PALMS

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The International Palm Society

Founder: Dent Smith

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Features

The fearsome leaf sheaths of *Zombia antillarum* are a distinctive feature of the species. See article by A. Henderson, p. 42. Photo by S. Zona.

FRONT COVER

An individual of *Mauritiella disticha* found in the region of the Cuieiras river, in the lower Rio Negro. See article by E.M.B. Prata et al., p. 57. Photo by P.-O. Albano.

BACK COVER

Coccothrinax spissa, a critically endangered palm, endemic to Hispaniola. See article by C. Bacon et al., p. 81. Photo by E. Fernández.

PALM NEWS

The interactions between parrots and palms are of great interest because both palms and parrots are charismatic organisms of conservation concern. An open-access study recently published by M. Carrete et al. (*Frontiers in Ecology & Evolution* https://doi.org/10.3389/fevo.2022.790883) examined 1,189 interactions between 135 parrots and 107 palm species in more than 50 countries across the six realms where palms are present as natives or introduced. They identified 427 unique parrot-palm interacting pairs. Antagonistic or predatory interactions were far less common (5%) than mutualistic ones (89%). Although commonly thought to be seed predators, parrots are important seed dispersers, even for palms with large, heavy fruits, and some parrots may even play a role in pollination.

Latania 47, magazine of Palmeraie-Union, the palm society of La Réunion, has just been published. In it is **an account of the laying of the foundation stone of the extension to Le Parc des Palmiers at La Tampon, La Réunion**. Approval for the extension of the park was given by the local government in February 2021, and now work has begun to extend the park by 10 ha. The foundation stone was laid at a ceremony held on 25 February 2022. When the extension is completed, the whole park will represent the most important dedicated palm garden in the whole of Europe (La Réunion is, of course, part of France, despite is location in the western Indian Ocean). Already boasting an extraordinary diversity of palms, the park is destined to become a wonderful place for palm enthusiasts to visit.

Ángela Cano and co-authors have just published a paper in *Global Ecology and Biogeography* (https://doi.org/10.1111/geb.13521) entitled "Recent and local diversification of Central American understory palms." Understory palms are diverse components of Central American rain forests, but little is known about their historical assembly. It is not clear when palms in Central America reached present diversity levels and whether most species arrived from neighboring regions or evolved locally. These questions were addressed using the most species-rich American palm clades indicative of rain forests. The results suggest that **most understory palm species that characterize the Central American rain forests today evolved locally after repeated dispersal events, mostly from South America after the formation of the Panamanian isthmus**.

Béat Arnold has just published **a remarkable, beautifully illustrated book about canoes constructed from palm trunks**. *Sur la Piste des Pirogues Palmier* is published by Alphil Press, Neuchâtel, Switzerland. The book illustrates 80 different canoes constructed from palm timber from across the world – an extraordinary record. A printed hardcopy is available from the publisher at Swiss Francs 30 or €30, or it can be downloaded as an open-access PDF at <https://www.alphil.com/livres/1208-1417-sur-la-piste-des-pirogues-palmier.html#/1-format-livre_papier>. An English text translation (minus the illustrations) is also available for downloading.

The Description of a Charismatic New Palm Species in the Amazon

Eduardo M.B. Prata[1]*, Maria Fernanda Torres Jiménez[2,3,4]*, Christine D. Bacon[2,3], Ayslaner V.G. de Oliveira[5] and Thaise Emilio[6]

This article profiles a new species, *Mauritiella disticha*, recently described from the Arc of Deforestation in the Brazilian Amazon.

Palms are common in the Amazon, comprising almost half of the 20 most abundant tree species in the region (ter Steege et al. 2013). Palms are indicators of current and past Amazonian ecosystems, such as flooded forests (*igapó* and *várzea*), non-flooded, clay soil forests (*terra-firme*), white-sand soil ecosystems (*campina*) and estuarine environments (Bernal et al. 2011, Bogotá-Ángel et al. 2021). Curiously, many of the most abundant palm species in the Amazon – such as *Euterpe precatoria*, *E. oleracea*, *Oenocarpus bataua* and *Astrocaryum murumuru* – are used by human populations and their distributions have been associated with pre-Columbian indigenous settlements (ter Steege et al. 2013, Levis et al. 2017). Crucial as sources for food and material, the palm family (Arecaceae) is a proxy for forest conservation and a target of botanical and ecological studies. Palms are diverse and ecologically and socially important in the Amazon, but despite their high abundance, there is still diversity to be discovered. One example is a charismatic palm species we recently described, *Mauritiella disticha* Prata, Oliveira, Cohn-Haft, Emilio and Bacon (Torres Jiménez et al. 2021), a plant with extraordinary ornamental potential.

Mauritiella disticha is characterized by its distichous phyllotaxy, where its leaves are arranged in a fan-like shape (Fig. 1), a beautiful pattern not present in any other species of the genus: *M. aculeata*, *M. armata*, *M. macroclada*, and *M. pumila* (for a recent review on *Mauritiella* see Bernal & Galeano 2010). It was this conspicuous characteristic that caught our attention and suggested it was a species new to science. Another important character that defines this species is the size of the scales on

[1]*Laboratório de Ecologia e Evolução de Plantas da Amazônia (Labotam), Instituto Nacional de Pesquisas da Amazônia, CEP 69011-970, Manaus, Brazil.*

[2]*Gothenburg Global Biodiversity Centre, SE-405 30 Gothenburg, Sweden.*

[3]*Life Sciences Centre, Vilnius University, 10257, Vilnius, Lithuania.*

[4]*Department of Biological and Environmental Sciences, University of Gothenburg, SE-405 30 Gothenburg, Sweden.*

[5]*Instituto Chico Mendes de Conservação da Biodiversidade, Parque Nacional do Juruena, CEP 78580-000 Mato Grosso, Brazil.*

[6]*Programa Nacional de Pós-Doutorado, Programa de Pós-Graduação em Ecologia, Institute of Biology, University of Campinas, P.O. Box 6109, Brazil.*

** These authors contributed equally to this research and shared first authorship*

1. A fruiting individual of *Mauritiella disticha* found on the Transamazonia road in southern Amazon in 2008. Photo by A.V.G. Oliveira.

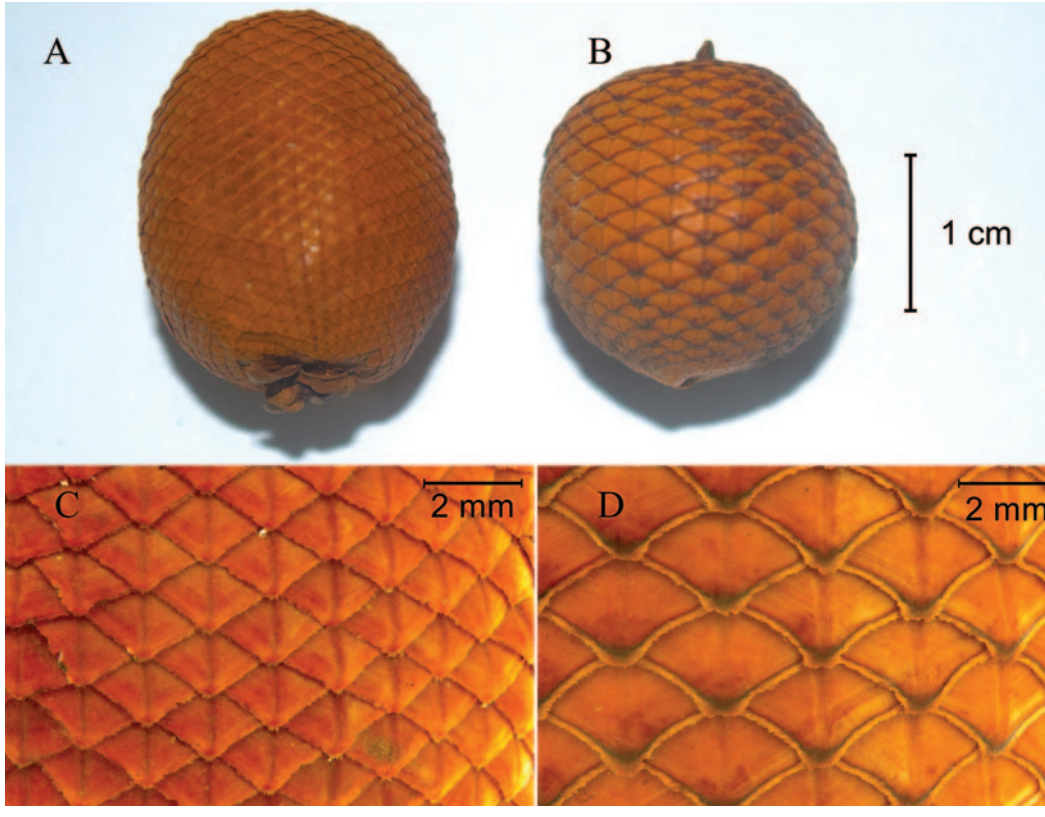
the fruits, which are the smallest in the genus. However, this characteristic was just more recently observed during the species description process (Fig. 2).

Interestingly, the new species co-occurs with *Mauritiella armata*, one of the most widespread species in the genus, which indicates that they are reproductively isolated, thus reinforcing the hypothesis that this is a new species. Ecologically, *M. disticha* is characterized by its narrow distribution strictly associated with white-sand habitats in southern Amazonia. Phylogenetically, *M. disticha* was found to be the early divergent species in the genus, meaning it is sister to a clade (group) including all other species in *Mauritiella*, corroborating our hypothesis of *M. disticha* as an independent lineage. All the evidence, taken together, was considered in the process of species delimitation.

The history of discovering *Mauritiella disticha* is relatively recent. Curiously, the species was first detected independently by different researchers, on the BR-319 road in 2007 and on the Transamazonia road in 2008. The plant was first observed by a local field assistant, Manoel Pereira, who attributed its distichous phyllotaxy to a plant disease. The first male flowering plant was collected and photographed in 2007, but this collection was lost at INPA herbarium before its incorporation. One year later, a fruiting individual of the new species was found hundreds of kilometers southward from its first record. One of the photographic records (Fig. 1) of this plant, taken by A. Oliveira, was published in the book *Flora Brasileira: Arecaceae (Palmeiras)* (Lorenzi et al. 2010), although unfortunately no mention was made of the author of the picture. Until that moment, the species remained impossible to be described after its only voucher was lost.

In 2010, we went on a field expedition of 30 days collecting plants from Porto Velho to Manaus in the BR-319 road, where botanical samples from around 500 species from different families were collected (all of them incorporated into INPA and NY herbarium), including a new collection of *Mauritiella*

2. Images comparing size, shape and color of the scales in fruits of *Mauritiella disticha* (A, C) and *M. armata* (B, D). *Mauritiella disticha* has smaller scales compared to all other species in the genus, which is a diagnostic characteristic of the species. Photos from E. Prata.



3. A male flowering individual of *Mauritiella disticha* on the BR-319 road, from which we collected the voucher INPA 239004 in 2010. Photo by E. Prata.

disticha. We collected a male individual bearing inflorescences (Figs. 3 & 4), the voucher of which is currently on loan at the NY herbarium (INPA 239004). One year later (2011), we made new collections in the region along the Transamazonia road of southern Amazonia, including samples from flowering male, female and fruiting plants (Figs. 5 & 6). These were deposited at the INPA herbarium, including the type specimen (INPA 299235).

Mauritiella disticha is endemic to white-sand soils ecosystems (WSE) in southern Amazonia (*campinas* and *campinaranas*; Fig. 7). White-sand ecosystems are characterized as vegetation islands varying from open grasslands to low forests, on nutrient-poor, acid-sandy soils, saturated by the outcropping of the water table or well-drained, usually scattered in the landscape in a matrix of terra-firme (clay/silt soil) forests. The flora of the WSE is less species-rich than the surrounding terra-firme forests, but it is remarkably high in endemism (Guevara et al. 2016, Fine & Baraloto 2016, Capurucho et al. 2020). When close to roads, these habitats are usually burned by voluntary or accidental fires, or destroyed by land occupation, including for sand mining for construction materials, when close to towns and cities. All observations of the species were made along roads that crossed intact or degraded patches of those habitats. Unfortunately, the geographic distribution of *M. disticha* occurs in one of the most threatened regions in Amazonia, the "Arc of Deforestation," a huge area along the Transamazonia road (Fearnside & de Alencastro Graça 2006, Andrade et al. 2021). It is important to point out the imminent possibility of reconstruction and paving the BR-319, a 885 km road connecting two Amazonian capitals (Manaus and Porto Velho) constructed in the 1970's that became impassable in 1988. This would significantly increase the illegal occupation and deforestation of the region by land grabbers (*grileiros*), illegal miners (*garimpeiros*) and loggers (Fearnside & de Alencastro Graça 2006, Andrade et al. 2021).

