

Elbert s.n. (tect) - Eyma 4580 (perm), 4857 (adin).

Flenley ANU 2267 (adin), 2334 (bros), 2527 (cong), 2692 (jiul), 2692 (anta), 2716 (jiul) - Floyd NGF 5406 (laut), 6440 (krau) - Foreman Lae 60005 (lcau), & Katik NGF 48434 (krau), 48469 (sp.4) - F.v.M. (leio).

Gafui BSIP 8684, 10158 (poly) - Garrett-Jones ANU 21062 (?) - Gerald s.n. (bale) - Gibbs 6213 (krau), 6248 (dubi) - Gideon LAE 57191 (navi), 73234 (adin) - Gillison NGF 25234 (adin) - Giulianetti & English 1897 (jiul) - Grant RSS 55 (macg) - Green RSNH 1016, 1299 (macg), 1072 (tect) - Gressitt 2745 (odoa) - Guppy (tect), (dubi).

Hamilton 122 (krau) - Hay v.20 (poly) - Hays 441 (bros) - Henty NGF 10655 (krau), 11581 (danc), 20829 (cong), 20866 (lcau), 20880 (anta), 38922 (lcau) - Hill 2744 (danc) - Hollrung s.n. (macg), 164 (krau), 175 (seti), 280 (danc) - Hoogland 3658 (hyst), 4214 (laut), 6206, 9266 (adin), & Schodde 6950 (adin) - Hope ANU 28085 (bros), 28086 (adin), 28087 (bros) - Hunt RSS 2648a (danc), 2332 (poly), 2371 (dubi), 2466 (palu), 2628 (cala), 2679 (poro), 2680 (tect), 2681 (poly), 2684 (cala), 2685 (poly), 2980 (rube) - Hyndman 1, 2 (cono), 176 (conc), 184 (galo), 194 (peni), 276 (limb).

Inokumae 537 (hyst), 574 (odoa), 603 (perm), 636 (pseu), 655 (poly), 677 (laut), 714 (papu), 716 (poly) - Isles & Vinas LAE 59036 (subu), 59036 (lcau).

Jacobs 9281 (danc) - Jebb 935 (poly), 936 (dubi), 937 (laut), 938 (krau), 939 (cono), 943 (adin), 946 (danc), 947 (krau), 949 (bale), 949 (sp.6), 950 (cast), 951 (becc), 952 (conc), 953 (peni), 956 (clar), 970 (peni), 983 (krau), 987 (danc), 1004 (bale), 1005 (subu), 1009 (rose), 1017 (sp.1), 1018 (sp.2), 1021 (cast), 1022 (clar), 1023 (cast), 1025 (clar), 1028 (danc).

Kaernbach (kaer) - Kairo 748 (krau) - Kajewski 1757 (kaje), 2299 (tect), 2303 (buin) - Kalkman BW 3469 (clar), 3489 (dubi), 3585 (poly), 3622 (tect), 4367, 4411 (anta), 4416 (conc), 6289 (odoa) - Kanehira & Hatusima s.n. (odoa), 12192 (perm), 12199 (peni), 12263 (pseu), 12682 (peni), 12685 (papu), 12805 (bale), 12807 (laut), 12809 (poly), 12877 (dubi), 12908 (macg), 13500 (odoa), 13974 (adin) - Katik LAE 46753 (krau), 70791 (limb) - Kerenga LAE 77496 (poly) - Kloss s.n. (odoa) - Koie & Olsen 1494 (tect), 1770 (papu) - Koster BW 6852, 13646 (kost) - Kosterman BW 6867 (perm), 15502 (poly) - Kraemer s.n. (cono) - Kurz s.n. (?).

Lauterbach s.n. (papu), 275 (tect), 863 (laut) - Lavarack & Ridsdale NGF 31464 (scho) - Leach NGF 34220 (cono), 34310 (peni), 34324 (laut) - Ledermann 8756 (rose), 9953, 10013, 10082 (odoa), 11117, 12335 (cong) - Lelean NGF 46147 (navi), & Stevens LAE 51222 (danc), & Streimann LAE 52502 (kaer).

MacGregor (macg) - Mack AM 343 (sp.3) - Maenu'u BSIP 2965, 5965 (danc), 6080 (palu) - Mauriasi BSIP 8821, 9844 (palu), 11417, 11795, 13615, 13917 (poly), 14345 (palu) - McArthur s.n. (jiul) - Millar 35288 (laut), & Dockerill NGF 35188 (laut), & Vandenberg NGF 37581 (papu), 40873 (dubi) - Munro 2 (bros), 3 (jiul).

