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A Revision of *Ptychococcus* (Arecaceae)

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ABSTRACT. Although known to European botanists since 1876, the genus *Ptychococcus* (Arecaceae: Arecoideae: Ptychospermatinae) of New Guinea has remained one of the most poorly known genera of the Ptychospermatinae. The present study, based on examinations of plants in the field, in herbaria, and in cultivation, reduces the number of species to two and presents a historical overview of this misunderstood genus, along with a taxonomic revision, a key, descriptions and synonymies of the two species. A neotype is designated for *Ptychococcus paradoxus*.

Ptychococcus Becc. had a most inauspicious beginning. It was founded on a species that was first mistaken for a *Pinanga* Bl., then doubtfully assigned to *Drymophloeus* Zipp., transferred to *Ptychosperma* Labill., and finally, for lack of a better solution, deposited in its own genus, *Ptychococcus*. The confusion as to its generic identity was in part the result of the paucity of specimens available to European botanists. The first specimen to come to the attention of a botanist was a fruit collection, seeds from which were sown in the Buitenzorg Botanic Garden (now Kebun Raya, Bogor, Indonesia). The fruits, and subsequently the living plants, were the basis for Scheffer's (1876a, b) descriptions of the aptly named type species, *Ptychococcus paradoxus* (Scheff.) Becc. (Zona 2003).

Like other genera of Ptychospermatinae, *Ptychococcus* has black scales at the apex of the leaf sheath, erose leaf segment apices, a peduncular bract that pierces the prophyll, lag time between bract fall and anthesis, bullet-shaped staminate buds that are perpendicular to the rachillae, many stamens, and bottle-shaped pistillodes (Zona 1999a). Its membership in the monophyletic Ptychospermatinae has never been in doubt and has been reaffirmed by recent molecular studies (Lewis et al., unpublished).

Very little has been written on its systematic relationships within the Ptychospermatinae. Uhl and Dransfield (1987) claimed that *Ptychococcus* was closely related to *Ptychosperma*. Zona (1999a) suggested that *Ptychococcus* was most closely related to *Wodyetia* A. K. Irvine and *Carpentaria* Becc., both of Australia, with which it shares the characteristic of black endocarps. Recent molecular analysis (Lewis et al., unpublished) shows *Ptychococcus* to be a member of a moderately supported clade comprising *Normanbya* F. v. Mueller ex Becc., *Drymophloeus* Zipp. *p.p., Carpentaria*, *Wodyetia*, and *Brassiophoenix* Burret. Within this clade, resolution is imperfect, but *Carpentaria* and *Wodyetia* comprise a moderately well supported clade. *Ptychococcus* is the moderately supported sister genus to *Brassiophoenix*, with which it shares a strongly ridged endocarp. The endocarp of *Brassiophoenix*, however, is straw-colored (Zona and Essig 1999).

The distinctive features that separate *Ptychococcus* from its related genera are the large, black or brown, elaborately five-lobed endocarps with black fibers and the pointed seeds.

MATERIALS AND METHODS

This revision is based on herbarium holdings (from A, BH, BM, FI, FTG, K, and L), plants in cultivation at Fairchild Tropical Botanic Garden and observations made in the field in Papua, Indonesia. Herbarium specimens were consulted for morphological data, supplemented by observations of wild or cultivated plants. Leaf segment measurements were taken from mid-leaf segments; widths were measured at the widest point (near or slightly below the middle of the segment). Floral measurements were taken from material rehydrated by boiling or from pickled material. Fruit measurements were taken from dried specimens or pickled specimens. Floral and fruit measurements were made with dial calipers graduated in tenths of a millimeter.

The distribution maps were drawn using the Online Map Creation website (www.aquarius.geomar.de/omc_intro.htm), edited in Adobe Illustrator and Photoshop CS.

DISTRIBUTION

Ptychococcus is restricted to New Guinea, including the Bismarck Archipelago. Its attribution to the Solomon Islands (Beccari and Pichi-Sermoli 1955; Hay 1984; Uhl and Dransfield 1987) was likely based on a specimen collected from Bougainville Island, which had been considered part of the Solomon Islands but is politically part of Papua New Guinea. No specimens have been seen from within the national borders of the Solomon Islands. A species found on Ponape (Pohnpei), one of the Federated States of Micronesia, was previously included in *Ptychococcus* by Zona (1999a). Molecular studies place it in the genus *Ponapea* Becc. as *Ponapea ledermanniana* Becc. (Lewis et al. unpublished).

In New Guinea (and the Bismarck Archipelago), *Ptychococcus* occurs in the wild in both lowland and upland localities. However, both species are also cultivated around villages to varying degrees. Ferrero (1996) mentioned that *Ptychococcus lepidotus* is often planted in cemeteries. Moreover, in some localities, the palms may

TABLE 1. Stem size of *Ptychococcus paradoxus* accessions in cultivation at Fairchild Tropical Botanic Garden, Miami, Florida, USA. Stem length (height) does not include leaf sheath or crownshaft. Diameter is at breast height. Contrast these measurements with those of the wild seed parent in Papua, Indonesia, which had a stem length of 400–500 cm and a diameter of 16.1 cm.

	August 2001		December 2004	
Accession	L (cm)	diam (cm)	L (cm)	diam (cm)
951397F	82	2.5	185	3.0
951397G	100	2.8	325	4.8
951397H	35	2.5	163	3.2

have naturalized from cultivated sources. Consequently, the precise extent to which their present range is the result of human activity cannot be ascertained.

MORPHOLOGY

Stem. The stems of *Ptychococcus* are invariably solitary and erect, with visible leaf scars and a brownish gray outer surface. The wood of the outer cortex is dense with dark, blackish fibers, and consequently is used for construction. It is a favorite wood for hunting bows and spears. The distribution of *Ptychococcus paradoxus* in New Guinea may have been affected, in part, by humans who value the wood of this palm.

