is the only place in Madagascar where such a palm population exists.

Aftermath of the expedition

Back at the Kew House we downloaded the images we had taken, burned a CD and sent it off, hand carried by another Kew colleague, back to John in Kew. John found the CD unannounced in his pigeon hole one lunchtime and opened up the files on his computer, hardly able to believe his eyes on seeing picture after picture of this wonderful population of *Beccariophoenix*. How he wished he could get on the next plane to Madagascar!

John looked carefully at the pictures. He felt pretty sure that the palm found west of Antsirabe represented an undescribed form of *Beccariophoenix* but, as usual, was reluctant to commit himself without actually seeing the specimens. In November 2004, while spending a short time in the Kew House in Antananarivo to examine a student, he was able to work with Joro and examine the specimens in detail. Everyone was now convinced that the Manalazina palm was not *B. madagascariensis* but an unnamed and undescribed species. In drawing up the description of the new palm, the differences became very apparent. We decided then and there to name the palm *Beccariophoenix alfredii*, recognizing the crucial role played by Alfred Razafindratsira in the discovery of this astonishing palm and acknowledging our debt of gratitude to him.

Beccariophoenix alfredii Rakotoarinivo, Ranarivelo et J. Dransf., **sp. nov.** a B. madagascariensi inflorescentiae infrafoliaribus, pedunculo simper brevissimo, bractea pedunculare coriacea, staminibus 15 vice 18–21 et fructu oblato bene distincta. Typus: Madagascar: Prov. Antananarivo, Andriambesoa, Betafo, Manalazina, 21.5.2004, *M. Rakotoarinivo, T. Ranarivelo, R. Ranaivojaona, T. Ranaivomanana, R. Rajaonarison RMJ136* (Holotypus K, Isotypi MO, P, TAN).

Robust, solitary, unarmed, pleonanthic, monoecious, tree palm. *Stem* erect, to ca. 15 m tall, 28–30 cm diam. at breast height, gray-brown, eventually becoming bare and closely ringed with leaf scars, internodes ca. 2.5 cm. *Leaves* 30–36 in crown, pinnate, marcescent in juvenile palms, abscising neatly in adults; sheath tubular at first, to at least 82 cm long, with two lateral, ± entire, triangular lobes to

5. Leaf of *Beccariophoenix alfredii* harvested from a palm partially felled by flood.

30 cm long, 10 cm wide at the base, tapering to ca. 8 cm, the abaxial surface of the sheath covered with thick caducous gray-brown indumentum, the body of the sheath disintegrating into a mass of robust sinuous gray fibers ca. 3 mm wide, adaxially the sheath glabrous, reddish-brown; petiole very short, ca. 4–5 cm long, to 8 × 2.3 cm wide and deep, with scattered caducous scales; rachis to at least 4.4 m long, to 7 × 2.3 cm wide and deep at the base, tapering gradually distally, adaxially ridged near the base, abaxially rounded, distally with 2 lateral grooves; leaflets ca. 120 on each side of the rachis, ± regularly arranged, very slender and crowded at the base, ± rigid or somewhat pendulous, ca. 47 × 1 cm at the base of the leaf, ca. 112 × 4 cm in mid leaf, ca. 65 × 1.8 cm at the tip, ± acute, easily splitting and becoming bifid, adaxially glabrous, abaxially lacking powdery white wax, transverse veinlets short, conspicuous, minute punctiform scales present on longitudinal veins. *Inflorescences* solitary, infrafoliar, branching to 1 order; peduncle moderate, 8–13 cm long, elliptic in cross-section, 4 × 1.7 cm, with caducous gray-brown indumentum, ± glabrescent in infructescence; prophyll not seen, presumably inserted at the base of the peduncle and included within the leaf sheaths; peduncular bract inserted at the apex of the peduncle, woody, with solid beak, the whole to 90 cm long, 3–5 mm thick, abaxially with conspicuous longitudinal grooves, at anthesis the peduncular bract splitting longitudinally and circumscissile at the insertion, leaving a collarlike scar, the bract curling up on drying after abscission, adaxially the bract smooth, shiny, yellowish green abaxially tomentose and longitudinally shallowly grooved; rachis very short, to 8–9 cm long, to ca. 4 × 2 cm diam., tapering to ca. 0.7 cm at the tip, bearing ca. 30–50 crowded, spirally arranged rachillae, each subtended by a short, triangular, acuminate, coriaceous bract 1.1–7.5 × 1.0–2.8 cm; rachillae glabrous and lacking white wax, yellowish, becoming crimson in ripe fruit, straight, rigid, held at a narrow acute angle to the rachis, 45–66 cm long, ca. 5–8 mm diam. at the base, tapering distally, each with a poorly defined swelling at the very base, proximally with a bare portion 15–18 cm long, distally bearing distichous triads in the proximal 13–19 cm, paired staminate flowers in the middle 11–17 cm and solitary staminate flowers in the distal 13–18 cm, rachilla bracts triangular 1–4 × 1–6 mm; floral bracteoles well developed, broad, rounded, striate, rather coriaceous, shorter than the rachilla bracts. *Staminate flowers* narrow ellipsoid, ca. 13 × 4 mm; sepals to 2 × 2 mm, joined in the basal 1 mm, distally triangular, free and imbricate, glabrous, not striate; petals coriaceous, ca. 12 × 3 mm, tapering to a short acute tip, basally very briefly joined, abaxial surface glabrous, lacking white wax, obscurely striate; stamens 15, filaments 2 mm, anthers elongate 8 × 1 mm, erect, ± basifixed; pistillode absent. *Pollen* not studied. *Pistillate flowers* in bud, irregularly globose to obscurely angled, 9 × 6 mm, perianths persistent and enlarging in fruit; sepals broadly imbricate, 8–9 × 5–6 mm; petals 8 × 7 mm, broadly imbricate with short valvate tips; staminodal ring membranous, ca. 1 mm high; gynoecium ellipsoid, 6 × 4 mm, stigmas pyramidal in bud, 2 mm high. *Fruit* 1-seeded, oblate, 16 × 24 mm, with a short triangular beak to 3 mm long, 4 mm wide at the base, dark purplish-black at maturity, smooth, becoming striate when dry, surface glabrous except the beak where minutely and obscurely scaly; mesocarp thin, fleshy 1 mm thick, with longitudinal fibers, endocarp 15 × 22 mm, very thin, scarcely lignified, pores rather obscure, just below the equator. *Seed* oblate 13 × 20 mm, attached near the base with a broad hilum, with numerous anastomosing raphe branches, endosperm deeply ruminate; embryo lateral below the equator. *Germination*: adjacent-ligular; eophyll entire, lanceolate. (Figs. 1, 3–12 & Front Cover).

