Principes, 39(3), 1995, pp. 123–129

A Checklist and Analysis of the Palms of the Bismarck Archipelago

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This analysis of the palm flora of the Bismarck Archipelago, although certainly incomplete, is intended both as a practical guide to the palms, and as a small contribution to the phytogeography of the region. The Bismarck Archipelago is a substantial chain of islands off the north-east coast of New Guinea, and is part of the independent nation of Papua New Guinea. The chain itself is bent into a "U," lying on its side just south of the equator. The two large islands of New Britain and New Ireland form the bulk of the archipelago, but both sides of the U-shaped chain extend westward in strings of small islands. The chain terminates on the north side with Manus Island (the Admiralty Islands), and on the south side with a series of small volcanic islands lying closely along the north coast of New Guinea (Fig. 1).

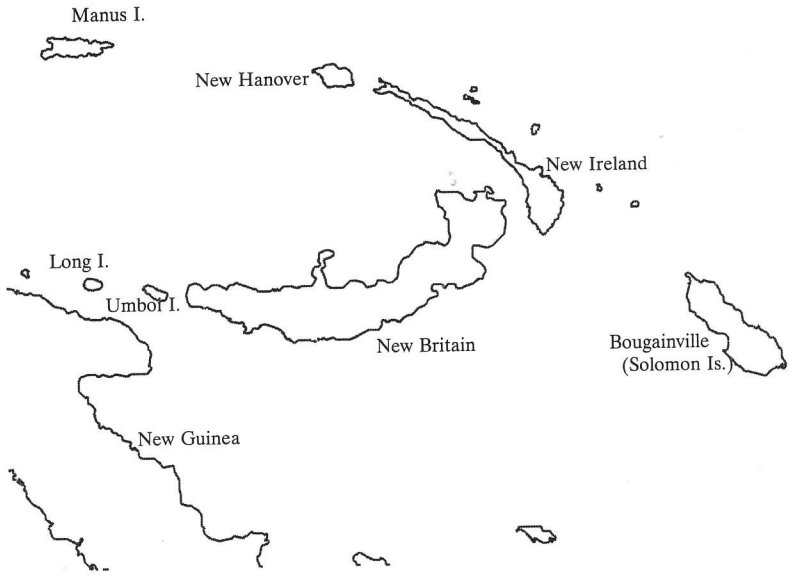
The largest of the islands, New Britain, is rugged and mountainous, consisting of over 36,000 square kilometers, with peaks up to 2,250 meters in elevation. The geology is complex, large areas of raised limestone alternating with extensive areas of volcanic rock and a number of active volcanos. New Ireland is much smaller and for the most part quite narrow, but the southeastern end is broad and mountainous, with peaks over 1,800 meters high. The higher elevations on both islands sustain montane forest and some of the unique elements of the palm flora.

Moore (1969b) considered the palm flora of the Solomon Islands to be primarily an extension of that of New Guinea, with some contribution (*Clinostigma*, *Physokentia*) from the ancient Pacific flora that survives primarily in New Caledonia. As one would expect, the palms of the Bismarck Archipelago show an intermediate character between those of New Guinea and those of the Solomon Islands. New Britain is separated from New Guinea by only 83 kilometers, the volcanic Umboi Island serving as a stepping stone between them. However, surprisingly few New Guinea palms have crossed the small gap. The Solomon Islands begin officially with Bougainville, some 120 miles east of New Ireland, with only a few very small islands lying between the two archipelagos. A number of palms have apparently migrated from the Solomons to the Bismarck Archipelago.

Most palm fruits in the western Pacific region are fleshy and rather heavy, and are presumably dispersed only short distances by animals (*Nypa* and *Cocos* are obvious exceptions). Some genera with large fruits, such as *Orania*, are absent from the Bismarck Archipelago, although abundant and diverse on New Guinea and some of the islands to the southeast. Even genera with smaller fruits (e.g., *Calamus*, *Gulubia*, *Gronophyllum*, *Hydriastele*, *Calyptrocalyx*, *Heterospathe*, and *Cyrtostachys*) are each represented by only one or two species in the islands. On the other hand, some genera with large fruits (*Ptychococcus*, *Actinorhytis*) are found in the Bismarck chain and in the Solomons.