Naumann s.n. (poly).

Parkinson (papu), 7 (tect) - Peekel 5 (macg), 209 (papu), 435 (danc), 917 (tect) - Pullen 8502 (?).

Rechinger 4385, 4998 (poly) - Ridsdale NGF 30530 (danc), 33770 (tect), & Galore NGF 33192, 33195 (galo), & Katik NGF 36791 (tect), & Lavarack NGF 31610 (atro) - Roberts 109 (bros) - Robinson 31 (ambo) - van Royen 3343 (odoa), 3361, 4613 (poly) - Rumphius, Hort. Amb. 4, p.143, t.76 (poly), t.79 (cono), t.80 (dubi) - Runikera BSIP 10637 (poly) - Russell 2, 3 (solo).

Sands 3038 (poly), Sands, Pattison & Wood 1464 (peni) - Schodde 4473 (rex), 4493 (lcar), & Craven 4472 (kaer), & Craven 4473 (laut) - Sijde BW 4132 (danc) - Sillitoe 83-14-a (conc) - Sleumer & Vink BW 14317 (adin) - Stevens & Lelean LAE 58280 (sp.7), Stevens & Veldkamp LAE 55586 (adin) - Stone 24 (solo), 1202 (solo), 2232, 2270 (tect), 2277 (rube), 2300, 2301 (poly), 2303 (solo), 2304 (danc), 2358 (decu), 2456 (poly), 2457 (dubi), 2458, 2460 (tect), 2463 (poly), 2464 (danc), 2466 (cala), 2467 (danc), 2468 (poro), 2469 (cala), 2473 (poro), 2474 (cala), 2476 (nemo), 2478 (flav), 2479 (nemo), 2482 (poly), 2483, 2486 (nemo), 2495 (dubi), 2496 (macg), 2497 (poly), 2498 (solo), 2499 (dubi), 2500 (tect), 2515 (poro), 2523, 2524, 2525, 2535, 2536 (tect), 2539 (danc), 2540 (magn), 2541 (poly), 2541 (macg), 2542 (tect), 2543 (macg), 2544, 2545, 2546, 2547 (tect), 2548 (poly), 2549 (macg), 2553 (dubi), 2555 (tect), 2556 (rose), 2557 (palu), 2559 (rose), 2560, 2561, 2562 (tect), 2563 (poly), 2564 (danc), 2565 (rube), 2566 (danc), 2567 (macg), 2568 (dubi), 2569 (tect), 2570 (macg), 2571 (dubi), 2573, 2578 (danc), 2583, 2584, 2585 (tect), 2586 (cala), 2589, 2593, 2595 (tect), 2596 (papu), 2605 (spod), 2614 (danc), 2615, 2616 (papu), 2617, 2618 (spod), 2619 (tect), 2620, 2620a (papu), 2621 (macg), 2624 (tect), 2625, 2627, 2628, 2629 (macg), 2630 (kaer), 2633 (tect), 2634, 2635 (papu), 2636, 2637 (macg), 2638 (dubi), 2639 (tect), 14999 (arch), 15000 (bros), 15002 (adin), 15003 (bros), 15004 (adin), LAE 53001 (bras), 53006 (papu), 53010 (bras), 53011 (meni), 53024 (krau), 53026, 53033 (papu), 53036 (krau), 53045 (danc), LAE 53059, 53060 (cono), 53061 (laut), 53063 (krau), 53077, 53082, 53082-b, 53083 (rose), 53086 (cono), 53448 (krau), 53456 (conc), 53480 (danc), 53488 (krau), 53517 (cono), 53518 (kaer), 53519 (papu), 53530 (adin), 53532 (arch), 53534 (anta), 53544 (conc), 53546 (anta), 53548 (cast), 53550 (papu), 53555 (rose), 53557 (leio), 53570 (krau), 53575 (kaer), 53577 (poly), 53590 (croc), 53614 (poly), 53690 (macg), 53694, 53695 (croc), 53804, 53805, 53806, 53807 (bros), 53810 (krau), & Galore LAE 53321 (kaer), 53322 (danc), 53323 (laut), 53325 (subu), 53326 (subu), 53327, 53328 (becc), 53367 (?), 53368 (tect), 53370, 53371 (becc), 53381 (kaer), 53382 (?), 53424 (lcar), 53431 (colu), & Rose 15001, 15005, 15006 (cono), & Streimann LAE 53564 (danc), 53568 (papu), 53573 (?), 53594 (croc), 53699 (macg), 53781 (kaer), 53787 (poly), & Womersley NGF 4864 (adin) - Street & Manner 442 (adin) - Streimann 8360 (danc), 8361 (krau),