Specimen Examined: MADAGASCAR: Prov. Antananarivo, Andriambesoa, Betafo, Manalazina, 20º 12′ 32.1″ S, 46º 30′ 04.3″ E, gallery vegetation, 1072 m alt, 21.5.2004, *M. Rakotoarinivo, T. Ranarivelo, R. Ranaivojaona, T. Ranaivomanana, R. Rajaonarison RMJ136* (Holotypus K, Isotypi MO, P, TAN).

The existence of this population of *Beccariophoenix* on the western slopes of the High Plateau of Madagascar is quite astonishing. This new species grows in a completely different phytogeographic zone from the humid rain forest zone associated with *B. madagascariensis*. Manalazina belongs to the zone of the western slope of the Domaine Centrale defined by Humbert (1955). The primary vegetation is formed of sclerophyll forest with *Uapaca bojeri* and members of Sarcolaenaceae (Humbert & Cours-Darne 1965), but the current vegetation of the area consists mostly of a scrubby savannah. Furthermore, the climate is very different from that experienced by *B. madagascariensis* at Mantadia. In fact, *B. alfredii* experiences a subhumid temperate climate (Cornet 1974),

drier than that of the east of Madagascar. The average temperature is 15–20ºC and the rainfall generally less than 1500 mm. The dry season is about five months long. The population of *B. alfredii* occurs at an average elevation of 1050 m above sea level; above that elevation, the palm becomes very rare, as the depressions between two mountains are too infrequent

7. View into the crown of *Beccariophoenix alfredii* showing the narrow leaf bases and a newly opened inflorescence.

8. Specimens of unopened inflorescences of *Beccariophoenix alfredii* split down the middle to show the thin peduncular bract and numerous flowers.

and where there are such depressions they are usually too dry. The soils in general in the region are ferralitic, but *B. alfredii* seems to grow solely on sandy soils on the banks of tributaries of the Mania River.

Beccariophoenix alfredii is the dominant species in the gallery forest and, reaching mostly 10–15 m, constitutes the only canopy species. The species grows so abundantly in the area that we estimated at least 500 mature individuals at this locality. In contrast, regenerating individuals are few. The dominance of this species may be due to the fallen leaves and inflorescences that carpet the ground, completely eliminating any other woody plants. Moreover, seed dispersal seems to be mostly by water. The flattened shape of the fruits allows them to be dispersed easily by water until they are deposited in a site favorable for germination. Sometimes seedlings are found actually growing in water but they mostly occur along the river bank.

Perhaps this explains why the adult palms are restricted to a band along all the valleys.

It could be asked why we consider this palm to be a new species of *Beccariophoenix* when *B. madagascariensis* is itself variable. Dransfield (2202) reported what was known of this variation and highlighted the presence of two distinct seedling morphologies of the palm in cultivation. One type of *Beccariophoenix* has juvenile leaves with a broad terminal pair of multifold segments displaying many windows. In contrast the second type of *Beccariophoenix* has narrow terminal segments composed of few folds and with one or two windows only. After some research in the field and discussion with seed importers and growers we can say that the population of *Beccariophoenix* from the lowlands near to Brickaville (the Ranomafana Est population, currently known with certainly from a single adult tree and, about twenty km away, a few more) produces seedlings with many windows. The population from the general area of Mantadia near the type locality of *B. madagascariensis* and the population at Sainte Luce produce seedlings with few windows. *Beccariophoenix alfredii* has seedlings with narrow terminal segments and few windows.