Genera with endemic species in the Bismarck Archipelago are *Ptychosperma*, *Gronophyllum*, *Heterospathe*, *Hydriastele*, *Calyptrocalyx*, *Cyrtostachys*, *Physokentia* and *Clinostigma*. The first six genera are widely distributed in New Guinea. The last two are distributed through the Solomon Islands and down to but not in New Caledonia. The remaining genera found in the region are represented by common, widespread species.

Genera found on New Guinea but lacking in the Bismarck Archipelago are: *Borassus*, *Brassiophoenix*, *Corypha*, *Daemonorops*, *Korthalsia*, *Linospadix*, *Pinanga*, *Sommieria*, and *Pigafetta*. Most of these genera are fairly restricted in their distribution, even in New Guinea, and not suitably positioned for migration eastward. *Korthalsia*, however, is widespread and common in



1. Map of the Bismarck Archipelago.

New Guinea, and its fruits are small. It would not be surprising eventually to find it somewhere in the Bismarck Archipelago.

Rhopaloblaste and *Livistona* are found in both New Guinea and the Solomon Islands, but seem to be lacking from the Bismarck Archipelago. Moore's (1969b) indication that *Livistona* occurs here appears to have been in error, although one would certainly expect it. Several species of this genus occur in New Guinea, including *L. woodfordii* Ridley, which also occurs in the Solomon Islands (Tulagi, Esa'ala). To date, however, I have seen no collections from this region.

One genus that has diversified among the islands is *Ptychosperma*, a large genus centered in New Guinea, and represented by two endemic species in the Bismarck Archipelago, and at least one more in the Solomon Islands. None of these seems to have any close relatives in New Guinea, however, with *P. hentyi* being an unusual endemic in New Britain, and *P. gracile* appearing to be most closely related to Solomon Island and Australian species. *Ptychosperma* subgenus *Actinophloeus*, on the other hand, is lacking altogether from the islands, although it is widespread in New Guinea.

When I first encountered specimens of *Ptychosperma hentyi*, I assigned them to *Drymophloeus* based on the elongate peduncles of the inflorescence, the broadly cuneate, apically convex leaflets, and the apparently globose seeds. My annotations (as well as some by Moore), and my mention of them in my Palm Flora of New Guinea (Essig 1977), regrettably may have lead to erroneous reports of the occurrence of *Drymophloeus* in the Bismarck Archipelago (as in Moore 1969b, Hay 1984). *Drymophloeus* is found only in westernmost West Irian, skips over the remainder of New Guinea, and reappears in the Solomon Islands, assuming one accepts the inclusion of Burret's genus *Rehderophoenix* in *Drymophloeus* (Moore 1969a). The tremendous geographic separation of these two parts of the genus, and the fact that the characters by which *Drymophloeus* is distinguished from the other genera of the Ptychospermatinae are primitive for the alliance as a whole, suggest that the issue should be further examined.

One final observation—These islands were settled by seafaring peoples many centuries ago, and there has undoubtedly been much interaction among the peoples of the islands and New Guinea since then. We must take into consideration, therefore, the possibility of human introduction and cultivation of some of the palms. *Ptychococcus* and *Caryota*, for example, have very hard "wood" used by the local people throughout the region for bows, spearheads and a variety of other purposes (pers. obs.). It is quite possible that early settlers or traders brought seeds of these species with them. In both genera mentioned, the single

species present in the Bismarck Archipelago appears to be indistinguishable from species distributed broadly through New Guinea and into the Solomon Islands. Similar interpretations can be argued for *Cocos nucifera*, *Metroxylon sagu*, *Areca catechu*, and *Areca macrocalyx*, as all are of economic importance.