Mauritiella disticha was known only from our six collections from four populations across the middle Madeira river basin. Recently, we were contacted by Mr. Pierre-Olivier Albano, who kindly shared with us his interesting record and photos of *Mauritiella disticha*. He and his colleague Jean-Michell Chaillet found a population of *M. disticha* in the Cuieras river, in the lower Negro river (Figs. 8), during an expedition of a group of people from the Association Fous de Palmiers, in 2017 (Front Cover). From a biogeographic and conservation point of view, this record is interesting because it extends the known distribution of the species to the north of the

4. The inflorescences of a male flowering individual of *Mauritiella disticha* on the BR-319 road, from which we collected the voucher INPA 239004 in 2010. Photo by E. Prata.

5. The flowers of a male individual of *M. disticha* on the Transamazonia road in 2011. Photo by E. Prata.

Amazon river. We argue its distribution to be considered rare, as it is a conspicuous plant never formally registered before by botanists, although collections had been made in these regions. Our preliminary Red List assessment suggested its status to be vulnerable (VU; Torres Jiménez et al. 2021).

Even with multiple morphological characters and good vouchers (at NY and INPA herbarium), the species remained undescribed for more than ten years. In part, this illustrates how long the species description process can be, especially in remote regions such as Amazonia, where the combination of high species diversity, large geographic distances, complicated logistics, few resources for science and small number of taxonomists make things more complicated for botanists and for scientists in general. Unfortunately, this is the reality of many other Amazonian countries in Latin America, and this should be seriously considered by progressive regional governments concerned with conservation and sustainable development.

In this context, the process of species description gained momentum with collaboration. We extracted DNA from four *M. disticha* individuals (see Fig. 8) and other 118 individuals from 42 species within Lepidocaryeae (approximately 82% of the tribe). We then sequenced sections (genes) of the genome. Each gene accumulates changes (evolves) independently and contributes to seeing the full picture of how species are related. Identified by Heyduk et al. (2016) and Loiseau et al., (2019), these 146 genes include between 48,965 to 355,729 nucleotides (DNA building blocks). Of around 50,000 nucleotides that we found vary between our samples, we kept 26,337 that vary within *Mauritiella* species and that helped us establish if *M. disticha* individuals are more closely related to each other than to other species in the genus (i.e., if it corresponds to a monophyletic group including a common ancestor and all its descendents).

Our analyses comparing genes and their variant nucleotides consistently grouped all *M. disticha* samples together. These samples are genetically more similar to each other than to other species, supporting the hypothesis that – based on distichous phyllotaxy and other morphological and ecological characters as discussed above – *M. disticha* is a distinct species. *Mauritiella disticha* is closely related (sister to) to a group containing all other *Mauritiella* species. Within the subtribe Mauritiinae, all *Mauritiella* species are more closely related to *Mauritia* than to *Lepidocaryum*. The genetic similarities between species and subtribes mirror the morphological traits shared by them. Based on the morphological descriptions summarized in

6. A flowering individual of *Mauritiella disticha* bearing female inflorescences on the Transamazonia road in 2011. Photo by E. Prata.

Dransfield et al. (2008), *Mauritiella* and *Mauritia* both have catkin-like staminate rachillae and equal width leaf segments but differ in e.g. habit (solitary individuals in *Mauritia* and clustered ones in *Mauritiella*) and spines (lacking in *Mauritia* and present in *Mauritiella*). Moreover, *Mauritiella* shares with *Mauritia* and *Lepidocaryum* its northern South American distribution and its reduplicate, palmate-shaped leaves (Dransfield et al. 2008).

We found, described and named it as a species new to science, *Mauritiella disticha*, combining morphological, ecological and genetic evidence in the process of species delimitation. This work brought important insights such as: How such a culturally and economically important plant group on which local communities depend is still poorly known in Amazonia? How important are national and international collaborations for science,

7. The white-sand soil (*campina*) ecosystem in Southern Amazon with the occurrence of *Mauritiella armata* (in the back), *Mauritia carana* (in the right) and *Mauritiella disticha* (in the center). Photo by E. Prata.

especially under the current scenario of underfunded science in Brazil (and even more in the Amazon) (Escobar 2018, Franzolin et al. 2020)? Species description in Amazonia is not a simple task, given the large geographic dimensions, the accessibility and the lack of taxonomists. Like *M. disticha*, many more species remain undescribed or understudied and at risk of becoming extinct before being discovered. This serves as an urgent call for conservation of Amazonian forests, its species and inhabitants, represented by a palm species only recently discovered but already vulnerable to extinction. Finally, we urge for the assessment of the genetic diversity within *M. disticha* populations and other palm species to inform conservation strategies and prioritize areas of high diversity (both inter- and intra-specific) for protection.

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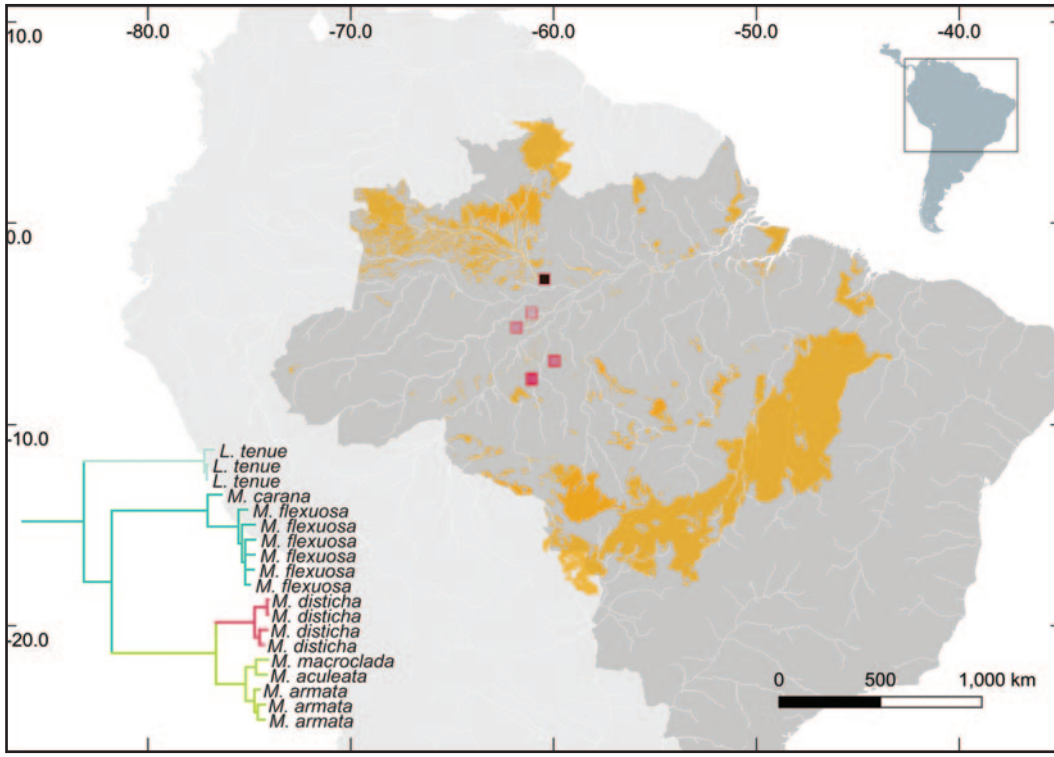

8. Map of the geographic distribution of *Mauritiella disticha* populations (red squares); one individual from each population was used for the genetic analyses (Torres Jiménez et al. 2021), except for the population more recently found by Pierre-Olivier Albano and Jean-Michel Chaillet, represented by the red square filled with black. The orange shades mark the distribution of white sand habitats (where *M. disticha* is found) and other open areas (Adeney et al. 2016; downloaded on November 26th, 2020 from http://www.botanicaamazonica.wiki.br/labotam/doku.php?id=projetos:campinas:mapas:inicio). The phylogenetic tree in the bottom left shows the evolutionary relationships between *M. disticha* (red), other *Mauritiella* species (light green), *Mauritia* species (teal), and *Lepidocaryum* species (light teal), all species within Mauritiinae.

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PALM LITERATURE

APPRENDRE À RECONNAÎTRE LES PALMIERS ENDÉMIQUES DE NOUVELLE-CALÉDONIE. VERSION NUMÉRIQUE – Émilie Ducouret & Charline Henry. Illustrations by Chris Montané. 2022. NOÉ. ISBN 978-2-9579335-1-8. Binding unknown. 40 pp. €10.

Noé is a non-profit NGO based in France concerned with conservation in France and internationally. For the last ten years, the organization has been working in New Caledonia to help protect endangered species of palms and conifers, with a project "Program for the Conservation and Restoration of the New Caledonian Forest."

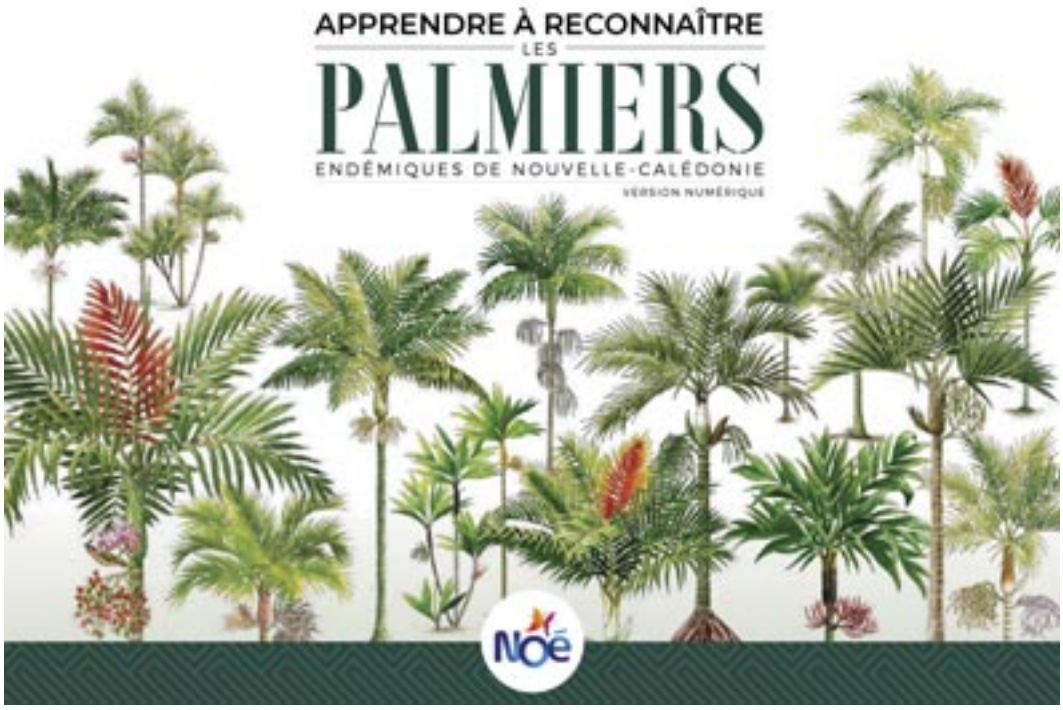
In assessing threats to the palm flora the organization has established that the major threat to the survival of many palms on the island is fire. Every year approximately 1% of the territory is destroyed by man-made fires. To address the problem, Noé has been running ecological restoration projects encouraging local communities to be involved in the protection of their environment by the joint formulation of conservation action plans, encouraging local communities to produce planting material of endangered species, by coordinating restoration initiatives and raising public awareness of environmental challenges.

As part of the New Caledonian interest Noé has just produced a beautiful new booklet about the palms of New Caledonia and the Loyalty Islands. Published in French, it is profusely illustrated with attractive paintings highlighting the key diagnostic features of the 19 most commonly encountered endemic species likely to be seen on jungle hikes. The species are arranged in color-coded geographic groups.

The booklet can be downloaded for free at https://noe.org/media/missions/livret-palmier-nc-version-numerique-sitenoe.pdf or can be purchased as printed hard copy from Association Noé (www.noe.org) for €10 or £8.40.

As the following sample page spreads illustrate, this attractive booklet will be of great interest to any IPS member hoping to visit New Caledonia.

JOHN DRANSFIELD
Co-Editor



Burretiokentia koghiensis

PALMIER DES KOGHIS

SIGNIFICATION DE L'ÉPITHÈTE

Burretiokentia des monts Koghis, car il n'est connu que de cette zone.

DISTRIBUTION ET HABITAT

Restreint à une veine de serpentine dans la forêt entre 400 et 700 mètres d'altitude.

DESCRIPTION

Grand palmier atteignant les 20 mètres de haut. Le stipe solitaire est vert avec des cicatrices indentées. La gaine est profondément fendue et partiellement couverte d'un tomentum blanc, le manchon est très peu marqué. La feuille est pennée et la nouvelle feuille est rouge. Le pétiole est cannelé et ailé. Les tiges de l'inflorescence sont d'abord rose pâle puis vert clair. Les fruits sont ovales, blanc verdâtre lorsqu'ils sont immatures, puis rouges à maturité.

PHÉNOLOGIE

La floraison a lieu d'août à octobre et la fructification de décembre à janvier.

CONFUSION POSSIBLE

Avec *Burretiokentia grandiflora* (p.17) et *Burretiokentia dumosa* (absent du livret), mais ces trois espèces ont des aires de répartition totalement distinctes les unes des autres. Si vous êtes aux Koghis, vous ne verrez que *B. koghiensis*.

ACCESSIBILITÉ

Sur les sentiers des monts Koghis.

