PALMS

Journal of the International Palm Society Vol. 67(4) Dec. 2023

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Palms (formerly PRINCIPES)

Journal of The International Palm Society

Publication of PALMS *is made possible by a generous gift from Drs. Kathleen Grant and Tom Jackson.*

PALMS (ISSN 1523-4495) is an illustrated, peer-reviewed quarterly devoted to information about palms and published in March, June, September and December by The International Palm Society Inc., 1401 Lavaca St. #751, Austin, Texas 78701 USA.

Periodical postage paid at Austin, TX, USA and additional mailing offices. Postmaster: Send address changes to *PALMS*, The International Palm Society Inc.,1401 Lavaca St. #751, Austin, Texas 78701 USA.

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Mailed at Hanover, Pennsylvania 15 Dec. 2023

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This publication is printed on acid-free paper.

Features

THE INTERNATIONAL PALM SOCIETY
Conserve. Learn. Grow.

Inflorescences of *Burretiokentia hapala* are densely covered with thick, short, pale brown hairs giving them a fuzzy appearance. Vallée des Palmiers, Col d'Amos. See article by D.R. Hodel, p. 196. Photo by D.R. Hodel.

FRONT COVER

The crownshaft of *Burretiokentia hapala* has a pale brown-whitish covering. Vallée des Palmiers, Col d'Amos. See article by D.R. Hodel, p. 196. Photo by D.R. Hodel.

BACK COVER

A population of *Chrysalidocarpus nauseosus* east of Ifanadiana in southeastern Madagascar. See article by D. Turk & M. Rakotoarinivo, p. 176. Photo by D. Turk.

PALM NEWS

A large-scale survey of weevil pollination found that weevils are the "most diverse [and] most neglected" brood-site pollinators in the tropics. Brood-site pollination occurs when plants attract insects, which pollinate the flower but also lay eggs in some flowers, bracts or the inflorescence axis. This pollination system has been reported for at least 87 palm species belonging to 26 genera, including *Attalea*, *Chamaerops humilis*, *Elaeis* and *Syagrus*. The paper is open access. Haran, J. et al. 2023. Most diverse, most neglected: weevils (Coleoptera: Curculionoidea) are ubiquitous specialized brood-site pollinators of tropical flora. *Peer Community Journal* 3: e49. 2023. https://peercommunityjournal.org/articles/10.24072/pcjournal.279/#

The poorly known cerrado rupestre habitat of Goiás, Brazil has revealed **a remarkable new species of *Butia***. The new, acaulescent palm is named *Butia soffieae*, in honor of Brazilian botanist Dr Patrícia Soffiatti, known as Soffi to her friends. The new species resembles *B. archeri*, but with staminate and pistillate flowers that are purple, different in size and congested in the rachillae. Two structures were recorded for the first time in *Butia*: scaley trichomes at the base of the pistil and osmophores (fragrance glands) on the staminodes. Unfortunately, the species is Critically Endangered. The paper is open access. Sant'Anna-Santos, B.F. 2023. A new purple-flowered *Butia* (Arecaceae) from the highlands of the Chapada dos Veadeiros (Brazil). *Plant Ecology and Evolution* 156: 383–398. https://doi.org/10.5091/plecevo.110654

The difficulty in determining the age of a mature palm has bedeviled growers, garden historians, foresters and ecologists for decades. Unlike broadleaf trees and conifers, palms do not produce growth rings. Diego Rivera et al. propose **a novel method using statistical methods to estimate the ages of mature palms that have reached their maximum crown dimensions**, provided a group of individuals of known age is available for calibration. Their method uses the ratio of the stem height to crown diameter and produces likelihood distributions of age. The researchers tested their method on *Phoenix canariensis* of known ages cultivated in mainland Spain. The study is open access. Rivera, D. et al. 2023. Expanding dendrochronology to palms: A Bayesian approach to the visual estimate of a palm tree age in urban and natural spaces. *Current Plant Biology* https://doi.org/10.1016/j.cpb.2023.100301

The Discovery of *Truongsonia*

Andrew Henderson[1]

A brief history is given of the discovery of *Truongsonia lecongkietii*, a newly described genus and species endemic to Vietnam.

In May 2020, Dr. Lý Ngoc Sâm of the Institute of Tropical Biology, Vietnam Academy of Science and Technology in Ho Chi Minh City, collected an unusual understory palm from the western mountain regions of Quang Ngãi Province in central Vietnam. Sâm sent images of the palm to me at the New York Botanical Garden. I did not recognize the genus and sent the images to Dr. John Dransfield. John was similarly stumped. It was obvious that the palm was something new, and equally obvious that molecular data were needed to try and identify the palm and its relationships. I was all for getting on a plane and going to Vietnam there and then, but travel restrictions during the pandemic prevented that.

Sâm sent DNA material to Dr. Wolf Eiserhardt at Aarhus University in Denmark. After more COVID-related delays, Wolf was finally able to sequence the material and compare the sequences with other palms. The results of the comparison were so surprising that Wolf, thinking there must be some mistake, re-sequenced the sample. He then sent the sample to Dr. Sidonie Bellot at Kew Gardens in London for an independent confirmation. Sidonie, who was working with Dr. Bill Baker on a phylogeny of arecoid palms, and helped by Jason Stevenson in the lab, was able to confirm Wolf's results. The Vietnam mystery palm (as it had become known) was indeed a new genus, and, most amazing, closely related to the West African genus *Podococcus*! Bill's reaction, on seeing the results of the molecular analysis: "Bloody hell. Seismic."

The next stage was to begin describing the new palm. In October 2022 I visited Ho Chi Minh City and met with Sâm. Together we drew up a preliminary description of the palm. This was followed by much discussion with John, Bill, Sidonie, and Wolf on a suitable name for the new genus. We eventually agreed to name it after the Truong Son range, the name of the mountains that run along the western side of Vietnam. The species was named for Professor Lê Công Kiêt of the Vietnam National University in Ho Chi Minh City, in honor of

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1. Habit of *T. lecongkietii*.

2 (top). The inflorescence of *T. lecongkietii*. 3 (bottom). Fruits of *T. lecongkietii*.

4. Habitat of *T. lecongkietii*.

his long-time contribution to Vietnamese botany. So, the Vietnam mystery palm became *Truongsonia lecongkietii*.

I then returned to New York and sent a specimen to Kew Gardens in London. Bill and John then revised the preliminary description and arranged for Lucy Smith to do a diagnostic drawing of the palm. The paper, with Sâm's photographs and Lucy's drawing, was submitted to the journal *Phytotaxa* in May 2023 and published in September (Lý et al. 2023, available at https://phytotaxa.mapress.com/pt/article/view/phytotaxa.613.3.1).

Because *Truongsonia* was so unusual it required its own tribe, the Truongsonieae, to accommodate it. This tribe is embedded in a broader group including three other tribes, the Podococceae (with one genus *Podococcus*), the Malesian and Madagascar Oranieae (with one genus *Orania*) and the West African Sclerospermeae (with one genus, *Sclerosperma*). This group, nicknamed the POST clade, is very strongly supported by DNA data, even though the genera within it are morphologically very different from one another. The arrival of *Truongsonia* in the POST clade only makes it all the more strange.

Truongsonia has short, saxophone-shaped stems, open leaf sheaths, and small, simple, bifid leaves (Fig. 1). Inflorescences are branched with a few slender rachillae (Fig. 2). Male flowers have six stamens and the female flowers have triovulate, tricarpellate ovaries. The fruits are ellipsoid and bright red in color (Fig. 3). It is known only from a very limited area in Quang Ngãi Province. Here it grows in understorey vegetation on steep slopes near streams in primary, evergreen, broad-leaf forest at about 1,000 m elevation (Fig. 4). Sâm recorded that he saw only 10–15 plants in an area of less than 500 ha. Its tiny population size and the threats that it faces from human activities render the species Critically Endangered by IUCN standards.

