

Beccariophoenix fenestralis

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1. Seedling of *Beccariophoenix fenestralis* showing terminal flabellum with conspicuous windows.

That there may be a third species of *Beccariophoenix* in Madagascar has long been suspected by palm growers. Before the discovery and introduction of the second species, *B. alfredii*, seedlings grown as *B. madagascariensis* presented two very distinctive morphologies, summarized in their informal names as *B. madagascariensis* “form without windows” and *B. madagascariensis* “windowed form” (Fig. 1). These names reflected the absence or presence of broad windowed seedling leaf tips.

In 1986 when a population of the charismatic *Beccariophoenix madagascariensis* was refound at Mantadia, near the type locality in the Andasibe area on the eastern escarpment of Madagascar (Dransfield 1988) it seemed inconceivable that there might be more than one species in the genus. For a couple of years, the Mantadia population was the only extant population known to botanists. Besides the type collection made before 1915, it had also been collected near the Manampanihy River by Humbert in 1948, in the extreme southeast of the island; this collection, although named, had languished in the Paris Herbarium, not properly inserted in the main Madagascar palm herbarium, and so was virtually inaccessible. Apart from a single fruit in the Bailey Hortorium, Cornell University, sent by Mardy Darian to Hal Moore for determination (but not identified), said to have been collected by a forestry officer from Taolagnaro, there were no other herbarium collections.

In 1988 Larry Noblick was shown a single tree of *Beccariophoenix* in cleared lowlands beside the road between the capital, Antananarivo, and the coastal port of Toamasina (Tamatave)

just east of Ranomafana Est (Fig. 2). This tree was apparently quite well known to seed collectors. The collection Larry made differed from collections from the Mantadia area in the very short rather than extended peduncle, the inflorescences thus appearing sessile when viewed from ground level. Then a third population of *Beccariophoenix* was discovered by Henk Beentje at Sainte Luce near Taolagnaro (Fort Dauphin), it too with rather short peduncles. Shortly after these herbarium collections were made, seeds of *Beccariophoenix* were collected by commercial seed merchants and amateur growers and exported to palm enthusiasts worldwide. Soon it became apparent that there were two strikingly different seedling types within the genus and that the two types behaved differently in cultivation. It was not immediately obvious from which of the populations of *Beccariophoenix* the seedlings had originated (Dransfield 2002). Eventually we were able to establish that the palm growing near the type locality has seedlings with leaves that have narrow leaflets with the distal-most two or three joined partially but split at the base to produce inconspicuous windows. Seedlings

2. View into the crown of the type plant of *Beccariophoenix fenestralis*, Ranomafana Est, showing the infrapalmar inflorescences with short peduncles (Photo: W.J. Baker).





3. Fallen staminate flowers beneath the type tree, showing pointed petals (Photo: W.J. Baker).

from the single tree by the roadside at Ranomafana Est have broader leaflets with the distal-most (up to 30) joined to form a broad bifid fan or flabellum but partially split near the rachis to give conspicuous windows. It was a seedling of this type that was illustrated in *Palms of Madagascar* (Dransfield & Beentje 1995). Seedlings from the population at Sainte Luce have seedlings similar to those from the type locality.

In 2004 a distinctive population of *Beccariophoenix* was discovered far from the eastern escarpment humid forests, growing in the western highlands, in an area where other palm species are largely unknown, and this showed substantial, consistent differences in inflorescence, flower and fruit structure from true *B. madagascariensis* and so was duly described as *B. alfredii* (Rakotoarinivo et al. 2007). This species has a seedling morphology very similar to that of *B. madagascariensis*, i.e., inconspicuous windows. *Beccariophoenix alfredii* has not yet been reliably reported from other localities, but we have heard reports of its occurring scattered in deep river valleys in the area to the southwest of Antsirabe.