Cyphophoenix fulcita

PALMIER ÉCHASSE

SIGNIFICATION DE L'ÉPITHÈTE

Cyphophoenix souteru, en référence aux racines échasses qui élèvent le stipe au-dessus du sol.

DISTRIBUTION ET HABITAT

Sur les sols miniers du Grand Sud, entre 10 et 1000 mètres d'altitude. Dans les zones de fortes pentes, rocheuses et à proximité des cours d'eau.

DESCRIPTION

Palmier de taille moyenne atteignant les 15 mètres de haut. Le stipe solitaire est vert avec des cicatrices indentées et des racines échasses, qui peuvent atteindre 2 mètres de haut. La gaine est tubulaire, et forme un manchon bien marqué et renflé. La gaine est bicolore, elle est verte en bas et couverte d'un tomentum blanchâtre sur la moitié haute. La feuille est pennée et le pétiole cannelé. L'inflorescence est pendante et les tiges épaisses. Les fruits sont ovales avec une pointe recourbée, verts lorsqu'ils sont immatures, puis rouge-brun à maturité.

PHÉNOLOGIE

Fleurit et fructifie, tout au long de l'année.

ACCESSIBILITÉ

Sur les sentiers forestiers de la rivière Bleue, la rivière Blanche, du GR sud, ou aux monts Koghis.

Basselinia pancheri

SIGNIFICATION DE L'ÉPITHÈTE

Basselinia de Pancher, nommé en l'honneur de Jean Pancher, un botaniste et un explorateur du XIXe siècle.

DISTRIBUTION ET HABITAT

À la lisière ou dans les forêts de l'ensemble des massifs miniers de la Grande Terre.

DESCRIPTION

Palmier de taille moyenne atteignant les 15 mètres de hauteur. Le stipe solitaire est annelé, vert ou bien gris et avec des racines adventives. La gaine est tubulaire recouvert d'écailles noires qui forment parfois un motif de lignes parallèles. La gaine forme un manchon bien marqué, dont la couleur est très variable avec de l'orange, rouge, noir et même du jaune. La feuille est en général pennée avec un pétiole plat et couvert d'écailles mais elle peut aussi être bifide ou bien irrégulièrement pennée. L'inflorescence peut être verte, rouge, brune ou noire et dressée. Les fruits sont bilobés et vert-jaune lorsqu'ils sont immatures puis noirs à maturité.

PHÉNOLOGIE

La reproduction de cette espèce est continue tout au long de l'année.

CONFUSION POSSIBLE

Avec *Basselinia deplanchei* et *Basselinia eriostachys* (p.29 & p.30) mais ces espèces ont des stipes plus fins et plus petits et leurs fruits sont ronds.

ACCESSIBILITÉ

Sur les sentiers des rivières Bleue et Blanche, du GR Sud, le mont Do.

31

Cyphophoenix nucele

SIGNIFICATION DE L'ÉPITHÈTE

Basé sur l'appellation en langue Drehu « Nu trehle », « nu » désignant la noix de coco et « trehle » la fronde car les fruits étaient autrefois utilisés comme projectiles pour la chasse aux oiseaux.

DISTRIBUTION ET HABITAT

L'unique population se trouve sur un plateau forestier sur l'île de Lifou.

DESCRIPTION

Palmier de taille moyenne atteignant les 15 mètres de hauteur. Le stipe solitaire est vert avec des cicatrices indentées et des racines adventives. La gaine est vert tubulaire et couverte d'un tomentum beige, elle forme un manchon bien marqué. Les feuilles sont pennées et le pétiole est cannelé. L'inflorescence est de taille moyenne (60 cm) et vert foncé. Les fruits sont ovales, verts lorsqu'ils sont immatures, puis orange avec l'extrémité rouge-rose à maturité.

CONFUSION POSSIBLE

Avec *Veitchia arecina*, un palmier introduit et largement utilisé en ornement. Cette espèce atteint les 30 mètres de haut, ses fruits sont plus petits et de couleur différente. Les fruits immatures sont verts puis jaunes et enfin entièrement rouges. De plus le pétiole est plat et les fleurs sont plus grosses et comptent de très nombreuses étamines par rapport à *C. nucele* qui n'en compte que cinq.

ACCESSIBILITÉ

Sentier guidé par les tribus.

37

A New, Large-Flowered *Licuala* from New Guinea

ANDERS S. BARFOD[1] AND WILLIAM J. BAKER[2]

As part of the Palms of New Guinea project we discovered a species of *Licuala* new to science with large white flowers, which is described here for the first time.

With more than 130 species, *Licuala* is one of the most diverse genera of palms in the Indo-Pacific, second only to *Calamus*. As a result of intensified research for the Palms of New Guinea project (Baker 2002), we have recorded 25 species on New Guinea and adjacent islands, several of which are new to science. The New Guinea representatives of *Licuala* contain many surprises both in their inflorescences, flowers and fruits. This is epitomized in earlier described species such as *L. longispadix*, which has 4–4.5 m long infructescences, partly lying on the forest floor, with 2–2.5 cm long fruits with 3-ridged endocarps (Banka & Barfod 2004). The species that we describe here has gone unnoticed since it was collected for the first and only time in 1957, by the Dutch botanist Christian Versteegh (1913–1983). It is highly aberrant from all other species of *Licuala* by having flowers more than 2 cm long, a record not only for the genus, but for all the genera placed in the tribe Trachycarpeae. Unfortunately, the original collection did not include fruits, thus the size and morphological details of these remain unknown.

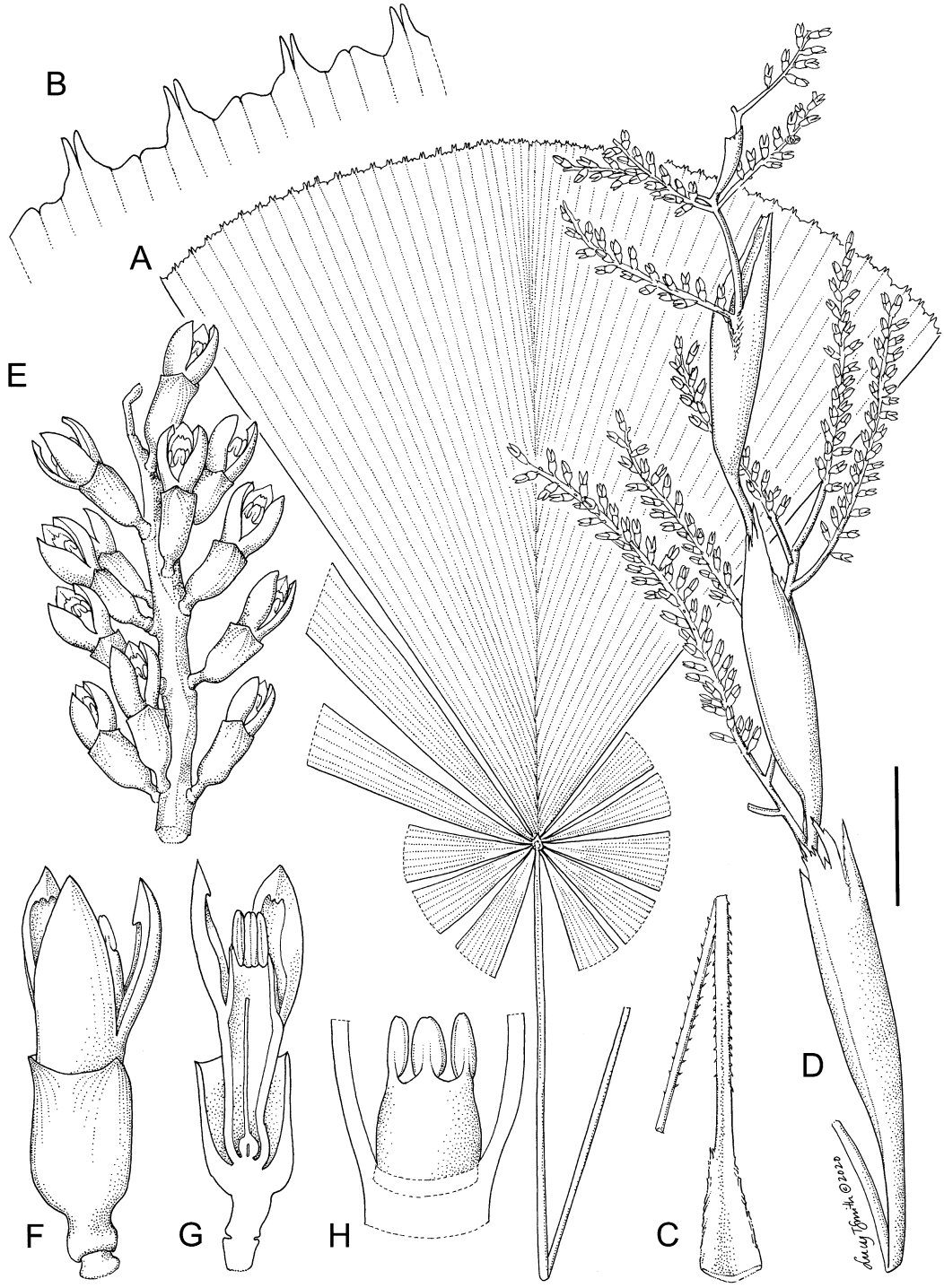
[1]*Dept. of Biology, Aarhus University*
Ny Munkegade 114
DK-8000 Aarhus C, Denmark
barfod@bio.au.dk

[2]*Royal Botanic Garden, Kew*
Richmond, Surrey, TW9 3AE, UK
w.baker@kew.org

Licuala heatubunii Barfod & W.J.Baker, sp. nov. Type: INDONESIA. West Papua Province: Jayapura Regency, Ayapo village, 80 m, 2°36′S, 140°34′E, 4 April 1957, *Versteegh BW 4711* (holotype L!; isotype CANB!) (Fig. 1)

Diagnosis: Differs from all other *Licuala* species by the size of the large flowers varying from 2.0–2.5 cm long and the alternating deep and shallow indentations of the leaf mid-segment. *Licuala heatubunii* differs from *L. crassiflora* by having loosely sheathing rachis bracts, truncate calyx and uniseriate stamens.

Solitary palm ca. 2 m tall. **Stem** ca. 7 cm in diam. **Leaves** 11 in crown; sheath 50–60 cm long tubular, eventually breaking up into a brown fibrous mesh; petiole variable in length up to 250 cm long, basal 40–50 cm armed with up 5 mm long, turbinate spines, covered with minute ferruginous ramenta; lamina rounded in outline, 130–150 cm across, glabrous above, below with minute ferruginous scales increasing in density towards major veins and



1. *Licuala heatubunii*. **A**. Leaf; **B**. Detail of the apical margin of the mid segment; **C**. leaf base; **D**. Inflorescence; **E**. Part of rachilla with flowers at anthesis; **F**. Flower; **G**. Flower in longitudinal section; **H**. Detail of flower showing staminal ring. A–H from *Versteegh BW 4711*. Scale bar: **A**, **C** = 15 cm, **B** = 3 cm, **D** = 9 cm, **E** = 1.5 cm, **F**, **G** = 7.5 mm, **H** = 4 mm.

towards the eccentric hastula, divided into 7–11 segments; mid segment with 30–35 adaxial ribs, 65–75 cm long, truncate at the apex and 28–30 cm wide, indentations alternating between 3–10 mm deep and 1–4 cm deep, the remaining segments with 3–9 adaxial ribs, basal segment 70–75 cm long, obliquely truncate at the apex, basal segments with generally deeper indentations than mid-segment. **Inflorescence** 80–100 cm long, branched to the second order with 4–5 first order branches; peduncle 20–25 cm long, covered by short ferruginous felt-like indumentum; prophyll 20–25 cm long, brownish chartaceous, splitting irregular apically and partly resolved in fibrous mesh; peduncular bracts lacking; rachis slightly sinuous, not exposed; proximal rachis bracts 23–27 cm long, inserted 20–25 cm above prophyll, brownish chartaceous, with ferruginous hairs increasing in density towards the base, tightly fitting proximally for 8–10 cm to loosely fitting distally, splitting irregular apically and partly resolved in fibrous mesh, main axis of proximal first order branch 1–5 cm long, carrying 3–5 rachillae, these 20–30 cm long and covered with scattered ferruginous hairs. **Flowers** 50–80 on longest rachillae, solitary, borne on flattened tubercles, 20–25 mm long, sausage-shaped in bud; calyx 9–11 mm long, distal 2/3 free of receptacle, expanded and loosely fitting, glabrous, truncate to slightly sinuous; corolla 17–19 mm long, glabrous, white, lobes 8–9 mm, cuculate; androecial ring 3–4 mm high, fused with the corolla in basal 9–10 mm, anthers subsessile, inserted in one level, elongate, about 2.4–2.6 mm long; ovary glabrous, globose, 1.5–2 5 mm long; style about 7.5 mm long. **Fruits** unknown.

Common Name: *Jaiboh* (Sentani language).

Etymology: The species epithet recognizes the great contributions to the study of New Guinean palms made by Prof. Charlie D. Heatubun of Universitas Papua, Manokwari, Indonesia.