So how did this small, unprepossessing palm come to be growing in a tiny area of forest in central Vietnam? And how can it be related to the West African *Podococcos*, to which it bears almost no morphological resemblance, and from which it is separated by more than 10,000 km? In our paper, we considered that it represented a relict of a previously wider distribution. The ancestors of *Truongsonia*, *Podococcus*, *Orania* and *Sclerosperma* may have originated in South America and spread into

Eurasia in the Paleocene, and from there to Africa during Eocene times. All that remains of this ancient group of palms are the scattered remnants that we see today.

Acknowledgements

I thank Dr. Lý Ngọc Sâm for making his images available for this article.

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Lý N. S., W. Baker, S. Bellot, J. Dransfield, W. Eiserhardt and A. Henderson. 2023. *Truongsonia* (Arecaceae: Arecoideae: Truongsonieae)—a new palm genus and tribe from Vietnam. Phytotaxa 613: 201–212.

PALM LITERATURE

USOS DE LAS PALMAS EN LATINOAMERICA – N.L Sander, M.T. Pulido Silva, C.J. da Silva (eds.). Sociedade Brasileira de Etnobiologia e Etnoecologia, Curitiba, Paraná, Brazil. 2023. Digital. ISBN 978-65-251-4374-3. PDF (in Spanish) free to download at https://www.editoracrv.com.br/produtos/detalhes/37755-usos-de-las-palmas-en-latinoamerica

The book offers a broad overview of the Arecaceae in tropical America through nine countries: Argentina, Bolivia, Brazil, Colombia, Costa Rica, Honduras, Mexico, Panama and Peru. The interesting thing about this publication is the approach it takes from ethnobiology and ethnoecology regarding human relationships with nature in the case of the extensive botanical family of palms. They have a very elaborate cultural use among the native peoples and among the inhabitants who arrived later in tropical America (ethnobotany, ethnobiology) as well as the important roles they play in the mainly tropical ecosystems of Latin America where human beings also live (ethnoecology).

It is also interesting to note that some of the selected palms have an important cultural use in most of the nine countries, such as *Acrocomia aculeata* and *Acrocomia totai* (except for Colombia and Peru). In Peru, no populations have been recorded, but further research could show important findings, as was the case with the genus *Parajubaea*. Other genera like *Attalea* (except for Argentina and Costa Rica) and *Euterpe* (except for Argentina, Mexico and Panama) also have a broad cultural use. Those of the genus *Bactris* do not appear to have a more widespread cultural use (Mexico and Argentina do not have them, Brazil and Panama do not mention them having an important cultural use. The curious thing is that Brazil has abundant populations of *Bactris*).

The tables on cultural uses of palms in each country have the merit of presenting for the first time a systematization of ethnobotany in terms of knowledge of the palm family for the nine cases presented. The maps with the different ecoregions of the countries mentioned augment the text and provide a clearer picture.

It is important to encourage works such as this one that help to have a regional or continental vision of the knowledge of flora, fauna, and ecosystems. For the Amazon biome of South America or the Mesoamerican corridor, it is very important to join efforts in the knowledge, protection and sustainable management of ecosystems, given their importance for the continent and the planet.

I have no doubt that this work will be very well received in the world of scientific knowledge, particularly in regard to the palm family and its relationship with human beings.

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The Identity of *Dypsis* Orange Crush

John Dransfield[1]

The identity of a species of *Chrysalidocarpus* widely cultivated as *Dypsis* Orange Crush is resolved.

About fifteen years ago a handsome large species of *Chrysalidocarpus* (as *Dypsis*) grown from seed from Madagascar, started to reach maturity in Hawaiian gardens. The palm, particularly when young, often has a striking yellow or orange crownshaft and soon acquired the moniker, *Dypsis* Orange Crush (Figs. 1–3). Bo-Göran Lundkvist recalls how sometime in 2003 to 2005 or so, Pauleen Sullivan and Don Tollefson were visiting his garden, and as they came upon the palms with their intensely orange crownshafts, Don instantly said, "We should call them *Dypsis* Orange Crush." This ended up being a very catchy name. Fragments of inflorescence and fruits sent to Kew by Bo-Göran suggested that the palm was close to, if not identical to, *Chrysalidocarpus pilulifer* (known then as *Dypsis pilulifera*, until the recent genus delimitation changes of Eiserhardt et al. [2022]), a variable widespread species that occurs throughout upland forest from central to northern Madagascar. In particular, the small pea-like fruits with homogeneous endosperm seemed a perfect match for *C. pilulifer*. Furthermore, a photograph taken by David Cooke, reproduced in *Palms of Madagascar* (Dransfield & Beentje 1995) of an individual of *C. pilulifer* from Marojejy displays an orange crownshaft. However, true *C. pilulifer* seems always to have irregularly arranged leaflets whereas Orange Crush has regularly arranged leaflets. In addition, Orange Crush lacks a petiole, and the basal pinnae are pendulous, which is not the case in *C. pilulifer*. Crownshaft color has proved not to be a particularly useful character for distinguishing these large *Chrysalidocarpus* from Madagascar. Not only is it inconsistent in Orange Crush itself, older and even some younger palms often having green crownshafts (Fig. 4), but also other species such as *C. pilulifer* and *C. hovomantsina* frequently have brightly colored yellow or orange crownshafts, especially when sheaths are newly exposed.

When I identified Orange Crush as *Chrysalidocarpus pilulifer*, growers were quick to point out these discrepancies (Figs. 1 & 5). The palm cultivated and distributed by Floribunda Palms as *Dypsis* Jurassic Park has recently been shown to be a good match for *C. pilulifer*. So, what is Orange Crush? Is it an

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undescribed taxon, or can it be matched with something already described?

In *Palms of Madagascar* (Dransfield & Beentje 1995) we considered *Chrysalidocarpus paucifolius*, described from Analamazaotra, to be a synonym of *C. pilulifer* (under *Dypsis pilulifera*). However, there are discrepancies between the two taxa. The protologue of *Chrysalidocarpus paucifolius* clearly describes a palm with no petiole and with the first few leaflets pendulous "as in *Neodypsis basilonga*" (= *Chrysalidocarpus basilongus*) (Jumelle 1922). Orange Crush lacks a petiole, and the basal leaflets are long and pendulous, just as described by Jumelle for *C. paucifolius*. These vegetative characters are very suggestive that Orange Crush is *C. paucifolius*. *Chrysalidocarpus paucifolius* is also clearly described as having equidistant leaflets, this also in Orange Crush, whereas *C. pilulifer* has fascicled leaflets. Adding to the potential for confusion, *C. pilulifer* also occurs in Analamazaotra, Andasibe and environs and can have newly emerged sheaths colored orange-yellow (Fig. 5), but more often has green sheaths (Figs. 6 & 7).

Apart from the type specimen of *C. paucifolius* I have seen no good herbarium material from Madagascar that can be matched with this taxon. I looked for *C. paucifolius* at Andasibe in 2016, but the palm I observed and collected matches *C. pilulifer* rather than *C. paucifolius*. Herbarium material of Orange Crush matches well with the type of *Chrysalidocarpus paucifolius*.

I here remove *Chrysalidocarpus paucifolius* from synonymy with *C. pilulifer* and accept it as a distinct taxon, corresponding to the palm known in cultivation as Orange Crush. I provide an extended description based on the type material and the protologue of *C. paucifolius* together with material of the so-called Orange Crush recently collected in Hawai'i.

Chrysalidocarpus paucifolius *Jumelle*, Ann. Inst. Bot.-Géol. Colon. Marseille, Sér. 10, 3: 9 (1922); Jum. & H.Perrier, Fl. Madagascar 30:102 (1945). Type: Madagascar, Analamazaotra, *Perrier 12004* (Holotype P; photos K).

Tall, canopy palm with stems to 20–25 m tall, 16–22 cm diam., leaves (4–6)–9 in crown, tristichously arranged. Crownshaft ca. 1.5 × 0.4 m, sheaths green to yellowish-green or bright orange, the color more intense in newly exposed sheaths, with scattered caducous dark

1. A grove of *Chrysalidocarpus paucifolius* in the Lundkvist Palm Garden, 2010. Photo by B.-G. Lundkvist.

2. Semi-mature specimens of *Chrysalidocarpus paucifolius* and one individual in flower, Lundkvist Palm Garden, 2010. Photo by B.-G. Lundkvist.