Meanwhile additional collections were made of the single Ranomafana Est tree, but we were at first unable to locate any further populations in the coastal lowlands near Toamasina. This

begged the question as to whether the single tree at Ranomafana Est represented an unusual individual of *Beccariophoenix madagascariensis* or whether it represented a different species. Unfortunately, despite many attempts, Alison Shapcott (Shapcott et al. 2007) was unable to obtain results from material of the Ranomafana Est population in her genetic diversity analysis of *Beccariophoenix*. In 2005, MR together with Franck Rakotonasolo discovered another population about 17 km SW from the single tree, growing among graves. Crucially, seedlings at this site showed the broad windowed leaf of the *Beccariophoenix* from Ranomafana Est. Unfortunately, because the trees were in a graveyard, a taboo or *fady* place, it was not possible to make full collections of the adult palm, but MR was able to collect small samples of the seedling leaf.

Beccariophoenix madagascariensis has now been discovered in a number of localities between Mantadia and Taolagnaro, including an excellent healthy population of well over 1000 individuals at Vondrozo, west of Farafangana, at Befotaka, Midongy Atsimo, at Tsitongambarika (Dransfield & Rakotoarinivo 2012) and several new populations in hills around Toalagnaro. In all these populations, the seedling leaves have inconspicuous windows, i.e., the same as that found in Mantadia.



4. *Beccariophoenix fenestralis* in cultivation at the garden of William and Paula Merwin, Maui, Hawai'i, showing infrafoliar inflorescences (Photo: J. Dransfield).

Ecologically there seem to be differences in habitat between the different taxa of *Beccariophoenix*. *Beccariophoenix alfredi* is restricted to gallery forest at 1100–1200 m in a deep valley in the western highlands. *Beccariophoenix madagascariensis* occurs within a narrow band of eastern escarpment forest,

occurring at about 900–1200 m elevation at Mantadia, at ca. 600 m farther south at Vondrozo, lower still at Befotaka, at ca. 300 m at Tsitongambarika and near sea level in the extreme south, just outside the tropic of Capricorn. The habitat is analogous throughout: the palm being restricted to poor

soils with an overlying thick humus layer developed on quartzite or white sands. In contrast, the Ranomafana Est population occurs in the lowlands, at ca. 60–160 m above sea level, at virtually the same latitude as the Mantadia population of *B. madagascariensis*, which occurs in a very different habitat in the highlands.

Although we have little material to work with and assess variation, we have been drawn to the conclusion that the single tree at Ranomafana Est and the small population in the graveyard nearby deserve recognition at the species level, representing a third species that we describe and name here as *B. fenestralis*, reflecting the characteristic seedling morphology. The distinctness of the new species has long been obvious to growers; the problem we have faced as palm taxonomists was to find enough material to discover robust characters, in addition to seedling morphology, which allow a clear demarcation between it and *B. madagascariensis* and *B. alfredii*.