8484 (danc), 8504 (lcau), NGF 23972, 23977 (adin), NGF 24424, NGF 25866, NGF 25867 (krau), NGF 25910 (danc), NGF 28562 (krau), NGF 28933 (danc), NGF 45214 (leio), LAE 51737 (limb), LAE 51748 (becc), LAE 52795 (peni), LAE 52816 (poly), LAE 54852 (adin), & Kairo NGF 39354 (poly), & Katik NGF 28615, 28926 (cast), & Lelean NGF 18337 (doli), 18439 (laut), 18448 (krau), & Martin LAE 52907 (krau) - St.John 2641 (tect), 26094 (kaer), 26096 (poly), 26099, 26100 (kaer), 26102 (danc), 26109 (doli), 26110 (peni), 26112 (atro), 26114 (tect), 26116 (krau), 26118 (cono), 26120 (danc), 26121, 26122, 26126, 26128, 26129, 26130 (tect), 26131 (poly), 26132, 26134 (danc), 26135, 26136 (tect), 26141 (krau), 26142 (papu), 26144 (krau), 26146, 26147, 26147a, 26148, 26149, 26150, 26155, 26156 (bras), 26159 (papu), 26160 (leio), 26162 (laut), 26165 (tect), 26168 (krau), 26171 (papu), 26172, 26174 (poly), 26175 (papu), 26176 (tect), 26177 (peni), 26178 (clar), 26180 (krau), 26181a (seti), 26183 (krau), 26184 (dubi), 26186 (clar), 26188 (danc), 26189 (cono), 26190 (danc), 26192, 26193 (krau), 26195 (laut), 26196 (tect), 26201 (cono), 26202 (laut), 26203 (anta), 26204 (arch), NGF 26207 (adin), 26212, 26214, 26215 (cono), 26219 (papu), 26220 (krau), 26221 (jiul), 26222, 26224 (bros), 26225 (cono), 26226 (papu), 26227 (cono), 26230 (dubi), 26231 (laut).

D'Urville Voy. Pol. Sud sur l'Astrolabe (cala).

Vandenberg NGF 42014 (adin), 42102 (limb), & Galore NGF 42064 (anta), 42085 (conc), 42102 (limb), 42234 (dubi), 42176 (poly) - Versteeg BW 1101 (lcar), 4660 (poly), 7474 (orni), & Vink BW 8255 (poly) - Vinas LAE 59619 (arch), & Akakavara LAE 59733 (sp.7) - Vink BW 12102 (poly), 16405 (adin), 16448 (sp.5).

Wam NGF 7965 (macg) - Warburg 21005 (poly) - Waterhouse 309-b (?), 316-b (?), 358-b (tect), 579-b (macg), 596-b (?), 617-b (buin), 945-b (danc), 946-b (dubi), 947-b (tect), 112, 124 (palu), 155 (poly), 240, 308 (dubi), 321 (tect), 1318 (dubi) - White 770 (tect), 10162 (danc), 10707 (jiul) - Whitmore BSIP 881 (decu), 1358 (dubi), 1549 (tect), 1836 (decu), 2104 (danc), 2131 (rose), 2196 (dubi), 2197 (poly), 2215 (tect), 2220 (solo), 2569 (danc), 2931 (poly), 5524 (danc), 18104 (danc), RSS 6089 (danc), 6097 (flav), 6283 (flav), 6345 (dubi) - Wiakabu LAE 73451 (lcau) - Womersley NGF 7964 (dubi), NGF 7965 (macg), NGF 24963 (krau), NGF 46474 (?), LAE 55373 (bras), & Coode NGF 24958 (anta), & Millar NGF 8496 (danc), & Simmonds 5099 (tect), & Stone NGF 43694 (subu), 43697 (laut), & Umba NGF 48726 (lcau), & Waikabu NGF 48716, 48718 (cong).

? NGF 9656 (bros), NGF 9663 (cono), NGF 41423 (macg).

APPENDIX 7

SOURCE MATERIAL FOR ILLUSTRATIONS

A listing of source material of the illustrations in the text. Some have been redrawn from earlier publications, the original source is quoted. Abbreviations: T: Tree, L: Leaf, C: Cephalium, D: Drupe, P: Phalange, MF: Male Inflorescence, A: Anthers. Italics with number = Specimen, and this is followed by an approximate locality. Roman Type (date) = illustration taken from the stated publication. Drawings at Lae were done by Terry Nolan.