Conservation: Data deficient (DD). The distribution and abundance of this species are insufficiently known. The most recent Google Earth imagery reveals that the area of the type locality has been heavily impacted by forest clearing, which raises concern for the survival of this species.

Notes: Collected only once in 1957 by Versteegh, who noted that this species was rather common in periodically flooded forest on silty soil. Obviously refinding this species and assessing its population in the wild should be a high priority. The type locality is situated near the village of Ayapo on the south bank of Lake Sentani, only a few hours drive from Jayapura.

Acknowledgments

We are grateful to the curators of L and CAN for sending herbarium material on loan. Lucy Smith prepared the analytical plate.

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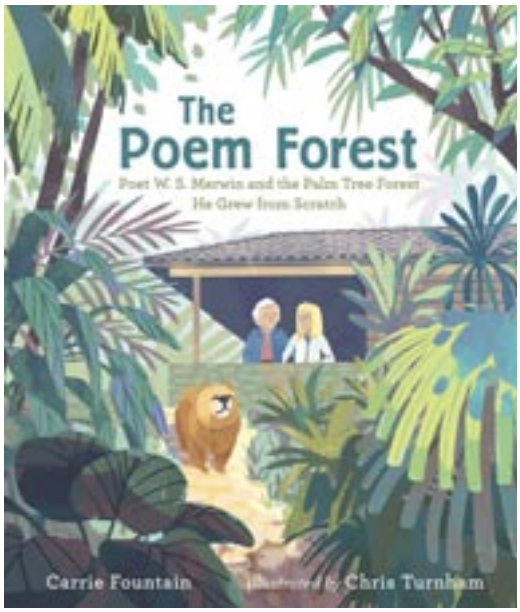
PALM LITERATURE

THE POEM FOREST: POET W.S. MERWIN AND THE PALM TREE FOREST HE GREW FROM SCRATCH – Carrie Fountain. Illustrated by Chris Turnham. 2022. Candlewick Press. ISBN 978-1536211269. Hardcover. 32 pp. US$18.99.



W.S. Merwin (1927–2019) was one of the most acclaimed and prolific poets in the United States whose work appeared frequently in the *New Yorker* and *Atlantic Monthly* as well as in dozens of his own collections of poetry, translations and prose. In addition to serving as the nation's Poet Laureate in 2010 and 2011, Merwin won two Pulitzer Prize for volumes published nearly 40 years apart, the first in 1971 and the second in 2009. In the 1970s Merwin moved to Maui where he put down roots on a slice of an abandoned pineapple plantation in a windswept valley on the island's sparsely populated north shore. There he continued to write and began learning how to reclaim the played-out land by first building up the soil and then planting what would become a forest of palms. Fountain's children's book tells the story of how Merwin came to Maui and, despite spending much of his life in cities and initially knowing nothing about palms, was able to grow a towering forest with palms from all over the world and change the course of neglect in that small valley forever.

Although written for children, the book explores some decidedly grown-up themes like Merwin's desire – almost an overpowering compulsion – to put life back into the earth and the need to preserve that life after his death. Fountain uses her skills as an accomplished and award-winning poet to distill complicated human emotions and desires into just a few carefully chosen words – in this case, words that can be read and understood by children.

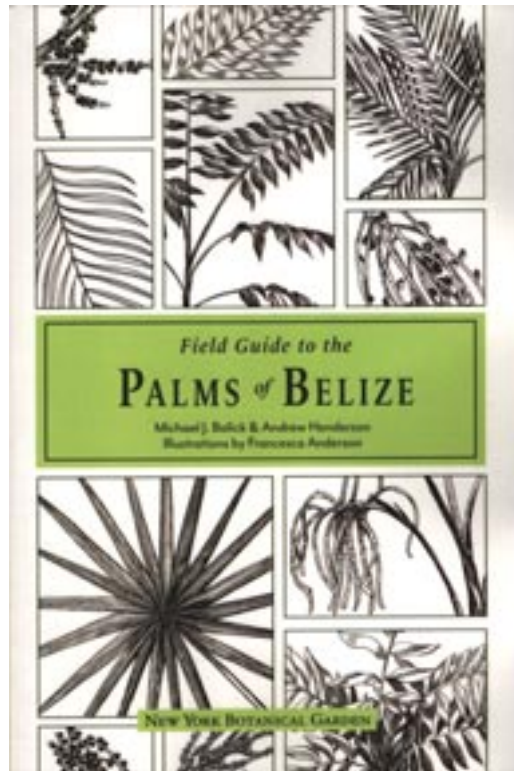
One of the recurring themes in the book is Merwin's wistful yearning for wild places he rarely experienced living in an urban setting. Fountain writes that towns and cities are "where the wild parts had been straightened out and turned into roads and lawns and driveways." Describing the abandoned and abused farmland that Merwin came to own, Fountain writes that "He'd found a straightened-out place longing to grow wild."

Fountain is able to make complex concepts accessible to young readers with help from Turnham's dreamy illustrations. Anyone who has seen a young child's brow furrowed in concentration, intensely studying the pictures of a storybook as it is being read, will understand just how important illustrations can be to fill in the gaps of understanding. Turnham's illustrations do more than just depict what is written, they take you deeper into the story. My favorite illustration shows Merwin sitting on a park bench; the text reads "He had a hunch he'd find his wilderness in Hawaii." The bench looks over a reflecting pool, but instead of mirroring the skyline of the city in the background, the reflection shows Merwin standing among palm trees under a tropical sun.

This is not, however, a "Baby's First Book of Palms," although I hope someone will write that too one day. There are no scientific names mentioned, nor can you identify the species of palms from the pictures. (*Licuala*-like leaves do seem to be particularly abundant perhaps due to their striking outlines). I recommend this book to my friends in the International Palm Society who want to share with the young people in their lives their love and desire to save the wild places where palms grow.

MARY LOCK
Hawaiian Island Palm Society
& The Merwin Conservancy

FIELD GUIDE TO THE PALMS OF BELIZE – Michael J. Balick and Andrew Henderson. Illustrations by Francesca Anderson. 2022. New York Botanical Garden. ISBN 979-8-795-33043-3. 153 pp., line drawings & halftone photographs. Hardcover US$29.95; softcover US$14.95.



Belize is a small country on the southeastern side of the Yucatan Peninsula, facing the Caribbean Sea. It borders Mexico to the north and Guatemala to the west and south. Its topography is low along the coast and in the northern half of the country, while the southern half has low mountains. The highest peak is Doyle's Delight at 1124 m (3688 ft), which is only about a fourth as high as neighboring Guatemala's highest peak. Lacking the area and topographic diversity of its larger neighbors, Belize has a correspondingly smaller palm flora, although it is home to many species familiar to growers and gardeners around the world.

The book is a guide to the 25 genera and 39 species that occur in the country. Most of the genera have only one or two species in Belize; *Chamaedorea* stands out with ten species. As you might expect, the palm flora is shared with southern Mexico, Guatemala, Honduras and other parts of Central America. *Schippia concolor* is the nearest thing to an endemic species, although the authors speculate that it may also occur in Guatemala.

Each species treatment provides information on the common name(s), identifying characteristics for use in the field, range and habitat, as well as traditional uses. The latter are the specialty of Dr. Balick, who has been cataloging the ethnobotanical knowledge of Belize since 1987. The text is clear and concise, providing a simple précis for each taxon. A key to the genera is provided. For the few genera that have more than one species, keys to the species are also provided. To its credit, the book generally avoids botanical jargon, making it accessible to a wide audience.

The line drawings by Francesca Anderson are equally clear and accessible and make a fine complement to the text. Each plate includes a drawing of the habit, along with useful studies of distinguishing features or other details. For four species lacking Anderson drawings, halftone photographs – or in one case, a reproduced engraving – are provided. The illustrations are placed either on the page with the taxon description or on the facing page, so there is no flipping through the book searching for the illustrations. The back of the book has a list of voucher specimens, literature cited and, of course, an index. Perhaps the only thing missing from this book are in-country distribution maps.

This field guide will be immensely helpful to anyone new to the palms of this part of the Yucatan Peninsula. It would be perfect to take along on a vacation to Belize that would include visits to national parks or Mayan ruins. At $14.95 for the paperback edition, this book is affordable and easily tucked into a carry-on bag. The Kindle edition, at under $10, is even more portable.

Scott Zona
Co-Editor

The History of a Hispaniolan Palm, *Zombia antillarum*

Andrew Henderson[1]

The taxonomic history of the Hispaniolan palm *Zombia antillarum* is reviewed.

Between 1687 and 1694, the French monk and botanist Charles Plumier (1646–1704) made three trips to the Caribbean. His purpose was to study the plants and animals of the French colonies, and he spent much of his time in Haiti. Plumier published several books on the plants he had collected (e.g., Plumier 1693, 1703), and illustrated them with his own excellent drawings. In his 1703 book, *Nova plantarum americanarum genera*, Plumier listed several palms that he had come across on his travels. Botanists at that time used polynomials to name plants (this was before the start of the binomial nomenclature of Linnaeus, in 1753), and Plumier referred to a Haitian palm as *Palma dactylifera radiata, minor, aculeata*. Plumier also made colored drawings of the palm, but these were not included in his book (the drawings are labelled *Palma dactylifera radiata spinosissima et thoracibus aculeatis munita*).

Plumier died relatively young and left behind thousands of unpublished drawings. These were eventually gathered together and deposited in the library of the Natural History Museum in Paris. There they were bound together into an eight-volume, unpublished work known as *Botanicon Americanum seu historia plantarum Americanis insulis nascentium*. In volume 7 there are 61 drawings of palms, some of them colored, including the two drawings of Plumier's Haitian palm (Figs. 1 & 2). Plumier's life and legacy have been the subject of several articles (listed in Stafleu & Cowan 1983); an entertaining account of his life is given by Pietsch (2018).

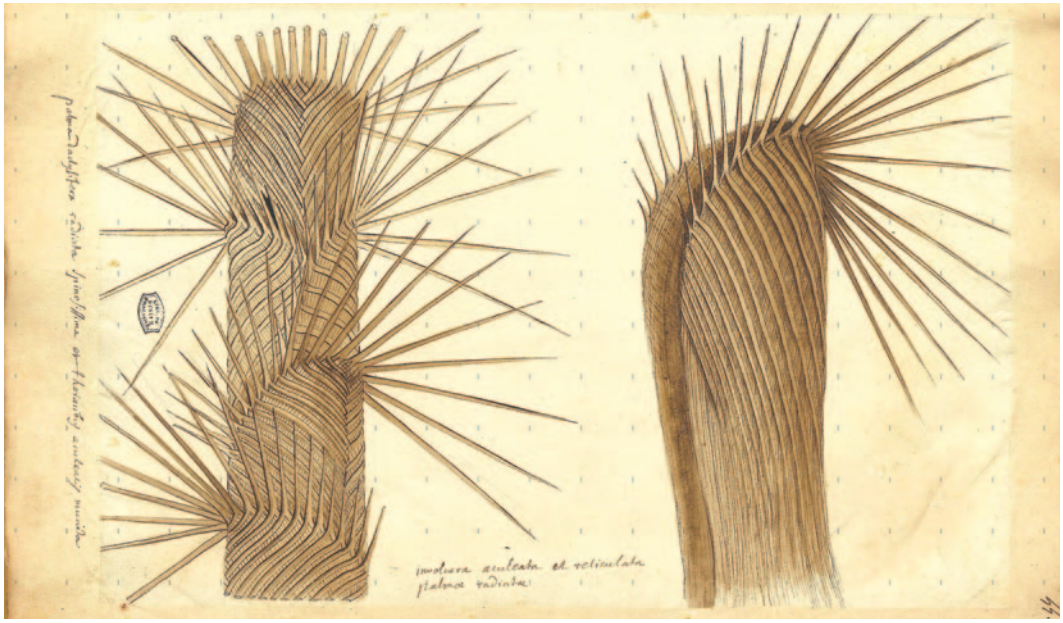
The second European to refer to the Haitian palm was the French doctor and botanist Michel Étienne Descourtilz (1775–1835). Descourtilz arrived in Haiti in 1799 and spent the next four years there. This was the time of the Haitian revolution, and Descourtilz was captured by the revolutionaries and was forced to act as their doctor. On his return to France, Descourtilz published a book on his adventures (Descourtilz 1809) and a second, eight-volume work on useful plants entitled *Flore médicale des Antilles* (Descourtilz 1821–1829). This must have been written mostly from memory because according to Stafleu and Cowan (1976) his collections and drawings were destroyed in Haiti. In volume one Descourtilz described and illustrated the Haitian palm, calling it *Latanier épineux ou hache* (Fig. 3).

At first sight, Descourtilz's painting looks like a reasonable representation of the Haitian palm. Based on the close resemblance of

[1]*Institute of Systematic Botany*
New York Botanical Garden
Bronx, NY 10458, USA

1. Plumier's colored drawing of *Palma dactylifera radiata spinosissima et thoracibus aculeatis munita*. © Muséum national d'Histoire naturelle.