Field workers report that stems of *Ptychococcus paradoxus* may be as much as 26 m tall and 25 cm in diameter. However, Scheffer (1876b) described and illustrated a cultivated specimen as a slender, medium-sized juvenile palm, a decision that resulted in subsequent taxonomic confusion. Beccari (1885) described *P. paradoxus* as 3–4 m tall and 6–7 cm in diameter and contrasted it to his *P. arecinus* (Becc.) Becc., which he claimed was larger and more robust. The discrepancy between wild plants and those in cultivation is likely the result of age and environment. As I have seen in Fairchild Tropical Botanic Garden, young plants maintain a slender trunk even as they begin to increase in height, which is unusual in that palm stems typically undergo an establishment phase in which the stem acquires its mature diameter before increasing in height (Tomlinson 1990). The seed-parent of Fairchild Tropical Botanic Garden's plants was a large wild palm with a diameter of over 16 cm (*Zona & Dransfield et al. 678*), but non-reproductive seedlings (accession 87226) are slender palms with stems less than 5 cm in diam and up to 325 cm tall (Table 1). I expect these plants to increase in girth via diffuse secondary growth as they mature. Because the stem undergoes developmental changes in diameter, the use of stem size to distinguish species is not justified.

Leaves. An adult individual of *Ptychococcus* bears approximately 6–13 leaves in its crown. Leaves are alternate, spirally arranged and pinnately divided. The sheathing leaf base forms a prominent crownshaft, and the petiole is short. The sheaths are covered to varying degrees by silvery or gray, branched, multicellular trichomes, and at the sheath apex, dark brown or black trichomes are present. These may continue along the petiole and leaf rachis, along with silvery scales.

Individual leaf segments are lanceolate or linear, with apices that are erose and oblique. Venation in *Ptychococcus* is not especially distinctive: a strong midvein, smaller marginal veins, numerous secondary and tertiary veins and few, indistinct transverse veins. The midvein may bear light brown ramenta on the underside of the leaf segment, especially at the base of the segment. Fine scales with hyaline margins dot the abaxial surface of the leaf segment. Terminal segments are like other segments but much reduced in size.

Inflorescences and Flowers. The inflorescence of *Ptychococcus* is solitary at the node, becoming visible only after the subtending leaf has fallen. The inflorescence position is thereby infrafoliar. Each inflorescence is enclosed by a prophyll (the first and outermost bract), which is deciduous at maturity, and a peduncular bract, also deciduous. The bracts are seldom preserved by field collectors, so data on their morphology are incomplete.

The inflorescence axes are creamy white, becoming green as fruits mature. The inflorescence is branched to three orders (counting the first branch from the peduncle as the first order). As is characteristic of the subtribe, buds are exposed a long time (weeks, possibly months) before anthesis. Flowers are unisexual, borne in triads of one pistillate flower flanked by two staminate flowers; however, at the distal ends of the rachillae, only staminate flowers occur. Flowers are subtended by minute bracteoles. In *P. lepidotus* H. E. Moore, the inflorescence axes are densely rusty lepidote.

Staminate flowers bear three, greenish, inconspicuous, imbricate sepals. Petals are three, ovate, coriaceous, and valvate. In *P. lepidotus*, both sepals and petals bear brown lepidote scales on their abaxial surfaces. In both species, the staminate flower bears a bottle-shaped pistillode.

Stamens may number over 200 per flower in *Ptychococcus paradoxus*, but the average number is around 100 for *P. lepidotus* and ca. 150 for *P. paradoxus*. The outermost filaments are slightly adnate to the petals. Filaments are subulate and creamy white. They are erect, not inflexed, in bud. Anthers are dorsifixed, slightly versatile, with connectives that turn dark upon drying. In *P. paradoxus* the anthers are bullate, a distinctive condition beautifully illustrated by Beccari and Pichi-Sermoli (1955).

One supposed difference between *Ptychococcus paradoxus* and *P. arecinus* is in the number of stamens: 120 in the former, and 200 in the latter (Beccari 1885). My own examination of a larger number of specimens (n

= 13) than was available to Beccari revealed a range of 100–213 stamens per flower (mean = 149; s.d. = 30.9). The continuous variation in this character makes it untenable as a species-level difference.

Pistillate flowers are globose, sessile, and pale green. Three imbricate sepals and three imbricate petals are strongly nerved, appearing striate with hyaline margins, and clasp the gynoecium even at anthesis. The perianth parts are persistent and enlarged in fruit. The staminode is reduced to three or more small flaps of tissue. The flower is dominated by the large gynoecium. The style is indistinct, and the three lobes of the apical stigma are short-lived. The ovary is green.

Neither staminate nor pistillate flowers have a noticeable fragrance, but flowers are functional during the day. Staminate flowers produce copious pollen. It is not known whether nectar is secreted by the pistillate and staminate flowers, as occurs in *Ptychosperma* (Essig 1973). The flowers are likely visited by bees and other Hymenoptera, as are other members of the Ptychospermatinae with similar floral morphologies (Essig 1973; Zona 1999b; Zona and Fuller 1999).

Fruits. The fruits of *Ptychococcus* are drupes, ripening from green to red. The epicarp is smooth and bright vermilion or orange-red at maturity. The mesocarp is orange, watery and shrivels greatly as the fruits are dried. The endocarp is brown with black fibers (in *P. lepidotus*) or black with adhering black mesocarp fibers (in *P. paradoxus*). The endocarp is lobed, ridged, and highly sculptured. The endocarp is 1.5–3.5 mm thick in *P. lepidotus* and 0.5–1.2 mm thick in *P. paradoxus*.

Modes of dispersal are not known, but the fleshy, colorful fruits are surely adapted to animal dispersal. Their large size, however, rules out small, fruit-eating birds. A local informant in Papua, Indonesia claimed that fallen fruits are eaten by cassowaries, which likely disperse the seeds.

Seeds. Seeds played a starring role in early classifications of *Ptychococcus*. From the very start, endosperm condition, whether homogeneous or ruminate, was thought to carry great weight. Both Scheffer and Beccari relied on the endosperm in distinguishing species. Because the genus was founded on the basis of fruits and seeds of *P. paradoxus* and because the endosperm condition was so important to early classifications, a brief review is presented here. A more detailed discussion can be found in Zona (2003).