Synopsis of the Palms of the Bismarck Archipelago

The only previous work on the plant life of the Bismarck Archipelago was that of Peekel (1984), a German Catholic priest who resided on New Ireland for many years. A truly enlightened individual, Peekel studied not only the botany of New Ireland, but also the language and culture of the people there. We are indebted to Peekel for the indigenous names from New Ireland and much of the ethnobotanical notes included in the following list.

Key to the Species

1a. Leaves palmate; small, solitary palms of the forest undergrowth ..... *Licuala lauterbachii*
1b. Leaves pinnate or bipinnate; habits various 2
2a. Leaves bipinnate; large solitary palms producing inflorescences from the top downward ..... *Caryota rumphiana*
2b. Leaves once pinnate 3
3a. Fruit in a dense, globose head; trunkless palms forming extensive colonies in brackish water of estuaries ..... *Nypa fruticans*
3b. Fruit loosely arranged or in dense, elongate heads; palms with distinct trunks and growing in more terrestrial habitats 4
4a. Stems weak, climbing by means of spiny leaves, or by spiny whiplike extensions from the leaves or leaf axils 5
4b. Stems erect, not climbing, and mostly not spiny .. 6
5a. Leaves with irregularly placed, broadly lanceolate leaflets, and extended into an elongate, spiny cirrus .. .. *Calamus hollrungii*
5b. Leaves with regularly placed, narrowly lanceolate leaflets, with whiplike flagella attached to the leaf sheaths ..... *Calamus ralumensis*
6a. Pinnae irregularly multi-ribbed 7
6b. Pinnae regularly arranged, each with a single prominent rib 9
7a. Palms stilt-rooted; pistillate flowers and fruit distributed along most of the length of the rachillae; fruit red ..... *Areca guppyana*
7b. Palms not stilt-rooted; pistillate flowers and fruit on the lower parts of the rachillae only; fruit yellow-green 8
8a. Fruit in a dense spike; small palms of the forest understory ..... *Areca macrocalyx*
8b. Fruit in a panicle; robust palms cultivated near villages and disturbed sites ..... *Areca catechu*
9a. Palms with stilt roots 10
9b. Palms without stilt roots 11
10a. Fruits dark purple; seed sharply angled; montane forest, New Britain ..... *Physokentia avia*
10b. Fruits red; seeds terete in cross-section; montane forest, New Ireland ..... *Clinostigma collegarum*
11a. Palms massive, clumping, producing a massive inflorescence at the apex of the trunk; leaf bases with sinuous spiny ridges ..... *Metroxylon sagu*
11b. Palms of moderate dimensions, or with solitary trunks, producing inflorescences in sequence from the axils of the leaves; leaf bases smooth 12
12a. Pinnae conspicuously toothed or ragged at the tips 13
12b. Pinnae acute or briefly notched at the tips 13
13a. Pinnae induplicate; clustering palms with coarse fibrous leafbases; crownshaft lacking ... *Arenga microcarpa*
13b. Pinnae reduplicate; solitary or clustering palms with non-fibrous leaf bases; crownshaft present 18
14a. Staminate flowers soft, with long, pointed, loosely closed petals, mature when first exposed; fruit terete in cross-section 15
14b. Staminate flowers hard, bullet-shaped, maturing slowly after exposure of the inflorescence; seed 5-lobed in cross-section, at least when immature 16
15a. Small, clustering palms ..... *Hydriastele kasesa*
15b. Tall, solitary palms; restricted to Manus I. ..... *Gronophyllum manusii*
16a. Pinnae broad, wedge-shaped, apically convex; seed subterete in cross-section ..... *Ptychosperma hentyi*
16b. Pinnae lanceolate, apically oblique to concave; seed clearly 5-lobed in cross-section 17
17a. Fruits less than 2.5 cm long, with thin, fibrous endocarp ..... *Ptychosperma gracile*
17b. Fruits more than 2.5 cm long, with thick, elaborate, bony endocarp ..... *Ptychococcus kraemerianus*
18a. Inflorescence appearing as several elongate unbranched spikes emanating from a single leaf axil ..... *Calyptrocalyx* sp.
18b. Inflorescence branched, not as above 19
19a. Fruit massive, more than 15 cm long. Widely cultivated, and growing wild along coasts . *Cocos nucifera*
19b. Fruit less than 10 cm long 20
20a. Fruit black; flowers and fruit crowded, slightly sunken in the thick rachillae ..... *Cyrtostachys peekelii*
20b. Fruit and flowers not as above 21
21a. Fruit grayish with conspicuous lighter ribs; pinnae pendulous ..... *Gulubia costata*
21b. Fruit orange to red 22
22a. Fruit small, spherical ..... *Heterospathe parviflora*
22b. Fruit the size and shape of a chicken egg ..... *Actinorhytis calapparia*