ACROSTIGMA

ACROSTIGMA: **P. adinobotrys**: T,D: *Jebb 943*, Mt.Gahavisuka, EHP, L: *Jebb 447*, Teptep, Madang, C: Stone (1978), Ok Tedi, MF,A: *Streimann NGF 23977*, Kainantu, EHP. **P. congregatus**: St.John (1973). **P. poronaliva**: T,L,D: Stone (1972); C: *Stone 2468* (K). **P. setistylus**: Left most Drupes: *St.John 26181*, Wewak (LAE), Warburg (1900). **P. pseudosyncarpus**: Kanehira (1940).

DIMISSISTYLI: **P. danckelmannianus**: T: *vide* Jebb, Crater Mt., EHP, L,C,D: *Jebb 946*, Madang, MF,A: *Jebb 1028*, Madang.

ROSTELLATI: **P. odoardi**: L,C,D: Drawing at LAE, Dx4: Merrill & Perry (1939). **P. permicron**: Kanehira (1940), D: *Kosterman 6867*, Kebar (LAE).

LAUTERBACHIANI: **P. lauterbachii**: T,L,C,D: *Jebb 937*, Madang, MF: *Brass 8138*, Western (LAE), A: *Streimann NGF 18439*, Oriomo R., Western.

PSEUDACROSTIGMA: **P. ornithocephalus**: Drawing at LAE, D: *Versteeg 7474*, Sorong (MAN).

KURZIA

CURVIFOLIA: **P. buinensis**: L,D: *Craven & Schodde 540*, Buin (LAE). **P. nemoralis**: T,L,A: Stone (1972b), C,D: *Stone 2476*, Santa Ysabel, (K). **P. decus-montium**: MF,A: *Whitmore 1836*, Guadalcanal (K, Lae). **P. paludosus**: Stone (1972b).

INVOLUTA: **P. leiophyllus**: T,C,D: St.John (1968), MF,A: *Stone 53557*, Morobe (LAE), L: *Streimann NGF 45214*, Morobe (LAE).

JEANNERETIA: **P. polycephalus**: T,L,C,D: Jebb 935, Madang, MF: *van Royen 3361*, Sorong (LAE), A: *Streimann Lae 52816*, Musu, Sepik.

KURZIA: **P. macgregorii**: L: *Stone 2627* (long leaf=P. minusculus), *Stone 2625* (short leaf = P. englerianus), C: drawing at LAE, D: various specs at LAE, MF: Stone (1971), A: Stone (1971 & 1974b). **P. subumbellatus**: L,MF,A: *Womersley 43694*, Central (LAE), C,D: *Brass 7118*, Western (LAE). **P. species 1**: *Jebb 1017*, Arfaks. **P. species 2**: *Jebb 1018*, Arfaks.

LEPTOCARPA: **P. leptocarpus**: *Stone LAE 53424*, Gulf (LAE).

MARGINATA: **P. meniscostigma**: T: ex descriptions, L,C,D: *Stone LAE 53011* (LAE).

MICROSTIGMA: **P. conoideus**: *Jebb 939*, Madang. **P. exiguus**: T: Brass photograph (LAE), *Brass 7070*, Western (LAE). D: Merr. & Perry (1939). **P. leptocaulis**: C,D: Drawing at LAE, L,Ds: *Henty 38922*, Western Highlands (LAE), MF,A: *Womersley 48726*, Telefomin (LAE).

PARALOPHOSTIGMA: **P. balenii**: L,C,D (long): *Jebb 1004*, Waigeo, D(short): *Gerald sn.*, Sepik (CRI), C: Kanehira (1941). **P. clarkei**: T,L,C,D: *Jebb 956* & *1022*, MF,A: *Jebb 1025*, Madang. **P. daymanensis**: C,D: St.John (1973), L: *Brass 23459*, Dayman (LAE). **P. limbatus**: L: *Brass 7228*, Western (LAE), C: Stone 1984, D: *Wright 1192*, Crater Mt. (LAE), and Merr. & Perry (1939).

UNNAMED: **P. navicularis**: Stone (1974a). **P. species 3**: *Mack 343*, Crater Mt., (LAE).

LOPHOSTIGMA

CAULIFLORA: **P. lamprocephalus**: L: *Corner 43*, San Cristobal (LAE), C: Stone (1972), MF,A: Stone (1975).

KARUKA: **P. brosimos**: T:Stone (1982), L: LAE herb, C,D: Stone (1984), MF,A: Stone (1974a). **P. carrii**: St.John (1968). **P. iwen**: Stone (1984). **P. jiulianettii**: T: *vide* Jebb, Goroka. L: Drawing at LAE, C: Stone (1982), D: Merr.& Perry (1939), *White NGF 10707* (LAE).

