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Features

The chalky gray leaves of the "ghost' *Plectocomiopsis*. See article by B. Kuhnhäuser et al., p. 5. Photo by B. Kuhnhäuser.

THE INTERNATIONAL PALM SOCIETY
Conserve. Learn. Grow.

FRONT COVER

Nannorrhops ritchieana in the Hangu Region of Khyber Pakhtunkhwa, Pakistan. See article by A. Abdullah et al., p. 14. Photo by A. Abdullah and S.M. Khan.

BACK COVER

Nannorrhops ritchieana has both open flowers and nearly mature fruits on the same inflorescence. See article by A. Abdullah et al., p. 14. Photo by A. Abdullah and S.M. Khan.

PALM NEWS


Matthias Rhomberg CC BY 2.0

Palms have complex sexual expressions. In addition to monoecious, dioecious and hermaphroditic species, some palms have various intermediate expressions such as andromonoecy (hermaphrodite and male flowers on the same individual), gynomonoecy (hermaphrodite and female flowers) and even polygamous monoecy-dioecy (hermaphrodite, male and female flowers in one individual), which can change over the life of the palm. ***Trachycarpus fortunei* appears to have a complex system of sexual expression, the genetic and developmental underpinnings of which are explored in a new paper by A. Jousson and colleagues** (*American Journal of Botany* 110: e16257. 2023.). They studied populations of *T. fortunei* in southern Switzerland where it has escaped and become invasive in natural habitats. They found that the anatomical and morphological changes among floral morphs occur late in development. Furthermore, they identified alleles that determine sex expression in female and predominantly male phenotypes. The genetic results suggest an evolutionary path toward an XY genetic system of sex determinism.


Coconut Rhinoceros Beetle Response

The **coconut rhinoceros beetle continues to pose a threat as an invasive pest in Hawaii**. The *Honolulu Star-Advertiser* reported last November that an arborist, who was hired to remove several dead coconut palms in Kihei, Maui, found more than a dozen live beetle larvae in one dead palm. The Department of Agriculture staff were alerted, and all the dead palms were chipped and placed in a secure container to be fumigated. The coconut rhinoceros beetle is a serious, lethal pest of palms with a wide host range of both ornamental and agronomic palms, as well as other plants such as banana, sugar cane, sisal and pineapple. If the beetle becomes widely established, it will threaten Hawaii's endemic *Pritchardia* species. Hawaii has a CRB Response website for information and reporting sightings: www.crbhawaii.org

Last year, the IPS announced **International Palm Day** to be observed annually on April 17th, the birthday of the "Father of Palms," Carl Friedrich Philipp von Martius. The purpose of International Palm Day is to achieve global recognition for palm species in jeopardy and the fragility of palm habitats worldwide. This year, the IPS will launch a social media campaign to generate awareness and interest in International Palm Day using the hashtag #PalmDay.

On behalf of the IPS, **we wish Dr. Larry Noblick a very happy retirement** after 30 years of service as Palm Biologist at Montgomery Botanical Center, Miami, Florida, USA. Larry is an intrepid field botanist and has devoted much of his career to documenting and telling the story of *Syagrus* and *Butia* in South America. Furthermore, during his tenure at MBC, its palm collection has grown to be one of the most important in the country. Job well done, Larry!

Plectocomiopsis hantu, a Distinctive but Elusive Rattan from Borneo

Benedikt G. Kuhnhäuser[1,2]*, John Dransfield[1] and William J. Baker[1]*

A distinctive rattan from Borneo that can be distinguished from all other species of palm, even using its vegetative morphology alone, has remained undescribed for over 90 years due to the lack of reproductive material. We describe the species formally as new to science here.

During an expedition in 2018 to the remote Lanjak Entimau Wildlife Sanctuary in Sarawak, Malaysian Borneo (Petoe et al. 2020), we (BGK and WJB) came across a rattan highly distinctive in its vegetative state, but with no sign of flowers or fruit (Figs. 1–4). The presence of a well-developed tubular ocrea (an extension of the leaf sheath above the point of insertion of the petiole) and the absence of a knee (a knee-like bulge in the leaf sheath below the petiole) suggested the genus *Plectocomiopsis*. However, the leaflets were strongly discolorous, with the upper surface glossy green and the lower surface chalky white, a characteristic not known in any described *Plectocomiopsis* species. The combination of climbing habit, well-developed ocrea, absence of a knee, and entire, discolorous leaflets sets the species apart from any other known species of the palm family, even in the absence of fertile material.

Subsequent research showed that the same species had first been collected in 1932 in West Kalimantan (Indonesia) and had been reported on this basis fifty years later as an incompletely known taxon with assumed affinity to *Plectocomiopsis* (Dransfield 1982). In 1993, 1995 and 2001, further specimens emerged from Sarawak and West Kalimantan (Fig. 5). Five records of the species are now known, including the most recent collection from 2018. However, all specimens lack fruits and flowers, impeding the definite generic placement of the species based on morphology. Phylogenomic research using the specimen collected in 2018 placed the species unambiguously within the subtribe Plectocomiinae, yet its affinities to the three

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1. *Plectocomiopsis hantu*. Habit.

Plectocomiopsis hantu. 2 (left) Stem. 3 (right). Ocrea.

genera, *Plectocomiopsis*, *Plectocomia* and *Myrialepis*, remained unclear (Kuhnhäuser et al. 2021). Fertile material as well as more phylogenomic data and analyses are needed for a confident assessment of the generic identity of the species.

Until such time as new data and in-depth analyses are available, this mysterious species remains invisible to science and conservation due to its lack of a formal name. Given that the species is highly distinctive even in vegetative state and has first entered scientific collections over 90 years ago, we believe that the species must be named, even if its flowers and fruits still remain unknown and its generic placement cannot yet be established with certainty. We therefore take a pragmatic approach here and describe it as a new species of *Plectocomiopsis*, the genus with the closest affinities based on the available morphological material. To reflect the elusive nature of the species and its discolorous leaflets, we have chosen the species epithet *hantu*, meaning ghost (Malay and Indonesian).