Actinorhytis calapparia H. Wendl. & Drude—New Ireland.

This species was reported from the Namatanai region of New Ireland by Peekel, but not seen elsewhere, despite being found in both New Guinea and the Solomon Islands. Moore (1969b) reports that this species is widely cultivated as far west as Malaya, so cultivation may be a factor in the palm's distribution. Indigenous names (New Ire-

land)—Kuanua: *vekaveke*; Pala: *Hakaheke, kakahiaka*; Lamekot: *kafa*.

Areca catechu L.—Universally cultivated in the region.

This is the widely used betel nut, and was most certainly spread to the Bismarck Archipelago as a cultivated plant. Indigenous names (New Ireland)—Kuanua: *buai*; Pala: *buei*; Lamekot: *vua* note these names all appear to be slight variations on the widespread Pidgin English name (*buai*) for betel nut, suggesting relatively recent introduction of the palm to New Ireland.

Areca macrocalyx Zipp. (as *A. jobiensis* in Peekel)—New Britain, New Ireland.

This species has spike-like infructescences derived from inflorescences in which the pistillate flowers are confined to the very base of each rachilla. The species serves as a substitute for the commercial betel nut. Indigenous names (New Ireland)—Kuanua: *Kumul*; Pala: *kumulo*; Lamekot: *makega, kega*.

Areca guppyana Becc. (as *A. novo-hibernica* in Peekel)—New Britain, New Ireland.

This is a slender, stilt-rooted species common in low-lying coastal areas, with noncongested fruits similar to *A. catechu*. It is found only in the Bismarck Archipelago and the Solomon Islands, nothing like it being found in New Guinea. It has not been reported by Peekel as used for betel nut. Indigenous names (New Ireland)—Pala: *misle, butno*; Ugana: *vapbua, bua*.

Calamus hollrungii Becc.—New Britain, New Ireland, Manus.

The two rattans known from this region are quite different from one another, but each appears to belong to very widespread species. *C. hollrungii* Warb. has leaves with widely spaced, irregularly arranged, broadly lanceolate leaflets, and a terminal flagellum, while *C. ralumensis* has closely spaced, narrowly lanceolate leaflets and a cirrhus arising from the leaf sheath rather than a flagellum from the leaf tip. *C. hollrungii* is common throughout New Guinea, the Bismarck Archipelago and the Solomon Islands. Indigenous names (New Ireland)—Kuanua: *magu*; Pala: *kalaua, kalawa*; Lamekot: *ni*.

Calamus ralumensis Warb.—New Britain.

This species is quite abundant in the lowland forest of New Britain. It is probably on New Ireland as well, but has not been collected from there. It resembles the widespread *C. vestitus* Burr. of New Guinea, which Moore also identified from the Solomon Islands. It is likely that the two are one and the same species. Indigenous names (New Ireland)—Kuanua: *kada*; Pala: *siribe, buso*; Lamekot: *iogel*.

Calyptrocalyx sp.—New Britain.

This one rather robust species resembles one collected in the Central Province of Papua New Guinea, but neither has been identified. The genus is particularly in need of revision.

Caryota rumphiana Mart.—New Britain, New Ireland, Manus, Long I. (Fig. 2).