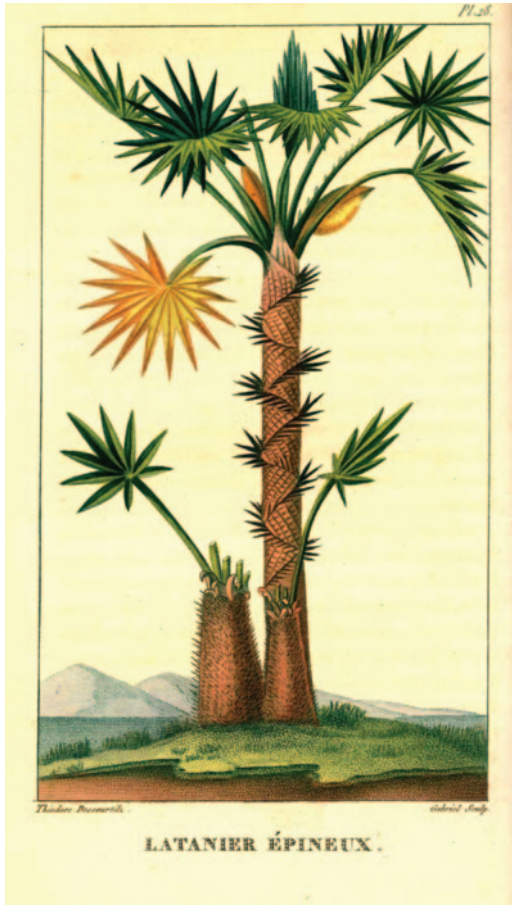
Plumier's and Descourtilz's paintings, it is likely that the latter copied or at least adapted the former's work. Descourtilz was certainly familiar with Plumier's work because he cited *Botanicon Americanum*. But on closer examination there is one discrepancy –



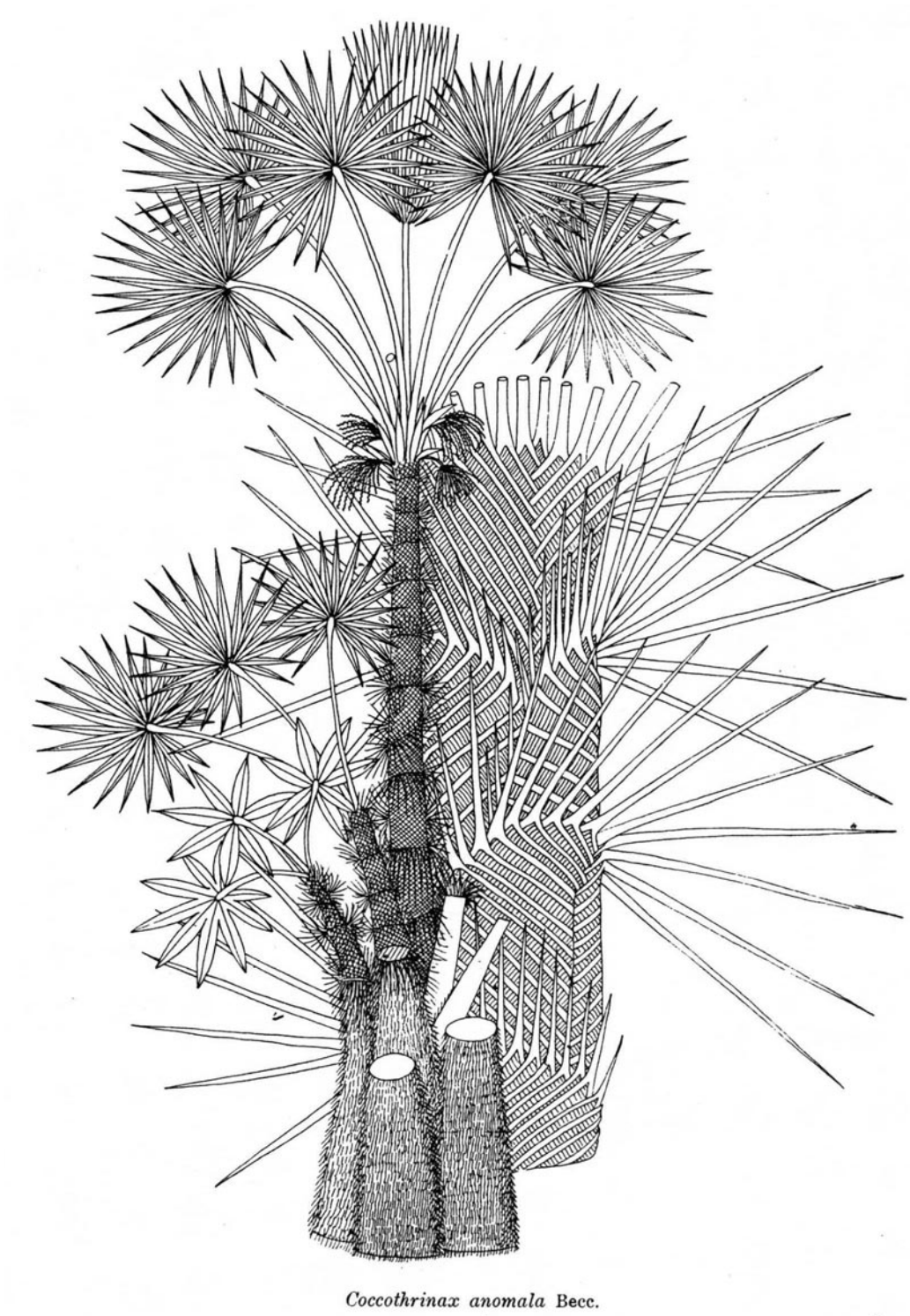
2. Plumier's colored drawing of the leaf sheaths of *Palma dactylifera radiata spinosissima et thoracibus aculeatis munita*. © Muséum national d'Histoire naturelle.

Descourtilz has added spines on one of the petioles in his copy. The reason for this becomes clear when we read Descourtilz's description of the palm. This is obviously based on several different species. He described the flowers as having a three-parted calyx and a corolla of three petals, and six stamens, and the fruits as the size of a lemon and reddish in color. As we shall see later, this is nothing like the Haitian palm. However, Descourtilz did one important thing. He referred the name *Chamaerops antillarum* as a synonym of his *Latanier épineux*. Because Descourtilz's publication came after the work of Linnaeus, where binomials were used instead of polynomials, *Chamaerops antillarum* became the first binomial applied to the Haitian palm.

The next botanist to concern himself with the Haitian palm was the Italian Odoardo Beccari (1843–1920). Beccari was the leading specialist in palms of his day (Moore 1981). In a paper published in 1908, Beccari described several new species of palm from the Caribbean. Amongst these was one that he called *Coccothrinax* (subgen. nov. *Oothrinax*) *anomala*. The specimen on which this was based was sent from Haiti by a German collector, Wilhelm Buch, to the herbarium in Berlin, whence Beccari saw the specimen. This specimen did not include the distinctive leaf sheaths of the Haitian palm, and Beccari did not associate it with the work of Plumier and

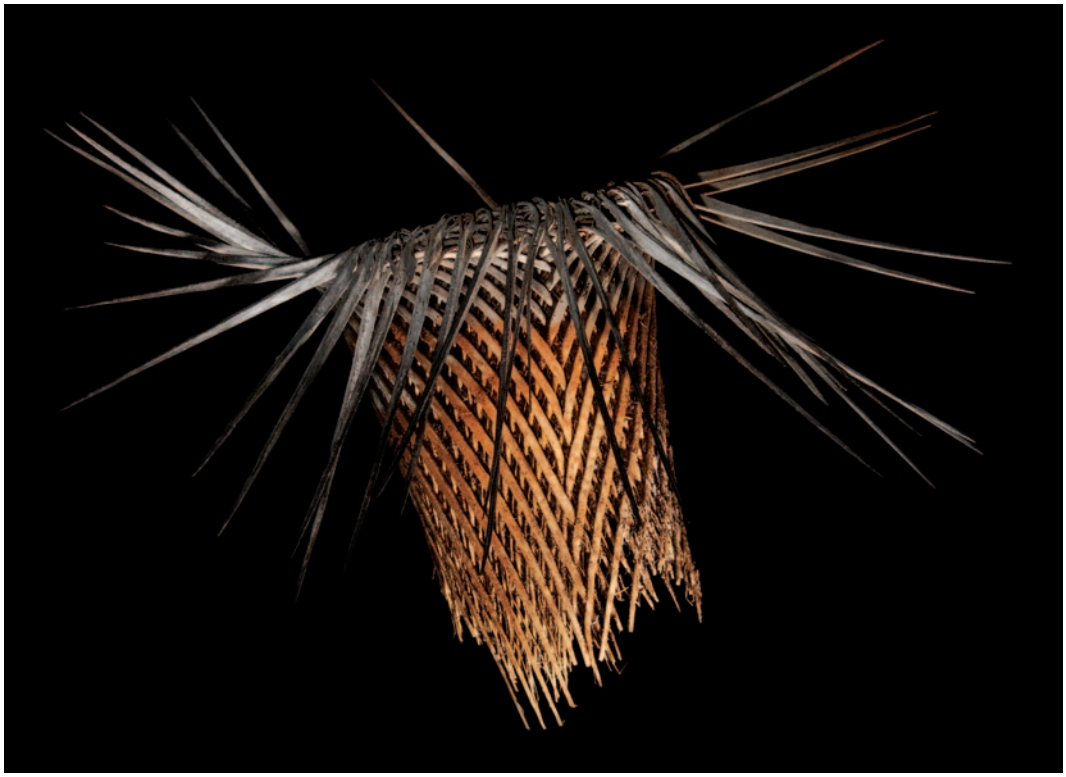


3. Descourtilz's painting of *Latanier épineux*.



4. Combination of Plumier's two drawings from the *Codex Boerhaave*.

Descourtilz. Beccari thought it was an unusual species of *Coccothrinax*, hence his specific epithet, *anomala*. However, Beccari's new subgenus, *Oothrinax*, was not validly published because it lacked a Latin diagnosis. Buch's specimen in the Berlin herbarium was



5. Leaf sheath fibers of *Zombia antillarum* (image by Eladio Fernández).

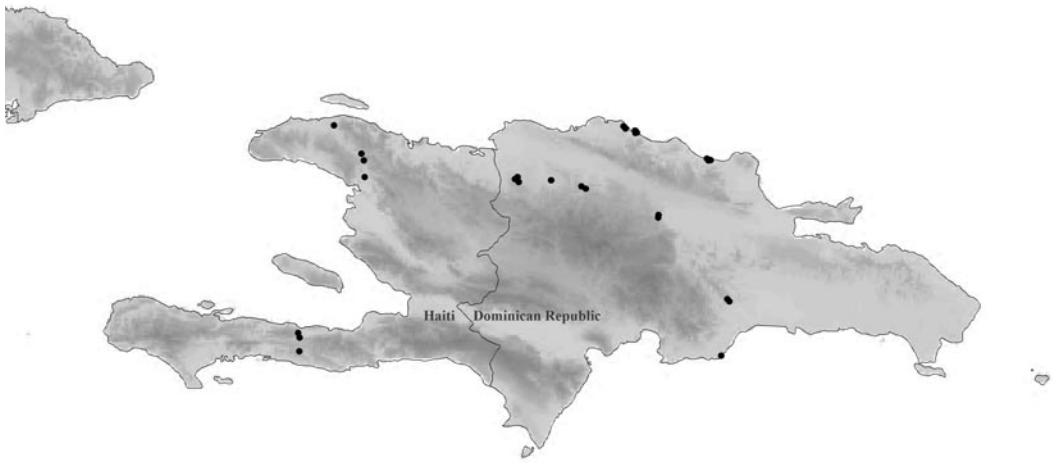
destroyed in the bombing of the herbarium during the Second World War.

It was not only Buch's specimen that was destroyed in the war, but much of the whole herbarium, including a manuscript of the genera of palms by the German botanist Karl Ewald Maximilian Burret (1883–1964). Burret was one of the most prolific botanists who worked on palms, and he described more than 600 new species. Eva Potztal, a colleague of Burret's in the Berlin herbarium, wrote an article on Burret's life and work (Potztal 1965). In 1929 Burret published a paper describing new species of palm from the Caribbean collections of the Swedish botanist, Erik Leonard Ekman. Burret correctly recognized that one of these collections was Beccari's *Coccothrinax anomala*, and he also realized that this was the same as Plumier's *Palma dactylifera radiata, minor, aculeata*. However, Burret overlooked the earlier name for the palm, *Chamaerops antillarum*, and identified the specimen as *Coccothrinax anomala*.

Burret (1929) reproduced Plumier's drawing in his paper. But this was not an exact reproduction of Plumier's work. Because of the importance of Plumier's unpublished drawings, they were studied, and in some cases copied, by several other botanists. Just over 500 drawings were copied in 1733 for a Dutch botanist, Herman Boerhaave. These copies are currently in the library of the University of Groningen in Holland, bound together in two volumes known as the Codex Boerhaave. Here it can be seen that the two Plumier drawings of the Haitian palm were artfully combined into one (Fig. 4), and it is this that Burret reproduced in his paper.