The habitat of the population at Sainte Luce at near sea level might be thought of as being very different from that of the montane ridgetops at almost 1000 m in Mantadia, but there are in fact considerable resemblances in vegetation – both areas support generally rather small-leaved dicotyledonous trees, growing on humus rich soils overlying extremely nutrient-poor sand or quartzite. The main difference between the Mantadia and Sainte Luce populations is in the length of the peduncle – always elongate at Mantadia, sometimes elongate, sometimes very short at Sainte Luce (incidentally, the one tree at Ranomafana Est is remarkable for it extremely short peduncles.

The main differences between *B. alfredii* and *B. madagascariensis* are listed in Table 1. The most striking differences are in the size and form of the inflorescence and fruit.

At the moment, the only scientifically proven and recorded locality for *B. alfredii* is Manalazina. This population is limited to the west by the Mania River. Individuals become abruptly very rare as soon as one approaches the Mania, the river into which the tributary lined with *Beccariophoenix* flows. Fewer than twenty individuals of *B. alfredii* grow on the banks of the Mania, possibly because of its depth, which is unfavorable to the dispersal and establishment of seedlings. As we climbed

9. View into the crown of *Beccariophoenix alfredii* showing inflorescences at various stages, including ripe fruit.

10. More or less ripe fruit of *Beccariophoenix alfredii*.

11. Carpet of fallen fruit of *Beccariophoenix alfredii*.

up another mountain chain in the hope of finding other populations in further localities, we saw not one palm on the horizon. Because of the extremely difficult access and the time we had already taken to reach Manalazina, we were unable to conduct further searches for the palm. Meanwhile, we are optimistic concerning the existence of more populations further away in the region. Justin Moat, GIS specialist at the Royal Botanic Gardens, Kew, using satellite imagery, has looked for habitats similar to that at Manalazina. After analysing the very distinctive spectrum and relief seen in the satellite images at the exact coordinates of Manalazina, Justin was able to search for similar spectra and relief elsewhere in this part

12. Seedling foliage of *Beccariophoenix alfredii* showing few narrow "windows."

of the plateau. He found similar habitats but much further away from Manalazina. Other populations of *B. alfredii* surely exist in the area – during our visit, we did not have the time to revisit Vilanitelo where the palms was first seen by Alfred's collectors, nor Marovato, the site of the large population mentioned by Alfred.

While we await the discovery of additional populations, we can declare that the population at Manalazina can be considered to be intact and not facing any major threat, thanks to mountain chains that effectively act as natural barriers protecting the population. This palm occurs in one of the most secure localities in the whole island. The area has one of the lowest densities of human population in the whole of Madagascar and this is, of course, very significant for the future survival of the species. Furthermore, no one locally seems interested in utilizing the palm at the moment, because it is virtually impossible to transport the palm or its products up the 300 m of extremely steep slope from the valley bottom, and the locality is inaccessible to any of the usual forms of mechanized transport utilized in Madagascar. It is for these reasons that the locality is so deserted. During our four days camping we five from Antananarivo and our two guides saw no one apart from ourselves in the area.

Of course, the discovery of this new species is of fundamental importance in developing our understanding of the taxonomy and biogeography of the genus, previously thought to be monotypic and confined to eastern Madagascar. The discovery of *B. alfredii* adds impetus to the initiation of an intensive study of the genus throughout its range in Madagascar. It is possible that *Beccariophoenix* comprises more than two species. During the last few years we have heard rumours of several new populations of *Beccariophoenix* but these have not always proved to be the real thing. There is clearly much more survey work to be done!

Table 1. Comparison between *Beccariophoenix madagascariensis* and *B. alfredii*.

Beccariophoenix madagascariensis	*Beccariophoenix alfredii*
Inflorescence interfoliar	Inflorescence infrafoliar
Peduncle to 120 cm long	Peduncle not exceeding ca. 13 cm long
Peduncular bract heavily lignified, 30–40 mm thick, not deforming when abscising	Peduncular bract leathery, 3–5 mm thick, rolling up on itself when abscising
Stamens 18–21	Stamens 15
Fruits ovoid	Fruits oblate

As this paper goes to press, our colleague Alison Shapcott from the University of the Sunshine Coast in Australia, who is working on an analysis of genetic variation within the whole genus and within populations, reports that *B. alfredii* is genetically very distinctive when compared with the other samples of *Beccariophoenix* that she has analyzed, adding support for the decision to recognize it as a distinct new species.

Acknowledgments

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