

# A Remarkable *Ravenea* from the Montane Forest of Andilamena, Madagascar

MIJORO RAKOTOARINIVO  
*Kew House*  
*Lot II J 131 B*  
*Ambodivoanjo Ivandry*  
*Antananarivo 101,*  
*Madagascar*

1. *Ravenea delicatula* in montane forest of Andilamena.



In this paper, an astonishing, beautiful new species of *Ravenea* is described for the first time.

Searching for palms in Madagascar is always exciting because every locality has its little secret. Despite the 70 species discovered by Dransfield and Beentje (1995) during the preparation of *The Palms of Madagascar*, locations not previously explored sometimes provide new species and unexpected information about species' distributions, and thus, the floristic composition of the site. Since 1995, four new species of *Dypsis* and one *Beccariophoenix* have been described for Madagascar but we are aware that there are probably several more yet to be described and named.

For the continuation of its program Threatened Plants Appeal, the Royal Botanic Gardens Kew decided in 2005 to begin again intensive research on the palms of Madagascar by funding me to study for a PhD at the University of Antananarivo. Among the aims of this research is to complete as far as possible the knowledge of palm distribution in Madagascar by targeting poorly known sites or areas not yet visited.

The first expedition as part of this research was carried out in April 2006 in the Andilamena region, in the centre of the island – an unknown locality for palms because all the previous research in the region had been

concentrated in the National Park of Zahamena, about 50km further south. This fieldwork in Andilamena gave interesting information on the species taxonomy as well as on the distribution of palms in the montane forest. The most exciting find was a new species of *Ravenea*, very different from those previously described.

*Ravenea*, the second largest genus of palms in Madagascar, includes 16 species of which only two are found outside the island, in the Comoros archipelago (Dransfield & Beentje 1995). The genus has always been thought to have a rather uniform appearance in its stems and leaves: almost of the species are arborescent, stems are usually solitary and unbranched and the leaves always have regularly pinnate leaflets (Beentje 1994) – that is until this fieldwork at Behorefo, near Andilamena, where I found a remarkable clustering palm with slender branched stems and with irregularly pinnate leaves. Only the inflorescence structure shows that the palm is a *Ravenea* (Fig. 1).

The discovery of this palm was a moment of pure jubilation because we had just collected a climbing palm that superficially looked exactly like *Dypsis scandens*, known from a single specimen near Ifanadiana, several

2 (left). Young shoot with clustering stems of *R. delicatula*. 3 (right). Branching stem in juvenile *R. delicatula*.





4. Male plant of *R. delicatula* with multiple inflorescences.

hundred kilometers farther south. This lianescent palm is in such abundance in Andilamena, that it was a real pleasure to look at it. Anyway, it was the first time for us participants in this fieldwork to find climbing palms in their natural habitat so everyone inspected with admiration the way the palm was growing and finding its way around the canopy. While I was contemplating the beauty of this *Dypsis*, I found another undergrowth palm that looked unfamiliar to me. At first I thought it was one of these undergrowth species of *Dypsis* because of the clustering and slender stems, which are occasionally branched, and also the fascicled irregularly arranged leaflets (Figs. 2 & 3). After some time of reflection, I was finally not sure because the inflorescences were sometimes solitary, sometimes multiple and there were always two large peduncular bracts in the inflorescence, while in *Dypsis*, inflorescences are always solitary and there is only one peduncular bract. Furthermore, the inflorescences were unisexual so it is certain that the palm is not a *Dypsis* at all. Moreover, the inflorescences are very different from those of *Dypsis*, and the flowers (Fig. 4 & Back Cover) reminded me of those of orchids rather than those of palms – only the

long spur is lacking! At this time the burning question for me was, what palm could it be? Once I had seen it, I forgot completely the climbing *Dypsis* and tried to work out what on earth the palm was. I asked everyone if they had any idea what the palm was, but they did not, so I collected some specimens. I had with me my copy of *Palms of Madagascar* (Dransfield & Beentje 1995), and after spending some time reading without conviction the description of the genus *Dypsis*, I was finally persuaded that the mystery palm was no species of *Dypsis*. There was even a moment that I thought I had found a new genus, but I renounced this idea quickly because I finally remembered that inflorescences of *Ravenea* can be solitary or multiple according to the sex of the plant (Fig. 4 & Back Cover). When I looked carefully at the base of the crown, it became more evident that the palm was a *Ravenea* because the structure of the crown seemed to me to resemble a miniature version of those of *Ravenea robustior*, *R. sambiranensis* or another species with a bulbous crown. Normally, these diagnostic characters should come automatically when you are in front of a *Ravenea* species, but the unusual vegetative characters troubled me. On the way