This species is both widespread and common, occurring from Indonesia (Ternate) to the Philippines, New Guinea, northeastern Australia, the Bismarck Archipelago, and the Solomon Islands (Gudalcanal). Varieties have been described for geographical variants in some parts of the species range, including variety *papuana* Becc. from West Irian. There is too little information available to determine the usefulness of such varietal names. As its wood is valued for construction purposes (pers. obs.), its spread may have been aided by human migration or trade. Indigenous names (New Ireland)—Kuanua: *gelep, kuraga*; Pala: *galah*; Lamekot: *gelat*; (Manus)—Kali: *Sahun*.

Clinostigma collegarum J. Dransf.—New Ireland.

Clinostigma is widespread in the Pacific, from the Bonin and Caroline Islands in the north to Fiji and Samoa in the east. This species was found in New Ireland in 1975, growing on ridges in montane forest at elevations of about 1,350 m. It resembles *Gulubia costata* in general aspect, but is distinguished most readily by its fruit with lateral stigmatic residue. The species is also notable for the mass of distinctive stilt roots at the base of the trunk.

Cocos nucifera L.—New Britain, New Ireland, Manus, Long I.

The widespread coconut palm is cultivated throughout the Bismarck Archipelago. Indigenous

2. Villagers from Matafuma Village on Long Island drive spikes of *Caryota rumphiana* "wood" into a log, during construction of a makeshift outrigger canoe. 3. The bright red fruits of *Heterospathe parviflora* are widely spaced on the branches of the inflorescence. This palm is known only from New Britain. 4. A villager from Sampantobil in the Nakanai Mountains of New Britain holds a leaf and inflorescences of *Ptychosperma hentyi*, a unique and beautiful species found only on this island.

names (New Ireland)—Kuanua: *lamamas*; Pala: *lamas*; Lamekot: *ni*.

Cyrtostachys peekeliana Becc.—New Ireland.

Cyrtostachys extends from Thailand to the Solomon Islands, with the greatest number of species in New Guinea. Only the one species is found in the Bismarck Archipelago, and so far only on New Ireland. One species has been found eastward, on Bougainville (*C. Kisu* Beccari). Peekel reports that the hard outer wood is used for planks. Indigenous names (New Ireland)—Kuanua: *a-ia*; Pala: *a-ihul*; Lamekot: *lifur*; Ugana: *varivan, ivin*.

Gronophyllum manusii Essig—Manus.

Found on Manus Island, but similar appearing palms have been noted from a distance on Long Island.

Gulubia costata (Becc.) Becc.—New Britain.

This widespread species of New Guinea has so far been found in only a few spots in the Hoskins area, West New Britain.

Heterospathe parviflora Essig—New Britain (Fig. 3).

Heterospathe is a widespread genus with many locally endemic species in both New Guinea and the Solomon Islands. This is the only species known from the Bismarck Archipelago. The genus has not been found in New Ireland and was unknown to Peekel.

Hydriastele kasesa (Lauterb.) Burr.—New Ireland, New Britain.

This species resembles *H. microspadix* (Becc.) Burr. from northeastern New Guinea, but dimensions overall are smaller. Widespread in lowland forests. Indigenous names (New Ireland)—Pala: *kasesa*; Lamekot: *kasi*; Ugana: *vakase, kase*.

Licuala lauterbachii Damm. & K. Schum. (*Licuala peekelii* Lauterb.)—New Britain, Bagabag I., New Ireland.

This is the only species of this widespread and diverse genus to be found in the Bismarck Archipelago. It is common in eastern New Guinea and is found also throughout the Solomon Islands. In New Britain it is the most common palm in the understory of lowland forests. Indigenous names (New Ireland)—Kuanua: *luga, uban*; Pala: *salaho*; Lamekot: *fi*.

Metroxylon sagu Rottb. (*M. laeve* Mart., *M. rumphii* (Willd.) Mart.)—New Britain, New Ireland, Manus.