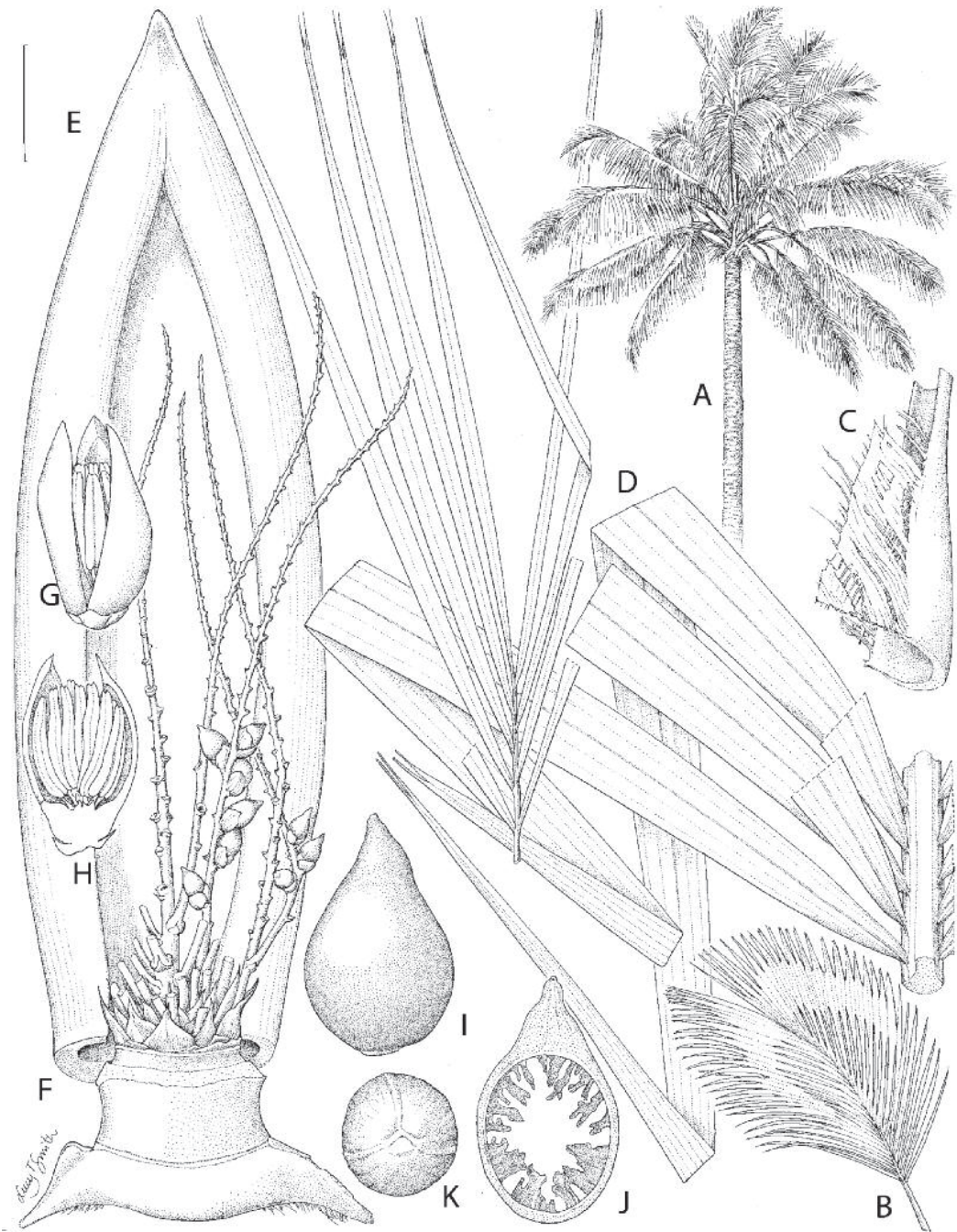
It has become apparent that there is rather substantial variation in the form of the inflorescence throughout the range of *B. madagascariensis*, with peduncle very short (as at Sainte Luce, Taolagnaro) to elongate (as at Mantadia and Tsitongambarika). Indeed peduncle length is inconsistent within some populations (as in Vondrozo). However, the inflorescence at anthesis and even in fruit is always interfoliar. The striking sessile inflorescences of the Ranomafana Est population are always infrafoliar, and that seems also to be the case with this species in cultivation. The shape of staminate flower buds does seem to be consistent in the three species: pointed in *B. fenestralis* (Fig. 3), irregularly blunt in *B. madagascariensis* and almost fusiform in *B. alfredii*. Fruit shape, although more difficult to describe, seems also to be consistently different. Stamen number, at first promising as a discriminating character, is now seen to be rather variable in *B. madagascariensis* (18–21), *B. alfredii* (15), *B. fenestralis* (18–20)

***Beccariophoenix fenestralis* J. Dransf. & Rakotoarin., new species**

Robust tree palm differing from other species of the genus in the broad terminal flabellum of the juvenile leaf, displaying conspicuous windows. From *B. madagascariensis* it further differs in the infrafoliar rather than interfoliar inflorescences and the pointed rather than blunt staminate flower buds and from *B.*

alfredii by the much thicker peduncular bract, the more numerous stamens (18–20 rather than 15) and the ovoid rather than obovate-shouldered fruit. Type: MADAGASCAR. Toamasina. Ranomafana Est, 1 km E of Ranomafana Est on R.N. 2, 5 Nov. 1999, W.J. Baker with J. Dransfield, A. Davis, F. Rakotonasolo & A. Rakotobe 1009 (Holotype K, isotype TAN). (Fig. 5).