3. The striking orange color that can be displayed by *Chrysalidocarpus paucifolius*, Lundkvist Palm Garden, 2010. Photo by B.-G. Lundkvist.

brown scaly indumentum, particularly towards the mouth of the sheath. Leaf 2.5–4.8 m long; petiole very short or effectively absent; rachis ca. 5 cm wide at base, tapering distally, with scattered inconspicuous pale brown scales; leaflets ca. 118 on each side of the rachis, very close and regularly arranged throughout, reins persistent, conspicuous, basal-most leaflets long pendulous, ca.150 × 2 cm, mid leaf leaflets to ca. 160 × 3.5–4 cm, apical leaflets to ca. 55 × 2 cm, all leaflets adaxially glabrous, abaxially with very thin white wax and scattered very

4. Variation in the color of the crownshaft displayed by *Chrysalidocarpus paucifolius*, Lundkvist Palm Garden, 2010. Photo by B.-G. Lundkvist.

narrow dark ramenta on the midrib alone. Inflorescence infrafoliar, to 2 m long, pendulous, branched to 3 orders, all axes creamy-white, with ca. 30 primary branches, the longest basal primary branch 140 cm long; prophyll 2-keeled, ca. 80 × 20 cm; peduncular

5. *Chrysalidocarpus pilulifer*, near Andasibe, displaying brilliant orange newly exposed sheaths; note also the fascicled leaflets Photo by J. Dransfield 2016.

bract not seen; rachillae pendulous, to ca. 70 cm long, ca. 5–6 mm diam. at the base, tapering to 2 mm diam. distally, bearing triads in the basal 2/3 and staminate flowers towards the very tip, glabrous; rachilla bracts very short forming low ridges subtending flower groups. Staminate flower in bud 3.5 × 2 mm; sepals 1.5 × 2 mm, keeled, imbricate, glabrous; petals

6. *Chrysalidocarpus pilulifer*, near Andasibe, with green sheaths. Photo by J. Dransfield 2016.

valvate, 3 × 2.5 mm, reflexed at anthesis, glabrous; stamens 6, filaments inflexed and folded in bud, at anthesis unfurling and somewhat zigzag, to 3 mm long, anthers 1 × 0.5 mm basifixed in bud but pendulous at anthesis; pistillode conspicuous, columnar and irregularly angled, 2.5 × 0.75 mm. Pistillate flower bud rounded, 3 × 2 mm; sepals imbricate, rounded, glabrous 2.5 × 2 mm; petals similar but smaller; staminodes 3, toothlike, minute; ovary 2 × 1 mm. Fruit spherical, 5–7 mm diam., epicarp smooth,

7. *Chrysalidocarpus pilulifer*, near Andasibe, detail of dead inflorescence. Photo by J. Dransfield 2016.

green turning black, mesocarp ca. 0.5 mm thick, thinly fleshy, endocarp smooth. Seed 4–5 mm diam., with homogeneous endosperm; embryo sub-basal.

SPECIMENS EXAMINED: Madagascar, Analamazaotra, without date, *Perrier 12004* (Holotype P; photos K). Cultivated: USA. Hawai'i, Island of Hawai'i, Mountain View,

Floribunda Palms, Jan 2023, *W.J.Baker with J. Marcus and S. Marcus 1476*; Lelani Estates, *B.-G. Lundkvist s.n.*, 2014 (K).

I have now seen many individuals of *Chrysalidocarpus paucifolius* in cultivation in Hawai'i. In general, this is a moderately robust single-stemmed palm, most distinctive in the combination of the very short or absent petiole with the regularly arranged somewhat pendulous leaflets, the basal-most conspicuous long and pendulous. The orange crownshaft that excited so much admiration and interest is unfortunately not consistent, with some individuals losing the bright color as they have aged and some never possessing it at all.

Acknowledgments

My particular thanks go to Bo-Göran Lundkvist for alerting me to the existence of Orange Crush, for sending material of flowers and fruit, for allowing reproduction of his photographs and for explaining the origin of the name Orange Crush. Bill Baker and Jeff and Suchin Marcus provided further herbarium material from palms cultivated at Floribunda Palms in Hawai'i. Bill's visit to Hawaii was funded by the Merwin Conservancy and the Hawaii Island Palm Society.

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Jumelle, H. 1922. Les *Chrysalidocarpus*, palmiers de Madagascar. Annales de l'Institute Botanique-Géologique Coloniale de Marseille, Sér. 10, 3: 5–32.

Masoala rasabotsyi, a New Species from the Ranomafana Arboretum, Madagascar

Dan Turk[1] and Mijoro Rakotoarinivo[2]

This paper describes a new palm in the genus *Masoala* from southeastern Madagascar, here named as *Masoala rasabotsyi*.

In 2005, in the process of establishing the Ranomafana Arboretum, near Ranomafana National Park in Ifanadiana district, southeastern Madagascar, it was decided to plant palms from across Madagascar to augment the *ex situ* collection of endemic Malagasy trees already growing there in tree trials planted in 1994. As part of this effort, a small palm seedling first collected in ca. 2002 from between Ifanadiana and Kianjavato was planted in the Arboretum in 2006. As it grew to be tree-sized, it became apparent that this palm was odd. John Dransfield once saw it and remarked that it might be an aberrant *Ravenea*, aberrant because it had the vegetative form of the genus, but the base of its leaf sheaths lacked fibers, which are characteristic of most species of the genus. When the palm flowered for the first time in late April 2019, it was immediately apparent that it was something new, and Dan Turk made a collection. The presence of a few female flowers in the middle of triads at the proximal end of some of the rachillae otherwise covered with numerous male flowers confirmed that it could not be *Ravenea*. The latter consists of dioecious taxa that have strictly unisexual inflorescences (Beentje 1994, Dransfield & Beentje 1995).

The appearance of the female flowers suggested those of species in the genus *Masoala*: size of the flowers, the strong cup-shaped perianth around the ovary and the apparently terminal stigmatic remains (Jumelle & Perrier de la Bâthie 1945, Dransfield et al. 2008). This was later confirmed when the developing fruits had apical stigmatic remains. *Chrysalidocarpus*, *Dypsis*, *Lemurophoenix*, and *Vonitra* have basal or subbasal stigmatic remains and *Marojejya* has subapical, lateral, or subbasal stigmatic remains (Eiserhardt et al. 2022). The fruits of this new species are very similar to those of *Masoala madagascariensis*. One of the most striking features is the shape of the inflorescence, which arches out from the leaf sheaths and then hangs vertically, perpendicular to the ground.

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1. *Masoala rasabotsyi* at the Ranomafana Arboretum, May 2019. Photo by D. Turk.