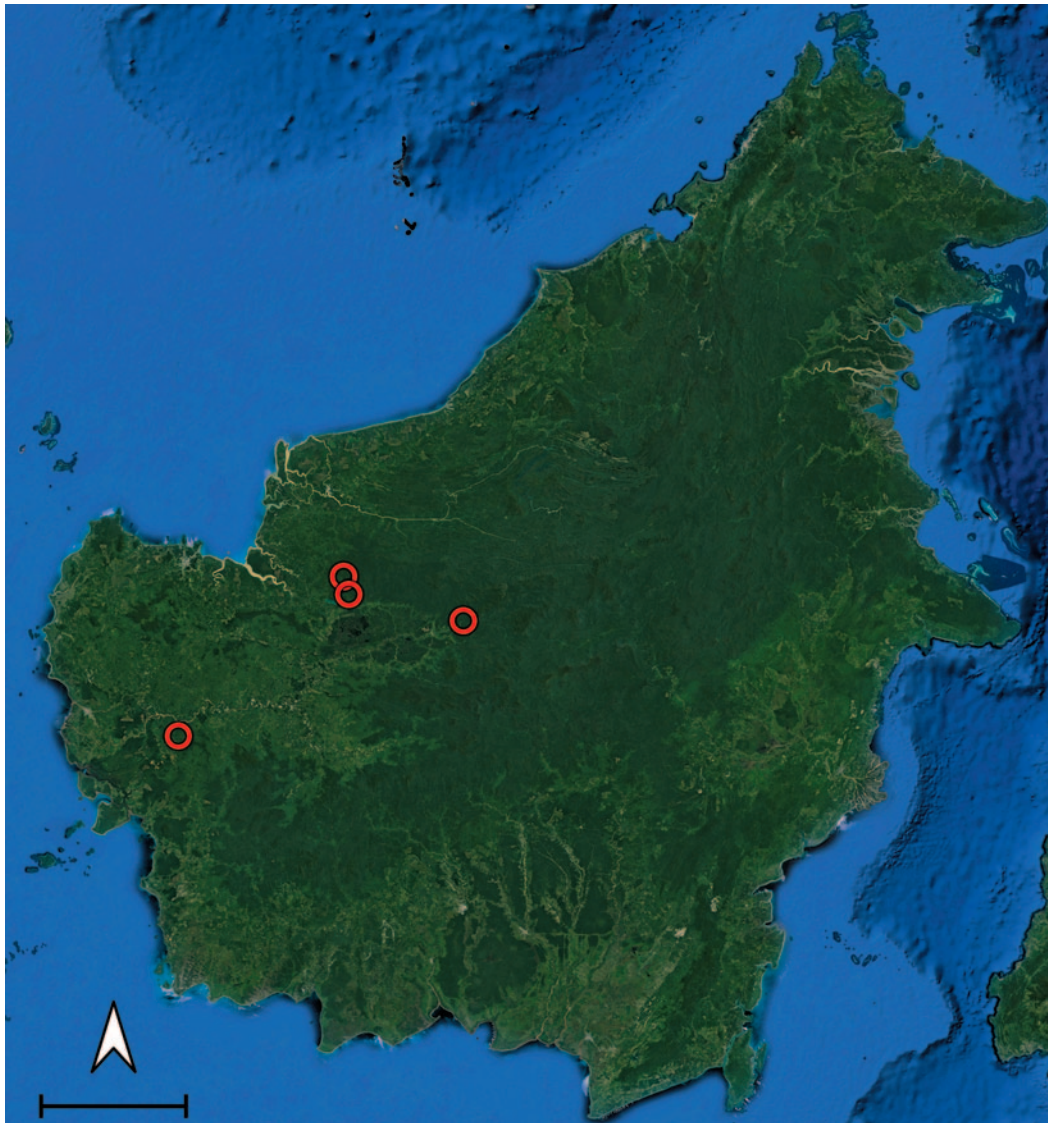
Plectocomiopsis hantu *Kuhnhäuser, J.Dransf. & W.J.Baker*, **sp. nov**.

Type: MALAYSIA. Sarawak: Sri Aman Division, Lubok Antu District, Lanjak Entimau Wildlife Sanctuary, ridge-top path east of Nanga Segerak Research Station, 1°24'42"N 112°0'36"E, 452 m, 4 November 2018, *Kuhnhäuser et al*. 35 (holotype K!, isotypes AAU!, SAR!).

Diagnosis: Distinguished from other species of *Plectocomiopsis* by the discolorous leaflets. Additional distinguishing characters are the thin leaflet texture, pronounced leaflet mid vein and inconspicuous transverse leaflet veins.

Slender, solitary rattan climbing to 20 m. Stem circular in cross section, with sheaths 7–17 mm diam., without sheaths to 6–12 mm diam.; exudate white; internodes 10–25 cm. Leaf cirrate, 1.4–1.7 m long including petiole and cirrus; sheath green, with thin, gray indumentum, with pronounced longitudinal, parallel ridges along stem ca. 0.5 mm high when dry, spacing ca. 1 mm, spines absent to very few, 1 mm long, conical to recurved, yellow, indumentum gray, scattered, spacing 2–10 cm; knee absent; ocrea obliquely truncate, 20–30 mm long opposite petiole, 13–15 mm long on side of petiole, entire–margined, closely sheathing, 1–2 mm wider than stem when dry, leathery, green, with thin, gray indumentum, unarmed or bearing scattered spines as the sheath, with short teeth

4. *Plectocomiopsis hantu*. Leaf. Filamentous leaflet tip marked by star.



5. Distribution of *Plectocomiopsis hantu* in Borneo. Occurrences marked by red circles. Scale bar = 200km. Arrow indicating North.

to 1 mm on the margin, persistent; petiole 2–10.5 cm long, 4–6 mm wide and 2–5 mm thick at base, flattened adaxially, rounded abaxially, indumentum grey, armed abaxially with single recurved spines to 2 mm long, spacing 25–50 mm; rachis 50–63 cm long, green, indumentum gray, armed abaxially with single recurved spines to 2 mm, spacing 20–30 mm; leaflets 11–18 on each side of the rachis, regularly arranged, spacing 20–50 mm, lanceolate, tapering into deciduous, filamentous tip to 30 mm long, unarmed, adaxially green, abaxially chalky white, middle vein conspicuous, transverse veinlets inconspicuous, texture thin, longest leaflets in mid–section of rachis, proximal leaflets 20–25 × 0.8–1.3 cm, mid–leaf leaflets 20–26 × 1.3–2 cm, apical leaflets 12–18 × 1.1–1.6 cm, apical leaflet pair free or rarely basally united to 5–10% of their length; cirrus 76–100 cm long, armed with clusters of 4–5 recurved spines, spines 1–2 mm long, spacing 5–30 mm. Inflorescences, flowers and fruit not seen. (Figs. 1–4).

Etymology: The species epithet *hantu* is the Malay and Indonesian word for 'ghost', referring to the gray leaf sheaths, white leaflet undersides, and incomplete knowledge of the species despite its distinctiveness.

Distribution: Known from five specimens at four locations in West Borneo: in Sarawak,

Malaysia, in Lanjak Entimau Wildlife Sanctuary and near Batang Ai National Park; and in West Kalimantan, Indonesia, in Betung Kerihun National Park and at Kuala Cupang, Sanggau. (Fig. 5).

Habitat: Slopes and ridges in primary and secondary mixed dipterocarp forest at 200–452 m.

Uses: Basketry and tying together of construction units. Young shoots edible.

Vernacular names: *wi mukoup*, *wee mukup* (Iban).

Specimens examined: MALAYSIA. Sarawak: Sri Aman Division, Lubok Antu District: Lanjak Entimau Wildlife Sanctuary, ridge top path east of Nanga Segerak research station, 1°24'42"N 112°0'36"E, 452 m, 4 November 2018, *Kuhnhäuser et al. 35* (holotype K!, isotypes AAU!, SAR!). Near Nanga Sumpa, river Delok, 1°14'N 112°4'E, 250 m, 29 May 1993, *Christensen 1187* (K!). Near Nanga Sumpa, river Delok, 1°14'N 112°4'E, 200 m, 21 March 1995, *Christensen 1747* (K!). INDONESIA. West Kalimantan: Betung Kerihun National Park, Mendalam River, study plot BK–1, 0°59'N 113°15'E, 200 m, 1 August 2001, *Watanabe 7* (K!, BO). At Kuala Cupang, Sanggau, 26 February 1932, *Beck bb 16310* (BZF!).