Large single-stemmed tree palm. Stem erect, to 15 m tall, 34 cm diameter, dull grey brown with conspicuous leaf scars, internodes to 5 cm long, in cultivation often with a dense mass of orange-brown adventitious roots forming a boss at the base of the stem. Leaves 18–25 in crown, pinnate, marcescent in juvenile palms in cultivation, abscising neatly in adult palms, spirally arranged; leaf sheath with base of leaf axis 150–165 cm long with a true petiole only 9 cm long, 10 cm wide and 5 cm thick, adaxially channeled, abaxially rounded; sheath fibrous; whole leaf ca. 6 m long, including the apparent petiole; rachis 300–320 cm long; leaflets 150–170 on each side of the rachis, regularly arranged but held rather untidily in one plane; basal leaflets 59–68 × 1.5–1.7 cm, mid-leaf leaflets 105–118 × 6.5–7.5 cm, apical leaflets 44–46 × 1–1.1 cm; leaflets with thin white wax on both surfaces, adaxially glabrous, abaxially with abundant pale brown ramenta along midribs and with abundant minute punctiform scales along minor veins, transverse veinlets conspicuous. Inflorescence solitary, infrafoliar at anthesis; 62–90 cm long, branching to 1(–2) order; peduncle 10–15 cm long, to 25 cm wide at the very base, flattened and winged; prophyll not seen; peduncular bract to 70 × 20 cm, boat-shaped, woody, ca. 12 mm thick, adaxially smooth, deeply grooved abaxially and covered with a dense layer of reddish brown indumentum, the bract tapering to a blunt tip ca. 2.5 cm wide, the whole bract circumscissile, leaving a broad scar on the peduncle; rachis 7–9 cm long; rachillae very crowded, spirally arranged, up to 40, 35–56 cm long, occasionally branched, each subtended by a triangular striate rachis bract 1.7–2.2 × 1.0–1.4 cm, basally swollen, with scattered caducous brown scales and thin white wax, 4–7 mm diam., sometimes with a basal portion to 11.5 cm long devoid of flowers, then a portion up to 25 cm long bearing triads, distally the rachillae bearing paired or solitary staminate flowers only, flower groupings distichously arranged; rachilla bracts triangular, 1–4 × 1–2 mm. Staminate flowers pale yellow, more or



5. *Beccariophoenix fenestralis*. A. Habit; B. juvenile leaf; C. Leaf sheath; D. Mid and apical leaflets; E. Peduncular bract; F. Base of inflorescence; G. Staminate flower; H. Staminate flower in vertical section; I. Fruit; J. Fruit in vertical section; K. Endocarp. Scale bar A = 2 m; B = 50 cm; C, D, E, F = 8 cm; G, H = 15 mm; I, J, K = 16 mm. A, B from photographs, C, D, E, G, H from Baker *et al* 1009, F from Noblick 5065, I, J, K from Britt & Randrimboavonjy 17. Drawn by Lucy T. Smith.

less symmetrical and pointed in bud, 1.85×0.7 cm; sepals 3×2 mm, imbricate, shallowly triangular, connate at the very base; petals stiff, almost woody, $18 \times 6-7$ mm, elliptic with

conspicuous triangular acuminate tips, drying inconspicuously striate and with thin white wax; stamens 18–20, filaments ca. 1 mm long, anthers 8–12 mm long, ca. 1 mm wide;



6. Copious development of adventitious roots at the base of a cultivated individual, garden of William and Paula Merwin, Maui, Hawai'i (Photo: J. Dransfield).

