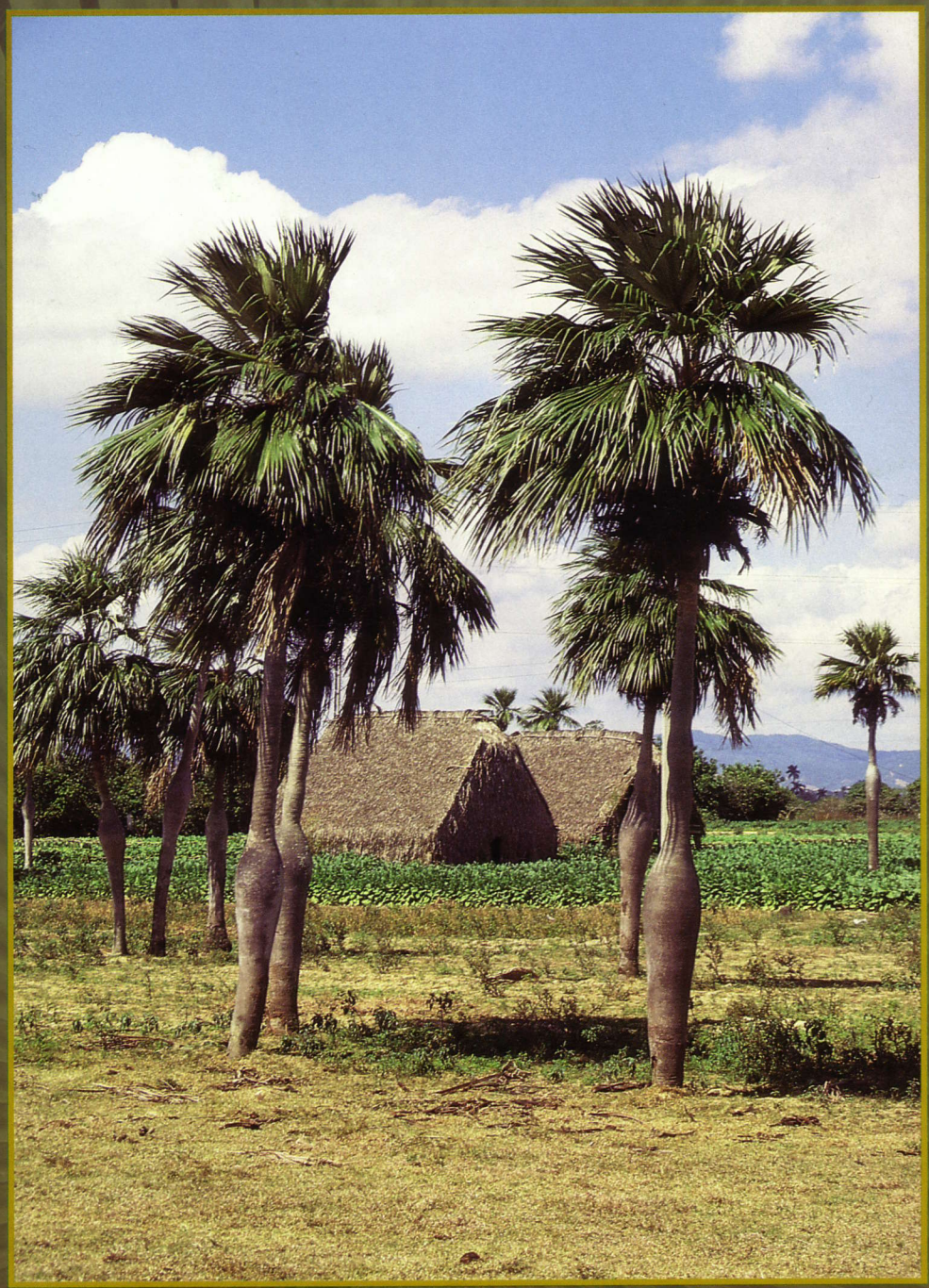
Palms

Journal of The International Palm Society

Vol 44(2) 2000



THE INTERNATIONAL PALM SOCIETY, INC.

The International Palm Society

Founder: Dent Smith

The International Palm Society is a nonprofit corporation engaged in the study of palms. The society is international in scope with worldwide membership, and the formation of regional or local chapters affiliated with the international society is encouraged. Please address all inquiries regarding membership or information about the society to The International Palm Society Inc., P.O. Box 1897, Lawrence, Kansas 66044-8897, USA.

OFFICERS:

President: Phil Bergman, 3223 Brant St., San Diego, California, 92103, USA, e-mail PalmNCycad@aol.com, tel. 1-619-291-4605.

Vice-presidents: Horace Hobbs, 7310 Ashburn, Houston, Texas 77061, USA, e-mail horacehobbs@pobox.com, tel. 1-714-643-4094.
Rolf Kyburz, K-Palms Nursery & Seeds, 39 Poinciana Drive, Browns Plains, Qld 4118, Australia, e-mail kpalms@ozemail.com.au, tel. 61-7-3800-5526.

Corresponding Secretary: Jim Cain, 12418 Stafford Springs, Houston, Texas 77077 USA, e-mail palm_dude@pobox.com, tel. 1-713-689-2416.

Administrative Secretary: Libby Besse, 6729 Peacock Road, Sarasota, Florida 34242, USA, e-mail libbesse@aol.com, tel. 1-941-349-0280.

Treasurer: Ross Wagner, 4943 Queen Victora Road, Woodland Hills, California 91364, USA, tel. 1-818-883-0447.

Directors: 1996–2000: Libby Besse, Florida; Jim Cain, Texas; Paul Craft, Florida; Martin Gibbons, United Kingdom; Rolf Kyburz, Australia; Leland Lai, California; Jeff Marcus, Hawaii; Lynn McKamey, Texas; Lester Pancoast, Florida; Sue Rowlands, California; Geoff Stein, California; Steve Trollip, Republic of South Africa; Ross Wagner, California; Richard Woo, B.C. Canada; Jim Wright, California; Scott Zona, Florida. 1998–2002: Phil Bergman, California; Norman Bezona, Hawaii; Jacques Deleuze, France; John Dransfield, United Kingdom; Ian Edwards, Australia; Don Evans, Florida; Horace Hobbs, Texas; Bo-Göran Lundkvist, Hawaii; Lynn Muir, California; Bernie Peterson, Florida; Bob Petersen, Florida; Jim Reynolds, B.C. Canada; Kampon Tansacha, Thailand; Natalie Uhl, New York; Ralph Velez, California.

Bookstore: Geoff Stein, 1196 Calle Jazmin, Thousand Oaks, California 91340-4930, USA, Fax 1-805-494-9214, e-mail IPSBooks@aol.com

Chapters: See listing in Roster.

Website: www.palms.org

FRONT COVER

Colpothrinax wrightii in Pinar del Río. See accompanying article p. 85. Photo by S. Zona.

Palms (formerly PRINCIPES)

Journal of The International Palm Society

(ISSN 1523-4495)

An illustrated quarterly devoted to information about palms.

Editors: John Dransfield, Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE, United Kingdom, e-mail j.dransfield@rbgkew.org.uk, tel. 44-181-332-5225, Fax 44-181-332-5278.
Scott Zona, Fairchild Tropical Garden, 11935 Old Cutler Road, Miami, Florida 33156, USA, e-mail zonas@fiu.edu, tel. 1-305-667-1651 ext. 3419, Fax 1-305-665-8032.

Associate Editor: Natalie Uhl, 467 Mann Library, Cornell University, Ithaca, New York 14853, USA, e-mail nwu1@cornell.edu, tel. 1-607-255-7984.

Supplement Editor: Jim Cain, 12418 Stafford Springs, Houston, Texas 77077, USA, e-mail palm_dude@pobox.com, tel. 1-713-689-2416.

Garden Editor: Lynn McKamey, Rhapis Gardens, P.O. Box 287, Gregory, Texas 78359, USA.

Horticultural Editors: Martin Gibbons, The Palm Centre, Ham Nursery, Ham Street, Ham, Richmond, Surrey TW10 7HA, United Kingdom.
Bernie Peterson, 2410 Stanford St., Cocoa, Florida 32926, USA.

Manuscripts for PALMS, including legends for figures and photographs, should be typed double-spaced and submitted as hard-copy and on a 3.5" diskette (or e-mailed as an attached file) to John Dransfield, Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey , TW9 3AE, United Kingdom. Further guidelines for authors are available on request from the Editors.

Annual membership dues of US$35.00 include a subscription to the Journal. Subscription price is US$40.00 per year to libraries and institutions. Dues include mailing of the Journal by airlift service to addresses outside the USA. Single copies are US$12.00 each, US$48.00 a volume, postpaid surface delivery; for airmail delivery, add US$7.00 a copy or US$28.00 a volume.

Periodical postage paid at Lawrence, KS, USA.

Postmaster: Send address changes to The International Palm Society, P.O. Box 1897, Lawrence, Kansas 66044-8897, USA.

Mailed at Lawrence, Kansas June 15, 2000

This publication is printed on acid-free paper.

CONTENTS

BACK COVER

Copernicia gigas. See accompanying article p. 88. Photo by N. Martinez Barboza.

Features

The stiff leaves of *Copernicia fallaensis* at the Jardín Botánico Nacional, Havana, Cuba. See accompanying article, page 69. Photo by S. Zona.

This special issue of PALMS features the palms of Cuba!

Are you registered for the IPS Biennial in New Caledonia and the post tour to Queensland? Do it today!

President's Message

Hello, International Palm Society members! I wish you my best and hope that all goes well with you.

The main emphasis I want to make in this message is to remind you to register for the **IPS Biennial and Post Tour 2000**. The deadline without penalty is 30 June 2000. After that date, you may register if space is still available, but there will be an additional late registration fee. The Biennial will be in New Caledonia and starts 8 October 2000. The Post Tour will be in Queensland, Australia and begins on 16 October 2000. Information on both events was sent to you with your last issue of PALMS. If that is not available, you can register online at the IPS website <www.palms.org>. Both venues will offer fabulous events with amazing palms, so you should plan to attend.

In the past you have told us that you want PALMS to include more articles with information that is useful to members. We are listening to you. Recent issues of PALMS have included more articles on general topics, palm horticulture and other subjects of use to readers. Our March 1999 issue was a "theme issue" dedicated entirely to palm horticulture. Our most recent issue had articles on the growing of cold-hardy species, palm pruning, and Bernie Peterson's Horticulture Column, which is a regular feature. It also included articles on unusual palm species, a clear explanation on the very latest ideas on palm evolution and a very interesting travel article on the palms of the Amazon by Andrew Henderson. The March issue of PALMS also introduced our new journal cover and format, which is easier to read. All in all, we are trying to give you value and enjoyment for your dues and hope that you find these changes satisfying. This issue, our second theme issue, features the palms of Cuba and should be of interest to all IPS members who have admired a magnificent *Copernicia baileyana* or a glorious *Roystonea regia*. The centerpiece of this issue is a checklist of Cuban palms written by two of Cuba's most well-known palm authorities, Celio Moya and Angela Leiva. The lengthy checklist (96 indigenous palms!) is a tantalizing introduction to the fantastic palms of that Caribbean island.

I am very pleased to announce that two new Chapters have joined the International Palm Society. These groups are Manureva of France and Palmeraie-Union of the Reunion Islands. *Bienvenue* and welcome aboard! We are hopeful that we shall welcome an additional new Chapter before the end of the year. It is apparent that we are indeed a truly international group with Chapters and Affiliated Societies stretching around the world. The Board of Directors encourages all of you to join your local chapters. If one does not exist, consider forming a new chapter in your locality. Please contact me personally, and I shall let you know the requirements for becoming an IPS Chapter.

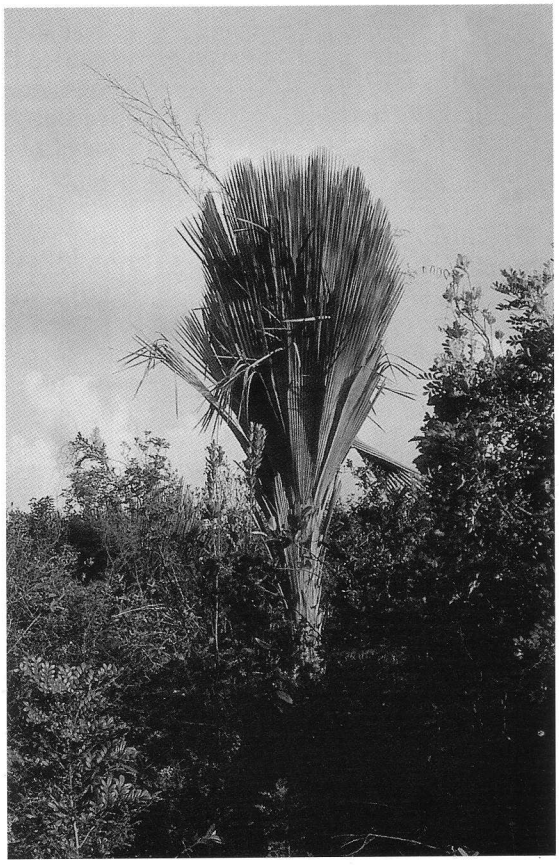
Our next Board of Directors meeting will be in October, in New Caledonia. Although Directors are in communication on a continual basis to run our Society, we have formal meetings once a year. It is at these meetings that decisions are made and plans constructed for the coming year. The Board also awards grants to fund research and education projects around the world. If there is anything you want discussed by the Board, please contact any Officer or your local Director. At the New Caledonia meeting, we shall install newly-elected Directors and Officers. The results of this year's election will be announced in the next issue of PALMS. If you attend the Biennial, you are invited to attend the Board of Directors meeting. You will also have ample time throughout the Biennial and Post Tour to visit with Officers and Directors. I encourage you to contact Officers or Directors if you have any concerns or questions about the IPS. The Society belongs to you.

I hope to see you in October in New Caledonia!

