Exploring for Palms in Remnants of Humid Forest in the Hills of the Anosy Chain, Taolagnaro, Southeast Madagascar

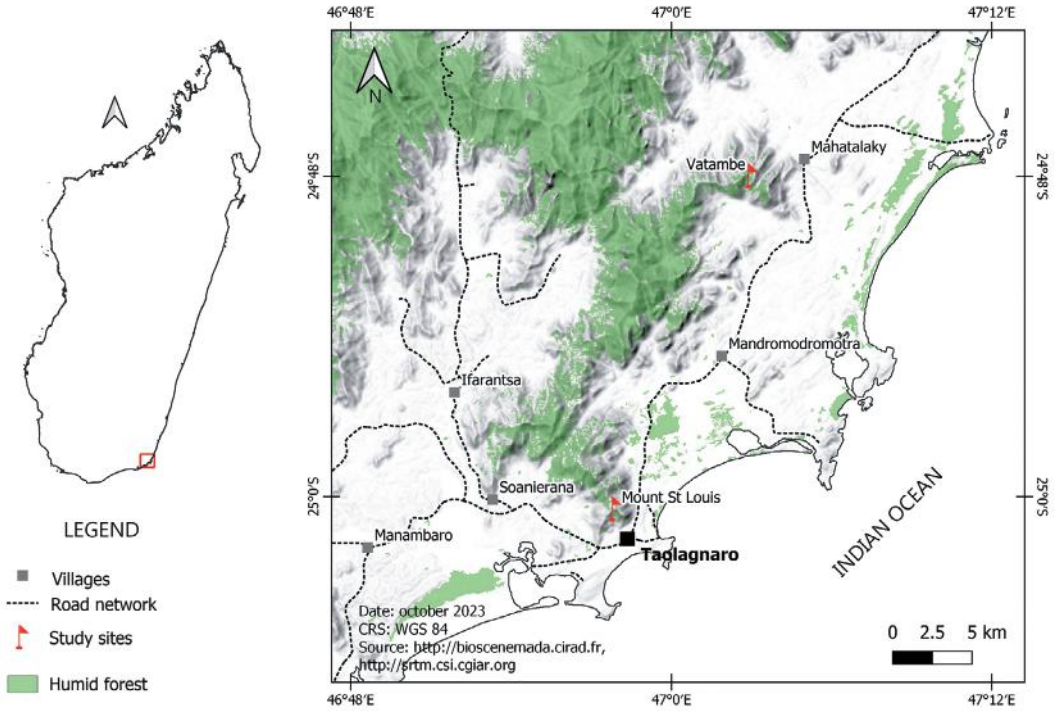
Mijoro Rakotoarinivo[1]

Many rare and remarkable palms are native to the region of Taolagnaro (Fort-Dauphin), located in the extreme southeast of Madagascar. The following is an account of the palms seen during fieldwork funded by the International Palm Society and includes the description of one new species.

This area is widely known for its palm flora being rich and diverse (Dransfield & Rakotoarinivo 2010). At the moment, the two aquatic palms *Dypsis aquatilis* and *Ravenea musicalis*, as well as the well-known triangle palm *Chrysalidocarpus decaryi* are restricted to coastal regions in the north or in Andohahela, west of the Taolagnaro. Recently, extensive research on Madagascar's palms, conducted by botanists and palm enthusiasts, has increased our understanding of the species composition of palms in some previously unexplored parts of the Taolagnaro region. About 20 species were identified in the Tsitongambarika forest in 2010, including a few undescribed species—three of which are in the genus *Dypsis* (*D. lilacina*, *D. pustulata* and *D. subacaulis*) and one acaulescent squat *Ravenea*, *R. declivium* (Dransfield & Rakotoarinivo 2010). Olivier Reilhes, member of Association Palmeraie Union, shared photographs of an astonishing stemless *Ravenea* that he taken near Taolagnaro. It appeared to be undescribed. A high priority for this expedition was to find the palm and to determine its identity.

The genus *Ravenea* appears to have one of its centers of radiation in the southeast of Madagascar. Since 2010, four new species of *Ravenea* have been described: *R. hypoleuca* and *R. beentjei* (Rakotoarinivo & Dransfield, 2010), *R. declivium* (Dransfield & Rakotoarinivo, 2010), and *R. cycadifolia* (Dransfield 2020). At

[1]*Mention Biologie et Écologie Végétales, Faculté des Sciences, Université d'Antananarivo, Antananarivo 101, Madagascar*
mijoro.rakotoarinivo@univ-antananarivo.mg



1. Map showing the two study sites in north of Taolagnaro, Madagascar.

present, all four have been observed in this region of Madagascar and documented in the forested hills of the Anosy chain in Taolagnaro region. The species *R. cycadifolia* has been described from a cultivated plant in Hawaii; however, Gunther Gottlieb's observation appears to support the species' existence in the wild in the Taolagnaro area (Dransfield 2020). For confirming this, the International Palm Society supported a trip to the Taolagnaro area, to try to find *R. cycadifolia* in the wild and to collect occurrence data and population abundance of palm species. The trip occurred in August 2021 on Pic Saint-Louis, a rocky peak just to the north of the town of Taolagnaro, and in the lowland humid forest of Vatambe, close of Mahatalaky village, at 50 km north of Taolagnaro (Fig. 1). Pic Saint Louis was chosen as it allowed verification of some long-standing rumors, including the existence of Olivier's *Ravenea* and a population of *Beccariophoenix madagascariensis*, whose inflorescences in the shape of a torpedo can even be visible with binoculars from the town of Taolagnaro.

The two study sites make up the final hills of the Anosy chain that abruptly and steeply ends (Fig. 2) towards the island's east coast (Paulian et al. 1973). Pic Saint-Louis is a striking hill (25° 00'28 "S, 46°57'54"E) dominating the town of Taolagnaro (Fig. 3 & 4). The site is well-known to tourists for trekking just out of the main town, and the southeastern slope of this mountain is still largely covered by a degraded forest near its summit (ca. 460 m elevation). The palm diversity of this forest fragment is quite high as seven species have been found there, including a new acaulescent *Ravenea* species, restricted to the edge of big boulders on the summit parts of the peak. The species was initially thought to be *Ravenea cycadifolia* but comparison of photos showed that the specimen from Pic Saint Louis differs in its leaflets in the basal part of the leaf that are very narrow and arranged in a very tight crowded way almost in parallel way to each other. The acaulescent palm of Pic Saint Louis appears thus to be a new species and is described here for the first time. As a result, *Ravenea* is now composed of 23 species, of which 21 are endemic to Madagascar.

Description of a new *Ravenea* species

Ravenea conferta *Rakotoarin.*, **sp. nov.**

Squat solitary palm, distinct from other acaulescent species by leaves barely arching and twisting at the tip, very narrow close crowded basal leaflets and the inflorescences solitary and erect (Figs. 5 & 6). The morphology of the inflorescence is close to that of *Ravenea nana* but this new species has a shorter and more robust peduncle and rachis (Fig. 7).

2. The southernmost hills of the Anosy chain, view from Pic Saint Louis.

Type: MADAGASCAR, ANOSY, Taolagnaro, Pic Saint-Louis, 25°00'32"S, 46°58'03"E, 406 m, 22 Aug. 2021, *M. Rakotoarinivo et al. RMJ 813* (holotype K!; isotype TAN!).

Medium size, acaulescent solitary, dioecious palm, up to 1.80 m tall. Leaves 9 in the crown, arranged spirally, leaf sheath open, covered in sparse white tomentum in the upper part, ca. 25 cm in cross section, 20–30 × 10–15 cm, pale green, covered in thick white tomentum, margins disintegrating, fibers up to 14 cm long (Fig. 7a); petiole 19–25 cm long, 3.5– 4 × 1.5–2.5 cm in cross section, deeply channeled, margins sharp, covered in white to greyish tomentum; rachis 1–1.30 m long, in midleaf 2.5–2.8 × 1.8–2.3 cm in cross section, pale green, covered in thick white tomentum especially on the abaxial surface, keeled on the adaxial surface; leaflets stiff, regularly arranged in one plane, dark green, 34 on each side of the rachis, slightly curved in distal part, proximal leaflets 36–53.5 cm × 0.4–1.2 cm, median leaflets 47.6–48.1 × 2.4–3.1 cm, distal leaflets 16–37 × 1.2–2 cm, leaflets spaced 0.2–2 cm apart (Fig. 7b, c & d), transverse veinlets sinuous. Inflorescences interfoliar, solitary. Staminate inflorescence erect, branched to 2 orders; peduncle 24–30 cm long, covered of thick brown-purplish tomentum (Fig. 7e), ca. 0.4–0.6 cm in cross section, prophyll not seen, peduncular bracts ca. 55 cm long, ca. 3.7 cm wide, purplish, covered in thick white tomentum; rachis 23–27 cm long; rachillae 6.2–10 cm long, ca. 1 mm in cross section; male flowers not seen. Pistillate inflorescence branched to 1 order, peduncle ca. 28 cm long, ca. 1.4 cm in cross section; prophyll not seen, peduncular bracts ca. 44 cm long (Fig. 7f); rachis 10–17 cm long; first order branches ca. 30; rachillae 6.2–11.5 cm long, up to 0.7 cm in cross section at the base; pedicel 3–5 mm high. Female flowers not seen. Fruits, young fruit, globose, 1-seeded, stigmatic remains basal.

Specimens examined: MADAGASCAR, ANOSY, Taolagnaro, Pic Saint-Louis, 25°00' 32"S, 46°58'03"E, 22 Aug. 2021, *M. Rakotoarinivo et al. RMJ 813* (K, TAN), idem. *M. Rakotoarinivo et al., RMJ 813* (holotype K!; isotype TAN!).

Local name: *Anivo*

Ecology: limited to the rocky summit of Saint Louis's ravines. Every observed specimen of this palm was found at the edge of large rocks, particularly in ericoid formations (Fig. 8).

Distribution: known only from a single site, Pic Saint-Louis in Taolagnaro, elevation 406 m.

3 (top). View of the Pic Saint-Louis, foreground left, with the town of Taolagnaro in background. 4 (bottom). Town of Taolagnaro observed from the Pic Saint-Louis.

Conservation: Pic Saint Louis is a summit of 529 meters of elevation, of remarkable gneiss overlooking the town of Taolagnaro. The site is currently considered as a tourist destination by the regional Tourism office of the Anosy region. In this context, the habitat of this palm is somehow protected against imminent degradation. However, this palm is threatened

5. General habit of *Ravenea conferta*.

with extinction because individuals have so far only been observed around two rocks on a single peak. Fewer than ten individuals of this palm have been seen there.

Palm flora of the most southern hills of the Anosy chain

An inventory of the palm flora in places that had few records was made during the expedition in the Taolagnaro area. The locations of Pic Saint Louis and the Vatambe forest, south of Mahatalaky, were visited for one day each. The visits of the two sites allowed the identification of ten palm species in total. The palm flora of the two sites is primarily composed of a fairly high frequency of *Chrysalidocarpus mananjarensis*, *C. prestonianus* and *Ravenea sambiranensis*. Some

6. Female plant of *Ravenea conferta* with crowded basal leaflets.

7. Herbarium specimens of *Ravenea conferta*. Each white line represents a 5cm length. a) fibrous leaf sheath, b) basal leaflets narrowly arranged, c) median leaflets, d) distal leaflets, e) Staminate inflorescence, f) Pistillate inflorescence.

species are found in both locations, such as *Dypsis pinnatifrons* and *D. scottiana*, but the former is more frequent in Pic Saint-Louis while the latter is more common in Vatambe. The palm survey in Taolagnaro area yielded the following species observations:

1. *Beccariophoenix madagascariensis* Jum. & H.Perrier

Robust solitary palm to 8 m tall, pinnate leaves with regular leaflets; the palms in Pic Saint-Louis have relatively greyish massive and thick inflorescence (Fig. 9). About 12 mature trees were observed in the remnant-degraded forest of the summit part of peak Saint-Louis, at around 450–500 m elevation. This species is now recorded from seven fragmented sites in eastern humid forests, between Moramanga and Taolagnaro regions, from sea level to about 1200 m elevation.

Vernacular name: *Sikomba*

8. *Ravenea conferta* growing on the edge of boulders on the rocky peak of Saint Louis.

2. *Chrysalidocarpus mananjarensis* Jum. & H.Perrier

A large solitary and tristichous palm characterized by the white scales on the emerging leaf. This palm is frequent in Pic Saint-Louis and in Vatambe forests, the most important in terms of individual abundance (Fig. 10). Most of the time, it grows in forests at low elevation on the east coast of Madagascar, from sea level to up to 900 m, between south of Toamasina to Taolagnaro.

Vernacular name: *Lafa*

3. *Chrysalidocarpus prestonianus* (Beentje) Eiserhardt & W.J.Baker

Solitary to 12 m tall and 40 cm diameter, leaves are huge and form a large crown of keeled, densely plumose, ascending leaves, gracefully arching at the tip. The massive leaf bases are whitish and do not form a closed crownshaft. The species is present in Pic Saint-Louis and Vatambe but is not common in both sites, relatively rare in Vatambe. The species is known from five widely separated localities in the southeast, between Mahanoro and Taolagnaro.

Vernacular name: *Tavilo*

4. *Chrysalidocarpus psammophilus* (Beentje) Eiserhardt & W.J.Baker

Clustering palms to 6 m tall with black slender stems, leaves arcuate, with pale green yellowish crownshaft partially covered in dense scattered scales in certain places. This palm was found only on the eastern slopes of Pic Saint-Louis (Fig. 11), relatively common. It has large but fragmented distribution range, extending throughout the east coast between Iharana to Taolagnaro, mostly from littoral station but in some cases, the species colonizes the first hills from the coastal plain, up to 400 m elevation.

Vernacular name: Lafaza

5. *Dypsis pinnatifrons* Mart.

Solitary palm of the forest undergrowth, up to 4 m tall, with a neat crown of arching leaves, leaflets are broad and rather sigmoid. The inflorescence is often relatively big and covered with reddish scales. The species is relatively widespread across the humid forest of Madagascar but appears to be quite rare in Taolagnaro area, being present only in certain areas of the forest. In both sites, this species seems to be restricted mostly to the summit part of hills.

Vernacular name: *Tsingovatra*

6. *Dypsis scottiana* (Becc.) Beentje & J.Dransf.

9 (top). *Beccariophoenix madagascariensis* growing in the summit of Pic Saint Louis. 10 (bottom). Individuals of *Chrysalidocarpus mananjarensis* dominating the summit part of Pic Saint Louis.

Clustering palms to 2–3 m tall, stems pale gray with dense red scales on the lower surface of the crownshaft, leaves pinnate with leaflets grouped but not fanned. Inflorescence erect with pale yellow rachis and rachillae. The species is quite common in lowland humid forest or on coastal area of Taolagnaro where it can form thick clumps in some areas.

Vernacular name: *Raosa*

11. *Chrysalidocarpus psammophilus* in lower slope of Pic Saint Louis.

7. *Ravenea conferta* Rakotoarin.

Stemless medium size palm, dioecious, pinnate leaves, leaflets regular slightly held in 180° position, leaves curved only near the tip but sliding laterally from the basis. Inflorescences erect, inside the crown. The species is known only from the rocky peak of Pic Saint-Louis in Taolagnaro.

Vernacular name: *Anivo*.

12. *Ravenea julietiae* in the forest of Vatambe.

8. *Ravenea julietiae* Beentje

Graceful medium palm, about 6 m tall, base of crown bulbous, leaves pinnate, strongly arching from the upper middle of the leaves; leaf sheath pale green with relatively pale brown tomentum; petiole quite long, leaflets stiff or with the distal part of the leaflet pendulous, the leaflets on opposite sides of the rachis at an angle of nearly 180° to each other, inflorescence with long peduncle, exserting from the crown (Fig. 12).

The species has been seen only in Vatambe forest, in low numbers of stemmed trees. This is the first time that *R. julietiae* has been recorded from Taolagnaro area while it was previously known from few fragmented and highly disjunct sites between Masoala Peninsula and Vondrozo area, mostly from lowland humid forest.

Vernacular name: *Anivo*

9. *Ravenea sambiranensis* Jum. & H.Perrier

Slender palm to 10 m tall, leaves ca. 12 in the crown, strongly arching, leaf sheath and petiole covered of leaf sheath with hard fibers in the margin, leaflets dark green, held in a slight upwards angle. The species is widespread in the lowland humid forest of Madagascar and seems to be one of the most common palms in both sites. Locally, *R. sambiranensis* seems to be present in most forest patches.

Vernacular name : *Anivo*

10. *Ravenea robustior* Jum. & H.Perrier

A majestic tree palm to 20 m tall, ca. 35 cm diameter, leaves straight and held in shuttlecock, base of crown slightly bulbous, leaf sheath covered in grey-brown tomentum, leaflets in one plane, inflorescence massive, pendulous in male. This species is not common despite its wide distribution range across Madagascar. It has only been recorded from Vatambe forest, mostly on lower slopes of the hills.

Vernacular name: *Vakaka*

The conservation of small fragments of forest in the two studied sites appears to be crucial for palm diversity preservation as these forests contain high-profile endemic species. By safeguarding this unique flora in small forest fragments, we can achieve several important conservation objectives such as maintaining the ecological balance in the local ecosystem. The occurrence of such rare palms in habitats that have fairly controlled human access should provide opportunities for researchers and naturalists to study and learn about these unique plants, fostering a deeper understanding of the natural world. The long-term sustainability of these forests relies on a collaborative approach, which recognizes the cultural, economic and ecological importance of these unique ecosystems.

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Literature Cited

Dransfield, J. 2020. *Ravenea cycadifolia*. Palms 64: 35–42.

Dransfield, J. and M. Rakotoarinivo. 2010. The Palms of Tsitongambarika, Southeast Madagascar. Palms 56: 161–179.

Paulian, R., C. Blanc, J.-L. Guillaumet, J.-M. Betsch, P. Griveaud and A. Peyrierias. 1973. Étude des écosystèmes montagnards dans la région malgache. II. Les chaines Anosyennes. Géomorphologie, climatologie et groupements végétaux. Bulletin du Museum National d'Histoire Naturelle 3, 22p.