The type specimen of *Ptychococcus paradoxus* was collected by J. E. Teijsmann on 7 July 1871, from New Guinea, near what is now Jayapura, Papua, Indonesia. Teijsmann mistook the palm for a species of *Pinanga* (Teijsmann 1876). He collected only fruits; Scheffer's later descriptions of vegetative characters were based on plants grown from the seeds of these fruits. When Scheffer (1876a, p. 53) proposed the name *Drymophloeus ?paradoxus*, he described the endosperm as ''subaequalibe'' (sub-homogenous), yet just a few lines later, he wrote that the endosperm was not ruminate. At the time, *Drymophloeus* was thought to comprise only species with homogenous endosperms. Some pages later, Scheffer (1876b, p. 121) suggested that his *D. paradoxus* may belong to the same genus as *Ptychosperma capitis-yorkii* H. Wendl. & Drude [= *P. elegans* (R. Br.) Bl.], a taxon noteworthy for its deeply ruminate endosperm. By page 155, Scheffer (1876b) was calling his taxon *Ptychosperma paradoxa* and admitting that his first description was incorrect and that the progeny of Teijsmann's seed collection have ruminate endosperms.

Upon describing a new species, *Ptychococcus arecinus* (Becc.) Becc. (as *Ptychosperma arecina* Becc.), Beccari (1877) noted that the endosperm of *P. paradoxus* was less ruminate than that of his new species. *Ptychococcus elatus* Becc. was described with a homogeneous endosperm (Beccari 1923). Clearly, the degree to which the endosperm was ruminate was influencing species concepts and taxonomic decisions for Beccari. Burret (1939) used endosperm condition to subdivide the genus into two sections, one ruminate and the other homogeneous.

Pichi-Sermoli (in Beccari and Pichi-Sermoli 1955) cast doubt on the usefulness of the endosperm character. He did not accept the subdivisions of Burret (1939), believing that species with superficially ruminate endosperms would be difficult to classify in Burret's sections. Pichi-Sermoli is the first botanist to question the usefulness of endosperm condition in classifying palms and to suggest that the distinction between the two conditions was not black and white.

After examining a series of 23 specimens (many more than were available to Scheffer, Beccari, Burret or Pichi-Sermoli), I began to doubt the usefulness of endosperm condition as a means of distinguishing species in *Ptychococcus* (Zona 2003). Specimens, appearing identical in vegetative and floral features, differed only in the condition of the endosperm, from completely homogeneous (*Pullen 1077* at A) to very slightly ruminate (*Furtado s.n.* at K) to moderately ruminate (*Heatubun CH195* at K) to profoundly so (*Dransfield et al. JD7683* at K). I see no way in which these specimens can be easily and unambiguously separated into species groups. Therefore, I believe that specimens cannot be unambiguously assigned to Burret's subgenera and that his classification should be abandoned (Zona 2003).

Ptychococcus paradoxus was said by Beccari to have fruits 4.0 cm long by 2.3–3.3 cm in diameter, whereas in *P. arecina*, they are 5.0 cm long by 4.3 cm in. Burret described *P. archboldianus* with fruits 5 cm long by 4 cm in diameter and *P. archboldianus* var. *microchlamys* with fruits ca. 4 cm long by 3.5 cm in diameter. The differences noted in the dimensions of the fruits are

inconsequential when a large number of specimens is examined. I found fruit length is 39.2–59.8 mm (n = 45; mean = 47.7; s.d. = 4.9), and fruit diameter is 21.6–45.0 mm (n = 45; mean = 30.0; s.d. = 4.9).

Burret (1928) noted the similarity in fruit size and shape between *Ptychococcus guppyanus* and *P. kraemerianus*. The type specimens are, essentially, indistinguishable. These species differ slightly from the description of *P. arecinus* in the shape of the seed. In the first two, the rapheal lobe of the seed is elongated beyond the other four lobes, forming a beak at the apex of the seed. The character is particularly pronounced in the type of *P. kraemerianus*. However, this character varies continually, from prominent (*Kraemer s.n.* at A) to moderate (*Pullen 1077* at A) to nonexistent (*Zona et al. 678* at FTG), so its taxonomic value is nil.

Few seed specimens of *Ptychococcus lepidotus* are available for study, so the degree to which its endosperm condition varies is incompletely known (Zona 2003). Moore (1965), in describing the species, noted ''shallow marginal ruminations on the lobes and a deep intrusion on the rapheal lobes.'' In contrast, one specimen (*Hoogland 9033* at K and L) appears to have a homogeneous endosperm. Additional seed material of *P. lepidotus* is greatly desired.

For the reasons outlined above, I cannot maintain species based on fruit size, seed and endocarp shape, or degree of endosperm rumination. Consequently, only two taxa are maintained. *Ptychococcus paradoxus* is the common lowland *Ptychococcus* of New Guinea; it is amply distinct from *Ptychococcus lepidotus*, the upland species from Papua New Guinea.

Taxonomic Treatment

Ptychococcus Becc., Ann. Jard. Bot. Buitenzorg 2: 100. 1885. Type: *Ptychococcus paradoxus* (Scheff.) Becc.

Ptychococcus subgenus *Ptychococcus* (''*Euptychococcus*''). Type: *Ptychococcus paradoxus* (Scheff.) Becc.

Ptychococcus subgenus *Stolidotococcus* Burret, J. Arnold Arbor. 20: 209, 210. 1939. Type: *Ptychococcus archboldianus* Burret (= *Ptychococcus paradoxus* (Scheff.) Becc.)

Emergent or subemergent, pleonanthic palms. Stem solitary, gray, ringed with conspicuous leaf scars. Leaves spirally arranged, pinnately divided; leaf segments borne in one plane, spreading, linear to lanceolate, each bearing a single, reduplicate fold; segment apex obliquely erose; sparse to dense black ramenta on the abaxial surface of the segments, especially along the midvein. Inflorescences infrafoliar, one per node, branched to 3 orders, creamy white but becoming green as fruits develop, glabrous or densely brown lepidote; prophyll caducous, apically pierced by the peduncular bract at maturity and splitting longitudinally along the abaxial or adaxial side; peduncular bract caducous, splitting longitudinally along the adaxial side. Staminate flower buds bullet-shaped, borne perpendicular to the rachillae; sepals reniform to semiorbicular, margins hyaline and minutely fimbriate, imbricate, green; petals ovate to narrowly ovate, margins entire, valvate, greenish white; stamens many, outer filaments basally adnate to the petals; anthers sagittate, dorsifixed, versatile, thecae often uneven in length, bullate or smooth, creamy yellow; dehiscence latrorse; pistillode lageniform, white. Pistillate flowers borne proximally or nearly throughout the length of the rachillae, spirally arranged; sepals shallowly shield-shaped with a thickened keel, margins hyaline, imbricate, green; petals shield-shaped to patelliform, margins hyaline at base, entire at tip, imbricate with valvate tips, greenish white; gynoecium ovoid, pseudomonomerous. Fruit a drupe with a single endocarp, ovoid to fusiform (when dry); perianth cupule persistent, clasping; pericarp strongly wrinkled and shriveled when dry; exocarp smooth; mesocarp watery with few fine fibers, innermost fibers adherent to the endocarp, black or brownish; endocarp ovoid to fusiform, five-lobed, with rapheal lobe sometimes longer than other four and tapering into a point; seed one per fruit, ovoid and more-or-less pointed at the apex, five-lobed (reflecting the lobes of the endocarp); testa brown; endosperm homogeneous to slightly or profoundly ruminate; embryo basal, small. Germination adjacent-ligular; eophyll bifid. $n = 16$ (Read 1965).