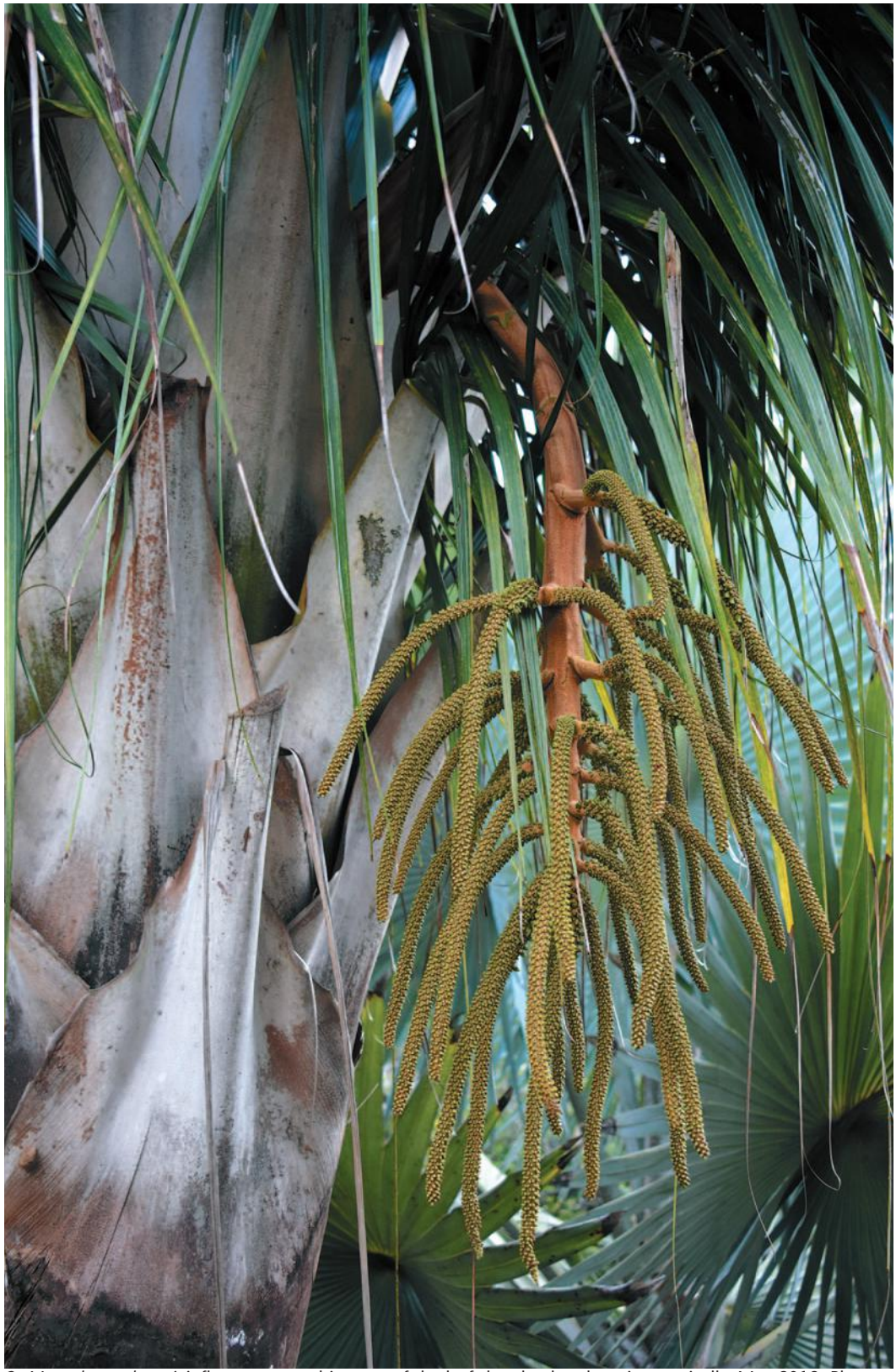
2. *Masoala rasabotsyi*: cream-colored indumentum on leaf sheaths, petioles, and leaf rachis, May 2019. Photo by D. Turk.

Masoala is a genus initially described from a palm collected by Perrier de la Bâthie in 1912, in the Marambo area of the Masoala Peninsula, northeastern Madagascar (Perrier de la Bâthie & Jumelle, 1945). Later, when Dransfield & Beentje (1995) prepared *The Palms of Madagascar*, a second species was found in the southeast, suggesting that the genus has quite a large but fragmented distribution range. The discovery of this new species of *Masoala* now brings the number of species in the genus to three. The new species differs from *Masoala kona* Beentje by the form of the inflorescence and by having leaves that are strictly pinnate rather than partially entire or with a few broad leaflets. It differs from *Masoala madagascariensis* by having dense cream-colored indumentum on the abaxial side of the leaf sheaths, petioles and much of the leaf rachis, along with the different form of the inflorescence. We here describe it as a new species.

Masoala rasabotsyi *D.Turk & Rakotoarin.*, **sp. nov.**

Large solitary palm, with pinnate litter-trapping leaves and interfoliar inflorescences, resembling *Masoala madagascariensis* Jum. but differing from it by having an inflorescence hanging vertically and having leaf sheaths with dense cream-colored indument on the abaxial side. Type: MADAGASCAR, Vatovavy Region, District of Ifanadiana, Rural Commune of Ranomafana, Ranomafana Arboretum, 1 May 2019, *Turk et al. DT2019/01* (Holotype K, isotype TAN).

Large solitary palm. Stem ca. 2.5 m tall, ca. 26 cm in diameter at breast height; internodes short, 3–7 cm apart (Fig. 1). Leaves ca. 20 in the crown, pinnate, straight in a shuttlecock, twisted and arched near end, spirally arranged; leaves 3.38–3.53 m long; leaf bases persistent and litter trapping around the crown part; sheath 79–89 cm long, open, edges thin and somewhat flared and undulate, abaxial side dull green, covered in cream-colored indument (Fig. 2); petioles 7–9 cm long, flat, glabrous and dull green on the adaxial side, convex and covered in cream-colored indument on the abaxial side; leaflets regular, broad, flat, 88–97 leaflets per side of the rachis, evenly spaced, green above and below; proximal ca. 87 × 2.5 cm, median ca. 104 × 4.5 cm; apical ca. 37 × 2.5 cm. Inflorescence solitary, interfoliar, arching out from the leaf sheaths, then hanging vertical (Fig. 3); up to 105 cm long including peduncle and rachis, branched to 2 orders at the base, peduncle covered in dense woolly tawny pubescence, 67 cm long, ca. 4.5



3. *Masoala rasabotsyi*: inflorescence arching out of the leaf sheaths then hanging vertically, May 2019. Photo by D. Turk.

4. *Masoala rasabotsyi*: tawny pubescence on inflorescence, May 2019. Photo by D. Turk.

× 2.3 cm; prophyll ca. 85 × 10 cm, abaxial surface densely pubescent; peduncular bract ca. 74 × 9 cm, including a narrow beak 12 cm long to a sharp point; 7 smaller peduncular bracts, roughly triangular in shape, green, the proximal the largest, 5.5 × 6.5 cm long, gradually getting smaller with the most distal being 4.5 × 0.7 cm long; rachis ca. 35 cm long, covered in dense woolly tawny pubescence extending to the rachillae (Fig. 4); 21–23 first order branches, up to 5 proximal first order branches with short bare portion bearing second order branches; rachillae stiff, 13–37 × 0.8–1 cm, densely pubescent at the base but glabrous or nearly so at median and apical parts. Flowers small, unisexual, in triads in the proximal two thirds of the rachillae and only staminate in the apical part; flowers in pits, continuously arranged in spiral along the rachillae. Staminate flowers, sepals 4.2–4.8 × 2.9–3.2 mm, keeled, acute, emarginate; petals, 6.4–7.9 × 4.8–5mm; stamens 6, anther 2.8–3.7 × 1.4–1.5 mm (Fig. 5). Pistillate flowers, sparse, female buds larger than those of male buds on either side (Fig. 6), sepals 4.5–5 × 3.1–3.5 mm. Fruits dull green, when young, ca. 25 × 12 mm, with apical stigmatic remains (Fig. 7).

Specimen examined: Madagascar, Vatovavy Region, District of Ifanadiana, Rural Commune of Ranomafana, Ranomafana Arboretum, 1 May 2019, *Turk, D., Tsehenoarizaka J.G., Razafindrabaonirina, J., Rafanomezantsoa C., & Tanjononizaka C. DT2019/01* (K, TAN).

Etymology: The specific epithet honors Rasabotsy François (Fig. 8), a former logger turned conservationist, who helped establish the Ranomafana Arboretum and has contributed much to the maintenance of its palm collection. He has also served as a mentor to a new generation of young people working to preserve Madagascar's amazing biodiversity.

Common name: not known.

Distribution: known only from the individual cultivated at the Ranomafana Arboretum. The species was planted from a seedling collected in forest from between Ifanadiana and Kianjavato in ca. 2002.

Notes: The genus *Masoala* now contains three species: the type species, *M. madagascariensis*, is from northeastern Madagascar, between Antanambe (Mananara Avaratra) and Marojejy, including the Masoala peninsula that gives the genus its name; the two subsequent species, *M. kona* and *M. rasabotsyi*, are both from southeastern Madagascar. The Ifanadiana region in southeastern Madagascar looks to be the center of diversity for the genus.