It was the American botanist Liberty Hyde Bailey (1858–1954) who finally brought all the various references to the Haitian palm together. Bailey (1939) reviewed the work of Plumier, Descourtilz, Beccari and Burret and realized that all four were referring to the same palm, that its earliest validly published name was *Chamaerops antillarum* Descourtilz, and that the palm was not a *Chamaerops* but a new genus to which he gave the name *Zombia*. The Haitian palm thus became *Zombia antillarum* (Descourtilz) Bailey, and this is the name by which it is now known.

Bailey had a distinctive style of writing. The opening sentence of his article is: "A strange palm grows on the hills of Haiti." Bailey noted how when preparing the manuscript of the *Zombia* paper he had some doubts about what



6. Distribution of *Zombia antillarum* in Hispaniola.

he had written and decided to make another trip to Haiti (at age 81!) to check some details. He found the palm again on that trip ("I took the zombi again, in fruit") and was able to finish the paper. Bailey described the flowers and fruits in some detail so that we can now see that Descourtilz's description was completely erroneous.

Bailey's paper was not the last word on *Zombia*. This belonged to the American botanist Orator Fuller Cook (1867–1949). Cook was a prolific and somewhat eccentric botanist. He described an alarming number of new genera and numerous new species. There is a trio of papers on Cook published in *Principes* (Correll 1983, Read 1983, Rudd 1983). As Read diplomatically put it "Time and rules of nomenclature have been unkind to many of Cook's described species and genera." In 1941 Cook wrote a paper on the Haitian palm. In typical style, he rambled on at some length (31 pages), casually introduced a new family of palms, used confusing terminology (e.g., subligule, antiligule, etc.), discussed the philosophy of taxonomy and nomenclature, and included sly digs at "Professor Bailey" and "Herr Burret." Cook did not accept Bailey's name *Zombia antillarum,* and instead recognized Beccari's subgenus at the genus level, and thus used the name *Oothrinax anomala*. He also did not accept the earlier name *Chamaerops antillarum*. He correctly pointed out the shortcomings of Descourtilz's (1821) work, considering that Descourtilz's description and illustration were based on several different palms, including *Sabal*, *Copernicia* and *Mauritia*. But what he did not realize was that once the name *Chamaerops antillarum* was published, with a reference to Plumier's drawing, then this became the correct name for the palm, regardless of what else Descourtilz wrote. Cook also discussed the leaf sheath spines (Fig. 5) in some detail. He asked how such an elaborate system of spines evolved when there are no grazing animals in Hispaniola.

We now know that the Haitian palm is in fact widespread in Hispaniola, in both Haiti and the Dominican Republic (Fig. 6), and also that it is endemic to the island. There it grows in scrub or woodland on serpentine, rocky soil, and persists in disturbed areas, at 35–380 m elevation. According to Taylor and Timyan (2004), *Zombia antillarum* is clearly associated with serpentine soils although it is occasionally found on calcareous soils. It seems to occur in several discrete populations, two in Haiti and several in the Dominican Republic. It is not clear if these different populations are different morphologically, but it seems likely. The fruits from one of the Dominican Republic populations are considerably larger than others. A specimen from another Dominican population was described as a new variety of *Z. antillarum*, var. *gonzalezii*, and was said to have fruits differing in shape and color (Jiménez 1960). Unfortunately, the type specimen of this variety has not been located. In general, we have too few specimens with fruits to draw any definite conclusions, and it seems best to recognize one, widespread, variable species.

Joel Timyan (pers. comm.) has recently assessed the conservation status of *Zombia antillarum* and considers it to be threatened,

mostly because of habitat loss and over-exploitation. This is unfortunate because there are several features of the palm about which we know nothing. Bailey (1939) made a few interesting observations on the natural history of *Zombia*. He wrote "It grows in separate or isolated clumps or stools of different ages, the older ones with two or more trunks…… The trunk dies and falls apparently after two or three fruiting periods….". He also commented on the unusual, spiny aerial roots that are produced at the base of the stems.

There remains one loose end to tie up concerning the taxonomy of *Zombia antillarum*. No type was ever designated, so here I designate Plumier's colored drawing (Fig. 1) as the lectotype:

Zombia antillarum (Descourtilz) Bailey (1939: 242). *Chamaerops antillarum* Descourtilz (1821: 135). Lectotype (designated here): Plumier, Botanicon Americanum seu historia plantarum Americanis insulis nascentium, vol. 7, plate 54.

Coccothrinax anomala Beccari (1908: 95). *Oothrinax anomala* (Beccari) Cook (1941: 21). Type: HAITI. No locality, no date, W. Buch s.n. (B, destroyed).

Zombia antillarum var. *gonzalezii* Jiménez (1960: 236). Type: DOMINICAN REPUBLIC. Santiago, near Santiago Rodriguez, no date, J. Jiménez 2590-B (holotype ?).

Acknowledgments

I thank Rafaël Govaerts for his nomenclatural expertise, Joel Timyan for his knowledge of Haitian palms, Max Antheunisse for his help with images, Eladio Fernández for providing Fig. 5, and the Muséum national d'histoire naturelle in Paris for permission to reproduce Plumier's drawings (Figs. 1 & 2).

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Dominican Discoveries

Christine D. Bacon[1,2]*, Teodoro Clase[3,4], Eladio Fernández[3], Xavier Gratacos[5], Andrew Henderson[6] and Oscar Montero[3,4]

Two recent expeditions to the Dominican Republic revealed numerous exciting novelties in palms.

Our new international collaboration has set its goal to create a better understanding of *Coccothrinax*. The genus is in tribe Cryosophileae of subfamily Coryphoideae (Dransfield et al. 2008). Relatedness amongst the genera in Cryosophileae is not well known (Baker et al. 2009, Cano et al. 2018), and much remains to be discovered about the genera of the Cryosophileae. Despite this, it has been shown that *Coccothrinax* is strongly supported as closely related to *Zombia* (they are sister genera; Cano et al. 2018), a monotypic genus endemic to the island of Hispaniola (Dominican Republic and Haiti) in the Caribbean.

[1]*Department of Biological and Environmental Sciences, University of Gothenburg, SE-413 19 Gothenburg, Sweden. christinedbacon@gmail.com*

[2]*Gothenburg Global Biodiversity Centre, SE-413 19 Gothenburg, Sweden.*

[3]*Herbário del Instituto de Investigaciones Botánicas y Zoológicas de la Universidad Autónoma de Santo Domingo, República Dominicana.*

[4]*Departamento de Botánica, Jardín Botánico Nacional Dr. Rafael M. Moscoso, Santo Domingo, República Dominicana.*

[5]*Montgomery Botanical Center, 11901 Old Cutler Road, Miami, Florida, USA.*

[6]*The New York Botanical Garden, Bronx, NY 10458-5126, USA.*

Coccothrinax is a genus of mostly medium-sized palms with palmate leaves that are usually silvery-white on the lower surface. The stems are initially covered by fibrous leaf sheaths that break down into fibrous nets, eventually leaving a bare trunk covered with leaf scars. The leaf sheaths are not split at the base, as they are in other Caribbean genera such as *Hemithrinax*, *Leucothrinax* and *Thrinax*, for example, and this is an important characteristic for field identification of sterile *Coccothrinax* individuals. Flowers are hermaphrodite and fruits are small and fleshy, with seeds that are deeply grooved and resemble a brain (Henderson et al. 1995).

Coccothrinax is the most diverse genus of Caribbean palms (Roncal et al. 2008), and the majority of species are endemic to Cuba. The genus is widely distributed throughout the islands of the Caribbean and in adjacent mainland areas, primarily on limestone or serpentine substrates, sometimes in dry and often exposed highlands, sometimes in valleys and on coasts (Dransfield et al. 2008). A lack of study has led to large variation in the number of species recognized; for example, Henderson et al. (1995) included 14 species in the genus and Govaerts et al. (2020) accepted 56 names. On Hispaniola there are 10 recognized species of *Coccothrinax*, although they remain poorly known (Fernández & Gottschalk 2017).

This lack of understanding of the number of species in *Coccothrinax* has implications beyond taxonomy. Biodiversity conservation

1. A population of *Coccothrinax boschiana*, with its curved stems arching over the Caribbean waters. It is an endangered species according to the local Red List for the Dominican Republic. Photo by E. Fernández.

regulations often require names on taxa before they can be protected. Without accurate understanding of what species are and what populations are included within these species, they cannot be protected by law or interested stakeholders. We cannot protect what we do not know. Currently, the International Union for the Conservation of Species (IUCN) has 11 entries in the Red List of Threatened Species for *Coccothrinax*. *Coccothrinax concolor* and *C. ekmanii* are both data deficient, *C. argentata*, *C. alta* and *C. gundlachii* are categorized as least concern, *C. inaguensis* is near-threatened, and *C. pauciramosa* is vulnerable. *Coccothrinax proctorii* and *C. spritiuana* are endangered and both *C. borhidiana* and *C. jimenezii* are critically endangered. Many more species urgently need information and IUCN categorization. The global Red List can be compared to the local Red List for the Dominican Republic (2011), for example, to see how taxonomy and threatened status may differ. There, we find the data for *C. ekmanii*, an endemic species to Hispaniola, is categorized as vulnerable to extinction, contrasting with the global list, which rates it as data deficient. If the species exists only on the island, then the local conservation assessment should be sufficient to warrant its protection. *Coccothrinax barbadensis* is also categorized as vulnerable to extinction. *Coccothrinax boschiana* (Fig. 1) and *C. gracilis* are both endangered, and *C. montana*, *C. scoparia*, and *C. spissa* (Back Cover) are all critically endangered. Most of these data are non-overlapping, and a comprehensive global Red List assessment is lacking. Clearly, a revision of *Coccothrinax* is urgently needed to understand and conserve these beautiful palms.

With the goals to understand and conserve, we began this project by consulting botanical collections in the herbaria of the New York Botanical Garden, Smithsonian Museum of Natural History and Jardín Botánico Nacional Dr. Rafael M. Moscoso. From this, we noted various issues with the current taxonomy as defined in Govaerts et al. (2020) and identified sites and species to target for more sampling. In December 2021, we traveled to Santo Domingo in the Dominican Republic to meet our local collaborators from the Jardín Botánico Nacional and begin multiple field expeditions with the goals of using morphology and genetics to define species in *Coccothrinax*, write a monograph of the genus with Red List assessments for each species, and produce a new version of the palms of Hispaniola book (Fernández & Gottschalk 2017).

2. *Coccothrinax argentea* with multiple stems collected in Guzmancito, Dominican Republic. Note the cleared pasture field surrounding the plants, highlighting human impact. Photo by E. Fernández.

We started in the Parque de la Biodiversidad, north of Santo Domingo. There we encountered *Calyptronoma rivalis*, *Coccothrinax argentea* and *Roystonea borinquena*. *Coccothrinax argentea* is endemic and widespread in Hispaniola and occurs in a variety of habitats at 0–1,000 m elevation, including dry forest, broad leaf forest, secondary forest or pine forest, and persists in disturbed areas. Indeed, disturbance from human impacts is

3. Christine Bacon and Oscar Montero in Cabrera, standing in pasture with *Coccothrinax* individuals. Photo by E. Fernández.

unavoidable for native species on Hispaniola; for example, Haiti is one of the most deforested places on Earth (Hedges et al. 2018). The impact of humans is likely a confounding factor in most island systems where the legacy of humans has been so strong, since the area is relatively small and geographic isolation is high.

4. The non-split leaf bases of the palms in the population on Morro de Montecristi. Photo by E. Fernández

Another population of *Coccothrinax argentea* was observed by the team in Guzmancito, near the northern coast. This population was distinct because of its clustered stems (Fig. 2), which we had not seen before in the genus. Other palms in the habitats in and around this

5. *Coccothrinax argentea* collections from the Falcondo mine. Photo by E. Fernández.

area are *Bactris plumeriana*, *Coccothrinax fragans*, *Copernicia berteroana*, *Coccothrinax gracilis*, *Pseudophoenix* sp., *Roystonea hispaniolana*, *Sabal causarium* and *Sabal domingensis*.

We then continued north to Cabrera, where we found a few palm individuals distributed in cow pastures along the side of the road (Fig. 3). The hot day drove out the wasps, whose stings left our legs swollen for days. The population appears quite like *Coccothrinax fragrans*, due to the stout stems and large leaves. After further examination of the population, we found it has smaller inflorescences then expected, white fruits, and a small costa at the abaxial base of the leaf, meaning it is slightly costapalmate, leaving us uncertain as to the specific identity of these palms. *Bactris plumeriana*, *Roystonea hispaniola* and *Sabal domingensis* were also seen at the site, forming a lovely assemblage of classic Caribbean species.

We continued to the area of Gaspar Hernandez, where on a small private farm we found a population of *Coccothrinax* with distinct morphological characters in terms of the shape of its leaf segments that had no indumentum abaxially and its erect inflorescences that scarcely projected beyond the leaves. This was a site of an interesting serpentine soil outcrop and unique plant community. In the area we found other palm species such as *Bactris plumeriana*, *Coccothrinax argentea*, *Copernicia berteroana*, *Roystonea hispaniolana* and *Sabal domingensis*.