PHIL BERGMAN,
IPS PRESIDENT

Copernicia rigida in Eastern Cuba

CARLO MORICI
Palmetum de Santa Cruz de Tenerife, Parque Marítimo, 38001 Canarias, Spain
palmetum@bitmailer.net



1. Adult specimen of *Copernicia rigida* with typical rigid aspect. Note that its leaves lack petioles.

Copernicia rigida was described in 1914 by Britton and Wilson. Its distribution, according to Moya (1999) is disjunct; there are populations both in central and in eastern Cuba.

I have observed and collected *Copernicia rigida* (Fig. 1) around the city of Moa, in eastern Cuba. The vegetation of the area has red serpentine soils. Its vegetation is called *charrascal*, an open scrub vegetation typical of the lowlands of Moa. *Copernicia rigida* grows together with *Bactris cubensis* and *Thrinax rivularis* var. *savannarum*.

All growth stages were present in the abundant populations observed. From seedling to adult there is an astonishing change in appearance, due to the development and then loss of petioles. Young seedlings produce strap-shaped leaves without visible petioles (Fig. 2.). The apex is well buried in the ground as in many *Copernicia* seedlings. As

2. Young seedlings of *Copernicia rigida* without visible petioles.

growth progresses, leaf blades become wider and triangle shaped (Fig. 3.). As the plants reach about 150 cm, still trunkless, the new wedge-shaped leaf blades are held on long robust leafstalks, armed with strong spines (Fig. 4.). As the palm grows older, successive leafstalks become shorter until they disappear altogether in the adult stage. Leaves of adults lack a conspicuous petiole, as in many other species of this genus.

Four year old plants of *Copernicia rigida* from two different localities are in cultivation in the Palmetum of Santa Cruz de Tenerife. Plants from seeds collected in eastern Cuba are distinguishable from the central Cuban ones by the shorter, thicker leaves that are slightly revolute and by the leaf margins that are yellowish-orange in the eastern Cuban plants, rather than the flatter leaves of a more uniform green in the central Cuban seedlings.

Literature Cited

Moya, C. 1999. Consideration on ecology and distribution of Cuban *Copernicia*. Acta Hort. 486: 149–154.

3. Older seedling of *Copernicia rigida* with wider leaves, still without petioles.

4. Two meter tall plants of *Copernicia rigida* with robust petioles.

Broom-Making from Palms in Cuba

NORA M. BARBOZA
Institute of Systematic Botany
New York Botanical Garden
Bronx, New York 10458 USA

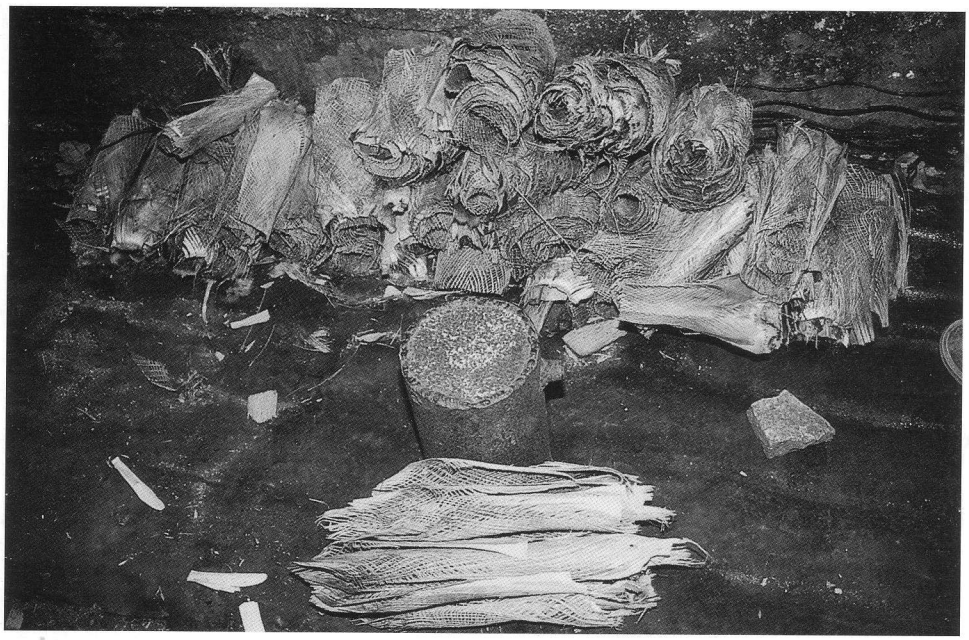
Various palms are still used for broom-making and are an important source of income for families in Cuba.

"Of the ancient Cuban forest only memories are left" expressed the concerns of Nuñez (1959) when he reported that 92 percent of the original Cuban forest had been destroyed. The remaining eight percent was restricted to the mountains, where ever since it has been highly protected. The original vegetation in the Cuban savannas or plains was replaced mainly by sugar cane and cattle-ranches and although most of this vegetation, such as mahogany and ebony trees, disappeared, the palm trees persisted. As remnants of the native vegetation, these palms form a very important component of their habitats. They include the royal palm, *Roystonea regia*, national tree of Cuba, which often appears in a typical Cuban landscape, the *Copernicia*, better known as jata or yarey, occurring in poorer soils of clay and serpentine, and species of *Coccothrinax*, often seen on hills, especially in the province of Sancti Spiritus.

It is well known that palms are one of the most useful trees in the tropics, and typical palm-crafting activities such as the making of hats and bags are seen also in Cuba. For example in Trinidad, province of Sancti Spiritus, a popular tourist destination because of its typical colonial architecture, handicraft makers can meet the demand by taking advantage of the leaves of the nearby population of *Copernicia macroglossa*. One also encounters palm climbers (*desmochadores*) who collect huge infructescences of *Roystonea*. The desmochador climbs up to the highest point of the trees in search of the fruits. The infructescences are collected and sold for ten Cuban pesos each. In Canesi, province of Matanzas, the infructescences are offered for sale in the middle of the day and fed to pigs.

The importance of palms in Cuba extends beyond the production of handicrafts and collection of fruits. Making brooms is another example of a small local industry that creates jobs for families and even entire communities. In the town of Las Minas in the province of Sancti Spiritus between Jarahueca and Sancti Spiritus, a small population of *Coccothrinax clarensis* occurs in the nearby hills. While I explored the area, it became apparent that

1. *Coccothrinax clarensis*, stripped of old leaf sheath fiber, Las Minas.



2 (left). *Coccothrinax clarensis* sheath fibers, ready for broom manufacture.

3. (below) Finished brooms made of *Coccothrinax clarensis* fibers, ready for sale.

a great number of individuals of *C. clarensis* were lacking the coarse fibers of the leaf sheaths that are used to make brooms (Fig. 1). I inquired about the broom-maker in town and soon met Francisco Diaz. Francisco, who makes his entire income from making brooms and brushes out of the fibers of *C. clarensis* leaf sheaths (Fig. 2), and showed me his skills. He began with a broom-stick that he had prepared from branches of nearby bushes. Then he placed twelve leaf sheaths on one side and twelve on the opposite of the stick creating a V-shape, which was tightened at the base with a piece of wire. In the next step, he cut the terminal ends of the leaf sheaths with a metal stick into strips. Two additional layers were wrapped around the open sides of the V-shaped structure and tightened at the center by a set of metal wires. As in the previous procedure, these supporting layers were bound tightly to the broom stick and cut into strips. It took Francisco approximately five minutes to assemble the 28 leaf sheaths around the stick to make a broom costing five Cuban pesos (Fig. 3). The broom can last for more than a year and a half under daily use.

On the main Cuban highway, men are quite often seen riding their bikes loaded with these brooms, especially in the Sancti Spiritus province. While the best and largest leaf sheaths are used to make brooms, the smaller sheaths are used to make long-lasting brushes. The brushes are so sturdy and of such good quality that they are even more durable than the brooms.

On the south-eastern edge of Cuba, in El Zabalo, province of Las Tunas (not to be confused with El Sabalo, province of Pinar del Rio, which is quite often cited as the locality for many herbarium specimens of *Copernicia*), a mixture of *Copernicia* species occur (Fig. 4). This population is composed

4. A mixed population of *Copernicia* palms at El Zabalo, including *C. rigida, C. vespertilionum* and others.

5. Fernando Zamora binds leaves of *Copernicia* onto a broom stick.

6. Further stages in the construction of the broom head.

of so many different species, varieties, and hybrids that it is very difficult to make precise identifications. El Zabalo provides a number of resources for an entire community. Crucita Zamora gets up very early in the morning and selects the youngest and most flexible young leaves or *collos*, as she calls them. One might think collecting about 60 *collos* could be an easy and fast procedure, but as *C. rigida* and its variants, which have tough and rigid leaves, comprise a great number of individuals in this population, Crucita has to work all morning to accomplish her task.

The process of making brooms from *Copernicia* leaves is more complicated and time-consuming than making brooms out of *Coccothrinax clarensis*. In addition, they are of lower quality and much cheaper, but *Copernicia* spp. are the only palms available in the area of El Zabalo. Late in the morning Crucita starts stripping with a knife the young, enclosed leaves that were collected earlier – they are about 1 m long. Her brother Fernando Zamora binds with a cord two to three *collos* in the middle around a wooden stick 30 cm in length. Fernando then places this bundle vertically between his legs (Fig. 5). He folds down only the outer strips of the upper side and ties them 2 to 3

7. *Copernicia* broom heads awaiting trimming.

cm below the first cord (Fig. 6). He also binds the inner strips of the upper side above the first cord. The inner strips of the upper side will become the inner strips of the broom. The outer strips that were folded down, are now folded back together with the strips from the lower side to their previous position. With this additional folding the original length of 1 m is decreased to 50 cm, and the bulk of the broom is increased. Once all the strips are tightened and nicely assembled into a broom (Fig. 7), the ends are cut to make them even. Finally, the short stick is removed and a broom-stick inserted, which can be replaced as needed. The Zamora family sells each broom for 50 Cuban cents in the market of the nearby village. This amount, compared with the 5 Cuban pesos paid for a broom made from *Coccothrinax* fibers, is very small, yet it is their only source of income.

Palm products are common everywhere in the tropics, but at present in Cuba the production of such items are a very important source of income for families and sometimes whole villages. The remnant stands of native palms, sometimes the only local vestige of the native forest, are exploited by local people to provide both traditional crafts as well as long-lasting utilitarian items. This tradition underscores the vital importance of palm species for human populations in the areas where they grow.

Acknowledgments

I thank Celio Moya, Leonardo Cañizales and Raul Verdecia for showing me the localities, and the villages, where the brooms are made.

LITERATURE CITED

NUÑEZ JIMENEZ, A. 1959. Geografía de Cuba, ed. 2. La Habana.

The Genus *Thrinax* in Cuba

CARLO MORICI
Palmetum de Santa Cruz de Tenerife, Parque Marítimo, 38001 Canarias, Spain
palmetum@bitmailer.net

1. *Thrinax radiata* on limestone rock, near Maguana, Baracoa.

Thrinax **palms, mostly *T. radiata* (Fig. 1) and *T. morrisii*, are the most common palms of the Caribbean coasts. In contrast to these two ubiquitous species, the rest of the genus is composed of unusual-looking palms, restricted to narrow habitats that are often difficult to access. Some species are true pearls of the Antilles.**

Species of *Thrinax* can at first be confused with *Coccothrinax*, but the former are easily recognized by their white fruits, the smooth seeds (although a few *Coccothrinax* bear smooth seeds) and the bases of the petioles that are split in the middle.

The genus *Thrinax*, composed of seven species, is much smaller and by far better understood than the related genus *Coccothrinax*. All the species are easily identifiable in the field and well circumscribed taxonomically, but it is not clear how they are related to one another.

Five species of *Thrinax* grow in Cuba. Two of them, in the subgenus *Thrinax*, are widespread throughout the Caribbean; these are the ubiquitous *T. radiata* and *T. morrisii* mentioned above. The rest of the native species are endemic to Cuba, are restricted to narrow habitats, and belong to the subgenus *Hemithrinax*.

The only two species of *Thrinax* which do not occur in Cuba are *T. excelsa* and *T. parviflora*, of the subgenus *Thrinax*, and both are endemic of Jamaica.

Distribution and soil restrictions – *Mogotes*

All *Thrinax* species in Cuba, except *T. rivularis*, are restricted to nutrient poor, calcareous soils. The distribution of these palms on the island seems to be determined by soil type rather than by the climate or habitat. All species, except *T. rivularis*, grow in sandy or rocky basic soils, often with limestone. *Thrinax rivularis* grows in serpentine soils, filled with heavy metals that jeopardize nutrient intake. All species grow at very low elevations, mostly in coastal conditions. *Thrinax compacta* is an exception; it grows on the *mogotes* of the Altiplanicie de Nipe, at 450 m elevation. These populations thrive on the calcareous rocks despite the habitat being much cooler and wetter than those of the other species. *Thrinax morrisii* also grows on mogotes in Viñales (Zona pers. comm.).

Mogote is the name used in Cuba for calcareous hills made of fossil coral rock. These limestone outcrops are usually dome-shaped and rise strikingly from a flat landscape. Their height is variable, from the 20 m of those that host *T. compacta*, to the 500 m of the famous *mogotes* of Viñales, home of *T. morrisii*. The *mogotes* have a wealth of vertical cliffs and are perforated by numerous holes made by karstic erosion. The rock provides little or no soil except some decomposing leaves trapped by trunks and rocks. This debris

2. Majestic leaf blades of *Thrinax compacta* can be more than 2 m in overall diameter.

3. In *Thrinax compacta* the infructescences are unusually compact.

4. *Thrinax ekmaniana,* overlooking the lowlands.

can be substantial as in the habitat of *T. compacta* (up to 10 cm thick) or very thin (0–1 cm) as in the *mogote* hosting *T. ekmaniana*. Most of the plants which grow on these hills are very specialized and endemic. The *mogote* species are: *T. morrisii*, *T. ekmaniana* and *T. compacta*. *Thrinax radiata* can also be found on coral rock in some localities. *Thrinax morrisii* also grows in the *formaciones mogotiformes* of northern Cuba. These hills are not dome-shaped and are formed by both coral rock and soil. They are a common sight in the lands around La Habana.