5. *Masoala rasabotsyi*: staminate flowers and buds, May 2019. Photo by D. Turk.

6. *Masoala rasabotsyi:* larger female buds in triads between smaller male buds in the proximal part of some rachillae, May 2019. Photo by D. Turk.

7. *Masoala rasabotsyi:* fruits, January 2022. Photo by D. Turk.

Very few female flowers and buds were present on the first two inflorescences produced by the *Masoala rasabotsyi* at the Ranomafana Arboretum in May 2019. The palm subsequently produced several inflorescences each year. These were larger than the first two inflorescences and had more numerous female flowers. Although young fruits developed, they gradually dropped off with none appearing to reach maturity until January 2022. Unfortunately, no seeds from those fruits have germinated.

Key to the species of *Masoala*, modified from Dransfield & Beentje (1995)

1. Leaves irregularly divided, basal part large and multifold, upper part neatly divided . . . . . *M. kona*

1. Leaves pinnate, with more or less equal leaflets along the leaf rachis 2

2. Leaf sheath and leaf rachis pubescent, sparsely scaly or with sparse tomentum in some places, inflorescence erect . . . . . *M. madagascariensis*

2. Leaf sheath and rachis covered with dense cream-colored tomentum on the abaxial surface, inflorescence pendant . . . . . *M. rasabotsyi*

Conservation: *Masoala rasabotsyi* is currently only known from a single tree that was planted in the Ranomafana Arboretum. No precise location where it occurs in the wild is known, other than the information that it occurs somewhere between Ifanadiana and Kianjavato, in the southeastern part of Madagascar. Recent efforts to locate the species in the wild have failed, though one trip did turn up a population of about 50 individuals of *Chrysalidocarpus nauseosus* (Jum. & H.Perrier) Eiserhardt & W.J.Baker (Back Cover). The fact that no population of *Masoala rasabotsyi* in the wild is currently recorded despite extensive exploration around Ifanadiana during the last decades, suggests that this palm is likely highly threatened with extinction. Its conservation status is uncertain, as the current available data are not enough to conduct a complete assessment of the risk of extinction of the species. Finding a wild population is urgent for the preservation of this new *Masoala* species. Additionally, getting new seeds to germinate and getting more trees into cultivation are important as a storm could possibly kill the single known palm and possibly make the species extinct. A close call happened in 2022 when cyclone Batsirai passed close to Ranomafana, knocking over a

8. Rasabotsy François with *Masoala rasabotsyi*, May 2019. Photo by D. Turk.

Chrysalidocarpus decaryi within a few meters of the *M. rasabotsyi*.

Acknowledgments

The authors thank John Dransfield for discussion and reviewing the manuscript, and for his continuous support on the study of the palms of Madagascar. Mijoro Rakotoarinivo expresses gratitude to the Royal Botanic Gardens Kew and the "TFT Today's Flora for Tomorrow" project for providing funds for his visit to Kew for the completion of this publication.

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Palm Profile

Masoala madagascariensis

Masoala madagascariensis in flower. Photo by Suchin Marcus.

Masoala madagascariensis has flowered for the first time in the palm collection at Floribunda Palms and Exotics, Hawaii. I bought one seedling of this rare Madagascar species in 1993. In 2003 the palm was large enough to be planted in the ground. Now 20 years later it has produced its first inflorescence. This is clearly a really slow growing palm but patience has been rewarded with a truly magnificent specimen. The differences between this species and the newly described *M. rasabotsyi* are strikingly displayed in these photographs.

Jeff Marcus
Floribunda Palms and Exotics, Big Island, Hawaii, USA

Jeff Marcus standing by his flowering *Masoala madagascariensis*. Photo by Suchin Marcus. Inset: Close-up of female flowers of *M. madagascariensis*.

The Pharaoh's Sandal, Unraveling the Palm Leaf Anatomy of a 3750-Year-Old Egyptian Sandal

Fred Stauffer[1], Matteo Auger-Micou[2], Didier Roguet[1] and Bernadette Rey-Bellet[3]

New and fascinating techniques, including X-ray computed tomography, ancient DNA extraction and molecular and histological analyses are increasingly being used to address unresolved questions in disciplines ranging from natural and social sciences to art and history (Estrada et al. 2018, Kobayashi et al. 2019, Przelomska et al. 2020, Orlando et al. 2021). Egyptology, defined here as the study of pharaonic Egypt (spanning the period between 4500 BCE to 641 CE), has always been considered as one of the most fascinating historical research fields. New and often interconnected techniques are being explored in order to understand better what everyday life looked like during the three major kingdoms spanning more than 1600 years of human history.

Several publications (i.e., Greiss 1948, Chadefaud et al. 1990, Barakat & Abd-el-Aziz 2010, Alya Abd El-Ghany et al. 2016) have described the important role played by palms during Ancient Egyptian times providing food, medicines, and raw material for the manufacture of a large diversity of handicrafts, shelters and constructions. Moreover, their presence in several tombs, both as physical objects (fruits or artifacts) or depicted in wall paintings, testifies to their overall presence in nature or crop gardens, and highlights their major role in daily life and in sacred uses and ceremonies.

One of the main problems with which archaeologists, anthropologists and ethnographers are often challenged is the difficulty

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1. Egyptian sandal 3570 years old (object deposited at the Museum of Art and History of the City of Geneva, inventory no. D 0370). Reproduced with the kind permission of the Museum of Art and History, Geneva.

to provide an accurate identification of the plant organs and often the specific species that were used to craft some Ancient Egyptian objects. In the case of the palm family, fruits, seeds, fragments of inflorescence, leaves used for various braided handicrafts and fibers from the leaf sheath are frequently found in the tombs of different periods (Greiss 1948). The available literature (i.e., Barakat & Abd-el-Aziz 2010) reports the use of three different species, namely the widespread and long-time cultivated date palm (*Phoenix dactylifera* L.), the doum or ginger-bread palm (*Hyphaene thebaica* (L.) Mart.) and the argun palm (*Medemia argun* (Mart.) Wurttenb. ex H.Wendl.). Organs of any of them could equally provide high quality leaf fibers potentially used to craft objects during Ancient Egyptian times. Telling which of them is the raw material has often been regarded as a challenging task.

In most cases, curators of ethnographic and art and history museums hesitate to suggest any species-level identification for "plant material" and sometimes ambiguously propose "palm leaves" as potential identification of the raw material used to craft some Ancient Egyptian objects. According to Greiss (1948), reed (*Arundo* spp., *Phragmites* spp., *Saccharum* spp.), halfa grass (*Desmostachya bipinnata*), soft rush (several species of Juncaceae), palm leaf, and palm fiber are among the most frequently used terms used to identify plant material employed in the making of various objects in Ancient Egypt. The same author states that these terms neither refer to the genus of the plant used nor even to its species and thus only gives a vague idea about the proper plant.

Our analysis of a precious Ancient Egyptian sandal stored at the Art and History Museum of the City of Geneva was needed to tackle this problem, which involved exploring anatomical methods that would potentially result in an accurate identification. We aimed to: 1) confirm that a palm organ was actually used to weave the sandal, and if so, 2) identify to the species level the palm that had been used during Ancient Egyptian times. In a more general sense, our main objective was to explore the value of leaf anatomy in the taxonomic identification of palms that are used to craft objects represented in ethnographic collections, including the ones present at the Conservatory and Botanic Gardens of Geneva (CJBG). Our paper provides some answers to these questions and brings attention to the promising use of resin-based anatomical analyses in the fields of palm archaeology and modern palm ethnobotany.

Material and methods

Our study is based on material kindly provided by the Museum of Art and History of Geneva. Indeed, we had the unique opportunity of receiving a 3 mm long fragment, extracted from a remarkably well-preserved Egyptian sandal (inventory no. D 0370) of a type known from the New Kingdom (Fig. 1). According to the studies undertaken in the museum, it is estimated to be 3570 years old (almost 1550 BCE). The object was temporarily removed from the public display for restoration and

this unique opportunity was seized upon to study in detail the plant material that was used for its manufacture.