Within Plectocomiinae, the well-developed and closely sheathing ocrea suggests an affinity with *Plectocomiopsis*, although no species of *Plectocomiopsis* with discolorous leaflets are known. Discolorous leaflets occur in most (though not all) species of *Plectocomia*, and the thin texture of the leaflets is most similar to the monotypic *Myrialepis*. However, the tightly sheathing, persistent ocrea is unknown in both *Plectocomia* and *Myrialepis*, and we thus consider the placement in *Plectocomiopsis* to be most conservative based on the available morphological evidence. Existing phylogenomic inferences are inconclusive, placing the new species either as sister to all three genera, or as sister to a clade formed by *Myrialepis* and *Plectocomiopsis* (Kuhnhäuser et al. 2021). This phylogenomic placement outside the existing genera suggests that the new species may represent a new genus, or indeed that the generic limits in Plectocomiinae may require reconsideration, which could result in the merging of some or all existing genera. More data and deeper analyses are needed before such a decision can be made with confidence.

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We thank Peter Petoe, Sirukit anak Dubod and our local guides Mugu anak Sanggap, Dellie anak Medie and Medie anak Aloh for their help in conducting field work at Lanjak Entimau Wildlife Sanctuary, and Connie Geri and Julia Sang from the Sarawak Forestry Corporation for logistical support. Funding was provided by the Bentham-Moxon Trust (BMT1-2017). Collecting and export permits were granted by Sarawak Forest Department (permits no. (207)JHS/NCCD/600-7/2/107, WL107/2018, and 18642).

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Sabal miamiensis: Not Extinct in the Wild

Daniel A. Tucker[1], Larry R. Noblick[1] and Tim Joyner[2]

A recent survey by Montgomery Botanical Center confirmed a thriving population of *Sabal miamiensis* Zona in the wild.

Sabal miamiensis is a species endemic to South Florida (Zona 1985). That original description (ibid.) highlighted its strong imperilment, stating that it was in danger of becoming extinct. The species was then presumed to be extinct in the wild due to the rapid urbanization of Southeastern Florida (Zona 1990, 1997). Subsequent searches did not find any wild plants, and the species was then formally listed as Extinct in the Wild (Walter & Gillett 1998) and thus only existing in ex situ conservation and the ornamental trade (Griffith et al. 2021).

At a field site in Miami-Dade County, we identified at least thirty healthy individuals matching the description as established by Zona (1985). Given the sensitive nature of the site, the precise location will not be disclosed. Many individuals were observed producing healthy seeds and varying levels of developmental plant growth (Fig. 1). The population is located on what is now a scrubby hardwood hammock, which contains surface-level oolite limestone and is in an elevated and restricted access area, which corresponds to the range of *S. miamiensis*, and the habitat type originally noted by Zona (1985, 1990). Besides geography and habitat, diagnostic characters of *Sabal miamiensis* center on infructescence structure and fruit and seed size (Zona 1985, Zona & Judd 1986). Infructescences observed were branched to three orders (Fig. 2). Average fruit diameter was 1.6 cm (Fig. 3), and seed diameter was 1.3 cm, matching or exceeding Zona's (1985) protologue, and definitely outside the range of *S. etonia* Swingle ex Nash (0.9–1.54 cm (Zona 1990)) or *S. palmetto* (Walter) Lodd. ex Schult. & Schult.f. (0.81–1.39 cm (Zona 1990, Zona & Judd 1986)0. This is the first confirmed sighting of *Sabal miamiensis* in the wild in several decades.

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1. Profile view of *Sabal miamiensis* as found in the wild.

After an extensive literature review and consultation with nomenclature specialists, we have determined that there has been no formal synonymizing of *Sabal etonia* with *Sabal miamiensis*. Furthermore, we acknowledge the previously established habitat, geographic and morphologic data that distinguish it (Zona 1985, 1990). These data, in addition to

2. Close-up of infructescence showing third-order branching.

3. Close-up of fruit showing size, 1.6 cm diameter. Caliper gradations have been overlaid in red text for legibility. Instrument is to read from the yellow line.

unpublished molecular data (Grinage, in prep.), floral volatile chemistry data (Maia, in prep.), and anatomical data (Younis, in prep.) support species status for *S. miamiensis*, and thus we recognize *S. miamiensis* to be a true species.

Acknowledgments

We would like to thank the Miami-Dade County Environmentally Endangered Lands Program team, and especially Joy Klein for their support of this project. Additionally, we would like to thank M. Patrick Griffith and Joanna Tucker Lima for their continued support and guidance of this project.

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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

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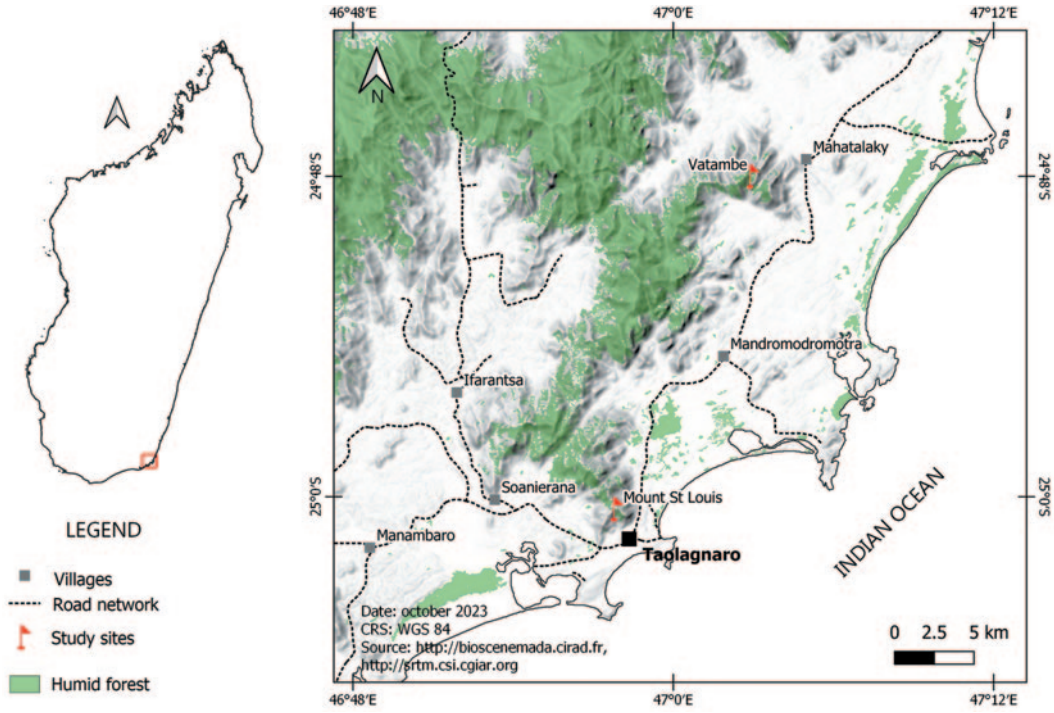

1. Map showing the two study sites in north of Taolagnaro, Madagascar.

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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On the Trail of the *Mazri* Palm (*Nannorrhops ritchieana*) in Pakistan

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***Mazri* (*Nannorrhops ritchieana*) is an economically important palm in Pakistan, Iran, Afghanistan, Saudi Arabia and Oman. We studied 63 different mazri populations in the plains and hilly areas of northwestern Pakistan. We collected data on population ecology and plant species associated with the palm, and we took soil samples, all of which we hope will help its conservation and sustainable use. We observed its variation in leaf color, seed size and shape, which by some authors has been interpreted as evidence of more than one species. Securing its habitat is needed to conserve its genetic diversity and ecosystem services.**

The palm *Nannorrhops ritchieana* (Griff.) Aitch., also known as the *mazri* palm, is native to Pakistan, Iran, Afghanistan, Saudi Arabia and Oman (Abdullah et al. 2020, Dransfield 2004). In Pakistan, *mazri* grows from sea level in semi-deserts along the Arabian Sea coast and it extends up the slopes of the Hindukush and Himalayan foothills to 1600 m elevation in subtropical forests (Champion et al. 1965, Abdullah 2019). Birds and cattle feed on the seeds facilitating their dispersal (Sayedi et al. 2022), but humans also disperse it, which gives the *mazri* a sporadic occurrence over its range (Fig. 1).