The seedlings of the *mogote* species germinate in small holes eroded in the limestone, that are full of rotting debris. These form "natural pots" and those that host seedlings are around 11 cm in diameter. As the plants grow, a mass of roots expands out of the hole. The size of this grotesque ball of roots can be up to 40 cm across, as observed in *T. compacta*.

In the *mogotes* of Viñales, *Thrinax morrisii* stands are more dense on the vertical external cliffs, probably because of the lack of competition from other species and the increased availability of light.

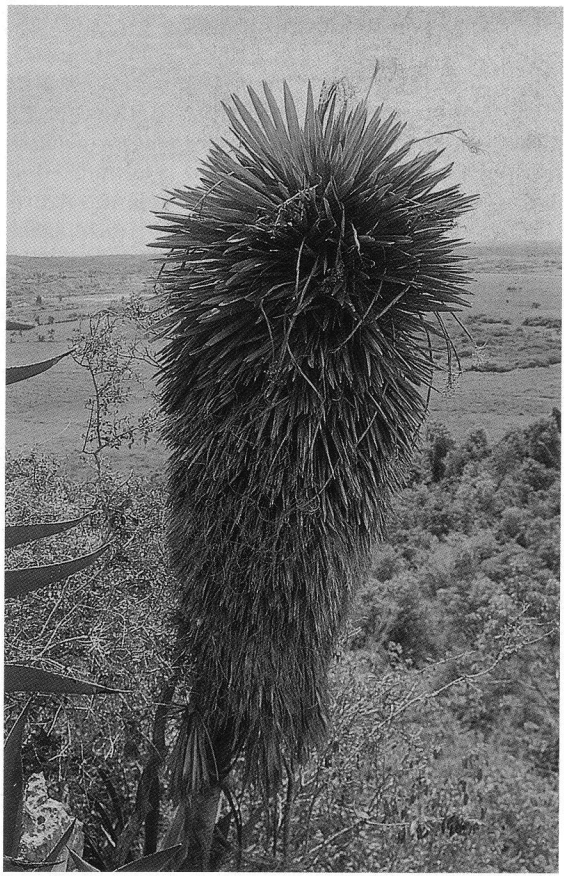
The Cuban endemic species

Thrinax compacta

This large species is endemic to the humid limestone *mogotes* of south-western Sierra de Nipe, in southeastern Cuba. Its habitat is composed of a low forest, with xeromorphic elements (*Agave*, *Plumeria*) and the palm *Coccothrinax pauciramosa*. *Thrinax compacta* is the only highland species of the genus in Cuba. Its habitat, at more than 400 m a.s.l. is within a very moist highland area, known as Altiplanicie de Nipe. Rainfall is high (more than 2500 mm/year), and the habitat is much cooler (mean annual temperature is around 22°C) and wetter than any other *Thrinax* habitat in the lowlands, due to the usually cloudy, rainy and foggy weather. In fact, *T. compacta* is the most massive of the Cuban species. Leaves of adult plants have an average diameter of 190 cm (Fig. 2) and recall in size and shape another highland species, *T. excelsa* of Jamaica.

The specific epithet of this palm, "*compacta*," given in 1883 by Grisebach and Wendland, recalls, I suppose, the unusual shape of its inflorescences. These are not only much shorter than the leaves,

5. *Thrinax ekmaniana,* with dry infructescences.



6. An unusual specimen of *Thrinax ekmaniana* that keeps most of its dry leaves.

but are also extremely compact and spherical and barely protrude out of the split base of the leafstalks which is virtually fiber free (Fig. 3). The rachillae are densely packed, curved and sinuous and the pedicels are very closely spaced (1–3 mm), so that when fruits are produced, they touch each other forming a "ball" about 25 cm large. Such a compact structure in a forested and mesic habitat is unlikely to be wind pollinated. It may be beetle-pollinated. It is the only Antillean member of the Thrinacinae to produce this kind of inflorescence.

Thrinax ekmaniana

This species is restricted to a few *mogotes* on the northern coast of Central Cuba covered by a low open scrub. The base of the hills is at 15 m a.s.l., the tops of the different peaks are at 80 m to 180 m. *Thrinax ekmaniana* (Fig. 4) is the most xeromorphic of all *Thrinax* species. The *mogotes* where it grows are, in fact, dry and fully exposed. The relatively low rainfall (1600 mm) is concentrated in the rainy season (May-Oct) and the palms survive during the remaining six months with only one fourth of the yearly rainfall. It is interesting to note that the dry infructescences of *T. ekmaniana* hang on the plant for at least a year, keeping the dry fruits on them (Fig. 5). *Thrinax ekmaniana* is unique in this respect. The unusal sheath fibers are pale, wirelike and floppy (Fig. 6).

In a recent issue of Palms (Morici 1999), I compared this rock-specialist *Thrinax* species with the most extreme rock-specialist *Coccothrinax*, *C. munizii*.

Thrinax rivularis var. *savannarum*

Thrinax rivularis var. *savannarum* (Fig. 7) is a small, compact and usually trunkless palm with shiny bright green leaves with yellowish and silvery tinges. The colorful brownish sheath fibers are joined together, forming a dark sword shaped structure. Also the white rounded fruits are visually attractive. It grows wild on the northern coast of eastern Cuba in wet sandy savannah at low elevations around the city of Moa. The rainfall is high (2000 mm/year) but the open vegetation is composed of small and tough-leaved savannah/scrub called *charrascal*, typical of the lowlands of Moa. This *Thrinax* variety grows only in these charrascales and in virtually all of them. The area is characterized by "toxic soils" derived from serpentine rock. The soil contains heavy metals that make plant growth difficult but host an exceptional flora with many endemic plants. Up to 30% of the species are endemic to this area and 70% to eastern Cuba in general (Borhidi 1991). The other palm species native but not endemic to the *charrascales* of Moa are *Copernicia rigida, Bactris cubensis* and a few species of *Coccothrinax* of uncertain status.

Inflorescences of *T. rivularis*, up to 2 m long, project out of the crown of leaves. In *T. rivularis* var. *savannarum*, the rachillae are held well above the entire plant and are a striking sight in the savanna. During sampling, I have noticed a considerable variation in fresh fruit size, ranging from 1 to 2 cm diameter.

Thrinax rivularis var. *savannarum* is very abundant in the *charrascales*, in hilly coastal landscape. Marie-Victorin and Lèon (1942–1956) wrote that they could distinguish the shiny leaves of these palms in the vegetation while flying over Moa by plane and considered this palm one of the most remarkable plants of the *charrascales*.

Thrinax rivularis var. *rivularis*

This variety can be found in a relatively widespread area around Moa that extends eastwards toward Baracoa, at least to Maguana. It grows within tall scrub or open forest. It is kept

7. Thrinax rivularis var. *savannarum* growing in open *charrascal* on serpentine soil near Moa.

separated from the other variety because it produces a robust trunk that can be 6–8 m tall (Fig. 8), leaves are up to two times larger than the other variety and leaf stalks are longer than the sword-shaped leaf sheaths. Thus, the two varieties have a distinct appearance, but it is disputable that characters of this larger variety could be caused by overshading and shelter from the surrounding vegetation.

Thrinax in Cultivation

The subgenus *Thrinax* has been extensively grown in gardens in the tropics. These palms are greatly appreciated for their small size and tolerance of drought, poor soils, wind and sun. They show some resistance to cold weather but they apparently need warm and long summers to thrive. *Thrinax radiata* has been planted successfully in the Mediterranean climates of southern Spain and southern Italy, where mature plants can bloom and set fruit (Morici & Puccio 1998). Some specimens have been tried successfully in the Canary Islands.

On the other hand, the subgenus *Hemithrinax* is almost unknown in cultivation apart from a few botanical gardens and it is totally absent from the nursery trade. For example, *T. ekmaniana*, according to the data of *Botanical Gardens Conservation International*, was cultivated only at Ventura College Community District, USA (Johnson 1996).

The Palmetum of Santa Cruz de Tenerife is currently growing all the species of the genus. All the Cuban species have been grown from wild-collected seeds, vouchered with field data and herbarium specimens and are now about 4 years old. Seeds of different species have been distributed to other botanical gardens.

None of the species suffered any special problems. I have noticed that species of the subgenus *Hemithrinax* grow much more slowly than the others. The slowest, *Thrinax rivularis* var. *savannarum,* has been the slowest palm species of the 430 that have been cultivated at the Palmetum. Two years after sowing, plants had produced just three or four leaves that were less than 14 cm long. *Thrinax radiata* of the same age had produced 10 leaves and were more than 30 cm tall. This slowness is evidently due to its origin – the "toxic" serpentine soils of Moa, charged with heavy metals. During my trips to Cuba I have collected seeds of many plant species from Moa and they are always among the slowest growers of their genera. Most Moa plants have to invest effort in expressing their adaptations to this difficult environment, the most evident being the thickness and rigidity of their leaves. Eophylls (the first leaf produced by a germinating seed) of *T. rivularis* var. *savannarum* are the most rigid of all the Caribbean Thrinacinae that I have observed (18 species).

Seeds of *T. ekmaniana* are hard to germinate. We have observed much better results by keeping pots at cooler temperatures (15–20°C) during about 4 months before warming up to the usual 30°C.

Acknowledgments

Two of my three visits to Cuba, between 1995 and 1998, were funded by the Palmetum of Santa Cruz

8. Tall plants of *Thrinax rivularis* var. *rivularis*, near Maguana, Baracoa.

de Tenerife. I am indebted to Manuel Caballero Ruano, director of the Palmetum project, who provided funding and help, both to organize the trips and to make the plants grow. I express my gratitude to all the people who helped me in Cuba, especially the botanists Juan Hamacho and Anel Matos, Carlos Pérez Morales director of the "Centro de Extensión Agrícola" of Santa Clara and the people of the herbarium of Academy of Sciences in La Habana (HAC). I also thank my friends Fabio Friscia and Javier Rodríguez Chávez, who accompanied me during the expeditions.

Literature Cited

Borhidi, A. 1991. Phytogeography and Vegetation Ecology of Cuba. Akadémiai Kiadó, Budapest, Hungary.

Johnson, D. (ed.) and the IUCN/SSC Palm Specialist Group. 1996. Palms: Their con-servation and sustained utilization. Status survey and action plan. IUCN, Gland, Switzerland and Cambridge, UK.

Marie-Victorin, F.É.C. and F.É.C. Lèon. 1942–1956. Itinéraires botaniques dans l'île de Cuba. Vol. I, II, III. Institut Botanique de Montreal, Canadá.

Morici, C. 1999. *Coccothrinax munizii*. Palms 43: 190–193.

Morici, C. and P. Puccio. 1998. A brief account on the cultivation of *Thrinax* and *Gaussia* in southern Europe and the Canary Islands. The Palm Journal 140: 32.

CLASSIFIED

Checklist of the Palms of Cuba, with Notes on their Ecology, Distribution and Conservation

CELIO E. MOYA LÓPEZ
Jardín Botánico Sancti Spiritus
Ministerio de Ciencia,
Tecnología y Medio Ambiente
Apdo. 52, CP 60200
Sancti Spiritus, Cuba
cmoya@yayabo.inf.cu

AND

ANGELA T. LEIVA SÁNCHEZ
Jardín Botánico Nacional
Carr. El Rocío, km 3 1/2
Calabazar, CP 19230
Ciudad de La Habana, Cuba
hajb@ceniai.inf.cu

Cuba has a rich palm flora despite its relatively small territory. The palms play an important role in Cuba's landscape and vegetation and in the everyday life of Cuban people, who have multiple uses for these plants (Muñiz & Borhidi 1982).

The goal of this study is to up-date the list of Cuban palms given by León (1946), taking into consideration the revisions of several palm genera from the new world and the new species reported for Cuba. This new checklist will allow future publications to use the correct nomenclature.

In preparing this checklist, we reviewed the following lists of Cuban species: Grisebach (1866), Sauvalle (1868), Beccari (1912, 1913), Dahlgren (1936), León (1946), Alain (1969), Muñiz and Borhidi (1982), Borhidi and Muñiz (1985) and Henderson et al. (1995). The nomenclature from these lists was up-dated according to the modern revisions of neotropical genera: *Calyptronoma* (Zona 1995), *Gastrococos* (Moore 1967), *Gaussia* (Quero & Read 1986), *Prestoea* (Henderson & Galeano 1996), *Pseudophoenix* (Read 1968), *Roystonea* (Zona 1996), *Sabal* (Zona 1990) and *Thrinax* (Read 1975), as well as the revision of *Bactris* for the Caribbean (Salzman & Judd 1995). The most recent additions to the list of palms from Cuba by Moya et al. (1991), Zona (1992) and Borhidi and Hernández (1993) were also included.

The family Palmae in Cuba is represented by 15 genera, two subgenera and 81 species, six hybrids and nine infraspecific taxa for a total of 96 indigenous palms (Table 1). Of these, 83 taxa (87%) are endemic, i.e., found only in Cuba. The percentage of endemics is high, one of the highest for Cuban plant families. One genus (*Gastrococos*) and two subgenera (*Copernicia* subg. *Copernicioopsis* and *Thrinax* subg. *Hemithrinax)* are endemic.

Our checklist differs from that of previous authors. *Scheelea cubensis* Burret is not included because its

Table 1. The Cuban palms according to Uhl and Dransfield (1987).