Key to the species of *Ptychococcus*.

Staminate flower perianth lepidote on the abaxial surface; anthers smooth; endocarp brown with embedded black fibers and 1.5–3.5 mm thick . . . . . 1. *Ptychococcus lepidotus*

Staminate flower perianth not lepidote on the abaxial surface; anthers bullate; endocarp black and 0.5–1.2 mm thick . . . . . 2. *Ptychococcus paradoxus*

1. *Ptychococcus lepidotus* H. E. Moore, Principes 9: 11. 1965.—Type: Papua New Guinea. Morobe District: ridge SW of Bupu village, on tract to Engebu above Wampit River, elev. 2500–2800 feet, *Moore & Millar 9259* (holotype: BH!; isotype: LAE).

Emergent palm bearing 10 or 11 leaves. Stem 6–19 m tall, 10–30 cm in diam. Leaf sheath 60–150 cm long, green with silvery indumentum; petiole 10–150 cm long; rachis 260–500 cm long; 44–46 pairs of segments, borne 4.9–7.8 cm apart, middle segment 60–85 cm

long, 5–8 cm wide. Inflorescence 43–90 cm long; prophyll 42 or 43 cm long, 7 or 8 cm wide; peduncular bract ca. 39.5 cm long, ca. 5.5 cm wide; peduncle 10–16 cm long, 1.9–3.5 cm wide; rachillae 15–25 cm long, 1.8–2.9 mm in diam, brown lepidote, with 4–6 pistillate flowers per 5 cm. Staminate flower (bud before anthesis) 12.2–13.8 mm long, 6.5–8.4 mm in diam; sepals 4.0–5.9 mm long, 5.6–7.7 mm wide, densely brown lepidote on the abaxial surface; petals 10.2–11.9 mm long, 6.1–7.8 mm wide, brown lepidote on the abaxial surface; stamens 69–138, 6.8–10.0 mm long, creamy white; filaments 4.1–6.3 mm long; anthers 4.0–6.1 mm long, 0.6–0.8 mm wide, smooth; pistillode 7.9–11.8 mm long, 1.0–1.4 mm in diam at base. Pistillate flowers ca. 6.9 mm long, ca. 7.0 mm in diam; sepals ca. 4.1 mm long, ca. 5.0 mm wide; petals ca 4.3 mm long, ca. 3.4 mm wide; staminode not seen; pistil ca. 3.2 mm long, ca. 1.7 mm in widest diam. Fruit 39.4–49.2 mm long, 25.1–33.7 mm in diam; endocarp 39.1–39.7 mm long, 25.9–32.1mm in diam, endocarp wall 1.5–3.5 mm thick, brown with embedded black fibers; seed ca. 23.2 mm long, ca. 19.2 mm in diam. (Fig. 1)

Distribution and Elevation. *Ptychococcus lepidotus* is a palm of montane rainforest, at 760–1620 m in elevation. Ferrero (1996) gave 3000 m as the upper limit in elevation. Hay (1984) said that it was a common element of the lower montane rainforest dominated by *Castanopsis* (D. Don) Spach, in the vicinity of Bulolo. Its natural distribution corresponds to central Papua New Guinea (Fig. 2), but it is widely cultivated and perhaps moved about by humans. The only known specimen from Indonesia was taken from a cultivated plant. It is not known to occur naturally in Indonesia.

Common Names. Tewi (Hube), suhunin (Yali), val, ba'ha, wakal, mbuna (languages not specified).

Uses. The wood is used for spears, bows, and arrow points.

Conservation Status. Ferrero (1996) noted that, although geographically widespread, the palm is never abundant. Ferrero (1996) also noted that this palm is widely cultivated, often in cemeteries, which may satisfy local needs for palm wood. Population sizes are unknown, as is the degree of pressure placed on wild populations by humans, who must kill the palms to harvest the wood. Until these factors are better understood, the species must be classified as Data Deficient (DD).

Representative Specimens. PAPUA NEW GUINEA. East Sepik Prov.: Tehundo village, Drekikir [cult.?], *Obrist 27* (LAE); Morobe Prov.: Wantoat, 1188 m, *Clemens 11350* (K!), Golden Pines logging road, vic. Bulolo, 975 m, *Katik & Larivita NGF 38095* (L!, LAE), road to Yamap, 1188 m, *Millar NGF 23092* (L!, LAE), ridge SW of Bupu village, 762–853 m, *Moore & Millar 9259* (BH!; LAE), Wagau, near airstrip, 1036 m, *Moore & Womersley 9293* (LAE), Vickbery Creek, 6 km N of Wau, *Prah 43* (LAE), Bulolo Forestry Plantation, 1067 m, *Katik & Larivita LAE 62044* (LAE), Aseki Patrol post, road to Menyamya, 1219 m, *Essig LAE 55141* (LAE), Bulolo-Watut divide, 1097 m, *Moore & Womersley 1964* (LAE); Western Highlands Prov.: Jimi Valley, 1828 m, *Street & Manner 556* (LAE), 1615 m, *Clarke ANU 9501* (LAE).

CULTIVATED. Indonesia. Papua (formerly Irian Jaya): Snow Mts. region, E of Baliem Valley, close to bottom of Sibi Valley, 900 m, *Milliken 1447* (K!). Papua New Guinea. Morobe Prov.: Mongi Valley, near Pindiu, 953 m, *Hoogland 9033* (K!, L!, LAE).