LINIOBTUTUS: **P. hystrix**: T: ex Brass description. L: Drawing at LAE, C,MF,A: *Brass 7007* Photographs (LAE). P: drawing at LAE. **P. penicillus**: T: *Jebb 970*, Madang, L: Drawing at LAE, C,P: Stone (1984). **P. species 4**: *Foremann & Katik NGF 48469* (LAE).

MAGNICAVERNOSA: **P. magnicavernosus**: L,P: St.John (1961).

MAYSOPS: **P. beccarii**: T: Jebb 951, Crater Mt., L:*Brass 6975*, Western (LAE), C,D: *Wright 1188*, Crater Mt., MF,A: Stone (1992) = *Stone 53082*, Lae (LAE). **P. castaneus**: T,L,C,D: *Jebb 1023*, MF,A: *Jebb 971*. **P. concavus**: L,D: Stone (1992) = *Kalkman 4416*, Mt. Antares, C: Stone (1984), Ok Tedi. **P. croceus**: Stone (1974a). **P. flavicarpus**, **P. roseus**, **P. rubellus**: Stone (1972b). **P. kosteri**: C: ex description, L,MF: *Koster 13646*, Wandamen (LAE), A: Stone (1987). **P. krauelianus**: T,C,L,D: *Jebb 938*, Madang MF: *Stone 53024*, Bulolo (LAE), A: Stone (1993). **P. spodiophyllus**: Stone (1972b).

MEGASTIGMA: **P. rex**: T: ex description, L,D: Stone (1974). **P. schoddei**: L: *Craven & Schodde 347*, D: St.John (1974).

METAMAYSOPS: **P. brachyphyllus**: L: Drawing at LAE. C,D: Merr. & Perry (1940). **P. galorei**: L: *Ridsdale & Galore NGF 33192* (LAE). C,D: Stone (1984).

PERRYA: **P. aggregatus**: T: ex description, L,D: Drawing at LAE, Merr. & Perry (1939). **P. archboldinaus**: T: Stone Photograph (LAE), L: *Stone LAE 53532*, Okapa (LAE), D: *Wright 232*, Crater Mt. (LAE). **P. galeatus**: L: St.John (1973), C: Brass Photograph (LAE), D: *Brass 24885* (LAE), Goodenough Is. **P. species 5**: T: ex description, L: Drawing at LAE, D: Vink 16448, Minj (LAE). **P. species 6**: *Jebb 949*, Karawari.

STONEDENDRON: **P. atropurpureus**: L,D: *Brass 13621*, Bernhard Camp (LAE), C: Merr. & Perry (1940). **P. columbiformis**: L,C,D: Stone (1974). **P. concinnus**: T: ex description, C,D: Merr. & Perry (1940). **P. species 7**: *Stevens & Lelean LAE 58280*, New Britain, MF,A: *Vinas Lae 59733*, Nakanai Plateau, New Britain.

UNCERTAIN: **P. pendulinus**: T: Martelli (1929), MF,A: Stone & Huynh (1983).

PANDANUS

ATHROSTIGMA: **P. calathiphorus**: T,L,C,P: Stone (1973), P: Merr. & Perry (1939).

AUSTROKEURA: **P. brassii**: T: Martelli (1929), L,P: *Brass 7931*, Western (LAE).

EXCAVATA: **P. antaresensis**: T,L,P,MF,A: Stone (1974), C: Stone (1984).

FAGERLINDIA: **P. dolichopodus**: T: ex description, L: *Streimann 18337*, Western (LAE), C: Stone (1984), P: Merr. & Perry (1940). **P. kaernbachii**: T,L,P: Stone (1973), C: Stone (1982). **P. species 8**: *Brass 28672*, Woodlark Is. (K).

INTRAOBTUTUS: **P. kajewskii**: P: Merr. & Perry (1939). **P. papuanus**: T,L: *vide* Jebb, Madang, C: *Wright DW 215*, Crater Mt. (LAE), D:Lae Botanic Gardens, A: Stone (1974b).

PANDANUS: **P. tectorius**: *vide* Jebb, Madang.

UNCERTAIN: **P. solomonensis**: C,P: Stone (1973), L: *Whitmore 2220* (LAE).

RYKIA

HOMBRONIA: **P. dubius**: Drawn by Rosemary Wise, Madang.

SARARANGA

S.sinuosa: T: Stone 1982, Stone (1961), Fruits: *vide* Jebb, Lake Sentani.