SUBFAMILY	TRIBES	SUBTRIBES	GENERA	TAXA
CORYPHOIDEAE	1	5	6	81
CEROXYLOIDEAE	2	–	2	3
ARECOIDEAE	2	5	7	12
TOTAL	5	10	15	96

presence in Cuba has not yet been confirmed. The name was based on a single collection that was probably erroneously attributed to the island or based on a cultivated specimen. Likewise, *Acrocomia subinermis* León ex Bailey, is omitted. This palm was described from along the road from La Cruz de Piedra to Guatao, Havana. We have found that only *Gastrococos crispa* occurs in this area. It seems likely that *Acrocomia subinermis* was based on an adult specimen of *Gastrococos crispa* with an unarmed trunk. *Elaeis guineensis* Jacq. is excluded; it was cultivated in Baracoa and erroneously considered naturalized in that region. *Hemithrinax*, formerly treated at the generic rank, is now considered to be a subgenus of *Thrinax* (Borhidi & Muñiz 1985).

In current literature, *Coccothrinax miraguama* has been cited as described by León. However, León only amplified and completed the original description made by Beccari.

Some modern authors have considered the list of Cuban palm species by Henderson et al. (1995) as definitive. However, Henderson et al. stated clearly that "... this Guide is not a taxonomic treatment, but a field guide for nonspecialists. For this reason we have tended to combine closely related and doubtfully distinct species and also groups of species that we consider to be part of species complexes." Hence, our list differs significantly from the list of Henderson et al. (1995).

There are still pressing taxonomic problems in Cuban palms. There is an urgent need for modern taxonomic revisions of *Coccothrinax*, *Copernicia* and *Acrocomia*, as well as detailed evolutionary genetic studies of hybrids and disjunct taxa.

CUBAN PALMS AND IMPORTANT SYNONYMS

Accepted names are in bold; synonyms are given in Italics.

CORYPHOIDEAE Griffith

THRINAX O. Swartz

Thrinax compacta (Griseb. & H. Wendl.) Borhidi & Muñiz

Hemithrinax compacta (Griseb. & H. Wendl.) Hook f.

Thrinax ekmaniana (Burret) Borhidi & Muñiz

Hemithrinax ekmaniana Burret

Thrinax morrisii H. Wendl.

Thrinax drudei Becc.

Thrinax microcarpa Sarg.

Thrinax punctulata Becc.

Thrinax radiata Lodd. ex Schult. & Schult f.

Thrinax parviflora Sw.

Thrinax wendlandiana Becc.

Thrinax rivularis (León) Borhidi & Muñiz var. **rivularis**

Hemithrinax rivularis León

Hemithrinax rivularis (León) Borhidi & Muñiz var. *rivularis*

Thrinax rivularis (León) Borhidi & Muñiz var. **savannarum** Borhidi & Muñiz

Hemithrinax savannarum León

Hemithrinax rivularis (León) Borhidi & Muñiz var. *savannarum* Muñiz

COCCOTHRINAX Sargent

Coccothrinax acunana León

Coccothrinax alexandri León ssp. **alexandri** León

Coccothrinax alexandri León ssp. **nitida** (León) Borhidi & Muñiz

C. alexandri León var. *nitida* León

Coccothrinax baracoensis Borhidi & Muñiz

Coccothrinax bermudezii León

Coccothrinax borhidiana Muñiz (Fig. 2)

Coccothrinax brevicrinis Borhidi & Muñiz

C. crinita (Griseb. & H. Wendl.) Becc. ssp. *brevicrinis* Borhidi & Muñiz

Coccothrinax camagueyana Borhidi & Muñiz

Coccothrinax clarensis León ssp. **clarensis**

C. clarensis León var. *perrigida* León

Coccothrinax clarensis León ssp. **brevifolia** (León) Borhidi & Muñiz

C. clarensis León var. *brevifolia* León

1. *Coccothrinax hiorami*, Guantánamo. (photo by S. Zona)

Coccothrinax crinita (Griseb. & H. Wendl. ex Wright) Becc.

Thrinax crinita Griseb. & H. Wendl.

Coccothrinax cupularis (León) Muñiz & Borhidi

C. miraguama (Kunth) Becc. var. *cupularis* León

Coccothrinax elegans Muñiz & Borhidi

Coccothrinax fagildei Borhidi & Muñiz

Coccothrinax fragrans Burret

Coccothrinax garciana León

Coccothrinax guantanamensis (León) Muñiz & Borhidi

C. argentea (Lodd.) Sargent var. *guantanamense* León

Coccothrinax gundlachii León

Coccothrinax hiorami León (Fig. 1)

Coccothrinax leónis Muñiz & Borhidi

Coccothrinax litoralis León

Coccothrinax macroglossa (León) Muñiz & Borhidi

C. miraguama (Kunth) Becc. var. *macroglossa* León

Coccothrinax microphylla Borhidi & Muñiz

2. *Coccothrinax borhidiana.* (photo by C. Morici)

Coccothrinax miraguama (Kunth) Becc. ssp. **miraguama**

*C. acuminata (*Griseb. & H. Wendl.) Sarg.

Thrinax acuminata Griseb. & H. Wendl.

Thrinax miraguana Mart.

Coccothrinax miraguama (Kunth) Becc. ssp. **arenicola** (León) Borhidi & Muñiz

C. miraguama (Kunth) Becc. var. *arenicola* León

Coccothrinax miraguama (Kunth) Becc. ssp. **havanensis** (León) Borhidi & Muñiz

C. miraguama (Kunth) Becc. var. h*avanensis* León

Coccothrinax miraguama (Kunth) Becc. ssp. **roseocarpa** (León) Borhidi & Muñiz

C. miraguama (Kunth) Becc. var. *roseocarpa* León

Coccothrinax moaensis (Borhidi & Muñiz) Muñiz

Coccothrinax munizii Borhidi

Coccothrinax muricata León

Coccothrinax nipensis Borhidi & Muñiz

Coccothrinax orientalis (León) Muñiz & Borhidi

C. yuraguana (A. Rich.) León var. *orientalis* León

Coccothrinax pauciramosa Burret

Coccothrinax pumila Borhidi & J. A. Hernández

Coccothrinax pseudorigida León

C. pseudorigida León var. *acaulis* León

Coccothrinax rigida (Griseb. & H. Wendl.) Becc.

Thrinax rigida Griseb. & Wendl.

Coccothrinax salvatoris León ssp. **salvatoris**

Coccothrinax salvatoris León ssp. **loricata** (León) Borhidi & Muñiz

C. salvatoris León var. *loricata* León

Coccothrinax savannarum (León) Borhidi & Muñiz

C. muricata León var. *savannarum* León

Coccothrinax saxicola León

Coccothrinax trinitensis Borhidi & Muñiz

Coccothrinax victorini León

Coccothrinax yunquensis Borhidi & Muñiz

Coccothrinax yuraguana (A. Rich.) León

C. miraguano Becc.

COLPOTHRINAX Grisebach & H. Wendland

Colpothrinax wrightii Griseb. & H.Wendl. ex Siebert & Voss.

Pritchardia wrightii (Griseb. & H. Wendl.) Becc.

ACOELORRAPHE H. Wendland

Acoelorraphe wrightii (Griseb. & H. Wendl.) H. Wendl. ex *Becc.*

Copernicia wrigthii Becc.

COPERNICIA Martius

Copernicia baileyana León

C. baileyana León var. *laciniosa* León

Copernicia brittonorum León

C. brittonorum León var. *acuta* León

C. brittonorum León var. *sabaloense* León

Copernicia x burretiana León (pro sp.) (**C. hospita x C. macroglossa**)

Copernicia cowellii Britt. & Wilson

Copernicia curbeloi León

Copernicia curtissii Becc.

C. *clarensis* León

C. *pauciflora* Burret

C. hospita Mart. var. *clarensis* León

Copernicia fallaensis León (Fig. 4)

Copernicia gigas Ekman ex Burret

C. excelsa León

Copernicia glabrescens H. Wendl. ex Becc. var. **glabrescens**

Copernicia glabrescens H. Wendl. ex Becc. var. **ramosissima** (Burret) Muñiz & Borhidi

C. ramosissima Burret

Copernicia hospita Martius

Copernicia humicola León

Copernicia longiglossa León

Copernicia macroglossa H. Wendl. ex Becc.(Fig. 6)

C torreana León

Copernicia molineti León

Copernicia x occidentalis León (pro sp.) (**C. curtissi x C. brittonorum**)

Copernicia oxycalyx Burret

C. clarkii León

Copernicia rigida Britt. & Wils. (Fig. 5)

Copernicia roigii León

Copernicia x shaferi Dahlgr. & Glassm. (pro sp.) (**C. hospita x C. cowellii**)

Copernicia x sueroana León (pro sp.) (**C. hospita x C. rigida**)

Copernicia x textilis León (pro sp.) (**C. hospita x C. baileyana**)

Copernicia x vespertilionum León (pro sp.) (**C. gigas x C. rigida**)

Copernicia yarey Burret var. **yarey**

C. holguinensis León

Copernicia yarey Burret var. **robusta** León

SABAL Adanson

Sabal domingensis Becc.

Sabal maritima (Kunth) Burret

S. florida Becc.

Sabal palmetto (Walt.) Lodd. ex J.A. & J.H. Schult.

S. parviflora Becc.

Sabal yapa Wright ex Becc. (Fig. 7)

S. mayarum Bartlett

CEROXYLOIDEAE Drude

PSEUDOPHOENIX H. Wendland ex Sargent

Pseudophoenix sargenti H. Wendl. ex Sarg. ssp. **saonae** (O. F. Cook) Read var. **saonae**

GAUSSIA H. Wendland

Gaussia princeps H. Wendl.

Gaussia spirituana Moya & Leiva (Fig. 3)

ARECOIDEAE

PRESTOEA Hook.f. ex Benth. & Hook. f.

P. acuminata (Willd.) H. E. Moore var. **montana** (Graham) Henderson & Galeano

Prestoea montana (R. Graham) Nichols.

ROYSTONEA O. F. Cook

Roystonea lenis León

R. regia (Kunth) O. F. Cook var. *pinguis* Bailey

Roystonea maisiana (L. H. Bailey) Zona (Fig. 8)

R. regia (Kunth) O. F. Cook var. *maisiana* Bailey

Roystonea regia (Kunth) O. F. Cook

Oreodoxa regia Kunth

3. *Gaussia spirituana*, Sierra de Jatibonico, Sancti Spiritus.

4. *Copernicia fallaensis*, cultivated in the Jardín Botánico Nacional, Havana.

5. *Copernicia rigida* and *Bactris cubensis*, near Moa. (photo by S. Zona)

Roystonea stellata León

Roystonea violacea León

COCOS L.

Cocos nucifera L.

ACROCOMIA Martius

Acrocomia aculeata (Jacq.) Lodd. ex Mart.

A. lasiospatha Mart.

Acrocomia pilosa León

GASTROCOCOS Morales

Gastrococos crispa (Kunth) H. E. Moore (Fig. 10)

Acrocomia crispa (Kunth) Baker ex Becc.

Acrocomia armentalis (Morales) Bailey

Gastrococos armentalis Morales

BACTRIS N. J. Jacquin ex Scopoli

Bactris cubensis Burret (Fig. 5, 9)

CALYPTRONOMA Grisebach

Calyptronoma plumeriana (Mart.) Lourt. (Fig.11)

Calyptrogyne clementis León

Calyptrogyne dulcis (Wr. ex Griseb.) G. Maza

Calyptrogyne intermedia (Griseb. & H. Wendl.) G. Maza

Calyptrogyne microcarpa León

Calyptrogyne occidentalis (Sw.) G. Maza

Calyptrogyne swartzii Becc.

Calyptronoma clementis (León) A. D. Hawkes ssp. *clementis*

Calyptronoma clementis (León) A. D. Hawkes ssp. *orientalis* Muñiz & Borhidi

Calyptronoma dulcis (Wr. & Griseb.) Bailey

Calyptronoma intermedia (Griseb. & H. Wendl.) H. Wendl.

Calyptronoma microcarpa (León) A. D. Hawkes

Notes on the ecology, distribution and conservation of Cuban palms

Much of the Cuban landscape is dominated by palms, a fact obvious to anyone who visits the country. Throughout the island, in mountains, plains, coastal habitats, thickets, savannas or forests, it is possible to encounter one, two, three or even four different palm genera or species growing side by side. On the other hand, because of its high palm diversity and significant number of threatened species, a national plan for palm conservation has been recommended by Johnson and the IUCN/SSC Palm Specialist Group (1996). Accordingly, a national approach is being taken. The conservation program includes assessment and management planning (11 palm species), studies on the seed germination of threatened palms (*Coccothrinax borhidiana, Thrinax ekmaniana*), *in situ* conservation actions for endangered and critically endangered species in the National System of Protected Areas (*Thrinax ekmaniana, Coccothrinax borhidiana, C. crinita, C. brevicrinis, C. victorini*), field work for establishment of conservation categories and *ex situ* cultivation and educational activities in botanic gardens, as well as ethnobotanical studies on sustainable use of palms (*Acrocomia pilosa, Gastrococos crispa, Copernicia baileyana*).

In following paragraphs, we provide an overview of the most interesting features of the ecological and geographical distribution of Cuban palms, as well as their conservation status according to the criteria given by UICN (1994), and Peña et al. (1998). For an easier approach, the different genera will be treated in alphabetical order, giving details on remarkable or noteworthy species. The names of Cuban political provinces are abbreviated as follows, from west to east: Pinar del Río (PR), La Habana (HA), Isla de la Juventud (IJ), Ciudad de La Habana (CH), Matanzas (MA), Villaclara (VC), Cienfuegos (CI), Sancti Spiritus (SS), Ciego de Avila (CA), Camagüey (CG), Las Tunas (LT), Holguín

6. *Copernicia macroglossa*, cultivated. (photo by S. Zona)

(HO, Granma (GR), Santiago de Cuba (SC) and Guantánamo (GU). Phytogeographical subprovinces are referred as Western, Central and Eastern Cuba.

Acoelorraphe

Acoelorraphe wrightii

Local name: Guano prieto.

This graceful fan palm is abundant in seasonally flooded savannas and semideciduos forests, swamps (fresh or brackish water) and in pine forests. It is fire resistant, as fire is a somewhat common event in its habitats. This beautiful species also occurs in Florida (Everglades), Mexico (Yucatán), Central America, Bahamas and Colombia in South America (Zona 1997). In Cuba, it is present only in Western and Central Cuba (PR, IJ, HA, MA, VC, CI, SS, CG). It is a rather abundant species, and there is no threat at present.