In order to generate a reference set of images to be used as a comparative framework, the objects chosen were those for which we had a clear idea of the taxonomic identity of the palm used. In our case, we used objects made from *Borassus aethiopum*, *B. flabellifer*, *Cocos nucifera*, *Elaeis guineensis*, *Phoenix dactylifera*, *Hyphaene compressa*, *H. coriacea*, *H. guineensis*, *H. petersiana* and *H. thebaica*. Most of these palm-made objects were collected between 2010 and 2021, in the frame of floristic, ethnobotanical and conservation studies of Continental African palms (Stauffer et al. 2021), as well as taxonomic studies on the palm genus *Hyphaene* (Stauffer et al. 2018). They are part of the ethnobotanical collection of the CJBG curated by the third author of this paper (Didier Roguet, honorary curator).

The histological study was conducted in the MorphoLab of CJBG. The 3 mm long leaf fragment removed from the objects were infiltrated during 10 days in the commercial kit Technovit 7100 of Kulzer (2-hydroxyethyl methacrylate [HEMA]), using protocols adapted from Igersheim & Cichocki (1996) and further developed in Fred Stauffer's MorphoLab. The specimens were then embedded in a block of polymer resin and cross sections in the blocks were made at 7 microns using a rotary microtome (Leitz 1512). Sections were stained with ruthenium red and toluidine blue and permanently embedded in EUKITT mounting solution. Images of anatomical sections were made with a light microscope (Leica DM750), using the image processing software (LAS V4.12, Leica). Finally, images were edited in Adobe Photoshop (CS5.1) and the layout of the plates using Adobe InDesign CS2. Permanent slides were deposited at the MorphoLab of CJBG. The recovered sections were compared with the reference work of Tomlinson et al. (2011) on palm leaf anatomy, as well as previous studies undertaken in the MorphoLab of CJBG.

Results and discussion

Leaf anatomy in *Hyphaene thebaica* and the genus *Hyphaene*

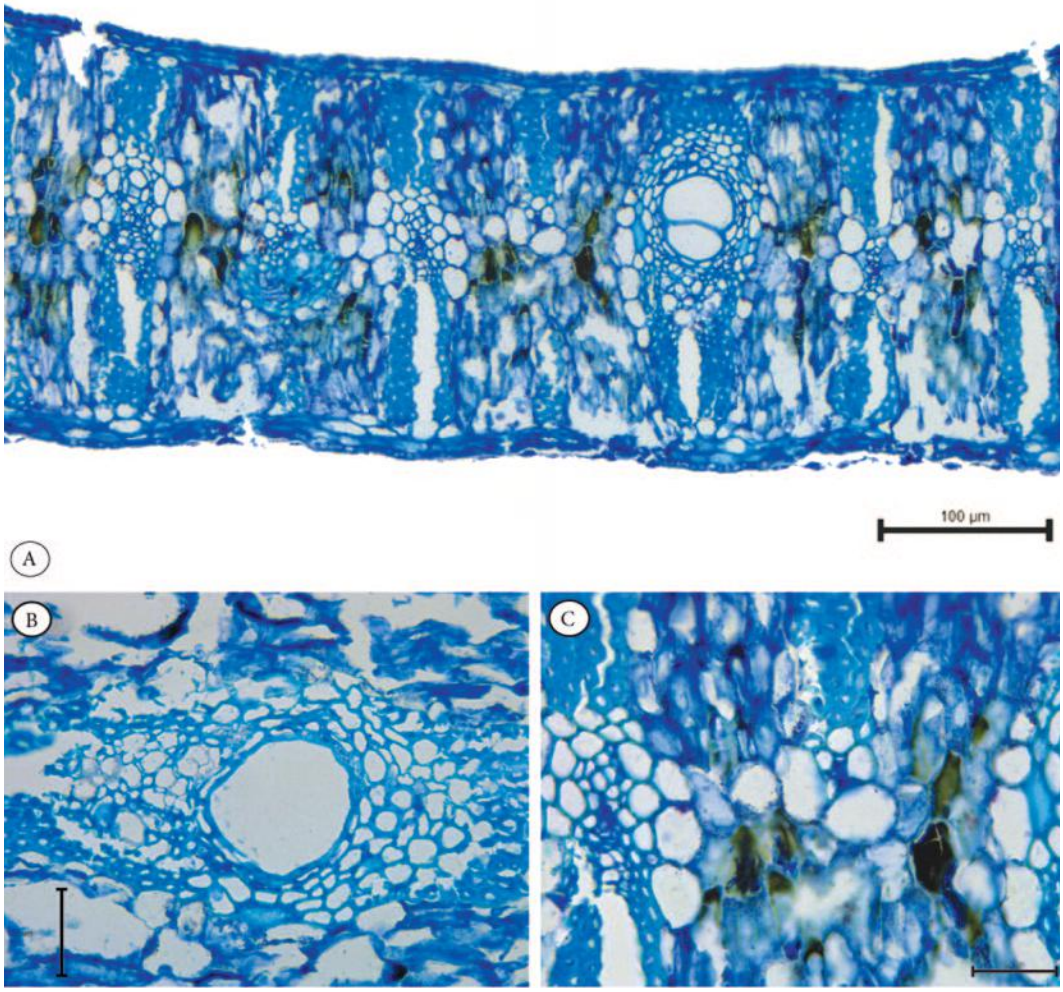
We compared the leaf anatomy observed in the fragment of the Ancient Egyptian sandal with that observed in other handcrafts made of leaves from several native or cultivated African palm genera used for similar purposes (i.e., *Borassus*, *Elaeis*, *Hyphaene*, *Phoenix*, *Raphia*), and the results were conclusive. The general histology of the tiny sandal fragment corresponds to that observed in the genus *Hyphaene*. Our study shows that leaf blade anatomy in all species of the genus share the presence of a 2-5 layered thick hypodermis and have large raphide-containing idioblasts. *Hyphaene coriacea* shows the largest variation within the samples studied. In all cases the hypodermis is up to 5-layers thick and the inner one is rather discontinuous. The main veins are connected to the upper and lower surfaces. *Hyphaene compressa* presents a slightly curved epidermis and a 2-layered thick hypodermis, the inner layers being flattened and discontinuous. *Hyphaene guineensis* shows an epidermis with very thick walls and free large veins with only the smaller ones connected to the hypodermis.

Hyphaene thebaica can be distinguished from the other species by the combination of an isolateral lamina, thick cuticle, epidermis with thick inner walls, 3-layered thick hypodermis, and fibers and veins mainly distributed in narrow bundles (Fig. 2). This leaf blade anatomy perfectly corresponds to the anatomy observed in the sandal fragment.

The case study of *Hyphaene thebaica*: a useful palm in ancient and modern Egypt

According to Alya Abd El-Ghany et al. (2016), *Hyphaene thebaica* was very common in southern Egypt in the past, whereas nowadays it seems to be more common in the northern Egyptian region, especially in Qena and Aswan, and in el Kharaga and Dakhla Oasis. Its presence seems to increase in southern localities such as el-Dakhakhen, Elmakes El-Bahary, El-Kebly, Dosh, El-Orman garden, Zoo garden, El-Azbakeya garden, Mohammed Ali garden at El-Rawda island and the Agriculture faculty at el-Giza.

Hyphaene thebaica has always been recognized as a very useful palm in Egypt. The roots are mainly exploited for their medicinal value. The leaves are used for handicrafts (fans, mats, baskets, ropes, hats, etc.). Fruits are used for their high nutritional value (Islam et al. 2002), pharmacological properties (Farag & Paré 2013), and palm wine extraction. The ivory hard seeds were used in the past for the manufacture of buttons and necklaces (Barakat & Abd-el-Aziz 2010). In Ancient Egypt it was regarded as a sacred plant, appearing to have been extremely important both in the ritual



2. Leaf anatomy of an Ancient Egypt sandal. A. General overview of the lamina in cross-section, scale bar = 100 microns; B. Detail of the vascular bundle complex, scale bar = 25 microns; C. Probably tanniferous idioblasts embedded in the leaf mesophyll, scale bar = 25 microns. Photo by Fred Stauffer.

ceremonies and the economy of the pharaohs. By the New Kingdom (ca. 1700–1550 BCE), many basket making and matting techniques using this palm were developed (El Hadidi & Hamdy 2011, Borojevik & Mountain 2013).