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Mazri leaves are an important economic source of livelihood and cash income in different parts of Pakistan (Marwat et al. 2012, Abdullah et al. 2020, Ali et al. 2020, Abdullah et al. 2022). Handicrafts such as baskets, mats, hats, ropes, brooms, hand fans, bedsteads, hot pots

1. Localities visited (•) in the search for *Nannorrhops ritcheiana* in the Khyber Pakhtunkhwa province in northwestern Pakistan. Names of town (o), districts, and other place names mentioned in the text. Insert shows Pakistan's location relative to other countries in which *N. ritcheiana* is known to occur.

and many others are produced from its leaves (Ali et al. 2020, Latif et al. 2004).

Sometimes, the *mazri* palm is found in dense patches, which, in the Pashto language, are called *tal*. Overexploitation, which has happened over the past century or maybe even longer, leads to drastic decreases in its populations. *Mazri* grows well on the banks of agricultural fields in different regions where it has been left standing.

During our fieldwork, we asked the 87-year-old chieftain of the Mian tribe, Niazbeen Mian,

about the past and present conservation status of *mazri* populations. He presented his view with these words: "When we were children, we used to collect *mazri* from the surrounding slopes for firewood. All the hills were full of old individuals of *mazri*. Then with the increase in the demand and prices of opium crops, we converted the *mazri* slopes into agricultural fields. Now we only have *mazri* plants on field banks where they are the remains of the previous vegetation."

At the beginning of the 20th century, the conversion of *mazri* habitats into agricultural fields was at its peak. The crops grown were mainly wheat, barley, rapeseed, maize, rice and sugarcane. In the middle of 20th century, when Pakistan was just seven years old, the government passed an act for its conservation called the Kohat *Mazri* Control Act of 1953 (Latif et al. 2004). The main objective of the act was to protect, preserve and propagate *mazri* in the region. In the act, the conversion of the *mazri* forest into agricultural fields was banned by law. The act was first devised for the Kohat division, which covered the whole province of Khyber Pakhtunkhwa in north-

2. **A**. *Mazri* palm growing on hard rock in Bajaur; **B**. *Mazri* population in Mansehra, which had been affected by fire. The scarred stems show, that apart from being cespitose with branching under the ground, branching also occurs as much as one meter above the ground.

3. *Mazri* palm in Bajaur with yellow leaves, which we assume is the results of magnesium deficiency.

4. *Mazri* palm recovering from fire, Mansehra district.

western Pakistan (Abdullah et al. 2019), and currently, the Kohat division is a section in the Khyber Pakhtunkhwa Forest Ordinance 2002.

In addition to overexploitation by humans, Indian crested porcupines (*Hystrix indica*) and black bears (*Ursus thibetanus gedrosianus*) uproot individuals of this palm and cause considerable damage to its populations. *Mazri* roots are the favorite food of the porcupines (Abdullah et al. 2019, Abdullah et al. 2022). With the decline in the population of *mazri*, the porcupine population is also decreasing in different parts of the study area (Abdullah 2019). Moreover, *mazri* populations in the wild lack natural regeneration, and the loss of population due to overharvesting may cause a huge reduction of the species' economic potential.

Despite the local uses of *mazri*, there are no studies on its ecology and conservation even though such studies would be helpful for its sustainable management. Keeping in mind this important research gap we explored the *mazri* populations across northwestern Pakistan as part of the more extensive PhD research of the first author of this contribution.

Northwestern Pakistan

The Khyber Pakhtunkhwa region is located in northwestern Pakistan, at 28–36°N longitude and 71–72°E latitude. The topography is diverse, varying from desert plains in the southeast to lush green plains, valleys, pastures and forests in the mountains to the north (Abdullah et al. 2022). The vegetation varies with the climate from xeric in the southeast to moist temperate coniferous forests in the east. The average daily temperature varies from 3.4° to 34.3°C, while average annual precipitation is about 1200 mm falling mostly from June to September as monsoon rains.

Mazri populations have been reported from the Peshawar Valley, Kohat, Indus Gorge (Mussarat et al. 2014), Bajaur (Abdullah et al. 2021), Kohe Safid (Hussain et al. 2018), Kurram Valley, (Ali et al. 2020), Hangu (Abdullah et al. 2020), South Waziristan (Aziz et al. 2016), North Waziristan (Khan et al. 2016), Frontier Region Bannu (Adnan et al. 2014), Malakand (Murad et al. 2011), Dera Ismail Khan (Marwat et al. 2012), Mohmand (Khalid & Shah 2016), around the Indus River and Sheikh Baddin National Park (Ullah 2015).

5. **A**. *Mazri* palm association with *Pinus roxburghii* and *Eucalyptus camaldulensis* in Abbottabad; **B**. *Mazri* population at Chapar Haripur; **C**. First author, Abdullah, collecting the *mazri* palm in Kafark Mountain on a steep slope.