back to our camp, I asked every member of the field team lots of questions, such as, if they had previously found a similar palm in other regions of Madagascar and if anyone had ever seen pictures of a similar palm, but the answer was always negative. Finally, I realized that I was sure that we had found a new form of *Ravenea*; it cannot be *Ravenea nana*, the smallest species of the genus, because this last has regular leaflets and is more robust compared to the palm of Behorefo.

Back in Antananarivo, I sent one picture to John Dransfield, and he confirmed my suspicion that it is a new species of *Ravenea*. This is the first description of a new species of *Ravenea* since the publication of the book *The Palms of Madagascar* (Dransfield & Beentje 1995). I propose the name *Ravenea delicatula* to express the beauty and the delicacy of this undergrowth palm of Andilamena montane forest.

***Ravenea delicatula*** Rakotoarinivo, *sp. nov.*, caulis gracilibus, aliquando caespitosis et ramificantibus, foliolis fasciculatis, inflorescentiis solum 2 bracteis peduncularibus grandibus distinctissima. Typus: Madagascar, Toamasina, Andilamena, Ambatobe, Behorefo, April 2006, *Rakotoarinivo RMJ 184* (Holotypus TAN, isotypi K, P).

Solitary or clustering, dioecious, pleoanthic palm. *Stem* 4–5 m tall, occasionally branching, procumbent, 1.2–1.7 cm diam. (near crown 0.7–0.8 cm), internodes 0.4–6 cm, scars 0.2–0.4 cm, surface smooth, sheath remnants occasionally persistent. *Leaves* 6–9 in crown, spiral, arching; sheath 6–15 × 1.6–4.4 cm, densely covered with red-brown to grey tomentum, marginal parts disintegrating, the tomentum persistent; petiole 4.3–8.6 cm long, proximally 0.2 × 0.1 cm, distally 0.1 × 0.1 cm, channelled, slightly convex abaxially, sparsely tomentose, the tomentum deciduous; rachis 21.6–33 cm, in mid-leaf 0.1 × 0.1 cm, medially sharply keeled, triangular, abaxially with red brown indument but soon glabrescent; leaflets 17–25 on each side of the rachis, 3 or 4 in each group, lanceolate, held in different planes, proximal 8.7–10.8 × 0.2–0.3 cm, median 11.8–14 × 0.3–0.4 cm, distal 9.6–10.6 × 0.2–0.4 cm, top pair with 2 or 3 main veins. *Staminate inflorescence* interfoliar, multiple in 3s or 4s, the central ones maturing first, individual inflorescence branching to 1 order, peduncle very slender, 4.5–11.8 cm long, with red brown tomentum; common prophyll 1.1–1.4 × 0.8–1 cm, prophyll 3.2–9.6 × 0.4–0.6 cm, keeled, with

dense red brown tomentum; peduncular bracts 2, ± the same size, densely pubescent with red brown tomentum, 15.4–17.2 × 1.1–1.3 cm, thickness less than 1 mm, opened at 5.8–7.6 cm from the base of peduncle; rachis 2.7–4.3 cm, ± glabrous, with ca. 6–9 rachillae, rachis bract 0.7–0.1 cm; rachillae 4.2–6.4 cm long, slightly zigzag, flowers 0.4–0.7 cm distant, pedicel ca. 0.5 mm. *Staminate flowers*, sepals connate at the base for 0.4–0.6 mm, free parts 0.6–0.8 × 0.8–1 mm, acute; petals 6.2–8 × 1.8–2.6 mm, imbricate; stamens 6, uniseriate, filament 0.8–1.2 mm (3 epipetalous, adnate for 0.6–0.8 mm), cylindrical; anthers basifixed introrse, 2.4–3 × 0.9–1.2 mm; pistillode 0.4 × 0.6 mm. *Pistillate inflorescence* interfoliar, solitary, branched to 1 order, 10.2–28.8 cm long, with red brown tomentum; prophylls 2, first 2.4–2.7 × 0.3–0.4 cm, second 5.1–21.2 × 1.2–1.8 cm, densely tomentose; peduncular bracts 2, 19.2–22.3 × 1.1–1.6 cm, thickness less than 1 mm, with dense red brown tomentum; rachis 2.9–4.7 cm, ± glabrous, with ca. 5–9 rachillae, 0.9 × 0.1 cm; rachillae 3.9–4.8 cm long, slightly zigzag, flowers 0.4–1.1 cm distant, pedicel c. 0.5 mm. *Pistillate flowers*, sepals connate at the base for 0.8–1 mm, free parts 1.4–2 × 1.1–1.4 mm, acute; petals triangular, acute, 6.8–8.5 × 2.2–3.1 mm; staminodes 6, triangular, ca. 1.4 × 0.3 mm; ovary ovoid, 3.5–4 × 1.4–1.6 mm, stigmas 3. *Fruits* not seen. (Fig. 5).