2. *PTYCHOCOCCUS PARADOXUS* (Scheffer) Becc., Ann. Jard. Bot. Buitenzorg 2: 96. 1885. *Ptychosperma paradoxa* (Scheffer) Scheffer, Ann. Jard. Bot. Buitenzorg 1: 155, 156. 1876. *Drymophloeus ?paradoxus* Scheffer, Ann. Jard. Bot. Buitenzorg 1: 53. 1876.—TYPE: INDONESIA. Irian Jaya: Humboldt Bay [vicinity of Jayapura], *Teysmann s.n.* (holotype: missing, presumed destroyed). Neotype (designated here): Indonesia, Papua, Manokwari, SP8 Transmigration Scheme, 160 m, *Dransfield et al. 7598* (K!; isoneotype: FTG!, MAN).

Ptychococcus arecinus (Becc.) Becc., Ann. Jard. Bot. Buitenzorg 2: 99. 1885. *Ptychosperma arecina* Becc., Malesia 1: 58. 1877.—TYPE: INDONESIA. Irian Jaya: on the coast, at Ramoi near Sorong, in flooded forests, 8 June 1872, *Beccari 423* (holotype: FI!).

Ptychococcus elatus Becc., Bot. Jahrb. Syst. 58: 451. 1923.—TYPE: PAPUA NEW GUINEA. alluvial forest on the Sepik River, *Ledermann 12291* (holotype: B, destroyed?).

Ptychococcus guppyanus (Becc.) Burret, Feddes Repert. Spec. Nov. 24: 262. 1928. *Actinophloeus guppyanus* Becc., Webbia 4: 264, fig. 22. [October] 1913 [as an offprint (Pichi-Sermoli 1994)] & [June] 1914 [in the journal].—TYPE: PAPUA NEW GUINEA. Bougainville Island: at the base of low hills, *Guppy 62* (holotype (excluding leaf): K!; fragment: FI!).

Ptychococcus kraemerianus (Becc.) Burret, Feddes Repert. Spec. Nov. 24: 262. 1928. *Actinophloeus kraemerianus* Becc., Bot. Jahrb. Syst. 52: 30. [24 Nov.] 1914.—TYPE: PAPUA NEW GUINEA. Bismarck Archipelago: New Ireland, Muliama, 7 May 1909, *Kraemer s.n.* (holotype: B, destroyed; fragment: FI!).

Ptychococcus archboldianus Burret, J. Arnold Arbor. 20: 209, 210. 1939.—TYPE: PAPUA NEW GUINEA. Palmer River, 2 miles below the union with Black River, 100 m elev., June 1936, *L. J. Brass 7120* (holotype: A!; isotype: BM! L!).

Ptychococcus archboldianus var. *microchlamys* Burret, J. Arnold Arbor. 20: 210. 1939. TYPE: PAPUA NEW GUINEA. Sturt Island, Fly River, October 1936, *L. J. Brass 8166* (holotype: A!; isotype: BRI, L!).

Emergent palm bearing 6–13 leaves. Stem 6–26 m tall, 9–25 cm in diam. Leaf sheath 63–150 cm long,

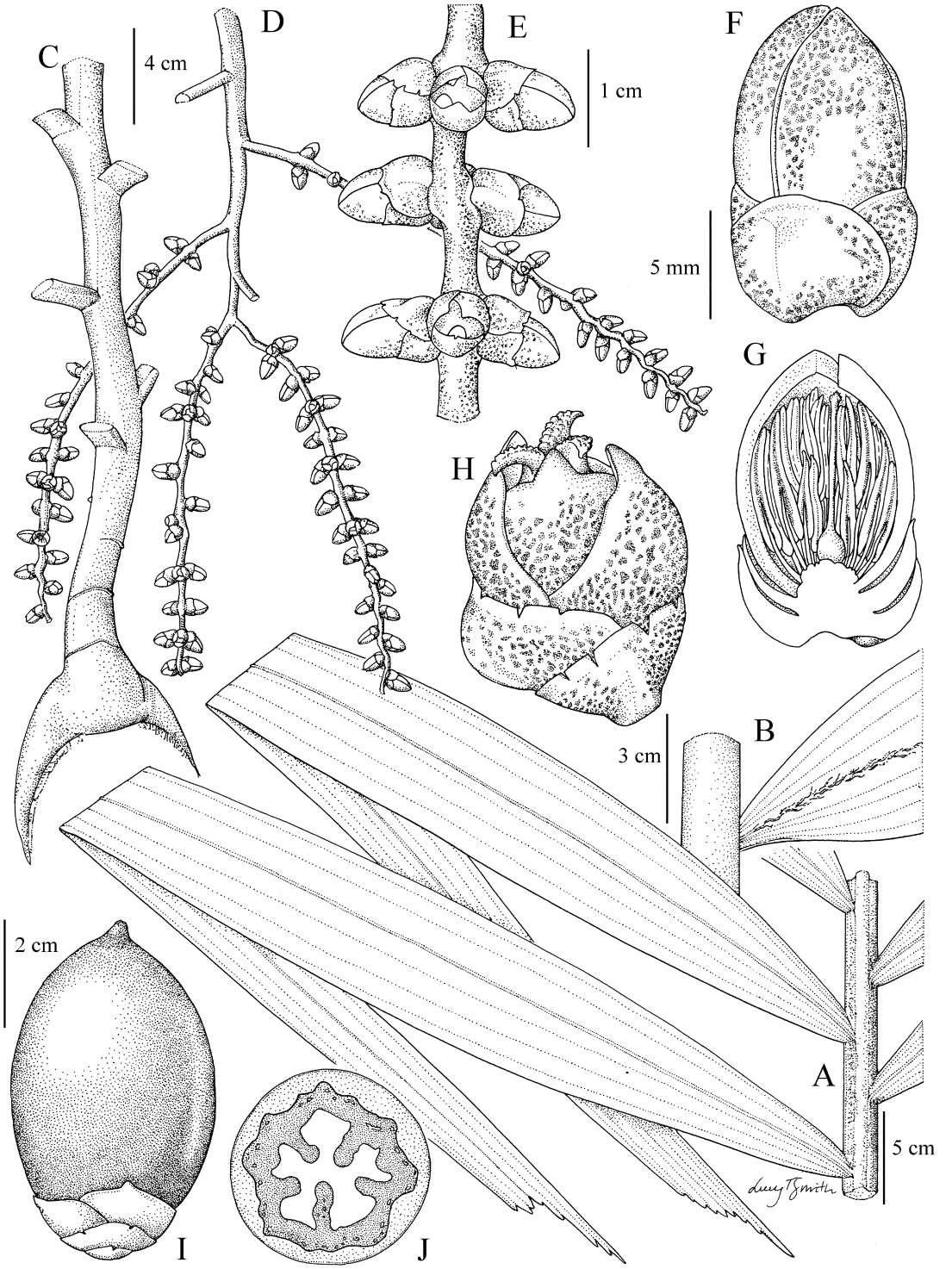

FIG. 1. *Ptychococcus lepidotus*. A. Mid-leaflets; B. Detail of underside of leaflet; C. Base of inflorescence; D. Inflorescence and rachillae (scale as in C); E. Portion rachilla with triads; F. Staminate flower bud; G. L.S. Staminate flower, T.S. (scale as in F); H. Pistillate flower (scale as in F); I. Fruit; J. Fruit, T.S (scale as in I). All from *Hoogland 9033.* Drawn by Lucy T. Smith.

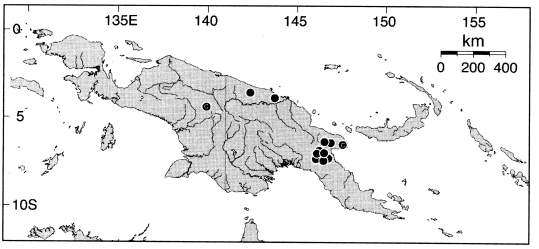

FIG. 2. Distribution of *Ptychococcus lepidotus* in New Guinea. The ''C'' dots indicated cultivated specimens.

green with silvery indumentum; petiole 0–33 cm long; rachis 250–470 cm long; 32–95 pairs of segments, borne 4.3–8.2 cm apart, middle segment 33–102 cm long, 3–12 cm wide. Inflorescence 50–150 cm long; prophyll 32–47 cm long, 4–15 cm wide; peduncular bract 33–58 cm long, ca. 7 cm wide; peduncle 8–19 cm long, 2–10 cm wide; rachillae 9–28 cm long, 1.3–4.3 mm in diam, glabrous, with 3–8 pistillate flowers per 5 cm. Staminate flower (bud before anthesis) 11.2–16.8 mm long, 5.4–9.6 mm in diam; sepals 3.6–6.8 mm long, 5.2–6.9 mm wide; petals 9.8–15.9 mm long, 4.2–8.4 mm wide; stamens 100–213, 4.7–13.1 mm long; filaments 1.9–10.7 mm long; anthers 2.0–6.5 mm long, 0.3–0.8 mm wide, bullate; pistillode 6.7–15.9 mm long, 0.7–2.9 mm in diam at base. Pistillate flowers ca. 7.6 mm long, ca. 8.8 mm in diam; sepals 4.2–5.4 mm long, 5.2–7.5 mm wide; petals 4.0–6.0 mm long, 2.6–5.5 mm wide; staminode ca. 1.2 mm long; pistil 2.5–6.3 mm long, 1.1–4.1 mm in widest diam. Fruit 39.2–59.8 mm long, 21.6–45.0 mm in diam; endocarp 31.0–55.4 mm long, 20.4–33.1 mm in diam, endocarp wall 0.5–1.2 mm thick, black; seed 20.9–28.1 mm long, 15.2–24.9 mm in diam. (Fig. 3).

Distribution and Elevation. *Ptychococcus paradoxus* is a palm of lowland rainforest or alluvial forest, often over limestone, at 0–850 m in elevation. The palm often grows in very wet or swampy habitats, sometimes in association with *Metroxylon sagu* Rottb., or along river banks or in flood plains. It is widespread throughout lowland New Guinea (Fig. 4), although much of its present range may be due to distribution and cultivation by humans.

Common Names. Apa imo (Bahasa Wamesa language), wilau (Wapi), nu (Wapi), nongrow (Orne), faia fili (Tuaripi), kem (Jal), mesigef akta (Meyah) tari, nium (languages not specified).

Uses. The wood is used for building houses and making bows, spears, and arrow points. The leaf sheaths are used for food platters. The terminal bud (heart-of-palm) is edible.

Conservation Status. Although *P. paradoxus* is widespread, it is rarely common. Population sizes are unknown, as is the degree of pressure placed on wild populations by humans, who must kill the palms to harvest the wood or heart-of-palm. Until additional field studies can be carried out, the species must be classified as Data Deficient (DD).

Representative Specimens. LOCALITY UNKNOWN: *Anonymous 2* (FI!); *Anonymous 42* [or *429*] (K!); *Raffill s.n.* (K!).

INDONESIA. Papua (formerly Irian Jaya): Without locality, ''coll. Burck 1904,'' *Teijsmann s.n.* (L-carp.!); Rouffaer [Tariku] River, *Docters van Leeuwen 11120* (K); Wandammen Peninsula, near Dotir Village, 20 m., *Barrow et al. 124* (K!, MAN); Ramoi, *Beccari 423* (FI!), Manokwari, SP8 Transmigration Scheme, 160 m, *Dransfield et al. 7598* (FTG!, K!, MAN), Fak-Fak, Timika, 5 m, *Dransfield et al. 7683* (K!), 20 m, *Heatubun 195* (K!, MAN); Nuni, 15–30 m, *Zona et al. 678* and *679* [seedling] (K!, FTG!, MAN); Sorong, *Wally 466* (K!, MAN); Sarmi, 1–3 km N of Sewan, 10–20 m, *McDonald & Ismail 3785* (A!).