Fieldwork

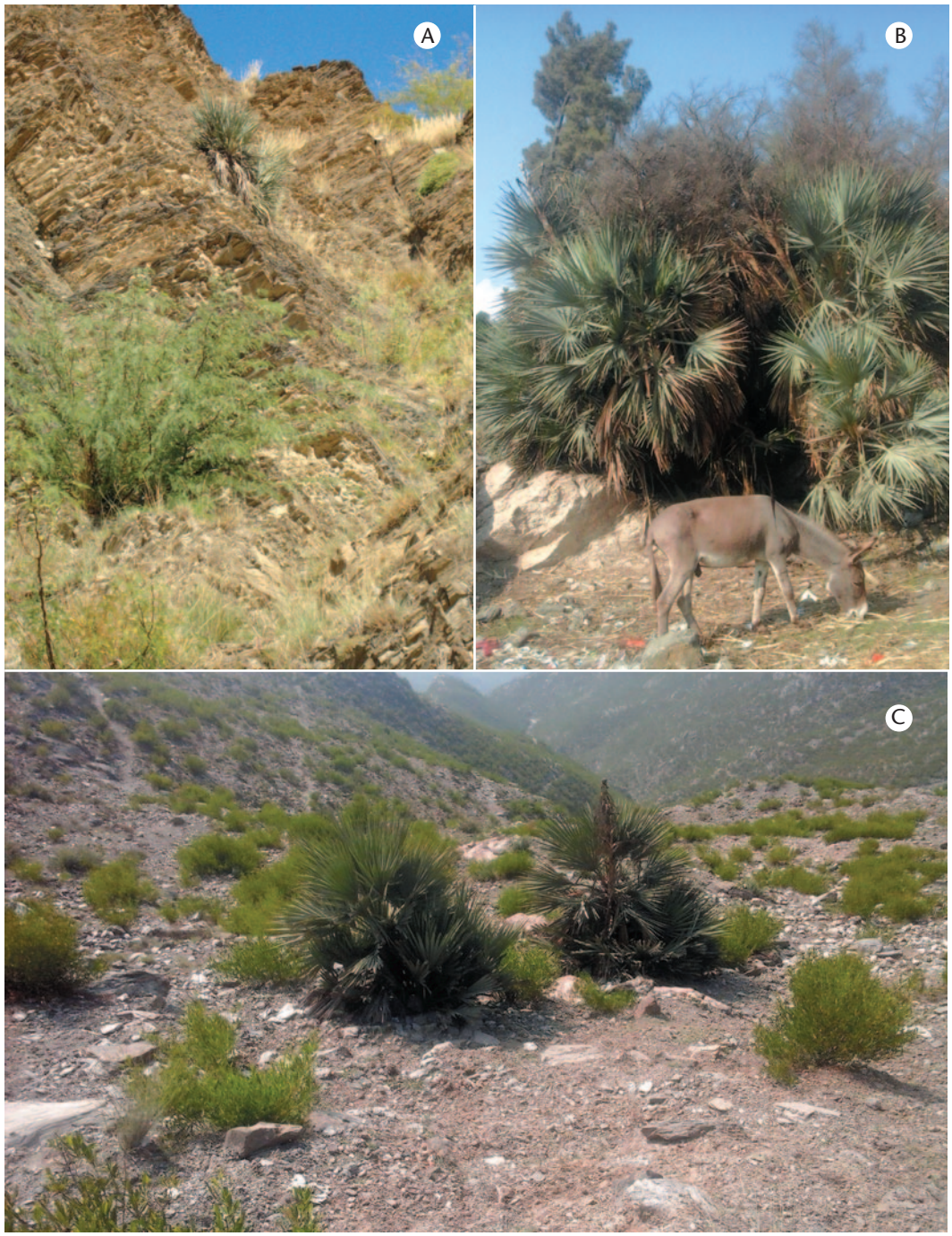
Islamabad (Ecology and Conservation Laboratory) was our central point and on Sunday, 14 July 2019, we started our fieldwork in the district Bajaur located along the Pakistan-Afghanistan border. In Bajaur, we sampled 10 *mazri* populations over 10 days. Bajaur is a hilly area, mostly on lime and soapstone, ultramafic and metamorphic bedrocks (Fig. 2A, B). In some places, *mazri* is planted by farmers at the edges of their fields. We observed that some palms had silvery leaves while others had green leaves. We asked the local people about the variation in the leaf color, and they told us that the silvery palms are softer than the green ones when used for different types of handicrafts. In Bajaur the *mazri* palm grows in association with *Gymnosporia royleana*. (Celastraceae), *Indigofera heterantha* (Fabaceae), *Olea ferruginea* (Oleaceae), *Sageretia thea* (Rhamnaceae), *Ziziphus oxyphylla* (Rhamnaceae) and other species including various types of grasses. Porcupines and black bears cause a significant loss to the

6. **A**. Man involved in the illegal cutting of *mazri* palms at Hangu; **B**. Young *mazri* palm uprooted by porcupine; **C**. A clone of old *mazri* palms growing in Hangu; **D**. A fertile old population of very large *mazri* palms at Ghorzandai graveyard where they are well protected.

mazri population by uprooting its seedlings and juveniles across Bajaur. In some parts of the same region, the palms have small and yellow leaves which are typical symptoms of magnesium deficiency (Fig. 3).

After two hours and 20 minutes by car from Bajaur, we reached the Maidan valley, where we found a few palm individuals. This *mazri* population was on the verge of extinction due to road construction work. The soil was sandy and formed of igneous bedrock. We found the *mazri* palm associated with *Indigofera heterantha*, *Rumex hastatus* (Polygonaceae) and *Saccharum spontaneum* (Poaceae). We returned to Islamabad, where we processed the plant and soil samples over two days and planned our next excursion to explore *mazri* populations in the Abbottabad and Mansehra districts. There was no record of these populations in the literature, and our information about the palms' presence there was provided by Associate Professor Zafeer Saqib, at the Islamic International University. On 29th July, we left Islamabad, and after five hours of journey, we reached Mansehra where we hired a taxi to explore the *mazri* population and collect data. The presence of this palm in the region can be now confirmed, but the populations were severely affected by fire and road construction (Figs. 2B & 4). The following morning, we travelled to Sherwan village. We saw a few *mazri* individuals in the *Pinus roxburghii* (Pinaceae) forests (Fig. 5A), which we sampled together with the associated plant species and collected soil samples.

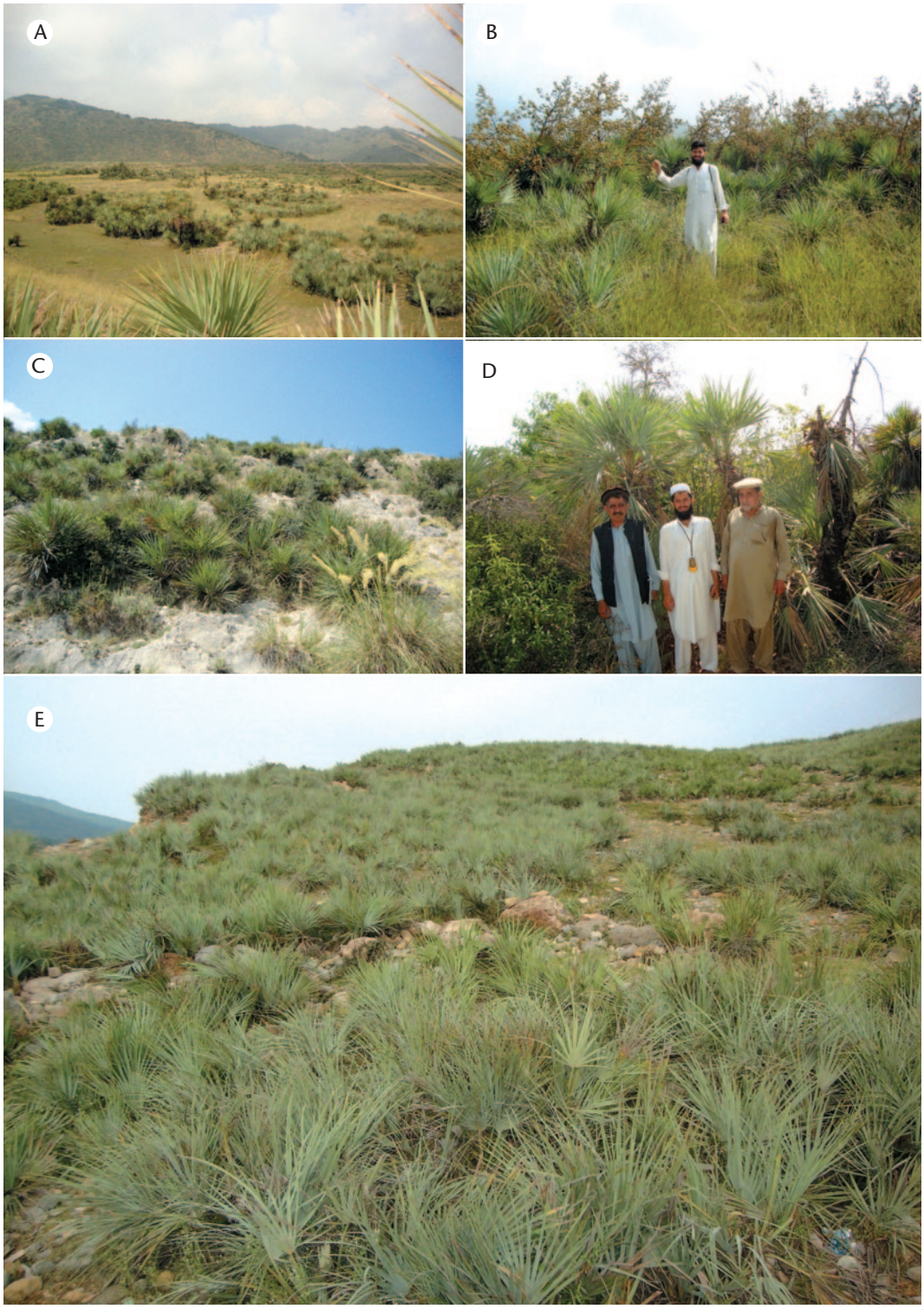
The information about the occurrence of *mazri* palm in Haripur had been provided by the late Dr. Habib Ahmad, professor emeritus at Hazara University. After three hours of travel, we reached Haripur city. On the next day, we hired a taxi and visited a *mazri* population (Fig. 5B) near the historic Tarbela dam. It was a natural and dense population with individuals of