pistillode inconspicuous, conical, less than 1 mm high. Pistillate flower 15 × 9 mm; sepals distinct, 10 × 9 mm, imbricate; petals 9 × 8 mm, similar to sepals, but with short valvate tips; staminodal ring ca. 0.1 mm high with ca. 9 teeth; gynoeceum ellipsoidal, 13 × 4 mm. Mature fruit dark purple, obpyriform, to 4 × 2.5 cm, including the pyramidal apical beak to 9 × 12 mm, tipped with short stigmatic remains to 4 × 4 mm; epicarp smooth when fresh, becoming striate when dry, glabrous; mesocarp ca. 2 mm thick; endocarp very thin, fragile, ellipsoidal, ca. 25 × 20 mm, distally with three low ridges, pores obscure. Seed ellipsoidal, ca. 24 × 19 mm; endosperm deeply ruminant; embryo lateral. Eophyll and first few leaves lanceolate, undivided; subsequent seedling leaves with a broad apical, furcate flabellum composed of up to 30 folds, the margin deeply lobed, the lobes corresponding to the adaxial folds, basally split along the abaxial folds to ca. 2/3 to 3/4 the length of the folds, the whole thus appearing "windowed."

Specimens examined: MADAGASCAR. Toamasina. Ranomafana Est, 1 km E of Ranomafana Est on R.N. 2, 18°58'5.76"S 48°51'16.86"E. Highly disturbed remnant vegetation with lateritic soils rich in organic matter, elevation 60 m, 12 Aug 1995, *Larry Noblick with B. Fischer & R. Todivelo 5065* (FTG, K); 5 Nov. 1999, *W.J. Baker with J. Dransfield,*

A. Davis, F. Rakotonasolo & A. Rakotobe 1009 (K, TAN); 8 March 2003, *A. Britt with T. Randrimboavonjy AB17* (K, TAN). Brickaville, Ambilanimana, Ranomafana Est, 10°1'6"S 48°48'49"E, alt 166 m, secondary vegetation, 5 Sept. 2005, *M. Rakotoarinivo with F. Rakotonasolo RMJ168* (K, TAN).

Distribution. East Madagascar, known only from Ranomafana Est, Ampasimanolotra.

Habitat. Lowland area with slightly undulating hills, 60–160 m elevation. Known sites are in highly degraded vegetation. The species colonizes either slopes or areas along watercourses. According to MR's guide, the species was abundant around Ambilanimana along the river Iaroka, but the population was destroyed by cyclone Geralda in 1994. Now, the remnant population is composed exclusively of some un-trunked and juvenile individuals.

Vernacular name. *Zarina* (Betsimisaraka).

Conservation Status: Critically Endangered [CR B2ab(i,ii, iii)+D]. Known only from Ranomafana Est area, where the population appears to be composed, at the moment, of only two mature individuals separated from each other by about 6 km and some juvenile individuals. The area of occupancy is estimated to be less than 1 km² in total, and the species is highly threatened with habitat loss,



7. Almost mature fruit, garden of William and Paula Merwin, Maui, Hawai'i (Photo: J. Dransfield).

although the occurrence is already recorded exclusively in an area under intense human pressure. The decline of the population of this palm may be related to the report of its utilization in the past as an edible palm-heart (pers. comm.)

Notes: According to Jeff and Suchin Marcus, *Beccariophoenix fenestralis* out-performs other species of the genus in cultivation in Hawaii, growing much more rapidly. Trees planted in the early 1990s are bearing seeds. In contrast *B. madagascariensis* is very slow, in fact too slow to be a useful horticultural subject. *Beccariophoenix alfredii* appears to have great potential in cooler and drier areas than Hawaii.

Many cultivated individuals of *B. fenestralis* have now reached maturity and have begun to flower and fruit abundantly (Figs. 4, 6 & 7). A specimen in National Tropical Botanic Garden in Kauai (NTBG 970355) has been vouchered by David Lorence and preserved in the herbarium there under the collector number *D. Lorence DL10428* (D. Lorence, pers. comm.).

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