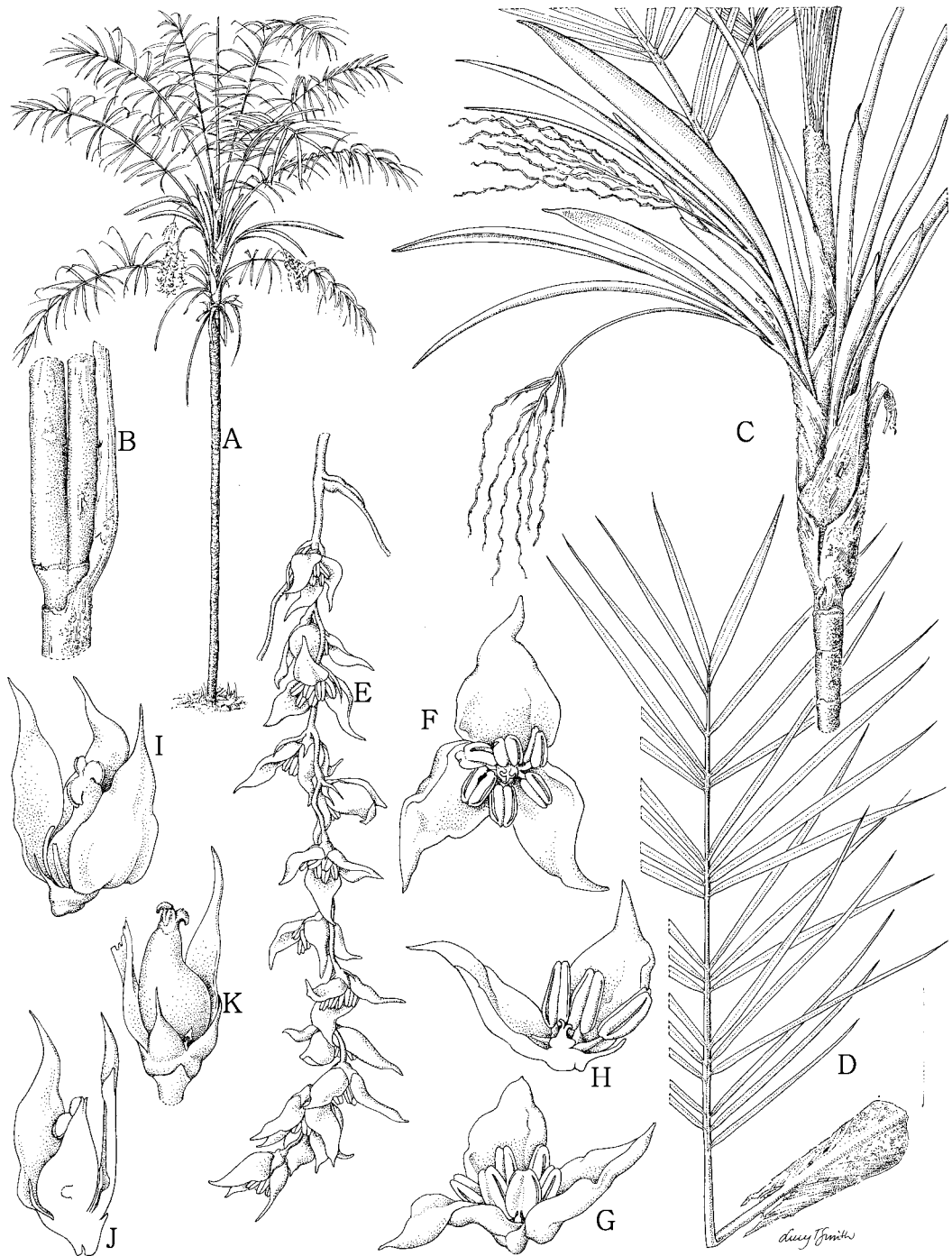
**SPECIMEN EXAMINED.** Madagascar, Toamasina, Andilamena, Ambatobe, Behorefo, April 2006, *Rakotoarinivo RMJ 184* (Holotype TAN, isotypes K, P).

**DISTRIBUTION.** Central Madagascar, known from a single site: Madagascar, Toamasina, Andilamena, Ambatobe, Behorefo. 16°59' S × 48°50' E.

**HABITAT.** *Ravenea delicatula* is an understory palm of montane forest occurring between 800–1000 m at Behorefo (Fig. 6). This forest has a low rather open canopy of 6 or 7 m tall. Trees are small, few in number and some are deciduous; the undergrowth is scrubby and full of bamboos and pandans. The humus is fine, and in certain places mosses may form a continuous lawn on the ground.

**LOCAL NAME.** Anivo (Sihanaka)

**NOTES.** From the data of BIOCLIM ([www.bioclim.org](http://www.bioclim.org)), the precipitation of the region is estimated annually to be between 1300–1400 mm and the mean annual temperature is about 20°C. Annual range is



5. *Ravenea delicatula*: A Habit, solitary stem  $\times 1/10$  B. Branching on the stem  $\times 1/2$ , C. Crown with multiple staminate inflorescences  $\times 1/6$ , D. Leaf  $\times 1/3$ , E. Detail of a staminate rachilla inflorescence  $\times 2$ , F. Male flower, view from above  $\times 4$ , G. Male flower, side view  $\times 4$ , H. Male flower, longitudinal section  $\times 4$ , I. Female flower, side view  $\times 4$ , J. Female flower, longitudinal section  $\times 4$ , K. Young fruit,  $\times 4$ . Scale bar: A = 15 cm; B, C = 2 cm; D = 3 cm; E = 2 cm; F–K = 4mm. All from Rakotoarinivo RMJ 184, Drawn by Lucy T. Smith.

very high because the minimum temperature can fall to 11°C whereas the maximum temperature is estimated at 28°C. Dry season

lasts about five months between May and September. Bioclimatic type, after Cornet (1974), is temperate humid with accentuated



6. Montane forest of Behorefo, the habitat of *R. delicatula*.

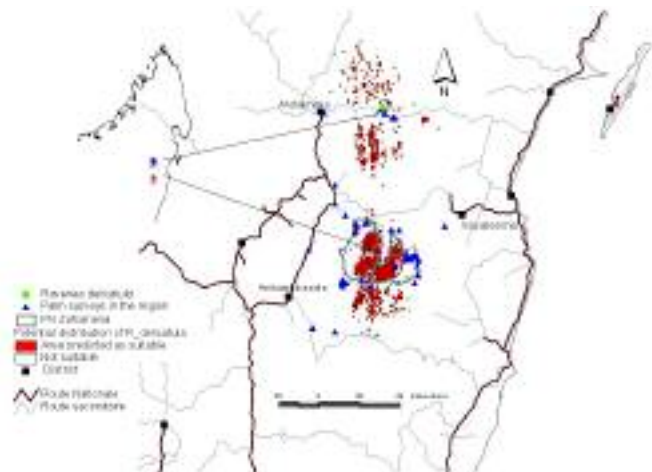
winter. The dry season coincides with the winter and is characterized by drizzle and fog in the morning (Morat 1969). The geology in this region is composed of Precambrian crystalline base made up of granite, gneiss and schists (Besairie 1970).

The modelling of the habitat of this species and the analysis of the region on Maxent 2.1 (Maximum Entropy Species Distribution Modelling, Version 2.1) shows that the species has similar ecological preferences to *Dypsis pumila*, *Ravenea latisecta* and *R. louvelii*. All of these species are only found along the summit

of the eastern escarpment. It seems that the distributions of these palms is closely correlated with the values of the precipitation of the driest month (34–62 mm, July), the precipitation of the coldest quarter of the year (168–260 mm between June and August) and the maximum temperature that should not exceed 29°C.

*Ravenea delicatula* is, at the moment, only known in the Andilamena area but the combination of all these factors and some ecological variables (annual precipitation, minimal temperature, altitude, geology, slope,

7. Potential distribution of *R. delicatula*.



and aspect) allowed Maxent 2.1 to model its habitat and predict the potential distribution of the species. The result shows that this palm is restricted in the region of Andilamena and Ambatondrazaka (Fig. 7). This species is not yet recorded in Zahamena but it is highly possible that it occurs in the center and the south of the Parc, since palm inventories were mostly concentrated in the eastern and western limits of the protected area, around Ambatondrazaka and Vavatenina.

Notes: The palm can form a bush with its numerous young shoots surrounding the 4–6 adult stems. Branching was found especially in juvenile individuals or immature stems. It seems that the first stem dies after branching, and the second branch continues then to live. Stems with inflorescences frequently show scars indicating previous branching

Conservation: *Ravenea delicatula* is abundant in this forest; more than 30 mature individuals together with about 40 juveniles were counted in Behorefo. At present, the forest fragment where the palm grows is not protected. Even though the place is not easy to access, the forest is being destroyed because the local population is clearing it to establish hill rice. Moreover, numerous finds of rubies have been made near Behorefo. This palm is threatened by the many holes dug by miners inside the forest in order to look for minerals.

#### Acknowledgments

This article is written in the context of my PhD preparation at the University of

Antananarivo. Fieldwork and the research on the Palms of Madagascar are sponsored by the Friends of the Royal Botanic Gardens, Kew through its program Threatened Plants Appeal in Madagascar. I am very grateful to Dr. John Dransfield, my PhD Supervisor at Kew, for the continual encouragement, his help during the preparation of the text and also for having done his best to improve my English. Lucy Smith made the plate at Kew. Roger Rajaonarison and Hanta Vololona Razafindraibe accompanied and helped me to collect palms in Andilamena.

#### LITERATURE CITED

- BEENTJE, H. 1994. A monograph of *Ravenea* (*Palmae: Ceroxyloideae*). Kew Bull. 49: 623–671.
- BESAIRIE, H. 1970. Précis de Géologie Malgache. Doc. Bureau de Géologie, pp. 127–132.
- CORNET, A. 1974. Divisions floristiques et étages de végétation à Madagascar. ORSTOM, p.28.
- DRANSFIELD, J. AND H. BEENTJE. 1995. The Palms of Madagascar, Royal Botanic Gardens Kew and International Palm Society. HMSO Norwich. pp. 475.
- MORAT, P. 1969. Note sur l'application à Madagascar du Quotient pluviométrique d'Emberger, Cah. ORSTOM, Serie Biol. no. 10, pp 117–132.

## CLASSIFIED

**PERMANENT BOTANICAL GARDEN SIGNS FOR PRIVATE OR PUBLIC COLLECTIONS.** Call or write for brochure. Phone: (760) 420-9143; Fax: (760) 645-7017; PLANT SIGNS (Gary Wood), 960 El Caminito, Fallbrook, CA 92028. E-mail: sales@plantsigns.com. Web Page: <http://www.plantsigns.com>

#### PALM / CYCAS SEEDS

We sell **RARE** and **UNCOMMON PALM / CYCAS** seeds from all over the world. Seeds from Madagascar, New Caledonia, Bolivia, Seychelles, Solomon Islands, Lord Howe Island and most other countries – including seeds of Coco-de-mer, the infamous Double Coconut.

We stock and sell over 300 species from over 40 countries. We supply any quantity. No quantity is too small and none too big. Fresh and viable seeds only.

We also carry rare *Pachypodium* and *Adansonia* seeds from Madagascar. Not to mention *Victoria cruziana* and its Longwood hybrid.

For more details – please visit our website at <http://www.ortanique.com> or email us at [plants@ortanique.com](mailto:plants@ortanique.com) or fax us at 510 494 0105 or write to us at Ortanique, 35314, Rutland Court, Newark, CA 94560, USA.