We also visited the Morro de Montecristi, a fantastic sandstone table-mountain that ends in the bluest of seas. The mountain is extremely arid and harbors endemic species, two species that are found on the mountain and nowhere else in the world – *Salvia montecristina* and *Mosiera urbaniana* (Veloz & Peguero, 2002). What we found, corroborated by specimens in the herbarium in New York, were palms without split leaf bases (Fig. 4) or transverse veins on the leaves, immediately ruling out *Thrinax radiata*. We think this population may be a form of *Coccothrinax fragrans*, or a possible new species, but more work is required to delimit it; particularly genetic data will be important to test its identity with other populations on the island.

On our second expedition to the Dominican Republic in March 2022, we visited a higher elevation area called Resolí. Based on a single specimen (*T. Zanoni, M. Mejía & C. Ramirez 14979*, 24 June 1981, JBSD), we were curious to see this population since it had very thick leaf sheath fibers, distinct from other

6. *Coccothrinax gracilis* from the Los Haiteses National Park, growing on karst surfaces. Photo by Christine Bacon.

Coccothrinax material we had seen. The specimen label said it grew on a "cliff face," but after three independent visits to the locality, we could not find any individuals in the original location based on the coordinates on the label. Not only does the top of the mountain cliff area have an old stone fort on it, but it also has a large antenna and there is a large reservoir at the base of the area, indicating a long and diverse history of human disturbance. We assume the population was eradicated by human activities and is now extinct. Because there is only a single specimen as a guide, it is difficult to say for certain the identity of the plant.

Human impact was also highly evident when we were looking for palms in the pine forests at 300m in the Falcondo nickel mine near Bonao. After donning protective equipment and preparing with a training video for permission to enter and collect in the mine, we headed first to the top of the mountain to work our way down. It is always wonderful to see these mixed forests of temperate and tropical elements, pines and palms mixed, and we were excited to find healthy populations of *Coccothrinax argentea* (Fig. 5). The plants were in full fruit, and we made herbarium collections as well as collected seeds for ex situ conservation in the Jardín Botánico Nacional Dr. Rafael M. Moscoso and the Montgomery Botanical Center.

The big adventure of our second trip was to visit the Los Haiteses National Park, found on the northeast coast of the island. The park harbors habitats varying from dense mangrove stands full of bird diversity to magnificent landscapes of rock formations formed from limestone karst. The park has a diversity of tree species including endemics such as *Tabebuia maxonii* and *Cinnamodendron eckmanii*, as well as large variety of native orchid species. Los Haiteses boasts a wonderful diversity of palms including *Bactris plumeriana*, *Calyptronoma plumeriana*, *Calyptronoma rivalis* and *Prestoea montana* (Mejía et al. 2017). We went to Los Haiteses in search of *Coccothrinax gracilis* (Fig. 6), an appropriate name because of its very graceful appearence. Interestingly we found this population varied between erect stems, rising straight from the rock to the sky with their elegant tuft of fine leaves, to curvy,

7. The group involved in an outreach event at the Jardín Botánico Nacional Dr. Rafael M. Moscoso in Santo Domingo, Dominican Republic in March of 2022.

bending stems, arching out over the water and above the other vegetation. What causes this variation? This same stem variation is noted in another fantastic Dominican species (Fernández and Gottschalk, 2017), of serious conservation concern, *Coccothrinax boschiana* (Fig. 1). This species occurs on the Sierra Martín García in dry forest on similar limestone formations as Los Haiteses, at 30–200 m elevation.

On our second trip we also focused on outreach activities with the Ministry of the Environment, the botanical garden, and the local university. We held a seminar series and workshop focused on palm evolution, cultivation, and identification (Fig. 7). Students and professionals alike were very interested, and we were able to easily use the dichotomous key in Spanish from the Field Guide to the Palms of Colombia (Galeano & Bernal 2010) to identify genera in the botanical garden. Our collaboration between the University of Gothenburg, the New York Botanical Garden, the Montgomery Botanical Center, the Jardín Botánico Nacional Dr. Rafael M. Moscoso and the Ministerio de Medio Ambiente is just beginning, and we are excited about these and future discoveries to be had.

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Livistona victoriae and the North Australian Exploring Expedition 1855–1856

John Leslie Dowe[1] and Ernst Schweizer[2]

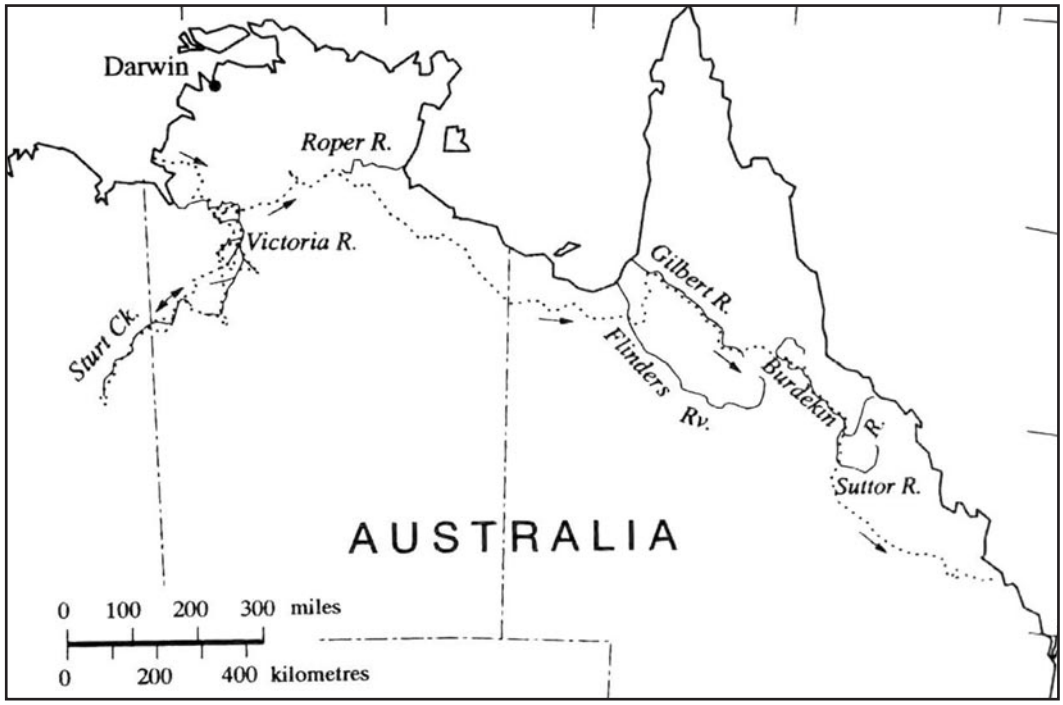
The first botanical collections and pictorial representations of *Livistona victoriae* are connected with the activities of botanist Ferdinand Mueller and artist Thomas Baines during the North Australian Exploring Expedition, 1855–1856. In this article, we bring together the earliest specimens and artworks of the palm for the first time and outline its 140-year taxonomic history.

The oldest recorded specimen of *Livistona victoriae* Rodd was collected as "*Livistona* sp." by botanist Ferdinand Mueller from a palm that he encountered at Victoria River, Northern Territory, Australia, during the North Australian Exploring Expedition, 1855–1856. Although it was later recognized as morphologically distinct, no formal name was proposed (see Jones 1984, Wilson 1992), and it was not until 1998, some 140 years later, that it was formally described and given its present name (Rodd 1998). After the Expedition, Mueller identified the palm as "*Livistona inermis*" and artist Thomas Baines provided the first pictorial representations, as "palm tree of the Victoria."

The Victoria River region is currently one of the most isolated and unpopulated areas in Australia. The ancient landscape through which much of Victoria River winds is dominated by spectacular high cliffs, escarpments, tablelands, buttes and mesas formed by the erosion of a sandstone formation with an estimated depositional age of ca. 840 Ma (Dunster & Ahmad 2013). At 560 km in length, Victoria River is the longest river in the Northern Territory. The river was named for Queen Victoria by Commander John Clements Wickham and Lieutenant John Lort Stokes in December 1839 during their survey of the north and west coasts of Australia (Stokes 1846). It is likely that the survey expedition encountered or at least distantly viewed *L. victoriae* during their forays in search of freshwater in the middle reaches of the river near locations where the palm is known to occur. However, the only references to 'palms' by Stokes (1846) in his account of the expedition were those growing on the banks of the lower reaches of the river and undoubtedly refer to the palm-like *Pandanus aquaticus* F.Muell., a plant that is ubiquitous in riparian environments in northern Australia. *Livistona victoriae* does not occur in such habitats.

[1]*Australian Tropical Herbarium, James Cook University, Smithfield, Qld 4878, Australia. john.dowe@jcu.edu.au*

[2]*P.O. Box 6478, Cairns, Qld 4870, Australia. eschweiz@bigpond.net.au*



1. Overland route of the North Australian Exploring Expedition of 1855–1856, represented by the dotted-line. Taken from Parkin (1996).

The next European exploration of the river was undertaken by the North Australian Exploring Expedition, 1855–1856. This expedition, sponsored by the British Government and the Royal Geographical Society, London, was led by government surveyor Augustus Charles Gregory and was tasked with examining the river and its hinterland to determine suitability for settlement and to ascertain what resources were available (Gregory 1857, 1858). The significance of the expedition was enhanced by the inclusion of scientific and artistic members, including surgeon and naturalist Joseph Ravenscroft Elsey, geologist James Spottiswood Wilson, assistant botanist James Flood, botanist Ferdinand Mueller and artist Thomas Baines (Cohn 1996, Parkin 1996, Gooding 2012). In particular, it is the last two expedition members who are relevant to this paper because of their specific involvement with collecting, documenting and illustrating *L. victoriae*.

The expedition left Sydney on 18 July 1855 in two vessels, the barque *Monarch* and the schooner *Tom Tough*, with a combined complement of 19 men and with provisions to last 18 months. They arrived in the north-west of Australia at Victoria River on 15 September 1855, with *Monarch*, after discharging its cargo of horses and sheep, sailing to Timor and *Tom Tough* remaining as a support vessel. Over a period of almost nine months, the expedition at first explored Macadam Range, 24 September to 12 October 1855 (Gregory 1858) and then the Victoria River catchment to as far inland as 700 km to the brackish/saline Lake Gregory at the edge of the Tanami Desert, 17 October 1855 to 21 June 1856. In late June 1856, the expedition separated into two groups, one of which, led by the artist Baines, sailed *Tom Tough* to Timor (about 750 km to the north-west) to replenish supplies and with a plan to eventually rendezvous in the Gulf of Carpentaria at Albert River with the other expeditioners, including Mueller, who were to travel overland eastward through the headwaters of streams that flow into the Gulf, then southward through central Queensland to end in Brisbane (December 1856) (Fig. 1).

In *Tom Tough*, one of Baines's responsibilities was to safeguard the botanical specimens that had been collected thus far by Mueller during the first phase of the expedition and return them safely to Sydney. However, on Baines's arrival at Timor the authorities declared *Tom Tough* to be unseaworthy, and she was ordered to Surabaya, Java, some 1300 km to the west, to undergo repairs (Baines 1858). After a series

2. Ferdinand Mueller, ca. 1863–1865. Photo by Johnstone & Co., Melbourne. Family collection.

of further adventurous misfortunes (including mutinous behaviour among the crew and physical assaults leading to court cases), the planned rendezvous at Albert River with the overland expeditioners did not take place and Baines finally arrived, in a replacement vessel the brigantine *Messenger*, in Sydney on 31 March 1857, some four months after the return of the overland expeditioners (Baines 1858). During this time, many of Mueller's botanical specimens were either damaged or destroyed (Mueller 1858, Bentham 1863).

Ferdinand Mueller (1825–1896) (later Baron von Mueller) (Fig. 2) was at the time of the expedition the most active botanist working in Australia. He was appointed government botanist for the colony of Victoria in 1853 and had established in Melbourne the foundation of the National Herbarium of Victoria with the personal ambition of elucidating the Australian flora as completely as possible. Mueller intended to visit the Kew Herbarium after the expedition to examine specimens collected by earlier botanists in Australia but remained in Victoria to secure his government position. Meanwhile, George Bentham accepted an

3 (left) . Specimen of *Livistona victoriae* collected by Mueller held at the National Herbarium of Victoria [MEL1059501]. With permission of the National Herbarium of Victoria. 4 (right). Specimen of *L. victoriae* collected by Mueller held at the Herbarium, Royal Botanic Gardens Kew, http://specimens.kew.org/herbarium/K000209792. © The Board of Trustees of the Royal Botanic Gardens, Kew.

5. *Livistona victoriae*, Jasper Gorge. Photo by E. Schweizer.

invitation from William and Joseph Hooker to write a flora of Australia. Mueller subsequently assisted Bentham by lending specimens from Melbourne to Kew (Stafleu 1967, Lucas 2003).

Mueller joined the Northern Australian Exploring Expedition after obtaining a leave of absence from his position of government botanist of Victoria (Cohn 1996). He saw the expedition as an opportunity to gain first-hand knowledge of the tropical Australian flora. After Mueller's return to Melbourne in 1857, he was appointed the additional role of director of Melbourne Botanical Gardens. He remained as government botanist until his death in 1896, but was controversially dismissed as director of the botanical gardens in 1873 (Maroske & Cohn 1996).