Representation of *Hyphaene thebaica* in Ancient Egyptian objects and fruits in museums worldwide

The frequent presence of *Hyphaene thebaica* fruits and leaf-made crafts in tombs from the first dynasty testifies to their sacred role as they were offered to the deceased in their travel to the world far beyond. Indeed, this is well depicted in the most renowned museums in Africa, America, and Europe. For example, in the impressive Ancient Egyptian displays in the British Museum in London, the *H. thebaica* fruits exhibited were found in a tomb-chapel commemorating Nebamun (ca. 1350 BCE), a middle-ranking official scribe and grain counter. This tomb is in the Theban Necropolis, on the west bank of the Nile at Thebes (present-day Luxor). Another fine example of sacred *H. thebaica* fruits can be seen in the Egypt Museum of Turin (Italy), which hosts several important objects associated with this palm found in the Tomb of the architect Kha (TT8) in Deir el-Medina (Figs. 3 & 4). The National Museum of Liverpool stores several *H. thebaica* seeds dating back to the time of the Middle Kingdom (2055–1650 BCE), collected at the pyramid town of Lahun, and from the New Kingdom (1550–1069 BCE),

3. Cup with seeds, three doum nuts and dried fishes, 1425–1353 BCE. Deir el-Medina, tomb of Kha and Merit (TT8). Inventory number: S.8225. Reproduced with the kind permission of the Museo Egizio, Turin. Italy.

found in the tombs at Thebes, the latter in some cases clearly displaying the ivory-hard endosperm. Other fine examples of *H. thebaica* fruits and palm-made objects dating back from Ancient Egyptian times can be appreciated in the Museum of Fine Arts of Boston (MFI) (Fig. 5).

Palm representation in Ancient Egypt wall paintings

The most beautiful example of palms cultivated in Ancient Egypt is probably the one depicted in the wall paintings of the vaulted crypt of the tomb of Sennedjem (TT l) in Deir el Medina, who lived under the reign of Pharaoh Seti 1st (XIX Dynasty, 1292–1189 BCE). This scene represents a row of palms and trees, where date palms can be identified by their pinnate leaves and hanging infructescences, whereas doum palms can be identified by their branching stems, fan-shaped and large-sized leaves (Fig. 6). Several interesting painted walls from Ancient Egypt are displayed in the British Museum in London and were thoroughly discussed by James (1985). One of them, representing the gardens of Ka-en-Amun, (panel 37983), is particularly impressive and interesting. Ka-en-Amun was an important government employee during the reign of King Thutmose III (XVIII dynasty, 1550–1292 BCE). The panel represents a rectangular pool containing a group of fish, ducks and geese, as well as papyrus plants. Other plants such as poppies and trees (probably sycamores), as well as some date and doum palms are also depicted in wall paintings.

Promising use of resin-based anatomical analyses in the identification of modern and ancient palm-made objects

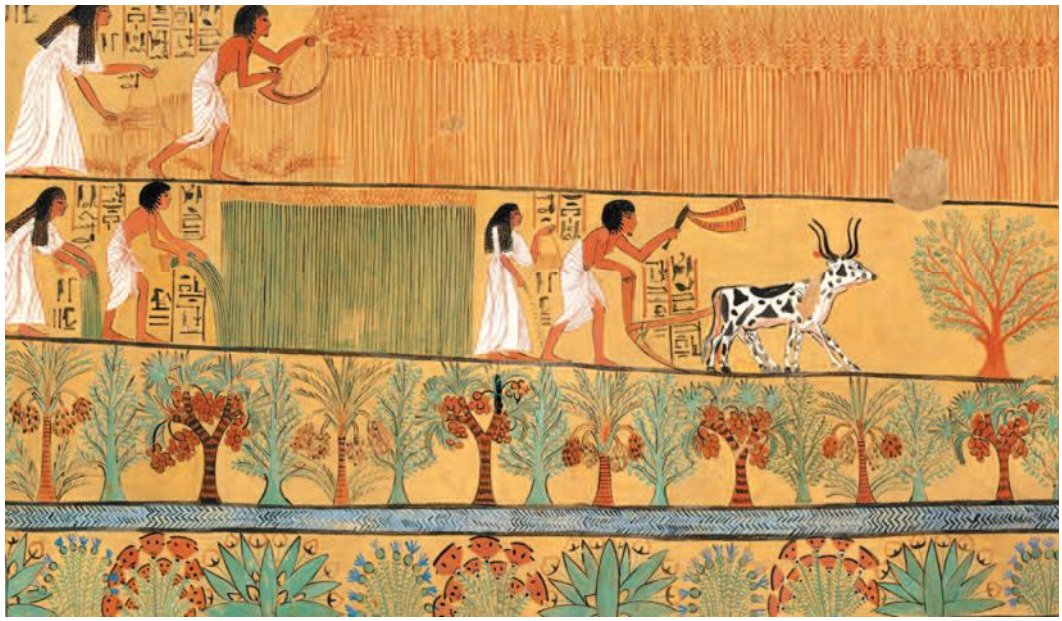
Our studies on palm-made craft samples by means of resin-based anatomical methods show that the protocols employed can successfully recover the inner structure of the leaves that were used to manufacture the object, no matter the type of object crafted (i.e., baskets, hats, mats, ropes or sandals), or how it was stored. The infiltration process of dry and sometimes highly compressed samples resulted in highly informative and well-preserved anatomical sections that allowed an accurate identification of the palm organ used and often the precise species involved as raw material. An important point from the conservation perspective in museums is that already tiny fragments of 2–3 mm in length are enough to recover the necessary information. In this sense, our anatomical methods can be regarded as non-destructive

4. Net bag containing doum palm fruits (New Kingdom), 1425–1353 BCE. Deir el-Medina, tomb of Kha and Merit (TT8). Reproduced with the kind permission of the Museo Egizio, Turin. Italy.

and respectful of the precious holdings stored in international museums and herbaria. Although our protocol was used for palm material, already challenging as it is rich in fibers and idioblasts, it can be easily adapted for any other plant material.

The identification of modern material associated with genera such as *Borassus*, *Cocos nucifera*, *Elaeis*, *Hyphaene* and *Phoenix* was not problematic as the leaf anatomy allowed us to not only recognize the main traits of the subfamilies Coryphoideae and Arecoideae to

5. Basket with three doum palm nuts and string inside (Hay collection 72.4748a). Reproduced with the kind permission of the Museum of Fine Arts, Boston, USA.



6. *Hyphaene thebaica* and *Phoenix dactylifera* cultivated in gardens of ancient Egypt. Wall painting displayed in the Sennedjem Tomb (TT I), Deir El Medina; attributed to the XIX dynasty 1280 BCE (published by Hala N. Barakat and Abd-el-Aziz. Guide botanique de l'Egypte ancienne). Reproduced with the kind permission of Dr. Hala N. Barakat.

which those palms belong, but also to the genus level because the inner structure of the leaves was clearly distinctive. The different crafts included in our study display unique combinations of leaf anatomical characters that allow further identification of the palms to the species level.

Final remarks

The resin-based anatomical method employed in our study not only successfully recovered the leaf inner structure of modern objects but was also extremely informative when interpreting the anatomy of ancient objects, such as our sandal from the New Kingdom Egyptian times, dating back more than three millennia. According to Garstang (1907), the sandals found in the tombs were indeed made from palms, also stating that given their very simple design they were not made for real use but probably to represent the fashion of the article in use at that time. The sandal studied by us is extremely well conserved and this could confirm Garstang's hypothesis supporting that they had only a symbolic importance. We believe that this was crucial to obtain the high-quality sections that we were able to recover.

Examples of identification of ancient Egypt plant-made objects based on morphological and anatomical methods are not very common. The few studies available (i.e., Borojevic & Mountain 2011, 2013) have concentrated on the analyses of the epidermal characters of the samples by means of Stereo and Scanning Electronic Microscopy (SEM). Although certainly informative, the latter are often exposed to harsh environmental conditions and therefore tend to fade over time. The leaf histological characters assessed in our study proved to be extremely well conserved and therefore much more informative for identification purposes.