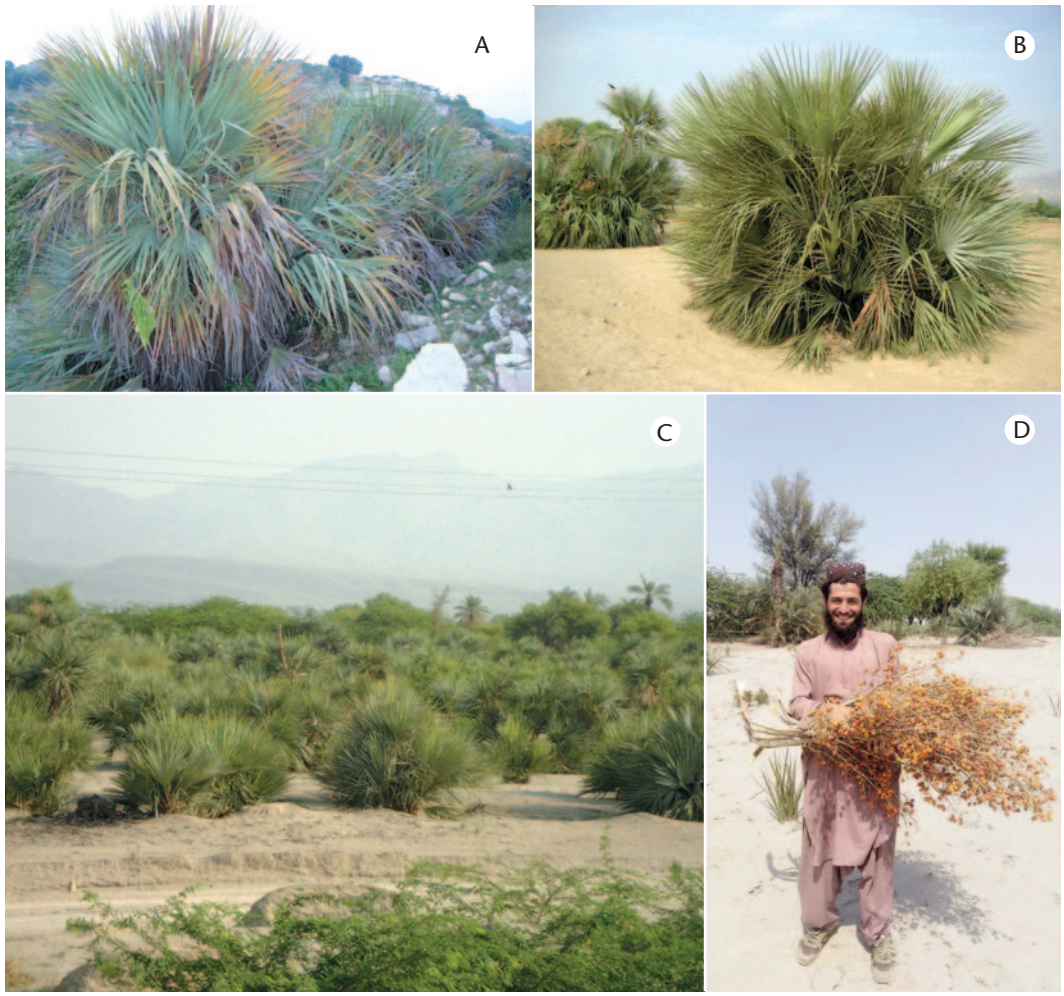
7. **A**. *Mazri* growing on a steep slope at the Khyber pass near the Pakistan-Afghanistan border; **B**. Almost flowering *mazri* individuals at Yusaf Baba Kandao growing on soapstone; **C**. Old, post-fruiting *mazri* individuals at Mani Baba Prang Ghar, district Mohmand.

different ages. We collected data and returned to Islamabad. On the next day, we processed our plant and soil samples and planned our visit to Malakand.

On Sunday, 4 August, we traveled from Islamabad to Mardan and onwards climbing over the Malakand mountain. The next day, we explored the *mazri* populations. *Ailanthus altissima* (Simaroubaceae), *Dodonaea viscosa* (Sapindaceae), *Melia azedarach* (Meliaceae), *Morus nigra* and *M. alba* (Moraceae) and *Olea ferruginea* dominated the vegetation in this



8. **A**. The extensive *mazri* population in Marghan Kurram valley; **B**. The first author, Abdullah, in a profusely fruiting population of the *mazri* palm at Govaki Kurram valley; **C**. A population of young *mazri* palms, still not fruiting with green leaves growing on igneous rocks near Sadda Kurram valley; **D**. Our helpers from the Forest Department during a field trip were Ghyour Turi range officer for Kurram valley with a black vest coat (left) and Amin Hussain (right) accompanying the first author (middle); **E**. A dense population of juvenile individuals of the *mazri* palm at Kasha Orakzai.



9. **A**. A *mazri* individual at the Sheikh Abdul Qadir Jelani point in Sheikh Badin National Park; **B**. A *mazri* palm in the semidesert of Dera Ismail Khan; **C**. *Mazri* palms at Abdulkhel Dera Ismail Khan; **D**. The first author with *mazri* fruits collected from the Rehmani Khel region at Dera Ismail Khan.

region. *Quercus dilatata* (Fagaceae) also occured but was rare. The soil was sandy clay, formed of soapstone and carbonate bedrock.