Acrocomia

Acrocomia pilosa

Local name: Corojo

This is a stout and spiny palm, endemic to Cuba, very closely related to (and sometimes mistakenly included with) *A. aculeata* Mart. from Tropical America, which is locally cultivated in central provinces. In Cuba, *A. pilosa* lives in anthropogenic savannas and semideciduous forests of Eastern and Central-Eastern Cuba, in limestone soils (GU, CG) where it is widely used as a source of edible oil. We consider it an endangered species (EN) because it is very scarce and occurs in fragmented populations, although it has been categorized as Rare by others (Dransfield et al. 1988). A very interesting local project on sustainable use of this palm is being developed in a rural locality in Camagüey province.

7. *Sabal yapa*, Jardín Botánico Nacional (photo S. Zona)

Bactris

Bactris cubensis (Fig. 5, 9)

Local names: Palma pajúa or Pajuá.

This very thin and spiny palm is rather abundant in pine (*Pinus cubensis*) and rainforests, and thickets on serpentine and serpentine-derived soils in the north-eastern mountain ranges of Eastern Cuba (GU, SC, HO). This palm is not a threatened species. It is very difficult to cultivate outside its natural habitat.

Calyptronoma

Calyptronoma plumeriana (Fig. 11)

Local names: Manaca, Palma manaca, Flor de confite

The distribution of this very interesting species is always related to water: It is found along river banks and gallery forests in lowlands, and in montane rainforests (PR, IJ, HA, MA, CI, SS, VC, GR, SC, HO, GU). In the mountains, this palm sometimes occurs in dense populations called "*manacales*" at elevations between 500 to 900 m. There are no threats for the species, although populations in lowlands are very disturbed by agriculture. Before Zona's taxonomic treatment of the genus (1995), there were four species attributed to the flora of Cuba: *C. dulcis, C. intermedia, C. clementis* and *C. microcarpa.*

Coccothrinax

Local names: Miraguano, Yuraguano, Yuraguana, Palma Petate (*C. crinita*)

Coccothrinax is by far the richest genus of Cuban palms, both at specific and infraspecific levels. In general, it is widespread over both the main island of Cuba and the Isle of Youth (formerly Isle of Pines). About 39 species occur in Cuba, and perhaps some more are to be discovered. However, there will also likely be some reductions to synonymy. Cuba is doubtlessly the center of evolution of this interesting palm genus, which is

8. *Roystonea maisiana*, Maisí, Guantánamo. (photo by S. Zona)

9. *Bactris cubensis*, near Moa. (photo by Virginia Salzman)

restricted to the Caribbean basin with few (about seven) species occurring outside of Cuba. *Coccothrinax* urgently needs a modern and multidisciplinary study, including phylogenetic, biogeography, taxonomy, ecology and ethnobotany, as recommended by Johnson and the IUCN/SSC Palm Specialist Group (1996).

Coccothrinax distribution is closely related to aridity or low availability of soil water: It is often found on coastal limestone, serpentine-derived or siliceous sandy soils with sharp drainage, and in seasonally-flooded, heavy, clay soils where the dry season is very long and severe. Every outcrop of serpentinite in Cuba has its own *Coccothrinax* species. It is also abundant in pine forests. Coastal limestones of Eastern Cuba are notably rich in *Coccothrinax* species.

There are eleven species that have been categorized under the different criteria of UICN (1994): six are categorized as Vulnerable (*C. baracoensis, C. fagildei, C. nipensis, C. pseudorigida, C. savannarum* and *C. yunquensis);* one is categorized under "Endangered" (*C. camagueyana*) and four are Critically Endangered (CR) (*C. borhidiana, C. brevicrinis, C. crinita* and *C. victorini).* We believe that three species, *Coccothrinax crinita, C. brevicrinis* and *C. borhidiana* (Fig. 2), are in greatest need of conservation actions in the Caribbean region (Johnson & the IUCN 1996). In the case of the first species, only one population of approximately 60 individuals was located during recent explorations in Pinar del Río province, in secondary semideciduous forests. Use of its fibers (in brush and broom manufacture, as well as for making mattresses) and fires during the dry season have pushed this species into the critically endangered category. *Coccothrinax borhidiana* (Fig. 2) has a very narrow distribution, only about one kilometer of coastal limestone west of Matanzas bay, in Matanzas province, Central-Western Cuba.

Colpothrinax

Colpothrinax wrightii

Local name: Palma Barrigona

This very curious belly-palm is restricted to western pine forests (*Pinus tropicalis*) and savannas on siliceous sandy soils very poor in nutrients, in Pinar del Río province and the Isle of Youth. Although abundant in such ecosystems, the use of land for agricultural purposes makes this jewel of Cuban endemic flora an endangered species (Peña et al. 1998). Rural people use this palms for several purposes: The big fan leaves for thatching, the timbers for house construction, the trunk for water containers and as mortars for grinding coffee beans (*"pilón"*), and the fruits for raising pigs. This species has special protection by the Forestry Law of 1998, regulating its use. It can be easily grown in rich, limestone-derived soils like the ones of the National Botanic Garden, where this species grows vigorously.

Copernicia Martius

Copernicia is the second largest palm genus in Cuba. There are 24 species, all endemic. The main center of diversification for the genus is Central Cuba, (mainly Central-Eastern), always in plains or low altitude hills, on very diverse soils. Particularly abundant and species-rich places are the serpentine-derived soils (PR, CH, HA, MA, VC, SS, CA, LT, GR, HO, CG) and the heavy clay, hydromorphic soils that prevail in subcoastal plains of Central Cuba. Depending on their size, *Copernicia* palms are commonly named as *"Jatas"* or *"Yareyes."* The first name is given to species with slender trunks that can have up to 5–7 m of height, and the name *"Yarey"* is applied to species bearing huge, massive and tall trunks of more than 10 m heigt. *Jatas* almost always occur in serpentine soils, poor in organic matter, whereas *Yareyes* are common in heavy, clay soils in secondary savannas. A new taxonomic treatment of this very interesting and highly confusing genus is urgently needed.

In regards to conservation, the situation is confusing. The problem arises with the doubtful taxonomic status of several species, whose boundaries are not well defined, and thus the number of threatened taxa varies from eight (*Copernicia brittonorum, C. curbeloi, C. fallaensis, C. gigas, C. humicola* and *C. roigii*, in IUCN-BGCS 1989) to six (*C.* x *burretiana, C. fallaensis, C. gigas, C. oxycalyx, C.* x *sueroana* and *C.* x *vespertilliorum* in Peña et al. 1998) to only one (*Copernicia brittonorum* in Johnson & the IUCN/SSC Palm Specialist Group 1996).

Gaussia

Local name: Palma de Sierra

There are two Cuban endemic species in this small genus, which is restricted the Caribbean (Yucatán, Guatemala, Belize, Cuba, Dominican Republic and Puerto Rico) and has a total of five species. The Cuban ones are located in almost vertical karstic hills of bare rocks known as *"mogotes."* They are always on steep cliffs, living in holes filled with humus. Those karstic formations are very well developed in Western Cuba (Sierra de Viñales) where the type species of this genus lives (*Gaussia princeps*). In Central Cuba, *Gaussia spirituana* (Fig. 3) is found on *mogote*-like karstic hills in the Sierra de Jatibonico. The first mentioned species is not threatened at all, as it is abundant, and its use by

local population is negligible. Moreover, the localities are under protection. *Gaussia spirituana* is very scarce in natural populations (fewer than 100 individuals). No agriculture or any other human activity is known in these rocky hills, and only natural events such as fire pose a significant risk. We categorize it as vulnerable.

Prestoea

Prestoea acuminata var. **montana**

Local name: Palma Boba, Palma Justa

Restricted to elevations up to 800 m, this palm can be found in Eastern Cuban mountains, (GR, SC, GU) as well as in other Antillean islands. There is no threat for this graceful palm, which is not known to be cultivated in Cuba.

Pseudophoenix

Pseudophoenix sargentii ssp. **saonae** var. **saonae**

Local name: Palma de Santa Lucía, Palma de Guinea

The variety *saonae* is considered to be endemic to the northern coast and keys of Central Cuba (VC, CA, CG, LT), which are areas floristically related to Bahamas. *Pseudophoenix* also occurs on Maisí, at the easternmost extreme of Cuba (S. Zona, personal comm.). This beautiful palm is threatened by human disturbance and destruction of its coastal habitats. Its potential as an ornamental has yet to be fully exploited, as it grows well when cultivated from seed.

Roystonea

Local names: Palma Real, Palma de Seda, Palma Criolla Azul, Palma Blanca

With five of the ten known species, four of which are endemic, Cuba appears again as a center for diversification of a palm genus. Zona (1996) stated that "the endemic species of eastern Cuba (*Roystonea lenis, R. stellata, R. maisiana* and *R. violacea*) are not sister species..... Their evolutionary history is perhaps the most vexing phylogenetic problem in the genus...." Zona favored the refugium hypothesis to explain the presence of four endemic species in eastern Cuba, but whatever their history, the fact remains that the greatest richness of *Roystonea* is found in Cuba.

Roystonea regia is by far the most widespread palm in Cuba, being a typical feature of Cuban landscape in rich and well drained soils. It is the national tree because of its omnipresence, its majestic trunk and beautiful crown of long leaves. The leaves and wood are used by rural people for construction, the fruits for feeding pigs, the oil they contain for soap-making and the roots for medicinal uses. The palm is also cultivated as an ornamental. This species is also protected by the Forest Law from 1998, although no threat is recognized. On the contrary, it can be an invader when primary forest is cut. *Roystonea regia* also occurs in Yucatán, Honduras, Belize, southern Florida, Cayman Islands and Bahamas (Zona 1996). The other three species (*R. lenis, R. maisiana* [Fig. 8] and *R. violacea*) are restricted to the Guantánamo province and have been preliminarily categorized as vulnerable. *Roystonea stellata* may be extinct, as no specimens have been found despite several searches.

Sabal

Local names: Palma Cana, Guano Cana.

There are four species in Cuba, none of which are endemic or threatened. *Sabal maritima* and *S. palmetto* are the most widespread in swampy or poorly-drained soils, mostly in Western and Central Cuba, in extensive secondary savannas and semideciduous forests together with *Bucida* spp. (Combretaceae). *Sabal yapa* (Fig. 7) occurs in semideciduous forests on limestone soils, and to a lesser extent in swamps. *Sabal domingensis* was confirmed by Zona (1992) to be present in southeastern coast of Cuba (GU).

Thrinax

Local names: Guano de Costa, Miraguano de Lana, Yuraguancillo, Palmita de Jumagua

This little genus comprises seven species, of which six taxa are present in Cuba, and four are endemic (*Thrinax rivularis, T. rivularis* var. *savannarum, T. compacta, T. ekmaniana*), belonging in subgenus *Hemithrinax*. All are considered to be threatened, and a status of vulnerable has been assigned.

The two non endemic species are very abundant, found in coralline sand along the coasts (*T. radiata*) or in limestone outcrops at the interior of the country on *mogotes* (*T. morrisii*).

Acknowledgments

The authors deeply thank Nora Barboza for translating of part of the manuscript to English and Dr. Scott Zona for revising the final text.

LITERATURE CITED

ALAIN, HNO. ["LIOGIER, A. H."] 1969. Flora de Cuba. Suplemento. Caracas.

BECCARI, O. 1912. The palms indigenous to Cuba, I. Pomona Coll. Journ. of Econ. Botany 2: 253–276.

_____ 1912. The palms indigenous to Cuba II. Pomona Coll. Journ. of Econ. Botany 2: 351–377.

10. *Gastrococos crispa*, cultivated at Jardín Botánico Nacional, Havana. (photo by S. Zona)

11. *Calyptronoma plumeriana*, Pinar del Río. (photo by S. Zona)

_____ 1913. The palms indigenous to Cuba, III. Pomona Coll. Journ. of Econ. Botany 3: 392–417.

BORHIDI, A. AND J. A. HERNANDEZ. 1993-94. Una nueva palma de Cuba. Acta Bot. Hung. 38: 195–197.

_____ AND O. MUÑIZ. 1985. Adiciones al Catálogo de las Palmas de Cuba. Act. Bot. Hungarica 31: 225–230.

DAHLGREN, B. 1936. Index of American Palms. Field Mus. Nat. Hist. Bot. Series. 14: 1–438.

_____ AND S. GLASSMAN. 1963. A revision of the genus *Copernicia*. 2. West Indian Species. Gentes Herb. 9: 43–232.

DRANSFIELD, J., D. JOHNSON, AND H. SYNGE (comp.). 1988. The Palms of the New World. A Conservation Census. IUCN-WWF Plants Conservation Programme, Publication, No. 2. U.K.

GRISEBACH, A. 1866. Catalogus Plantarum Cubensium. Leipzig.

HENDERSON, A. AND G. GALEANO. 1996. *Euterpe, Prestoea* and *Neonicholsonia*. Flora Neotropica Monograph 72:1–90.

_____, _____ AND R. BERNAL. 1995. Field Guide to the Palms of the Americas. Princeton Univ. Press. Princeton. New Jersey.

IUCN-BGCS. 1989. Rare and Threatened Plants of Cuba: Ex Situ Conservation in Botanic Gardens. U.K.

JOHNSON, D. (ed.) AND IUCN/SSC PALM SPECIALIST GROUP. 1996: Palms: Their Conservation and Sustainable Utilization. Status Survey and Conservation Action Plan. IUCN, Gland, Switzerland and Cambridge, UK. 116 + viii pp.

LEÓN, HNO. 1946 Flora de Cuba I. Gimnospermas, Monocotiledoneas. Contrib. Ocas. Museo Hist. Nat. Col. La Salle 8: 236–269.

MOYA, C., A.. LEIVA, J. L. VALDES GARCIA, J. VALDES-FORTUN AND A. HERNANDEZ-MUÑOZ. 1991. *Gaussia spirituana* Moya et Leiva, *sp. nov.*: Una nueva palma de Cuba central. Rev. Jardín Bot. Nacional 12: 15–19.

MUÑIZ , O. AND A. BORHIDI. 1982. Catálogo de las palmas de Cuba. Act. Bot. Ac. Sc. Hung. 28: 309–345.

NAUMAN, C. AND R. SANDERS. 1991. An annotated key to the cultivated species of *Coccothrinax*. Principes 35: 27–46.

PEÑA, E., P. I. LÓPEZ, J. LAZCANO, A. LEIVA AND U. SEAL. 1998: Taller para la Conservación, Análisis y Manejo Planificado de Plantas Silvestres Cubanas. IUCN/SSC Conservation Breeding Specialist Group. Apple Valley, MN.

QUERO, H. AND R. READ. 1986. A revision of the palm genus *Gaussia*. Syst. Bot. 11: 145–154.

READ, R. 1968. A study of *Pseudophoenix* (Palmae). Gentes Herb. 10: 169–213.

_____ 1975. The genus *Thrinax* (Palmae: Coryphoideae). Smithsonian Contr. Bot. 19: 1–98.

SALZMAN, V. T. AND W. S. JUDD. 1995. A revision of the Greater Antillean species of *Bactris* (Bactridinae: Arecaceae). Brittonia 47: 345–371.

SAUVALLE, F. A. 1868. Flora Cubana. Revisio Catalogi Grisebachiani vel Index Plantarum Cubensium. Havana.

UHL, N. AND J. DRANSFIELD. 1987. Genera Palmarum. A Classification of Palms Based on the Work of Harold E. Moore, Jr. International Palm Society and L. H. Bailey Hortorium, Lawrence, Kansas.

UICN. 1994. Categorías de las listas rojas de la UICN preperadas por la Comisión de Supervivencia de Especies de la UICN. Gland, Suiza.

ZONA, S. 1990. A monograph of *Sabal* (Arecaceae: Coryphoideae). Aliso 12: 583–666.

_____ 1992. Distribution update: *Sabal domingensis* in Cuba. Principes 36: 34–35.

_____ 1995. A revision of *Calyptronoma* (Arecaceae). Principes 39:140–151.

_____ 1996. *Roystonea* (Arecaceae: Arecoideae). Flora Neotropica Monograph 71: 1–35.

_____ 1997. The genera of Palmae (Arecaceae) in the southeastern United States. Harvard Papers in Botany 2: 71–107.

La Palma Barrigona

SCOTT ZONA
Fairchild Tropical Garden
11935 Old Cutler Road
Coral Gables (Miami), Florida 33156 USA
and Dept. of Biological Sciences
Florida International University
Miami, Florida 33199 USA

DON EVANS
AND
KATHERINE MAIDMAN
Fairchild Tropical Garden
10901 Old Cutler Road
Coral Gables (Miami), Florida 33156 USA

***Palma barrigona* is the common name given to *Colpothrinax wrightii*. The name may be translated as "pot-bellied palm," but so inelegant a name is an injustice to this striking palm of western Cuba.**

The native habitats of this palm are the flat, open savannas of Pinar del Río Province and the Isle of Youth, where the soil is acidic, silica sand and the land is seasonally flooded. It shares this habitat with other palms such as *Acoelorraphe wrightii*, *Coccothrinax miraguama* var. *arenicola*, and *Sabal maritima*. The ubiquitous *Roystonea regia*, so common throughout most of lowland Cuba, is not an associate of *Colpothrinax* as it prefers richer soils.

The stem of *Colpothrinax wrightii* is the palm's most striking feature (Fig. 1). At maturity, the palm may achieve 12–15 m in height. On most mature individuals, the stem is conspicuously swollen, usually beginning about two meters above the soil. Below the bulge, the stem diameter is around 30 cm, but the bulge itself may exceed 90 cm in diameter. The bulge is likely to be an adaptation for water storage, and individuals in cultivation, where water is not limiting, often have a less conspicuous "belly." Cultivated individuals have stems above and below the bulge that are much thicker in diameter than those of wild individuals. Thus, cultivation seems to lessen the appearance of the "belly" not by diminishing the swollen area, but by increasing the diameter of the non-swollen parts of the trunk.

Unlike the girth ignominiously acquired by men at middle age, the *palma barrigona* acquires its bulging midsection during adolescence. The palm does not reach reproductive maturity until after the stem has begun forming a bulge. The stem has an outer cortex that is rough, furrowed and dark brown. As the palm matures (and perhaps hastened by fire), the outer cortex sloughs off to reveal a silver, smooth trunk (Fig. 2)

The swollen stem of the *palma barrigona* is much used by local people. Stems are used as water barrels, feed troughs, planters, house posts (Fig. 4), furniture, canoes, and even beehives (Alain 1961). The leaves are still commonly used as thatch (Figs. 1 and Front Cover).

Although the stem of *Colpothrinax wrightii* grabs all the attention, the foliage and flowers are also worth noting. The crown is nearly spherical, and the leaves are dark green with pendulous tips. The leaves are unarmed, and the petiole bases are hidden among masses of slender, brown fibers. The inflorescence branches and flowers are

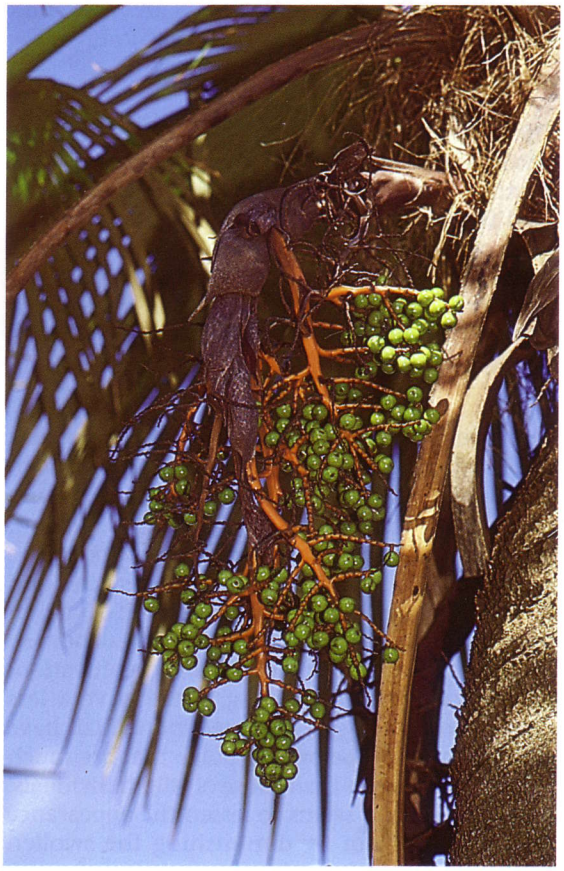
1. *Colpothrinax wrightii* growing near fields of tobacco. The tobacco drying sheds in the background are thatched with *Colpothrinax* leaves.

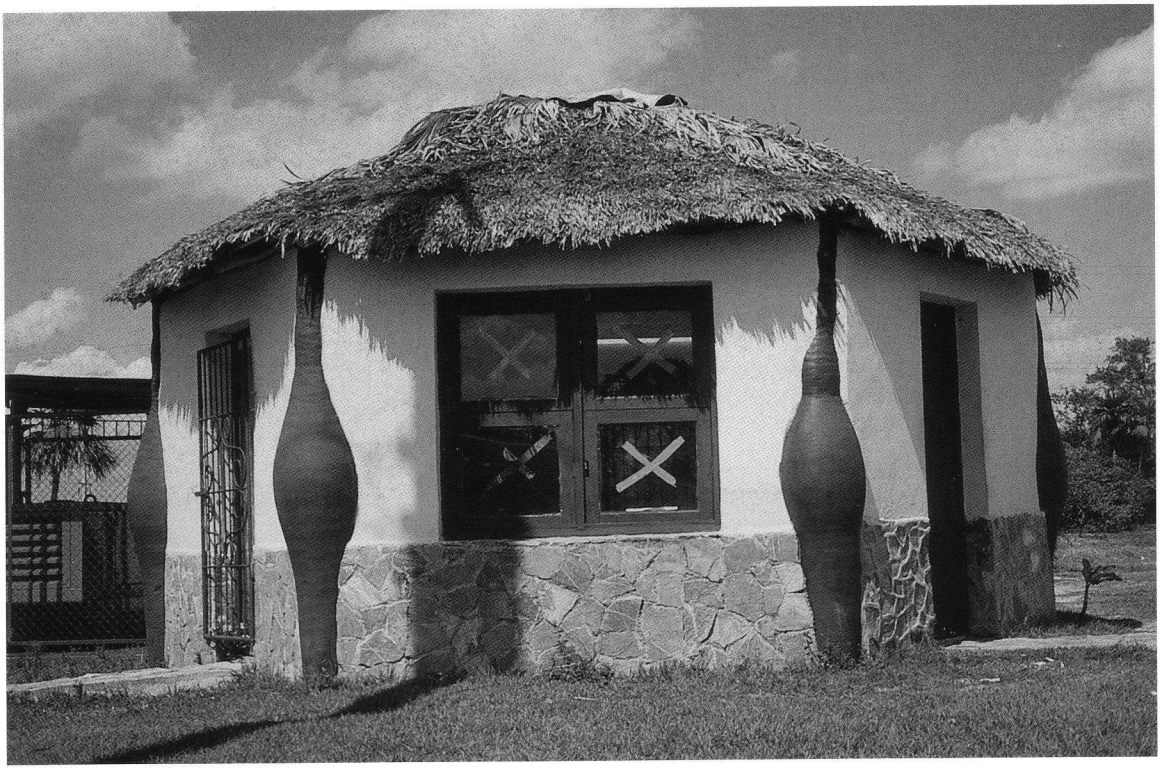
yellowish ivory, but as the fruit mature, the inflorescence branches become bright orange. The fruits ripen to dark green and at maturity contrast markedly with the orange rachillae (Fig. 3).

Although the *palma barrigona* grows readily in the National Botanical Garden in Havana, it has a reputation of being difficult to cultivate in Florida (Smith 1960). At Fairchild Tropical Garden, we

2. The bulging stem of *Colpothrinax wrightii* with the outer cortex sloughing off.

3. Unripe, green fruits contrast with the bright orange rachillae.





4. *Colpothrinax* trunks as the corner posts of a small house.

have found, however, that planting the palm near the edge of a lake, where water is constantly available, mitigates the effect of our alkaline soil and encourages healthy growth (Fig. 5). Our low-lying planting site was inundated by tidal surge during Hurricane Andrew in 1992, but the palms were unaffected by the soaking with salt water. Loomis (1958) reported that seeds germinate in 55 days, although Paul Craft (pers. comm.) reported 120 days.

Acknowledgments

We thank Dr. Angela Leiva S. and staff of the Jardín Botánico Nacional, Havana, Cuba, for their hospitality and for showing us these amazing palms. This paper is contribution number 19 to the Program in Tropical Biology at Florida International University.

LITERATURE CITED

ALAIN, BRO. 1961. Palms of Cuba. Principes 5: 59–70.

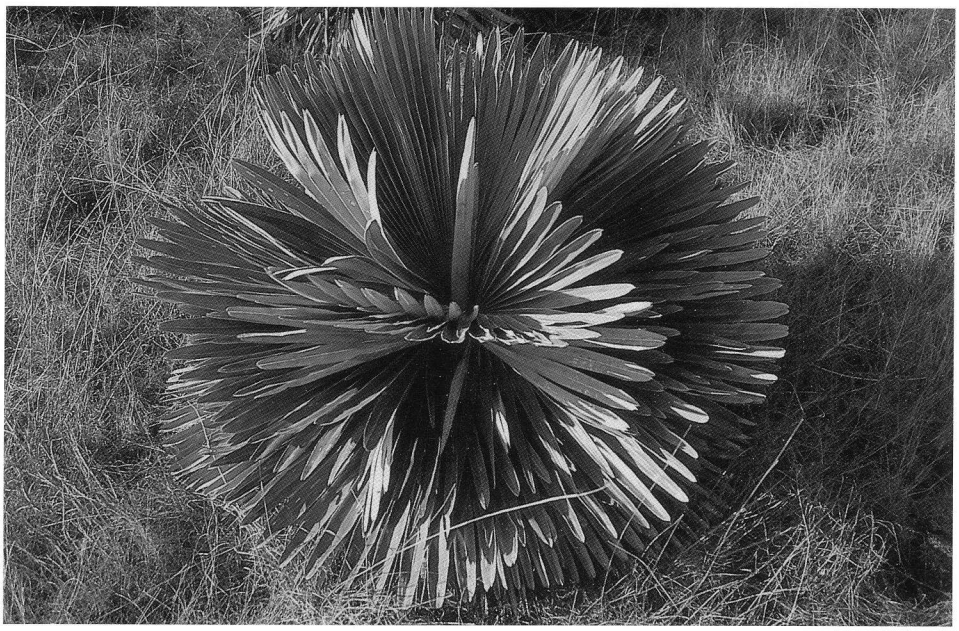
LOOMIS, H. E. 1958. The preparation and germination of palm seeds. Principes 2: 98–102.

SMITH, D. 1960. In and out of the palm garden. Principes 4: 64–66.