In the case of palm-made Ancient Egyptian objects, identifying the organs from which they were made and telling the exact palm species of the raw material has been often regarded as a challenging task for curators of ethnographical or anthropological museums. The three palms currently reported for the Egyptian flora, namely the date palm, the ginger-bread palm and the argun palm can equally provide high quality leaf fibers potentially used to craft objects during Ancient Egypt. Our study identified the leaves of the ginger-bread palm (*Hyphaene thebaica*) as the plant material used to weave the old sandal, and this confirms the major economic and ceremonial roles played by this palm at the times of the Pharaohs. Different wall-paintings,

objects and fruits found in Egyptian tombs tell us about the critical role of this palm, nowadays considered as an important plant resource in the entire Sahelian region. Indeed, *Hyphaene thebaica* provides resources ranging from food, beverage (palm wine) and medicinal to craft-making, construction, and thatching. Its role in the future could become even more important if major efforts are undertaken to identify and document populations displaying large morphological and genetic diversity potentially useful for domestication programs.

Acknowledgments

We would like to express our gratitude to the Art and History Museum of the City of Geneva for providing fragments of the precious Ancient Egyptian sandal. Johannes Auenmüller from the Egypt Museum of Turin and Carolyn Cruthirds from the Museum of Fine Arts of Boston kindly granted permission to reproduce images of the objects stored in their valuable collections. The A. Lombard Foundation (SPHN, Geneva) is greatly thanked for permanent support to our research on the palm genus *Hyphaene*.

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Corrigendum

In the article on *Basselinia* (PALMS 67(3): 143–152) the captions for Figsures 8 and 9 were inadvertantly switched. Figure 8 is *B. glabrata* with its stacked, pendulous inflorescences, and Figure 9 is *B. sordida*.

Donald R. Hodel
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Burretiokentia

Donald R. Hodel[1]

If ever the quintessential New Caledonia palm existed, there's a pretty good chance that it is a *Burretiokentia*, a genus of at least five, endemic, solitary, moderate to tall, pinnate-leaved species. Their glossy, dark green stems or trunks with prominent, indented, ring-like leaf scars are handsome and ornamental. One species, *B. vieillardii* is widespread and often gregarious throughout the island (Fig. 1) while the other four species are locally distributed.

Two of the species, *Burretiokentia hapala* and *B. vieillardii*, have well developed crownshafts and unwinged petiole margins while the other three species do not have a crownshaft or, if one is present, it is poorly developed and the petiole margins are prominently winged. *Burretiokentia hapala* is immediately distinguished from *B. vieillardii* when in flower by the inflorescence being densely covered with thick, short, pale brown hairs giving it a fuzzy appearance (Front Cover). Also, the crownshaft of *B. hapala* (Fig. 2) has a pale brown to whitish covering while that of *B. vieillardii* has a reddish brown or dark brown to glossy copper-colored covering.

Of the three species lacking a well developed crownshaft, *Burretiokentia koghiensis* can be distinguished by its conspicuously ascending to erect leaves and more numerous pinnae (35–45 per side) (Fig. 3). The remaining two species, *B. grandiflora* (Fig. 4) and *B. dumasii* (Fig. 5), have spreading leaves with only 20–25 pinnae per side, and the former differs from the latter in its wider pinnae (8–11 cm vs. 5–8 cm), new leaf expanding green vs. red, and larger fruits (2.2 × 1.7 cm vs. 1.3 × 1.1 cm).

Burretiokentia is closely related to *Cyphophoenix* (including *Campecarpus* and *Veillonia*), and further work is needed on this relationship.

Look for *Burretiokentia grandiflora* in the upper reaches of the Rivière Bleue Botanical Reserve; *B. vieillardii* along the road to the north at Col des Roussettes between Bourail and HouaÏlou; *B. hapala* in the far north near Col d'Amos; *B. dumasii* at the Nodela Botanical Reserve; and *B. koghiensis* at the Mt. Koghi Botanical Reserve near Noumea.

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

1. *Burretiokentia vieillardii* is widespread and typically gregarious in New Caledonia, often forming large stands as here on Mt. Aoupinié.

2. *Burretiokentia hapala*, like *B. vieillardii*, is one of two species in the genus having a well developed crownshaft with unwinged petiole margins. Vallee des Palmiers, Col d'Amos.

3. *Burretiokentia koghiensis* typically has ascending leaves. Mt. Koghi Botanical Reserve.

4. *Burretiokentia grandiflora* has spreading leaves like *B. dumasii* but differs in its wider pinnae, new leaf expanding green, and larger fruits. Montagne des Sources.

5. *Burretiokentia dumasii* has spreading leaves and lacks a well developed crownshaft. Me Maoya.

Palm Profile

New Guinea Rheophytes

Four species of New Guinea palm are rheophytes, one rattan (*Calamus reticulatus*) and three medium-sized tree palms (*Heterospathe macgregorii*, *Hydriastele rheophytica*, *H. simbiakii*). These species are restricted to the flood-zones of large rivers. Their flexible stems and narrowly pinnate leaves offer little resistance to fast-flowing water, and their strongly clustering habit enables easy regeneration after flood damage. Two of these amazing palms are depicted here. *Heterospathe macgregorii* (above, photographed by Osia Gideon), which was first collected by botanists in 1890, is known from scattered localities in southern Papua New Guinea, including the Kikori and Fly River catchments. It forms dense colonies, sometimes in association with *Calamus reticulatus*. *Hydriastele simbiakii* (opposite page) was much more recently discovered as new-to-science by a joint University of Papua-Royal Botanic Gardens, Kew expedition to the Tamrau Mountains in 2013. It is recorded from only one site on the Sujak River.

These remarkable palms are just two of the 250 species that will be documented and illustrated in the forthcoming *Palms of New Guinea*, to be published by the Kew Publishing in early 2024. Recieve a 20% discount off the retail price for a limited time when you pre-order your copy of *Palms of New Guinea* from the Kew online shop (shop.kew.org) using the discount code PALM.

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UNITED STATES POSTAL SERVICE® Statement of Ownership, Management, and Circulation (All Periodicals Publications Except Requester Publications)

1. Publication Title	2. Publication Number	3. Filing Date
Palms	782-720	10/06/2023
4. Issue Frequency	5. Number of Issues Published Annually	6. Annual Subscription Price
Quarterly	4	$55.00

7. Complete Mailing Address of Known Office of Publication (Not printer) (Street, city, county, state, and ZIP+4®) — Contact Person: Scott Zona; Telephone (Include area code): (512) 851-1411
International Palm Society
1401 Lavaca St. #751
Austin, TX 78701-1634

8. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer)
International Palm Society
1401 Lavaca St. #751
Austin, TX 78701-1634

9. Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor (Do not leave blank)
Publisher (Name and complete mailing address)
International Palm Society
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Austin, TX 78701-1634
Editor (Name and complete mailing address)
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☑ Has Not Changed During Preceding 12 Months
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13. Publication Title: Palms	14. Issue Date for Circulation Data Below: September 2023	
15. Extent and Nature of Circulation	Average No. Copies Each Issue During Preceding 12 Months	No. Copies of Single Issue Published Nearest to Filing Date
a. Total Number of Copies (Net press run)	574	561
b. Paid Circulation (By Mail and Outside the Mail) (1) Mailed Outside-County Paid Subscriptions Stated on PS Form 3541 (Include paid distribution above nominal rate, advertiser's proof copies, and exchange copies)	372	368
(2) Mailed In-County Paid Subscriptions Stated on PS Form 3541 (Include paid distribution above nominal rate, advertiser's proof copies, and exchange copies)	0	0
(3) Paid Distribution Outside the Mails Including Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Paid Distribution Outside USPS®	80	176
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c. Total Paid Distribution (Sum of 15b (1), (2), (3), and (4))	557	544
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h. Total (Sum of 15f and g)	574	561
i. Percent Paid (15c divided by 15f times 100)	99.4	99.3

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