PAPUA NEW GUINEA. Bougainville Prov.: interior islands of Bougainville Straits, *Guppy 62* (FI!, K!), Bougainville, Kugugai village, 229 m, *Schodde & Craven 3657* (A!, L!, LAE); East Sepik Prov.: Kudiman Yauyang village, near Amboin Patrol post, 30 m, *Leach NGF 34232* (LAE), Wewak, 2 mi W of But village, 6 m, *Essig LAE 55123* (LAE); Gulf Prov.: E Purari River delta channel, sea level, *Schodde & Craven 4508* (L!, LAE), Kikori Dist., 13 km S of Kikori, 10 m, *Baker et al. 1108* (K!), Purari River delta, 32.5 km E of Baimuru, 5 m, *Croft et al. LAE 61097* (L!, LAE), between Kerema and Malalaua, 30 m, *Henty & Katik LAE 72481* (K!, L!, LAE); Madang Prov.: Baiteta village, 100 m, *Baker & Utteridge 572* (K!), Trans-Gogol, Tadup village, 100 m, *Baker & Utteridge 579* (FTG!, K!), Gogol River forestry camp, *Essig & Katik LAE 55054* (L!, LAE), Ivarasik River, near Josephstaal airfield, *Pullen 1077* (A!, L!, LAE), Sakula Valley, near Bari village, 30 m, *Pullen 1179* (L!, LAE); New Ireland Prov.: without locality, *Peckel 113* (FI!), Muliama, *Kraemer s.n.* (FI!), 70 km SE of Namatanai, 800 m, *Giddeon et al. LAE 57194* (LAE); West New Britain Prov.: Near Dami, Kavui logging camp, *Essig LAE 55211* (L!), Kapore, 9 mi SW of Dami, 30 m, *Essig LAE 55212* (LAE); West Sepik Prov.: Miwautei, 950–1000 m, *Barfod et al. 385* (FTG!, K!), near Marok village, 9 m, *Darbyshire & Hoogland 7908* (A!), Along Pieni River, near Walwali village, 30 m, *Darbyshire & Hoogland 8016* (A!, BM!, L!, LAE), 5 mi from Fatima on road to Lumi, 182 m, *Essig LAE 55100* (LAE); Western Prov., Lower Fly River, Stuart Island, *Brass 8166* (A!, L!), Fly River, *D'Albertis s.n.* (FI!), Palmar River, 2 mi below junction with Black River, 100 m, *Brass 7218* (A!, BM!, L!); same locality, *Brass 7120* (A!, L!), Honinabi Mission Station, 250 m, *Essig & Young LAE 74035* (L!), junction of Strickland and Herbert Rivers, 50 m, *Gideon LAE 76181* (A!, K!, L!).

CULTIVATED. Indonesia: Bogor, Botanic Garden, V-J-9, *Anonymous 22* (FI!), same locality, *Schoute s.n.* (L!),

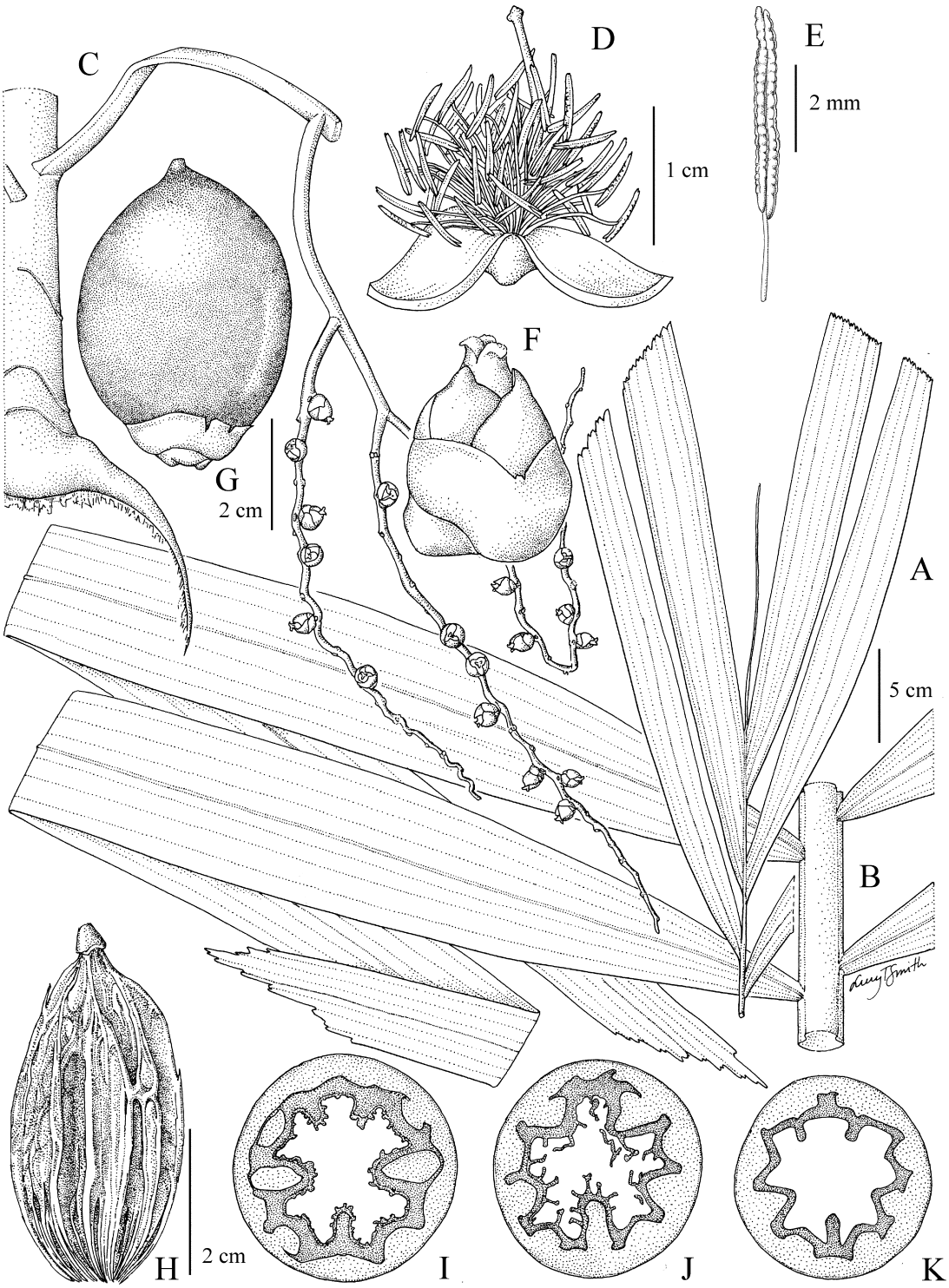

FIG. 3. *Ptychococcus paradoxus*. A. Apical leaflets; B. Mid-leaflets (scale as in A); C. Portion of inflorescence (scale as in A); D. Staminate flower; E. Stamen; F. Pistillate flower (scale as in D); G. Fruit; H. Endocarp; I. Fruit T.S. with shallowly ruminate endosperm (scale as in H); J. Fruit T.S. with profoundly ruminate endosperm (scale as in H); K. Fruit T.S. with homogeneous endosperm (scale as in H). A–I from *Barrow et al. 124,* J from *Heatubun 125*; K from *Baker & Utteridge 579.* Drawn by Lucy T. Smith.

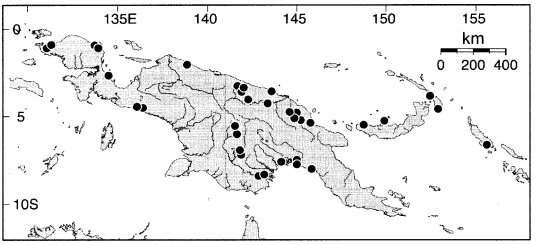

FIG. 4. Distribution of *Ptychococcus paradoxus* in New Guinea and Bismarck Archipelago.

XI-B-10, *Anonymous 226* (FI!, L!), X-D-32, *Anonymous 34* (FI!), X-D-32, *Furtado s.n.* (K!), X-D-98, *Anonymous 325* (FI!); ''Da semi portado della Nuova Guinea da Teijsman,'' *Beccari s.n.* (FI!), *Treub s.n.* (FI!); Sibolangit Botanic Garden, *Lorzing 12110* (K!, L!), same locality, *Mogea 420* (K!, L!). Singapore. Botanic Gardens, *Anonymous s.n.* (K!), *Ridley s.n.* (BM!), lawn X, *Furtado s.n.* (K!).

Notes. The type of *Drymophloeus paradoxus*, the basionym of *Ptychococcus paradoxus*, was a collection of fruits made by Teijsmann in New Guinea on 7 July 1871. The whereabouts of this collection are not known. The type specimen, a single fruit, was said to be in poor condition (Scheffer 1876b), and it may have been destroyed in favor of subsequent collections. Two carpological collections, one at BO another at L, both bearing Teijmann's name, are contenders for the role of type, however, as will be shown, neither specimen fits Scheffer's protologue and subsequent descriptions.

In 1999, Dr. John Dransfield, Royal Botanic Gardens, Kew, examined a Teijsmann specimen of *Ptychococcus paradoxus* found in the carpological collection at BO. The collection is labeled ''N. Guinea, Leg Teijsmann,'' but there are other labels inside the bag (''Hatusima 2603'' and ''Fly River D'Albertis'') suggesting that other collections could have been intermixed. The seeds showed, according to Dransfield, ''absolutely no signs of rumination.'' This specimen, however, cannot be the type, as Scheffer (1876b) wrote that he had only one defective fruit upon which to base his original description (the other seeds from Teijsmann's collection were presumably used for propagation).

A second carpological collection at the National Herbarium of the Netherlands in Leiden is another possible Teijsmann type. It consists of five fruits and is labeled ''Teysmann s.n. N. Guinea.'' The label also bears the words ''coll. Burck 1904.'' The meaning of this second part is obscure. It seems to imply that Burck obtained a portion of Teijsmann's type in 1904, but the seeds of Burck/Teijsmann collection at L have slightly ruminate endosperms whereas those in the Teijsmann carpological collection at BO have homogeneous endosperms. Again, as the description was based on a single fruit and seed, the five fruits in the carpological collection at L cannot be part of the holotype. They may, however, be part of material subsequently collected from Teijsmann's plants growing in Bogor and may have been used by Scheffer in amending his description, but there is no solid evidence to point to this conclusion.

A collection made by Beccari in May, 1878, at the Bogor Botanical Garden bears the notation ''Da semi portato della Nouva Guinea de Teijsman'' [''From seeds brought from New Guinea by Teijsmann'']. It would be a possible choice for neotype on grounds of its provenance, but the specimen is sterile.

Because neither of the carpological collections is in complete agreement with the protologue and Beccari's specimen is sterile, a modern collection, *Dransfield et al. 7598* (at K, with duplicates at FTG and MAN) is designated as a neotype. The specimen has seeds that are very slightly ruminate, thus agreeing with Scheffer's (1876a, p. 53) original description of the endosperm as sub-homogeneous.

Actinophloeus guppyanus Becc. is typified by the fruits preserved at K. The specimen, *Guppy 62,* not *Guppy 302* as noted in Beccari's publication, consists of fruits and a leaf segment. The segment, which has an acuminate apex, likely belongs to *Cyrtostachys kisu* Becc., as was noted by Beccari in an annotation. Because Beccari noted the mixed collection and specifically excluded the leaf segment, the name does not require lectotypification.

EXCLUDED NAMES

Ptychococcus albertisianus Becc. ex Martelli, Nuov. Giorn. Bot. Ital. 1934 n.s. 41: 708. 1935. Nuov. Giorn. Bot. Ital. 1935 n.s. 42: 74, 78. 1935. *nomen nudum.*

Although the name was never validly published, Beccari used it *in schedula* for a specimen of *Ptychococcus paradoxus* collected near the Fly River. The name has appeared in print on several occasions but never with a description and typification.

Ptychococcus ledermannianus (Becc.) Zona, Mem. New York Bot. Gard. 83: 262. 1999. = *Ponapea ledermanniana* Becc., Bot. Jahrb. Syst. 59: 14. 1924.

Ptychococcus schumannii (Becc.) Burret, Feddes Repert. 24: 262. 1928. = *Brassiophoenix schumannii* (Becc.) Essig.

Ptychosperma novo-hibernica Becc., Bot. Jahrb. Syst. 52: 29. 1914. This species was synonymized under *Ptychococcus kraemerianus* by Burret (1928), but I have chosen to exclude it from synonymy. The holotype, presumably at B, was destroyed, but a photograph and a fragment of the holotype (*Kraemer s.n.*) are preserved at FI. The fragment consists of leaf segments and a portion of an infructescence without fruits. The leaf segments (deeply

excavate and bicaudate) appear to belong to *Ptychosperma*, but the infructescence branches resemble *Ptychococcus*. It is possible that this specimen is a mixture of two species. As no fruits of *Ptychosperma novo-hibernica* were seen or described by Beccari, I cannot with certainty assign it to *Ptychococcus*. Additional collections from the vicinity of the type locality of *P. novo-hibernica* (New Ireland, Bismarck Archipelago) may clarify this puzzling species.

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