In the Macadam Range and Victoria River area, Mueller collected specimens of palms, all identified by him as Livistonas. There are four known surviving specimens, two each are held respectively in the herbaria at Royal Botanic Gardens Victoria, Australia, and Royal Botanic Gardens Kew, U.K. Three of the specimens consist of only a few fruits and small portions of rachillae, and only one has leaf material. Their paucity suggests that they were possibly among those specimens that were damaged in the *Tom Tough* misadventure. Two of the specimens have been identified as *L. victoriae* (Figs. 3 & 4) and the other two as *L. leichhardtii* F.Muell., a name that had been languishing in synonymy mainly under *L. humilis* R.Br. until Dowe (2018) proposed a resolution of the correct identity of that species. An examination of the original description of *L. leichhardtii* indicated that it was the same taxon later described by Beccari (1921) as *L. lorophylla* Becc., a name that is now placed in synonymy under *L. leichhardtii* because of its nomenclatural precedence.

All botanical, geological and zoological specimens collected by participants belonged to the British Government, which sponsored the expedition. Mueller negotiated an agreement under which he was to retain duplicate specimens for his own herbarium in Melbourne. Mueller (1857) wrote that he sent the best and most representative and complete specimens to Kew and kept only fragments or poorer specimens in Melbourne. It is of interest to note that a record survives of the specimens being received by Kew in July 1857, under the names of "*Livistonia inermis* Br." and "*Livistonia*" (RBG Kew 2022). Mueller (1857) considered that the specimens were "so much more useful at Kew than in Australia." This situation may partly explain the poor condition of the specimen of *L. victoriae* (Fig. 3) in the herbarium at Royal Botanic Gardens Victoria and that the better specimen is held in Kew herbarium (Fig. 4). Mueller also noted the difficulties in preparation of specimens in the field, in respect to drying and pressing, and the damage caused by transporting them over long distance by pack-horse. He later also

6. *Livistona victoriae*, Jasper Gorge. Photo by E. Schweizer.

7. Juvenile *Livistona victoriae,* Jasper Gorge. Photo by E. Schweizer.

acknowledged the damage caused by the problems associated with the unseaworthiness of *Tom Tough* (Mueller 1858). As suggested above, the palm specimens from Macadam Range and Victoria River appear to have been among the water-damaged specimens.

In his report on the expedition, Mueller (1858) consistently identified what is now known to be *L. victoria*e as "*L. inermis*." He wrote that "*Livistonia* [sic] *inermis* and an allied species supplied us occasionally with palm-cabbage" and that "the sandstone tableland forms in its

8. Exposed root mass of *Livistona victoriae*, showing the densely aggregated fine roots and evidence of fire. Photo by E. Schweizer. 9. Fruit (semi-desiccated) and seeds of *L. victoriae*, Jasper Gorge. Photo by J.L. Dowe.

endless extent a landscape equally arid and cheerless … *Livistona inermis* gracing now and then its declivities." Mueller did not explain his choice of the name "*L. inermis*," but it can be postulated that the lack of petiole armature (*inermis*, Latin for unarmed) may have been significant as a defining character. *Livistona inermis* R.Br. was one of two palms described by Brown (1810) when he established the genus *Livistona*, the other *L. humilis*. Both were

described from islands in the Gulf of Carpentaria, some 900 km to the east of Victoria River. Of these, the palm from Victoria River with unarmed petioles was the best "fit" for the existing names available to Mueller. Given the unresolved and developing nomenclature of *Livistona* in Australia at the time, it is understandable that Mueller applied the name *L inermis* to *L. victoriae*. Brown's original description of *L. inermis* was very brief, and the main distinguishing character, an unarmed petiole, also applies to *L. victoriae*, at least in juvenile and mature individuals (seedlings have moderate armature on the lower part of the petiole). A subsequent account of *L. inermis* by Martius (1838), based on additional specimens, reiterated that it had unarmed petioles, thus establishing a clear and definable character as part of the circumscription of the species.

As for Mueller's "allied species," this can be interpreted as referring to what he was to later describe as *L. leichhardtii*, which he named in admiration for the lost explorer/botanist Ludwig Leichhardt (Mueller 1865, 1874). In the prologue Mueller (1874, p. 221) highlighted the distinguishing characters of *L. leichhardtii*, including "petiolo spinuloso [petiole thorny] … sinubus foliorum filo destitutis [sinuses of leaves lacking filamentous threads] … floribus minutis [flowers minute] … carpidiis ovatis [fruit ovate]." This description clearly does not apply to *L. victoriae*, Mueller's misnamed "*L. inermis*."

In comparison to *L. leichhardtii*, which Mueller collected at Macadam Range, *L. victoriae* is present throughout much of the lower Victoria River catchment and its tributaries and would have become a familiar sight for the expeditioners during the many months spent there. *Livistona victoriae* (Mueller's "*L. inermis*") and *L. leichhardtii* are readily distinguishable on gross morphology and physiognomy: *L. victoriae* is a tall palm, the leaves have broad rigid segments, the petioles usually unarmed and the fruit are globose; whereas *L. leichhardtii* is a smaller palm, has deeply divided leaves with pendulous narrow segments, the petioles armed with strong spines and fruit are ovoid-ovoid to infrequently pyriform. The two species occupy distinctly different habitats: *L. victoriae* is mostly confined to the bases of sandstone cliffs or escarpments, or associated with watercourses that descend from such formations (Figs. 5–9). In contrast, the preferred habitat of *L. leichhardtii* is in open forests and woodlands and only rarely in confined gorges (Fig. 10). The population of

10. *Livistona leichhardtii,* Explosion Gorge, El Questro Station, Western Australia. Photo by J.L. Dowe.

L. leichhardtii in Macadam Range is the eastern extent of an otherwise wide distribution to the west and is found throughout much of the Kimberley of Western Australia, sometimes forming significant populations. *Livistona victoriae* has a more restricted overall range, occurring in the Victoria River and Keep River areas in the Northern Territory and intermittently, where suitable habitat occurs, through to Bungle Bungle Range in Western Australia where there is a significant population (Dowe & Jones 2011).

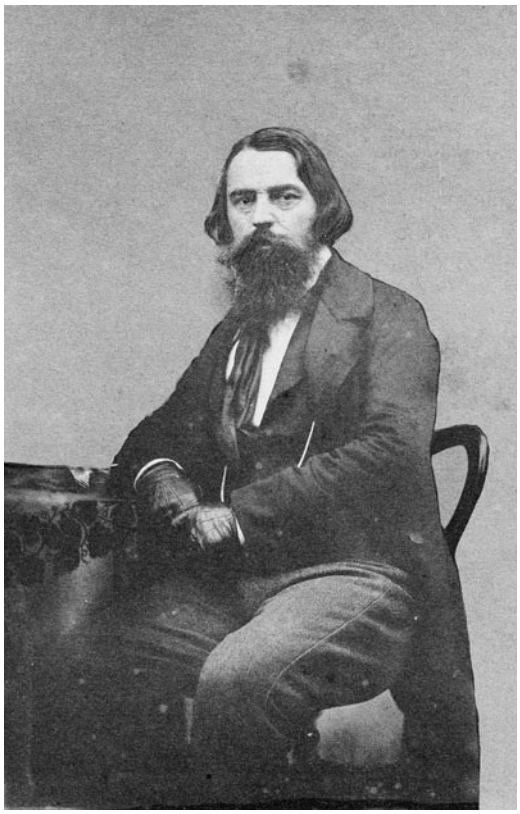
Livistona victoriae occurs in a strongly monsoonal climate, within the latitudinal range of 15–17°S. Rainfall is mostly in the "wet season," December to March, and many of the other months are usually rainless, or with only small totals. Data from Victoria River Downs Station indicates a rainfall average of 654 mm per annum, with 53 rain days. Temperature mean range is 19.5°C–34.6°C. Meeting these ecological requirements presents a challenge for the cultivation of this species. Both species are regularly subjected to low intensity fires.

Ethnobotanical investigations have identified a number of uses of *L. victoriae* by First Nations people in the Victoria River area. The Gurindji people, of the lower catchment, consume the cabbage, which is cut out of the leaf base; they describe it as having a texture similar to cabbage and sweet in taste (Wightman et al. 1994). The Ngarinyman people, of the upper catchment, similarly consume the cabbage, either raw or cooked on hot coals, but also use the leaves to cover meats when cooking, as mats for sitting around their camps and as placemats for food (Smith 1993).

Apart from Mueller's brief references in expedition reports, he did not expand or offer any additional information about the palm that he referred to as "*L. inermis*" from Victoria River. From Mueller's first "discovery" of *L. victoriae*, it took another 140 years for it to be formally described. As noted by Rodd (1998), it was remarkable that *L. victoriae* had remained unrecognized as a distinct species for so long even though it would have been seen by pastoralists and others for nearly one hundred years. *Livistona victoriae* was named by Rodd with the epithet dually recognizing the distribution in the Victoria River area and also Queen Victoria.

Thomas Baines, "artist to the expedition": a pictorial record of *Livistona victoriae*

In addition to Mueller's work on the palms, a significant record of the Victoria River environment and the expedition activities was depicted in the illustrations and paintings produced by Baines, considered as "the most important expedition artist to have worked in northern Australia" (Smith 2012). John Thomas Baines (Fig. 11) was born in King's Lynn, Norfolk, on 27 November 1820. Prior to the North Australian Exploring Expedition, he had been based in South Africa since 1842 as a marine, portrait and "war" painter (McAleer 2014). Because of his reputation as an excellent artist and experienced explorer, he was commissioned by the British Government in 1855 to accompany Augustus Gregory as draughtsman and artist. Baines was also assigned the position of storeman as part of his responsibilities (Gregory 1858, Braddon 1986).



11. Thomas Baines, undated [c. 1855]. Kerry Stokes Collection, Perth, with permission.

During the expedition Baines produced a number of historically important paintings and illustrations that documented activities of the expedition and in particular their mostly friendly, though occasionally hostile, contact with the First Nations peoples of the region (Stiebel 2008). He also illustrated the flora and fauna, as well as general scenery and coastline

12. *Pools of the Victoria in Stokes' Range, Saturday May 55*, watercolour by Thomas Baines, illustrating *Livistona victoriae*. Kerry Stokes Collection, Perth, with permission.

profiles. His oil paintings, mostly worked up later from sketches (Gardiner 1975), were examples of imperial exploration of the time, often depicting the expeditioners as action heroes facing danger and death and operating in a hostile, alien and untamed environment, i.e., fighting crocodiles, subduing the natives and scaling and securing the most rugged and dangerous locations in the landscape. It is for such paintings, depicting successful colonial "conquering" and "British entitlement" that Baines is best remembered (Gooding 2012, Smith 2015). After completing the expedition, he briefly returned to England in 1857, and then to Africa in 1858 to join David Livingstone's Zambesi Expedition, from which he was eventually removed having been accused of theft, apparently falsely (Carruthers 2012). Apart from a few intermittent journeys to England, Baines spent the remainder of his life in Africa (Luckett 1975), struggling as an artist, explorer and occasional botanical collector, but only to die in poverty of dysentery in Durban on 8 May 1875 (Goyder 2016, Stiebel & Carruthers 2019).

Baines produced at least three works that depicted palms in the Victoria River area (Figs. 12 & 13). These, though somewhat stylised, are all recognizable as *L. victoriae*. Only one of the palm sketches has locality details and refers to Stokes Range (Fig. 12), although the distinctive formation depicted has not been identified. He produced no illustrations of *L. leichhardtii*, as he did not join the expedition when traversing Macadam Range (where Mueller collected that species) but remained with *Tom Tough* in Victoria River to tend to the sheep and other logistical tasks (Baines 1858). The two watercolour sketches of *L. victoriae* (Figs. 12 & 13) are in one of four albums of watercolours, wash paintings and pencil drawings completed during the expedition, with a combined total of about 400 individual items. In addition, Baines completed at least 24 oil paintings of the expedition, and these are now held in public and private collections (Birman 1992).

Departing Australia in July 1857, Baines arrived in London in late September (Gardiner 1975). At a meeting of the Royal Geographical Society on 9 November 1857, it was reported that "a series of paintings, from the pencil of Mr. Baines, illustrating the natural scenery of the regions visited by him" during the Australian expedition were on display (Shaw 1858), but whether those depicting *L. victoriae* were

13. *The palm tree of the Victoria, Friday May 55*, watercolour by Thomas Baines, illustrating *Livistona victoriae*. Kerry Stokes Collection, Perth, with permission.

included is not known. Baines's expedition sketchbooks remained in the collection of the Royal Geographical Society until 2015, when they were purchased by the Kerry Stokes Collection, Perth, because of their importance to the history of early exploration of Australia.

Conclusion

Although Ferdinand Mueller was not a palm specialist, his early contribution to the taxonomy of Australian palms was significant. The collections and observations he made during the North Australian Exploring Expedition established a basis on which new palm species were subsequently discovered and described, especially in the genus *Livistona*. Thomas Baines's sketches and paintings of the Victoria River area hold considerable historical importance as they are the first visual record of that part of Australia, depicting the landscape, encounters with First Nations people and at least one species of palm, *L. victoriae*. In this article we bring together the earliest specimens and illustrations of the palm for the first time and outline its 140-year-old taxonomic history.

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