5. A 19-year old *palma barrigona* cultivated at Fairchild Tropical Garden, Miami.

Searching for *Copernicia* in Cuba

NORA M. BARBOZA
Institute of Systematic Botany
New York Botanical Garden
Bronx, New York 10458 USA

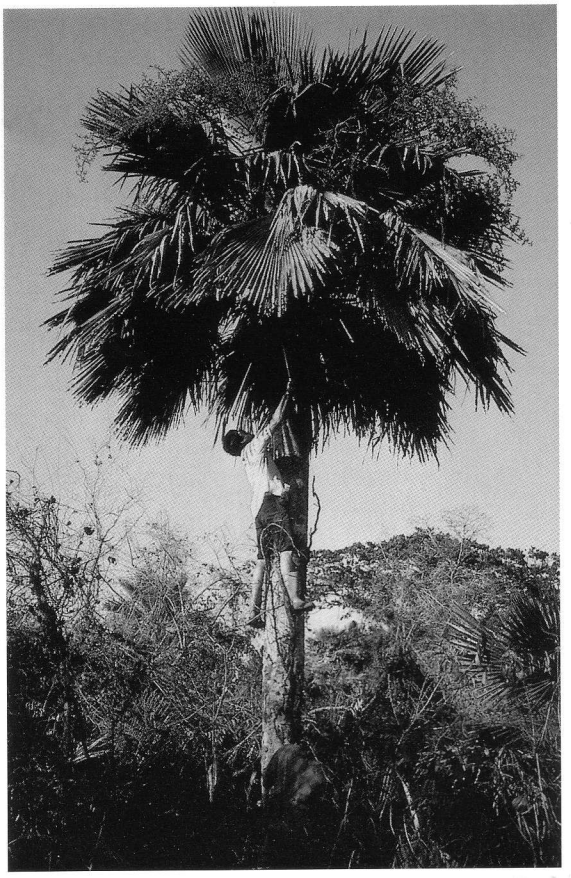


1. *Copernicia cowellii*, Minas.

In March 1999, I had the opportunity to visit Cuba for a six-week field trip to study the systematics of the genus *Copernicia* for a Ph.D. research project. After waiting for over half a year to obtain the necessary licenses, visas and collecting permits, I was ready to travel and collect *Copernicia* palms, a genus found almost exclusively in Cuba

Although the island is relatively small, six weeks of fieldwork is barely enough time to visit all populations, considering the number of forms occurring there. My priority was to visit all the different type localities, that is, the places where the collections were originally made on which descriptions and names of new species were based. These were selected based on the work of Dahlgren and Glassman (1963) as well as on herbarium specimens, further facilitated by the help of Cuban botanists, and *guajiros* (field-men). It was impossible to find many of the species at the original collection sites, as many changes have occurred on this small island over the last 60 to 70 years.

The Cuban *Copernicia* are impressive and majestic palms; some are quite charming, such as the huge



2 (above). Damian Zamora climbing *Copernicia textilis*, Florida, Cameguey. 3. (below) *Copernicia hospita*, between Las Minas and Jarahuoca.

specimens of *C. gigas*, in the eastern provinces, or the beautiful, small specimens of *C. cowellii* – *El repollito* (the little cabbage) (Fig. 1), an expression used by a man I met in Camaguey. Nonetheless, it was not only the beauty of *Copernicia* that attracted me, since there are many beautiful palms. It was their resilience in the face of habitat destruction that impressed me the most. In spite of the fact that clearing is evident on the Cuban plains, it is striking to see in some regions, especially in the East, hundreds of *Copernicia* seedlings reclaiming the areas where they once flourished. Even older, tall individuals appear healthy and lush despite clear signs of earlier damage.

In older literature, *Copernicia* palms were reported as being very abundant in Cuba. I was expecting to find *Copernicia* on the roadside while driving the main highway across the backbone of the island from La Habana to Santiago de Cuba. However, the only visible palms were species of *Sabal*, *Gastrococos* and *Roystonea*. This changed in the eastern side of the island, near the city of Las Tunas. There, specimens of *Copernicia yarey* occur along the highway from Las Tunas to Holguin.

Further to the southeast, *Copernicia yarey* is replaced by members of the *C. baileyana* complex. *Copernicia baileyana* occurs in more open savannas, so these palms look more impressive by virtue of their large numbers. On the main road between Bayamo and Holguin, it is amazing to see hundreds of individuals that fit the description of

C. baileyana and, for that matter, of any one of the *yareyes* (*C. curbeloi* and *C. textilis*) described by León in 1931. On this road also lies the town of Cacocum where *C. baileyana*, *C. curbeloi* and *C. textilis* (Fig. 2) have been reported. While driving along the road for hundreds of kilometers, I saw large numbers of similar-looking palms. The change in habitat from the warm plains to the temperate mountains of Sierra Maestra prevents *C. baileyana* from expanding its range. Although I collected a number of herbarium specimens in this area, it was challenging to collect this kind of *Copernicia* that has an average height of 16 m. I must mention that the collection of these vouchers was possible only due to the help provided by the *guajiros*. They had a ladder and a hand-made long pole to cut the leaf and inflorescence needed for a complete herbarium specimen. It seemed that I had only to introduce myself as a Mexican student studying Cuban palms for a *guajiro* to climb a 16 m trunk without any gear.

On my way back to La Habana we stopped in Las Tunas. There we met Raul Verdecia, the director of the Las Tunas Botanical Garden. With Raul's help I managed to sample most of the *Copernicia* localities in Las Tunas province. His knowledge and familiarity with these sites was invaluable. We visited *Copernicia curbeloi*, a species described from Puerto Padre in honor of Maximiliano Curbelo (an amateur palm enthusiast). Of the population of *C. cubeloi* that once existed on the farm of Curbelo only four palms are left today (R. Verdecia, pers. comm.). Because these four individuals grow on the property of the sugar cane factory in Puerto Padre, they are considered to be protected from external influences. In Puerto Padre, we visited a few individuals of *C. roigii*, which grow in a coastal forest on serpentine. That same day near the forest, we found a family building a hut using the trunks and leaves of this species.

We continued onward to the neighboring province of Granma, located at the southeastern tip of Cuba. There, we planned to search for *C. humicola*, reported to be the most southerly occurring species of *Copernicia* on the island. We dedicated two days to searching for it in Niquero. Following reports of León, and Dalhgren and Glassman, we scanned the area of "El Varadero" approaching it from a different side each day. The first day while exploring the mangroves and traveling through mud and grassland with grass up to our waists, we found all the palms reported for that area – *Sabal*, *Coccothrinax*, *Calyptronoma*, *Thrinax*, and *Roystonea* – all except *Copernicia*. The second day, we extended the search inland following several hints from helpful *guajiros*. Despite our efforts and

4. *Copernicia macroglossa*, near Trinidad.

5. *Copernicia* x *burretiana*, near Trinidad.

extensive searches in the western part of Sierra Maestra, we detected only one *Copernicia*, *C. yarey*. Yet the search was worth the effort. Until this collection it was assumed that all *Copernicia* grew only on poor soils of the savannas, and none of the species, with the exception of *C. glabrescens*, had been reported to grow in the mountains of Sierra del Rosario. Although we did not find *C. humicola*, the day was quite an adventure, and I have fond memories of the pleasant, helpful *guajiros*. Having searched for *C. humicola* in the region of Varadero Niquero for two days without success, and having seen many fields completely cleared up to the mangroves, I suspect that the population of *C. humicola* has vanished from Varadero.

Once we finished surveying locations of interest in the East, we decided to move westwards towards Camaguey. Cromo lies a few kilometers north of Camaguey, and there populations of *C. cowellii* and *C. hospita* (Fig. 3) interbreed to produce what Dahlgren and Glassman called *C.* x *shaferi*. We visited *C. cowellii* further north from Camaguey in Minas behind a pine plantation, growing with *Coccothrinax pseudorigida*, and near Cromo growing in a large field with *Copernicia hospita*.

In the central plains of the provinces of Cienfuegos and Sancti Spiritus, we looked *C. macroglossa*. Near Trinidad we found communities that include specimens of *C. macroglossa* (Fig. 4), *C.* x *burretiana* (Fig. 5), and others that look more like *C. macroglossa* but with a small, stout petiole approximately 15 cm long and thin inflorescences. León (1931) reported the abundance of *C. hospita* in this area which he assumed interbreeds with *C. macroglossa*. The population in Trinidad (Sancti Spiritus) occurs from mangroves to sandy terrain further inland. Several kilometers away from the coast, within the same population of *C. macroglossa*, a few individuals of *C.* x *burretiana* were seen.

To the north of Cienfuegos, we took a local road from Santa Clara to Matanzas so we could stop in Canesi to see *C. macroglossa*, and to see *C. glabrescens* near Cantel. In the hilly terrain of Canesi, province of Matanzas, *C. macroglossa* occurs as uniform populations with sessile leaves and thick inflorescences. It appears that *C. macroglossa* does not interbreed with *C. hospita*.

A week before my departure, on the western side of the island in the province of Pinar del Rio, we continued collecting with Dr. Armando Urquiola from the Instituto Pedagogico. His familiarity with the area was very helpful. There we found *C. glabrescens* growing with *Colpothrinax* in the lowlands, such as in Sabanalamar, on white, sandy

6. *Copernicia glabrescens* growing in forst near Cajalbana, Pinar del Río.

7. *Copernicia glabrescens* growing in a dry habitat near Los Botinos.

soil in a pine-oak forest near the mangroves. In addition, I found them growing on Sierra del Rosario near Viñales (Burret named plants from this area *C. pauciflora*, but this is now regarded as a synonym of *C. glabrescens*), where they grow under the canopy of a thick forest (Fig. 6). I also visited a population in the hills of Los Botinos, Matanzas, in a drier vegetation zone (the type locality of Burret's *C. ramosissima*, also now regarded as a synonym), where most of the specimens were about one-and-a-half meters tall and appearing as if they were periodically exposed to fire (Fig. 7).

To understand the genus *Copernicia* it takes more than reviewing herbarium specimens or observing them at botanical gardens. *Copernicia* is a very complex genus. Its biological complexity can be seen clearly in hybrid zones between populations of distinct species, where one can observe a whole range of variation in characters intermediate between the different parents. Cuba is not only the land of cigars, sugar cane, and charming people, it is also the land of *Copernicia*.

Acknowledgments

I express my gratitude to Celio Moya, Raul Verdecia, Armando Urquiola, the staff of the Botanical Gardens and the Institute of Ecology and to the *guajiros* for their invaluable help and friendly assistance.

LITERATURE CITED

DAHLGREN, B. E. AND S. F. GLASSMAN. 1963. A revision of the genus *Copernicia*. 2. West Indian species. Gentes Herb. 9: 42–232.

LEÓN, HNO. 1931. Contribución al estudio de las palmas de Cuba. Rev. Soc. Geogr. Cuba 4: 33–59.

Identity of the *Hyophorbe* Palms at the Botanical Garden of Cienfuegos, Cuba

CARL E. LEWIS
L.H. Bailey Hortorium
462 Mann Library
Cornell University
Ithaca, New York 14853 USA

AND

NORA MARTINEZ BARBOZA
Institute of Systematic Botany
New York Botanical Garden
Bronx, New York 10458-5126
USA

An unusual population of cultivated *Hyophorbe* palms caught the attention of Rolf Kyburz (1998) during his recent visit to a public garden in Cuba. The population appeared to be a stand of *Hyophorbe amaricaulis*, which is considered to be the most endangered palm species. With just a single known *H. amaricaulis* plant in existence today, any record of additional living individuals would be an important discovery. We investigated the plants in Cuba in order to determine their identity. After analyzing key morphological features and DNA sequences from the phosphoribulokinase (PRK) gene, we concluded that the unidentified *Hyophorbe* palms at Cienfuegos are individuals of *H. lagenicaulis* rather than *H. amaricaulis*. Although we did not confirm the existence of a viable *H. amaricaulis* population in Cuba, our analysis is a step toward unraveling the evolutionary history of the genus. We also show that DNA sequences can complement morphological data in the identification of living palms.

Hyophorbe palms have an endearingly distinctive appearance, with stiff pinnate leaves, smooth crownshafts, and a variety of unusual trunk shapes. All five species of the genus are endangered in their native Mascarene Island habitats, but four of them are being preserved in cultivation throughout warm parts of the world. The bottle palms *Hyophorbe lagenicaulis* and *H. verschaffeltii* are by far the most familiar of these species, but some gardens include *H. indica* and even *H. vaughanii*.

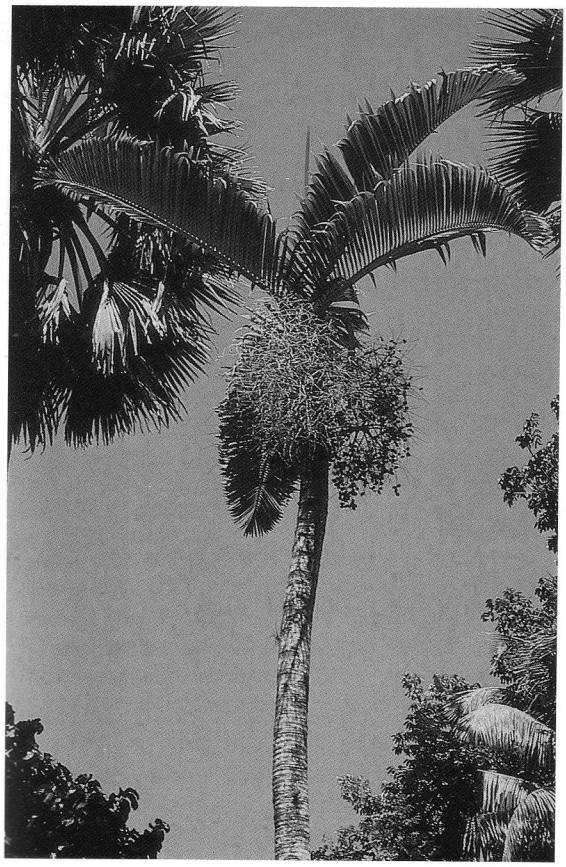
Sadly, there is no known stock of cultivated specimens to ensure the survival of *Hyophorbe amaricaulis*, which has the unfortunate distinction of being the world's most endangered palm species. There is just a single individual of *H.*

Table 1. Sampling for the DNA analysis and for morphological comparison

Species or sample	Collector number	Origin
Hyophorbe amaricaulis Mart.	CEL 98-064	Curepipe Botanical Garden, Mauritius
Hyophorbe indica Gaertn.	CEL 98-076	Fairchild Tropical Garden, Miami
Hyophorbe lagenicaulis (L. H. Bailey) H. E. Moore	Fantz 3297	Fairchild Tropical Garden, Miami
Hyophorbe vaughanii L. H. Bailey	CEL 98-059	Florin reserve, Mauritius
Hyophorbe verschaffeltii H. Wendl.	Fantz 3301	Fairchild Tropical Garden, Miami
CUBA 1	NMB 789	Cienfuegos Botanical Garden, Plot 13
CUBA 2	NMB 790	Cienfuegos Botanical Garden, Plot 13
CUBA 3	NMB 791	Cienfuegos Botanical Garden, Plot 15

amaricaulis known to exist today, persisting on the grounds of the Botanical Garden at Curepipe, Mauritius. It is not clear whether this palm represents the last survivor of a wild stand, or if it was planted early in the garden's history. In either case, it had an unassuming presence in the garden for many decades before its significance was discovered. Since then, there has been great interest in propagating this last remaining tree, but to date all attempts have failed. The seeds produced by the tree are infertile, and tissue culture experiments have not yielded plants that can survive outside the test tube (Douglas 1987).

1. One of the palms in plot 13, Cienfuegos Botanical Garden suspected of being *Hyophorbe amaricaulis*.



While efforts to save *H. amaricaulis* were directed toward the remaining individual in Mauritius, Rolf Kyburz (1998) drew our attention to an unusual *Hyophorbe* population growing on the opposite side of the globe. The palms were cultivated at the Botanical Garden of Cienfuegos, Cuba, and were labeled *H. lagenicaulis*. Kyburz noticed several features of the palms that didn't match the familiar bottle palm appearance (Fig. 1), and he suggested that they might in fact be *H. amaricaulis*. There is a history of confused nomenclature surrounding *H. amaricaulis* and *H. lagenicaulis*, so it was conceivable that the palms at Cienfuegos were simply mislabeled.

We found ourselves in a good position to examine the palms at Cienfuegos and determine their identity. Our graduate research projects brought us to Mauritius (C. Lewis: systematics of *Acanthophoenix* and *Tectiphiala*) and Cuba (N. M. Barboza: systematics of *Copernicia*), allowing us to compare the Cienfuegos plants with all five species of *Hyophorbe*. In our comparisons, we examined distinguishing morphological features and DNA sequences.

Table 2. Distinguishing morphological features of the five *Hyophorbe* species (Moore 1978) and observations from the Cienfuegos palms (CUBA 1, CUBA 2, CUBA 3).

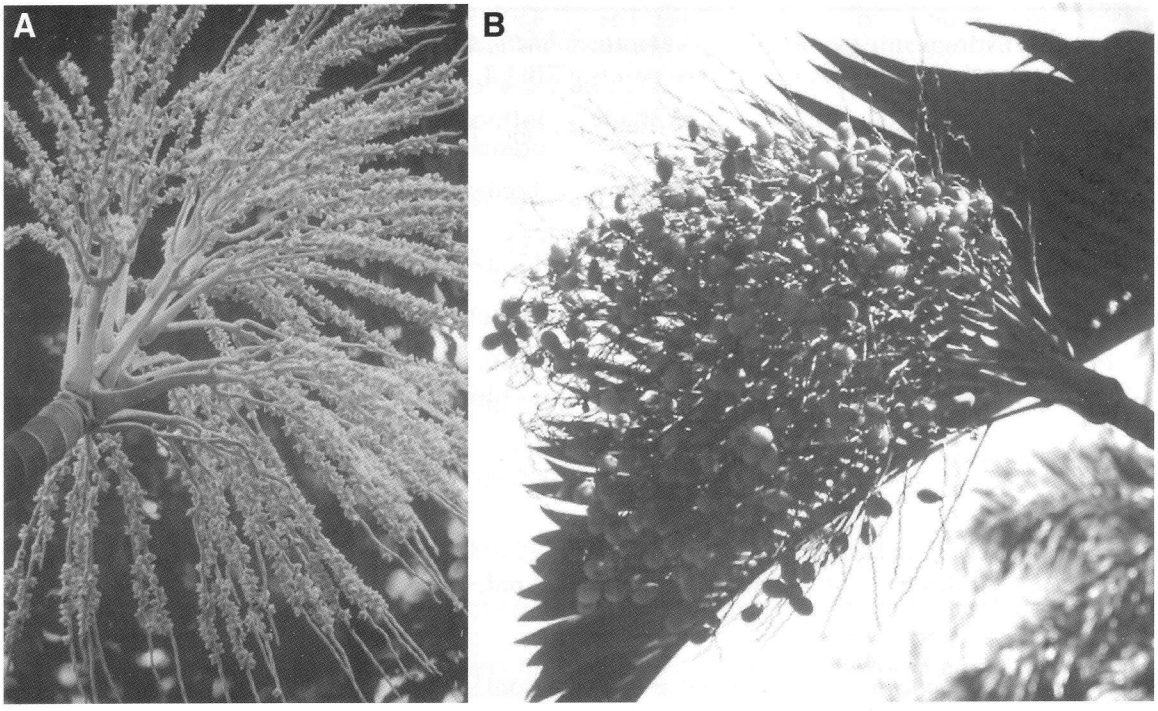
Species or sample	Height	Trunk shape	Inflorescence branching	Fruit length and color	Color of foliage
Hyophorbe amaricaulis	6 m or more	not swollen	3 orders	3.8 cm; dull red	green
Hyophorbe indica	to 8 m	not swollen	4 orders	2.2-3.7 cm; red or orange	green, sometimes with yellowish veins
Hyophorbe lagenicaulis	6 m or more	swollen at base,tapered above	4 orders	2.5 cm; black or orange	red- or orange-tinted when young, green at maturity
Hyophorbe vaughanii	to 10 m	not swollen	3 orders	4.4-5.0 cm; orange-brown to red	orange-tinted
Hyophorbe verschaffeltii	6 m or more	swollen in middle	4 orders	1.2-1.9 cm; black	green, sometimes with yellowish rachis
CUBA 1	7 m	swollen at base, tapered above	4 orders	±2 cm; orange	green
CUBA 2	7 m	swollen at base, tapered above	4 orders	±2 cm; orange	green
CUBA 3	5 m	swollen at base, tapered above	4 orders	±2 cm; orange	red-tinted

Morphology

There are two clusters of *Hyophorbe* palms at the Botanical Garden of Cienfuegos, located in garden plots 13 and 15. It was the cluster in plot 13 that seemed atypical to Kyburz (1998). He noted that the trunks were tall and lacked the strongly tapered bottle shape that distinguishes *H. lagenicaulis*. Also when looking at the plot 13 plants, he observed a "green color in crownshaft, petioles, and leaves." However, the palms in plot 15 were more like what he expected *H. lagenicaulis* to look like, with short, fat stems and red-tinted foliage.

We gathered observations from palms in both plots and compared them to morphological descriptions of the five *Hyophorbe* species (Moore 1978). We examined the characters mentioned by Kyburz (1998; height, trunk shape, color of foliage) for all palms in the two plots. For three representative plants (CUBA 1, CUBA 2, CUBA 3; Table 1), we also examined inflorescence branching and the fruit sizes and colors. Character states for the species of *Hyophorbe* and for the three representative plants from Cienfuegos are listed in Table 2.

Trunk size and shape are striking features of some *Hyophorbe* species. At up to seven meters in height, the plot 13 plants appeared taller than the *H. lagenicaulis* specimens we normally see in cultivation. Nevertheless, Moore's (1978) descriptions indicate that all *Hyophorbe* species can grow to more than six meters tall. Stems of all *Hyophorbe* palms in plots 13 and 15 were swollen at ground level and tapered toward the crown, and *H. lagenicaulis* is the only species of *Hyophorbe* that exhibits this growth form.



2. A: Inflorescence of *Hyophorbe amaricaulis,* branched to three orders, photographed in Mauritius. B: Infructescence of *Hyophorbe* specimen CUBA 3, branched to four orders, photographed in the Botanical Garden of Cienfuegos.

Another important character in the genus *Hyophorbe* is the pattern of inflorescence branching. The CUBA 1, CUBA 2, and CUBA 3 individuals all had fourth-order inflorescence branching, which is found in *H. indica*, *H. lagenicaulis*, and *H. verschaffeltii*. The inflorescences of *H. amaricaulis* and *H. vaughanii* are more simple, branching to only three orders. Figure 2 shows the inflorescences of *H. amaricaulis* and an infructescence of the CUBA 3 sample.

Developing fruits on the CUBA 1, CUBA 2, and CUBA 3 plants were also examined. For all samples, the fruits nearest to maturity were about 2 cm in length and appeared to be changing color from green to orange. These observations most closely match the fruits of *H. indica* and *H. lagenicaulis*.

What about the lack of red-tinted foliage in the plot 13 plants? According to Moore (1978), purely green foliage can be found in all *Hyophorbe* species except *H. vaughanii*. The color of foliage in *H. lagenicaulis* is variable, but mature plants typically have green leaves without an orange or red tint.

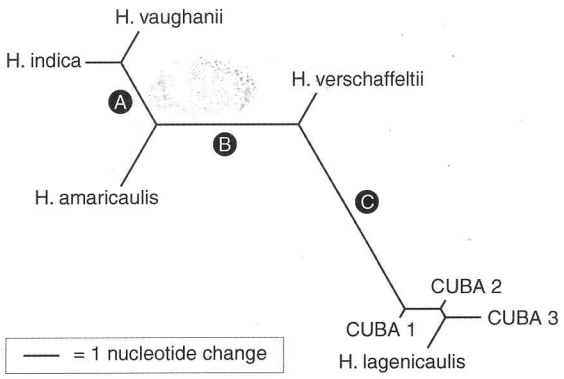
Based on similarities in the morphological characters listed in Table 2, the CUBA 1, CUBA 2, and CUBA 3 plants all appear to be *Hyophorbe lagenicaulis*.

DNA sequences

We collected DNA from all species of *Hyophorbe*, sampling a wild individual of *H. vaughanii* and cultivated individuals of the other four species (Table 1). Of the *Hyophorbe* palms in the Botanical Garden of Cienfuegos, we sampled the same individuals that were observed for morphological comparisons (CUBA 1, CUBA 2, CUBA 3; Table 1).

For all DNA samples, we compared nucleotide sequences from a portion of the phosphoribulokinase gene (PRK). Present in plants, animals, and fungi, the gene is known for its role

3. Unrooted phylogenetic tree resulting from a cladistic analysis of PRK sequences. The length of the tree is 20 steps (when uninformative characters are excluded, length = 15, CI = 0.87, RI = 0.93).



in the release of energy from sugar molecules. The fact that PRK is well characterized in many organisms made it useful for this project.

Using the available information on PRK, we were able to target the gene in each *Hyophorbe* DNA sample and copy it using the polymerase chain reaction. Automated DNA sequencing methods were used to read the nucleotide sequence from the PRK copies. We used sequence alignment software (ClustalX; Thompson *et al.* 1997) to match corresponding nucleotide positions in the sequences, and we used phylogenetic analysis software (PAUP* 4.0b2; Swofford 1999) to build a tree diagram of relationships (Fig. 3). A detailed description of the experimental methods and results is available upon request from the first author, and a general review of DNA sequencing in palms is available (Lewis et al. 2000).

Figure 3 shows relationships among the five species of *Hyophorbe* based on PRK sequences. The length of each branch in the diagram is proportional to the number of nucleotide changes unique to each lineage. For example, there are two changes unique to the *H. indica* and *H. vaughanii* lineage (branch A), and these changes are evidence that those two species are related. There are four nucleotide changes found only in the *H. indica*, *H. vaughanii*, and *H. amaricaulis* lineage (branch B), indicating a relationship between those three species.

All three Cuban samples share six unique nucleotide changes with *H. lagenicaulis* (branch C), indicating that they belong to the same lineage. Therefore, the DNA data corroborate the morphological data, identifying the Cuban plants as members of *H. lagenicaulis*.

Discussion

The morphological data and DNA sequences revealed that the unidentified *Hyophorbe* palms sampled from Cienfuegos are *H. lagenicaulis*. Plants in plot 13 and plot 15 differ in height and foliage color, but this may be the result of environmental differences between the two plots. Plot 13 is a small islet that is inundated with water for much of the year, while plot 15 remains more dry. Perhaps the different levels of available moisture caused the two groups to develop their distinct appearances.

We have not resolved relationships between *Hyophorbe* and other palm genera, so the tree diagram shown in Fig. 3 has no root connecting the genus to other palms. Without a rooted tree, we cannot interpret our results in the context of evolutionary history. Nevertheless, we can conclude that *H. indica* and *H. vaughanii* are related to each other and to *H. amaricaulis*. It also appears that *H. lagenicaulis* and *H. verschaffeltii* may be related to each other. We shall continue to analyze DNA sequences along with morphological and anatomical information as we work to reconstruct the evolutionary history of the genus and its relatives.

The search for cultivated *H. amaricaulis* plants should continue, because it is still possible that the species is being cultivated in Mauritius or elsewhere.

Acknowledgments

We thank Rolf Kyburz for bringing the Cienfuegos palms to our attention, and for helping us arrange to collect material from them. We also thank the staff of the Botanical Garden of Cienfuegos, Fairchild Tropical Garden, and the National Parks and Conservation Service of Mauritius for allowing us to collect leaf material from living palms. The laboratory experiments would not have been possible without the help of Jeff J. Doyle at the L.H. Bailey Hortorium, Cornell University.

Literature Cited

Douglas, G. C. 1987. Embryo culture of a rare plant *Hyophorbe amaricaulis* (Palmae). Journal of Plant Physiology 130: 72–78.

Kyburz, R. 1998. *Hyophorbe amaricaulis* in Cuba? *Principes* 42: 9–10.

Lewis, C. E., W. J. Baker, and C. B. Asmussen. 2000. DNA and palm evolution. PALMS 44: 19–24.

Moore, H. E., