Heterospathe barfodii, a New Species from Papua New Guinea

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1. *Heterospathe barfodii* in type locality, showing habit (Photo: Anders Barfod).

An extraordinary new species of *Heterospathe* from Papua New Guinea, which is already established in cultivation under an incorrect name, is described here for the first time.

We first became aware of this puzzling, slender palm with a striking silvery-white crownshaft when it featured on the cover of the *Field Guide to Palms in Papua New Guinea* (Barfod et al. 2001) identified as "*Rhopaloblaste* sp." Anders Barfod from Aarhus University had found and collected the palm with Roy Banka (PNG Forest Research Institute) and John Dowe (James Cook University) in 2000 in a relatively remote area of Milne Bay where it grew along a roadside on the edge of disturbed forest (Fig. 1). Through research for a revision of *Rhopaloblaste* (Banka & Baker 2004), we realized that this palm did not fit well within this genus, for example in its inflorescence with elongate, rather than short peduncle and persistent, rather than caducous prophyll (Figs. 2 & 3). At that time, we decided that the species most closely conformed to *Heterospathe*, except for one confounding fact – it had a conspicuous crownshaft, a feature unknown in any other species of that genus (Baker & Dransfield 2006, Dransfield et al. 2008).

In 2008 John Dransfield visited the nursery of Jeff Marcus in Hawaii and was shown a palm cultivated under the name *Heterospathe glauca* (Scheff.) H.E. Moore (Figs. 4 & 5). *Heterospathe glauca* is an enigmatic species described in the 19th century as *Ptychandra glauca* Scheff. and not collected in recent years. Only a few herbarium specimens are known from Bacan and Ternate islands in Maluku, Indonesia, and from cultivation in Bogor and Singapore Botanic Gardens. The most recent specimen was collected by John Dransfield in Bogor Botanic Garden from the last cultivated plant, which was struck by lightning during a storm in 1971. Its re-discovery in cultivation would certainly have been significant.

As part of a revision of *Heterospathe* for the Palms of New Guinea project (Baker 2002, Trudgen & Baker 2008), we compared specimens and photographs of the plants cultivated by Jeff Marcus with an extensive range of material from relevant herbaria and concluded that the cultivated palm is the same as the palm collected by Barfod and colleagues in Milne Bay, Papua New Guinea. We also found that the species does not match the specimens, type description and illustration of *H. glauca* (Scheffer 1876). The staminate flowers of *H. glauca* are more robust and have many more stamens than those of the unidentified palm (Fig. 6), 24 or more in the case of the former and just 6–9 in the latter. Similarly, *H. glauca* bears large, globose fruits "the size of a rifle ball" (Scheffer 1876) up to 17 mm in diameter, whereas the unidentified palms bears similar but much smaller spherical fruits which are 7–9 mm in diameter (Fig. 7).

2. *Heterospathe barfodii* in type locality, showing maroon infrafoliar inflorescences (Photo: Anders Barfod).

3. Roy Banka with inflorescence of *Heterospathe barfodii* (Photo: John Dowe).

From the specimens and images available to us, it remains uncertain whether or not *H. glauca* has a crownshaft, like that of the unidentified palm.

It is clear that the unidentified palm is in fact an undescribed species, which we publish here as *Heterospathe barfodii*, in honor of the collector of the first specimen, Anders Barfod, and his contribution to New Guinea palm taxonomy and exploration. Using DNA methods, we have confirmed that the species is indeed a member of the genus *Heterospathe*, despite its unusual morphology, which means that the concept of the genus has to be broadened to account for the presence of a crownshaft in rare instances.

Quite how the species became established in cultivation is unclear. Jeff Marcus obtained seed from former IPS President Donn Carlsmith in 1990. It has been distributed widely since this time throughout the USA and North Queensland, Australia, but from whom

4. *Heterospathe barfodii* growing at Floribunda Palms and Exotics, Hawaii (Photo: John Dransfield).

5. *Heterospathe barfodii* growing at Floribunda Palms and Exotics, Hawaii, showing crownshaft, inflorescence and developing infructescence (Photo: Jeff Marcus).

Carlsmith obtained his material remains a mystery. Several individuals of the new palm were observed by JD in 2008 in the Robert and Catherine Wilson Botanical Garden at the Las Cruces Biological Station, in southern Costa Rica, where they were unnamed and lacked provenance (Fig. 8). We speculate that they could have originated from the same source as

Donn Carlsmith's plants – perhaps an early distribution of seed from Papua New Guinea via the Palm Society Seed Bank. It appears to be a faster grower in cultivation than other *Heterospathe* species.

Unfortunately, the name *Heterospathe glauca*, which seemed so appropriate for this species with its startling glaucous crownshaft, cannot be used, but perhaps this will inspire palm experts to track down the true *H. glauca*, which is so poorly known and perhaps even threatened in its native Maluku.

Heterospathe barfodii L.M. Gardiner & W.J. Baker, **sp. nov.** Type: Papua New Guinea, Milne Bay Province, along the Kabawawa highway, March 2000, *Barfod et al. 4539* (holotype K!; isotypes AAU!, LAE, BRI, CANB). Fig. 9.

Medium, solitary palm. **Stem** erect to (2–)8 m tall, 7–10 cm in diam.; leaf scars 1–2 cm wide; internodes 3–10 cm (up to 17 cm in juvenile stem); green to dark brown but upper few internodes covered with white farinaceous indumentum. **Leaves** 7–9 in crown; sheaths 55–67 cm long, forming a well-defined crownshaft, pale green, covered with dense, thin farinaceous white indumentum with scattered, minute, pale brown, white-edged scales; petiole 20–40 cm long, concave adaxially, bright green, indumentum as for sheath; rachis 205–240 cm long, 10–12 mm wide at midpoint; leaflets 38–56 per side, borne 4 cm apart (along mid-section of leaf), regularly arranged, in a single plane, held horizontally with tips drooping slightly, narrowly to broadly linear, leathery, singlefold but apical leaflet pair sometimes multifolded and partially joined, tapering to bifid apices, bright green, concolorous, red-brown or whitish medifixed ramenta to 5 mm long scattered on abaxial surface of proximal portion of midrib and secondary veins, transverse veinlets conspicuous, proximal leaflets 39.5–49 cm long, 1.2–2.1 cm wide, middle leaflets 67–78 cm long, 4–5.5 cm wide, distal leaflets 22–23.5 cm long, 1.5–2.4 cm wide. **Inflorescence** 68–99 cm long, infrafoliar, branched to 3 orders, branches spreading, deep maroon at anthesis; prophyll 25–34 cm long, 5–7 cm wide, opening apically, persistent, covered with white farinaceous indumentum; peduncular bract similar to prophyll, caducous or persistent, exserted from prophyll, insertion ca. 14 cm from base of the peduncle, enclosed within prophyll; peduncle 32–33 cm long, 20–22 mm wide; rachillae 14–36 cm long, 2.5–3 mm in diam., with ca. 6 triads per 1 cm, rachilla bracts minute to 1 mm, triangular; all inflorescence axes sparsely covered with floccose to lanate brown to pale brown indumentum, diminishing along branches. **Staminate flower** 2.9–3.7 mm long, 2.7–3.3 mm in diam. in bud, ovoid; 7.5–8.4 mm in diam. and deep maroon at anthesis; sepals 3, imbricate, thick, triangular, 1.1–1.5 mm long, 1.0–1.7 mm wide; petals 3, 3.0–4.0 mm long, 1.7–2.4 mm wide, valvate, triangular; stamens 6–9, 4.2–5 mm long; filaments 3–3.5 mm long, 0.4–0.5 mm in diam., fused at base for 0.4 mm to form a ring around pistillode, white, inflexed; anthers 1.2–1.9 mm long, 0.6–0.9 mm wide, medifixed; pistillode 1 mm long, 0.8 mm in diam. at base, conical, minutely

6. Staminate flowers of *Heterospathe barfodii* on rachilla at anthesis (Photo: John Dransfield).

7. The fruits of *Heterospathe barfodii* (Photo: John Dowe).

trifid. **Pistillate flower** immature, bud ca. 4.9 mm long, ca. 2.7 mm in diam., globose-ovoid, deep maroon; gynoecium ca. 2.1 mm long, ca. 0.9 mm in diam., perianth imbricate. **Fruit** 1 cm in diam., spherical, surface striate, red when mature; perianth cupule clasping; stigmatic remains subapical; endocarp thin bony, dark brown; occasionally bilobed with two developed carpels or one developed and one partially developed carpel. **Seed** 7 mm in diam., spherical, pale brown; endosperm ruminate; embryo basal.

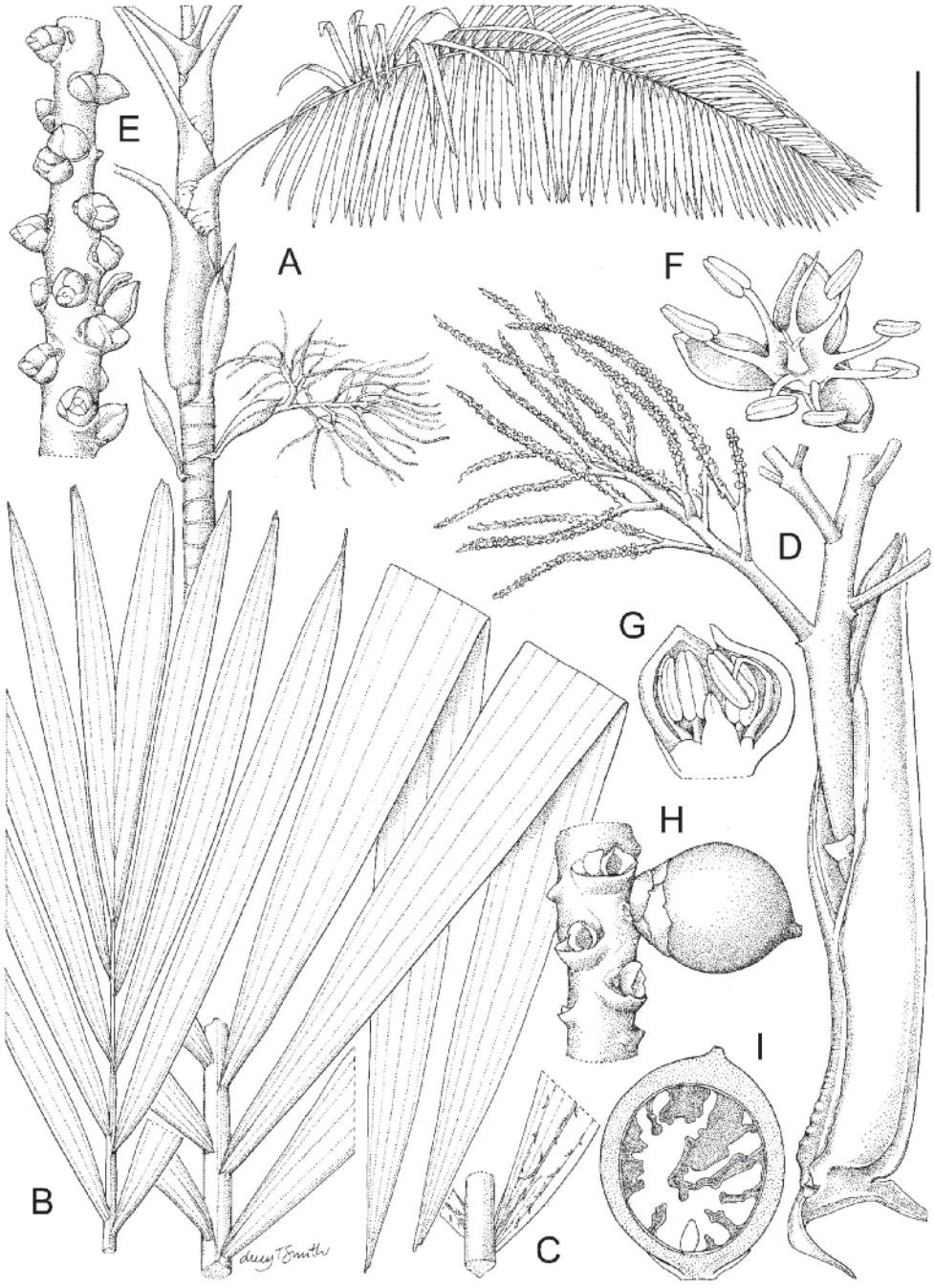
Distribution: Known only from one wild-collected specimen, from the lowlands of mainland Milne Bay Province, Papua New Guinea.

Habitat: Lowland tropical rainforest vegetation at about sea level. The type locality is an open grassy area at the side of a dirt road through the forest

Vernacular name and uses: There are no known records of local names or uses for this palm.

8. Row of mature *Heterospathe barfodii* trees at Las Cruces Biological Station, Costa Rica (Photo: John Dransfield).

Conservation status: This palm meets the criteria for threat category Critically Endangered (CR B1ab(i,ii, iii, iv, v), C2(ai, aii), D; IUCN 2001) as it is only known from a small population at a single location, and therefore its extent of occurrence is estimated to be less than 100 km^2. Similarly, the area of occupancy is estimated to be less than 10 km^2, the palm is only known from one location, and the population size is suspected to number



9. *Heterospathe barfodii*. **A**. crownshaft, inflorescences and leaf; **B**. apical and middle portion of leaf; **C**. detail of leaflet underside showing ramenta; **D**. inflorescence showing prophyll; **E**. buds on portion of rachilla; **F**. open staminate flower; **G**. staminate bud in section; **H**. fruit on rachilla; **I**. fruit in section showing ruminate seed. Scale bar: A = 50 cm; B, C, D = 8 cm; E, H = 1 cm; F = 5 mm; G = 3 mm; I = 7mm. A-I from *Marcus 1*. Drawn by Lucy T. Smith.

fewer than 50 mature individuals as no other individuals were seen (A.S. Barfod, personal communication). The type locality is a disturbed forest edge, along the side of a dirt road – by definition individual plants in this location are vulnerable, and the area is under threat from logging, mining and oil palm plantations. Therefore the population of this species is likely to decline unless conservation action is taken.

Additional specimens examined: Cultivated: United States of America, Hawaii, Floribunda Palms and Exotics, June 2009, *Marcus 1* (K!).

Notes: The genus *Heterospathe* Scheff. is defined by a combination of characters that occur in other genera of tribe Areceae, rather than by any unique synapomorphies: "leaf sheath splitting to the base, interfoliar inflorescences (at least at anthesis), peduncle longer than the rachis, peduncular bract longer than the prophyll, prophyll persistent, and peduncular bracts persistent" (Norup et al. 2006). *Heterospathe barfodii* shares most of these characters. Although *H. barfodii* has a distinct crownshaft with the outermost leaf sheaths remaining largely tubular, it appears that the oldest sheath is at least partially open with fibrous margins, a condition that can be observed on inner leaf sheaths of other species of *Heterospathe*. It would appear that the possession of a crownshaft is a matter of degree in *Heterospathe*. The fact that the inflorescences are infrafoliar in *H. barfodii* is most likely related to the physical constraints imposed by a well-defined crownshaft.

As noted by Norup et al. (2006), the combination of a crownshaft and persistent prophyll, as is found in *Heterospathe barfodii*, occurs elsewhere in tribe Areceae only in *Dransfieldia*, *Drymophloeus*, *Roscheria* and some species of *Dypsis*. Of these, *H. barfodii* most closely resembles a robust *Dransfieldia*, on account of its crownshaft, infrafoliar inflorescence, elongate peduncle and persistent prophyll. However, *Dransfieldia* is a much more slender palm, with slim, bullet-shaped staminate buds well-spaced along the rachillae (unlike the relatively crowded arrangement of ovoid buds along the rachillae in *H. barfodii*), more stamens (up to 19) and an inner whorl of erect stamen filaments (the filaments all being inflexed in *H. barfodii*). *Dransfieldia* is also restricted in geographic distribution to the far-western Papua province in Indonesian New Guinea. We have generated DNA sequence data for the two low-copy nuclear genes PRK and RPB2 from the cultivated material of *H. barfodii*, integrating these into the recent arecoid dataset of Baker et al. (2011) and re-analysing the data following their methods. The resulting molecular phylogeny places the species firmly within the genus *Heterospathe*, and although the sampling of New Guinea taxa is incomplete, resolves it in a clade with two other New Guinea taxa, *H. delicatula* H.E. Moore and *H. elegans* subsp. *humilis* (Becc.) M.S. Trudgen & W.J. Baker. In this revised analysis, *Dransfieldia* remains quite distinct from *Heterospathe*.

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