This is the common sago palm found from Malaya and the Philippines to New Guinea and beyond. It is found in swampy areas throughout the larger islands of the Bismarck Archipelago, and on Guadalcanal as well, while *M. salomonense* is found also on Guadalcanal and elsewhere in the Solomons. Another species, *C. bougainvillensis* has been described from Bougainville. As it is an important economic plant throughout its range, *Metroxylon sagu* may also have been spread by humans. According to Moore (1969b) the genus is Melanesian in origin, rather than Asian or New Guinean. Indigenous names (New Ireland)—Pala: *bia* (spiny form called *bia-gargarat*); Lamekot: *sasak*.

Nypa fruticans Wurmb.—New Britain, New Ireland.

Nypa is found in brackish estuaries from Sri Lanka and eastern India to the Solomon Islands, Ryukyu Islands, and Australia. Peekel reports that *Nypa* fronds provide excellent material for atap matting, and is commonly called "wild sago palm" or "*sak-sak*." Indigenous names—Kuanua: *manimua*; Pala: *bia-to, bia-ta*; Lamekot: *ulagai*.

Physokentia avia H. E. Moore—New Britain.

Physokentia avia is related to species in the Solomons and beyond, and is found at relatively high elevations.

Ptychococcus kraemerianus (Becc.) Burr.—New Britain, New Ireland.

This species was described from New Ireland, but the type consists of only a few large fruits with deeply grooved and heavily armored endocarps, and seeds with homogeneous endosperm. Recent collections from New Ireland and New Britain, with matching fruits, are indistinguishable from *P. elatus* Becc., a species abundant in northeastern New Guinea. Furthermore, the species from the Solomon Islands also closely resemble this one. *Ptychococcus* is valued by the indigenous people for its hard wood, which is used for bows and spear heads. It may have also been spread among the islands by humans, and in fact, dispersal of its large fruits by any other means seems unlikely. Thus it appears that there is but one widespread species of *Ptychococcus* in lowland

eastern New Guinea, the Bismarck Archipelago, and the Solomon Islands. The name *P. kraemerianus* has nomenclatural priority.

Ptychosperma gracile Labill.—New Britain, New Ireland, Long I.

This species has elongate leaflets and ruminate, weakly grooved seeds, and is similar to *P. elegans* of Australia, and *P. salomonense* of the Solomon Islands. The group of solitary medium-tall palms with red fruit and ruminate endosperm has no obvious close relatives in New Guinea, and thus could be considered part of the "extra-New Guinea" element of the palm flora.

Ptychosperma hentyi Essig—New Britain (Fig. 4).

This species is widespread and abundant on New Britain, but has not been found elsewhere. It has unusual broadly cuneate leaflets with convex tips, that gradually decrease in size toward the end of the strongly arched leaves. Its seeds are nearly terete at maturity (although clearly 5-lobed when immature) with ruminate endosperm.

ADDENDUM

Elaeis guineensis Jacq., the African Oil Palm, has recently become widely cultivated on New Britain. There is no indication, however that it has escaped and become part of the flora.

Ptychosperma novo-hibernica Becc. in Lauterb., Beiträge zur Flora von Papuasien. IV. Engl. Bot. Jahrb. 52:29. 1914. (Holotype: *Kraemer s.n.*, 1909, New Ireland (B)).

This species was described from New Ireland from incomplete material. The leaves are clearly of *Ptychosperma*, possibly *P. gracile*. The inflorescence fragment is unusual, however, as it has what appears to be an elongate main axis and numerous short rachillae. It resembles more a *Heterospathe*, leading me to suspect that the type collection was mixed. Flowers and fruit were lacking, and the specimen at Berlin was probably destroyed, so it is not likely that this specimen will be further identified.

Acknowledgments

I thank the staff of the Division of Botany, Office of Forests, Lae, Papua New Guinea, for their assistance on my several trips to the Bismarck Archipelago, and the National Science Foundation and the National Geographic Society for financial support.

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