On Tuesday, 6 August, we explored the *mazri* populations in Kafark mountains (Fig. 5C). The following day, we left for the Hazar Nao mountains. We reached Hazar Nao forest, which is lush and green and dominated by *Pinus roxburghii* (Pinaceae) and where the *mazri* palm grows in association with *Indigofera heterantha* and *Isodon rugosus* (Lamiaceae). We started our collection by climbing the Hazar Nao hill from the north. On the top of the hill, we photographed the plants, and then we descended along the east face because we saw many *mazri* individuals that we could collect before returning to the road. The soils were sandy clay rich in organic matter formed by granite bedrocks.

At the road, we had a lift to Kot, and then on to Barh in a rickshaw where we climbed a hill and saw many *mazri* palms and were able to collect data. We saw a few *mazri* juveniles uprooted by porcupines (Fig. 6B). From Barh to Mena we walked along a mountainous route for 40 minutes and found *mazri* growing together with large *Ficus elastica* (Moraceae) trees. We collected data and returned to the village at dusk.

Sunday, 18 August, we traveled from Islamabad along the Kohat highway. At the District Forest Office, we were given information about different locations where we could find *mazri* palms. The DFO officers facilitated our fieldwork. At noon we left for Hangu where some sites such as Karbogha Sharif are famous for their *mazri* palms, and some regions have old individuals (Fig. 6C). After an hour of

driving, we reached the Hangu Forest office, where we stayed for the night. On the next day in the early morning, we began our search for *mazri*. We repeated this routine continuously for six days working from dawn to dusk traveling on motorbikes and gathering data from several *mazri* habitats. The Hangu vegetation was supposed to be conserved under the Kohat *Mazri* Control Act of 1953, but unfortunately, in some areas, illegal cutting of *mazri* leaves persists (Fig. 6A). Moreover, *Neltuma juliflora* (Fabaceae) is invading the *mazri* habitat, which is an additional threat to its conservation. The region has subtropical vegetation dominated by *Ailanthus altissima*, *Celtis caucasica* (Cannabaceae), *Ficus carica* (Moraceae), *Grewia tenax* (Malvaceae), *Gymnosporia royleana*, *Olea ferruginea*, *Senegalia modesta* (Fabaceae) and *Ziziphus nummularia* (Rhamnaceae). The soil varied from sandy loam to sandy clay. The most common bedrocks were sandstone, siltstone, carbonaceous shale, coal and laterite.

After exploring the Hangu district, we returned to Kohat to gather additional information about *mazri* populations. We stayed in the forest office guest house for the night and next morning before dawn, we started our journey to Ghorzandai, a remote region in Lachai Tehsil. After driving 64 km, we saw an old village with narrow streets at the end of which there was a dense stand of old and tall *mazri* in an old sacred graveyard, unlike anything we had seen across northwestern Pakistan (Fig. 4D). We collected the needed data and continued to visit some *mazri* populations of Shahzadi Banda some 10–12 km from Ghorzandai. We collected until late noon and then returned to Kohat, where we rested for the night. On the following morning, we left for the beautiful Ibrahimzai region on the Kohat-Hangu border where the Orakzai river enters the Kohat districts and *mazri* grows abundantly in the gorges. We sampled this population and returned to Kohat. After lunch, we traveled by van to Karak, which we reached at dusk. The road was under construction and very dusty; the 75 km distance took us more than three hours. From Karak, we continued by rickshaw for 17 kilometers to Ahmad Abad. After breakfast, we had a lift to the van station because we planned to explore the Banda Daud Shah and its *mazri* populations. We were lucky to get seats for the short 30 km journey on a road in poor condition. The next day, 30 August 2021, we explored the nearby *mazri* populations that grew along streams with salty water. In the evening, the range officer Karak Yaqoob Khan Marwat let his cook prepare the delicious local rooster Painda for us. It is a cultural dish offered to special guests. We slept peacefully, and the next day our host took us to Kohat where we said goodbye and returned to Islamabad.

We planned to explore the hard-to-visit, ex-federally administrated tribal area. On Monday, 9 September 2019, we left for Peshawar. We planned to visit the famous Khyber Pass to the west of Peshawar city. This coincides with the so-called Durand line that delimits Pakistan from Afghanistan. We traveled by motorbikes and searched for *mazri* along the road. We found a small population of *mazri*, which, however, had been damaged by grazing animals. We gathered data and continued to the Khyber Pass. When we reached a village near the pass we asked an old man about the *mazri* population. He told us that there were sporadic populations of small palms about two km from the city along the main Khyber Pass road. After 20 minutes of driving, we saw the *mazri* population. This place had been visited by Gibbons and Spanner (1995), but they did not report any *mazri* palms. We were excited and collected samples for herbarium records. The palm grows over poor and dry, gray quartzite rocks (Fig. 7A).

The next day we met with a district forest officer to discuss *mazri* occurences in the region. In the early afternoon, we started our search in Bergina in the hills east of the Kabul River. Interestingly, here the *mazri* palm grows on limestone and slaty shales. We collected samples in a population, which was old and included sporadic large plants, whereas another population was intensively harvested by local people for its leaves. The next day, the district forest officer Mohmand arranged a one-day excursion for us in the rugged mountains of Yusaf Baba hills (Figs. 7B, C). We started our visit in the early morning riding by motorbikes and following the Charsadda route we reached the Yusuf Baba shrine, where an old and historical *mazri* population is located on soap stones. In the evening, we returned to Islamabad to rest and plan our exploration of the Kurram and Orakzai valleys.

On Monday, 16 September, we left in a public van for the Kurram Valley, which we reached after traveling for more than eight hours. On the following day, we met the range officer,

Ghayour Touri, and he assisted our visit to the valley. We sampled *mazri* at Taindu, Marghan. The Marghan area hosts a very dense *mazri* population (Fig. 8A) on sand and limestone rocks. We found more fertile individuals in the Govaki region (Fig. 8B). The next morning, we were accompanied by the range officer to the Midani dam, the refugee camp area and Sharqi. The Midani dam *mazri* population was being encroached by the invasive *Neltuma juliflora*. These areas had mixed types of geology characterized by limestones, shale and different igneous rocks. The color of the palm leaves was mostly green in these regions (Fig. 8C). The next day, we said goodbye to Ghayour Turi and his team (Fig. 8D) and left for Orakzai district, a mountainous and forested region. We traveled on motorcycles and reached Kasha, where *mazri* population were very dense (Fig. 8E). We collected data and moved to Ibrahimo and several other nearby sites. After collecting data for two days we returned to Orakzai. As in other regions, we observed old individuals of the *mazri* palm conserved in many graveyards. The next day, we left Hangu in the morning and reached Islamabad in the evening.

In Islamabad, we prepared our search for *mazri* in Dera Ismail Khan, a semi-desert known for its *mazri* and date palm populations. On the morning of Friday, 23 September, we headed for Dera Ismail Khan from the Punjab side, where we saw abundant date palm gardens. At noon, we reached Dera Ismail Khan city. In the forest office, the staff were very helpful and suggested that we should start our fieldwork in the Sheikh Badin National Park. To get there we travelled in a van for about two and a half hours, finally reaching the Pezu Pass.

The next day, 25 September, we started our journey to the national park. The road was damaged by many landslides. Unfortunately, during this journey we were not accompanied by any local inhabitants of the area nor by anyone from the forest department; however, in the forest office, they told us that a forest guard, who was living uphill, could help us. We continued by foot and our next stop was the peak of Sheikh Badin National Park, famous for its cultural heritage stemming from the British era and also known for its cold weather and a dry forest with dense shrubby vegetation. We did not observe any *mazri* palms on the way. After a 2-hour uphill hike in the blazing hot sun, we reached a small humid area, where subtropical vegetation started and contrasted with the xeric vegetation we had observed along the way. We did not meet any people along the access trail. After a 17 km hike, we reached the top where we found six or seven houses and some 40–50 people living there. We stayed in a guest house. During our visit to the national park we found only seven individuals of *mazri*. One palm, located on the Sheikh Abdul Qadir Jelani Point, was 4–5 m tall and growing at an elevation of 1412 meters (Fig. 9A). Being a sacred plant, local people had tied its leaves into talismans to gain good fortune. On 27 September, we visited the surrounding areas, but we found only eight more individuals, so the *mazri* was not common in Sheikh Badin National Park. The leaf color of the palm was silvery. The geology of Sheikh Badin is composed of variegated sandstone, with subordinate mudstone, siltstone and shale rocks.

On the next day, we decided to return to the Pezu forest office, hiking, which turned out to be easier than the previous climb. The next day, 29 September, we hitchhiked to Gilot some 10–15 km from Pezu along a plain highway, arriving at 7 a.m. We found tall *mazri* palms with large canopies and long and wide leaves growing in silty loamy soil. We sampled many individuals and left for the Paniala semi-arid region (Fig. 9B), which is famous for its mango and date plantations. We continued by rickshaw to Abdul Khel and then moved to Rehmani Khel and collected *mazri* fruits (Fig. 7D). We left by the China-Pakistan Economic Corridor (CPEC) route, which is a mega-project worth more than 51.5 billion USD organized in cooperation between China and Pakistan (Lashari et al. 2020). It comprises subprojects and infrastructure development, including a network of highways between different cities across the country. The CPEC is very important from a socio-economic point of view but detrimental to our native and threatened biodiversity (Nabi et al. 2017). The *mazri* palm is among the plants whose populations are devastated along CPEC construction routes. We observed many stumps of *mazri* dug out in road construction. On both sides of the CPEC route, there are thousands of *mazri* individuals with silvery-colored leaves with a soft texture. These places are hot and dry. *Mazri* and date palm form oases in silty and loamy soils. We collected fruit and leaf samples and after dusk returned to Paniala.

On 29 September, our expedition looking for *mazri* palms in northwestern Pakistan ended. We had collected data on *mazri* population ecology from 508 plots. In hindsight, we were left with the impression that there may be more than one taxonomic species covered by the folk species called *mazri*. There are mazris with different leaf colors varying from green to silvery. Green palm leaves are hard while the silvery leaves are soft. There is also a considerable variation in seed size and shape. Our fieldwork was not designed to explore this question. Proper taxonomic and genetic analyses would be required to solve this mystery of whether there is only a single in *mazri* (*Nannorrhops ritchieana*) or whether the variation covers different species as previously suggested.

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Chambeyronia

Donald R. Hodel[1]

I remember walking into Fairchild Tropical Botanical Garden nearly a half-century ago to attend my first International Palm Society Biennial Meeting in June 1974. My timing could not have been better, because there, right in front of me under the shade of some live oaks, was a *Chambeyronia macrocarpa* in its full, unabashed glory, its brilliant red, new leaf unfolding like a flame in the forest. I had never seen such a sight, so it was an appropriate initiation for me to the wonderful world that is palms.

Chambeyronia, a genus of small to large, solitary, crownshafted, pinnate-leaved palms endemic to New Caledonia comprises nine species, although it was not always that way. In 2021, the genera *Actinokentia* and *Kentiopsis* were rolled into *Chambeyronia* (Hodel et al., PALMS 65: 109–131) adding six species to the genus of three species. Many workers had long suspected that this arrangement was appropriate, and a molecular analysis and a fresh look at morphological features supported the move.

Chambeyronia macrocarpa is probably the best-known and most widely cultivated New Caledonia palm (Fig. 1). Famous for its red, new, unfolding leaf, it has several varieties based mostly on crownshaft color (Figs. 2 & 3). Look for it at Col d'Amieu and the Mt. Koghi Botanical Reserve. The newest species, *C. houailouensis*, has rigid, recurved leaves and a greenish-yellow to cream-colored crownshaft (Fig. 4). Look for it at Kua Valley. Another species, *C. lepidota*, occurs near the summits of a few, difficult-to-access mountain peaks in northeast New Caledonia, such as Mt. Panié (Fig. 5).

The four species of *Chambeyronia* that once comprised *Kentiopsis* include *C. piersoniorum* on the lower slopes of Mt. Panié (Fig. 6) and *C. pyriformis* in southeastern New Caledonia near Goro and Yaté (Fig. 7). Both have recurved leaves. Of the other two species, *C. oliviformis* is in the south-central part of New Caledonia and might be the tallest indigenous palm on the island (Fig. 8). Its broom-like inflorescence is distinctive, especially when heavily laden with small, bright red fruits. Look for it at Plateau de Oro. To the north of the Island at Col d'Amos, one encounters *C. magnifica* (Fig. 9), which when I first saw it in 1976 reminded me of the king palm (*Archontophoenix cunninghamiana*).

The final two species, formerly in *Actinokentia*, are small to medium palms typically holding a much smaller quantity of leaves than other *Chambeyronia*. They are from the central and southeastern parts of New Caledonia. The better-known *C. divaricata* also has a rather striking red, unfolding leaf (Fig. 10). Look for it at the Rivière Bleue Botanical Reserve and near Goro and Yaté, while the lesser-known *C. huerlimannii* is limited to a few difficult-to-access sites on and near Mt. Nékando and the upper reaches of the Ni Valley.

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Editors' Note: This is the third of four commissioned articles highlighting the exceptional palm diversity of New Caledonia, the destination for the IPS Biennial in 2024.

1. *Chambeyronia macrocarpa* is the best known and most widely cultivated New Caledonia palm. Here it is at Col d'Amieu.

2. *Chambeyronia macrocarpa* var. *hookeri* has a distinctive, yellowish crownshaft, as here near Ba on the east coast.

3. *Chambeyronia macrocarpa* var. *flavopicta* is known for its yellow streaked and spotted crownshaft and is sometimes called the "watermelon Chambeyronia."

4. The recently named *Chambeyronia houailouensis* is noted for its stiffly recurved leaves and greenish yellow to cream-colored crownshaft, as here near Poindimié.

5. The rare *Chambeyronia lepidota* is known from only a few, difficult-to-access mountain peaks in northeast New Caledonia, such as here on Mt. Panié.

6. *Chambeyronia piersoniorum* is gregarious on the lower middle slopes of Mt. Panié.

7. Chambeyronia piersoniorum has stiffly recurved leaves, as here at Kuébéni near Goro.

8. *Chambeyronia oliviformis* might be the tallest indigenous palm in New Caledonia, as here at Col de Koh.

9. At Col d'Amos one encounters *Chambeyronia magnifica*.

10. *Chambeyronia divaricata* is a small, few-leaved palm but with the new leaf unfolding bright red, as here at Me Moya near Nodela.

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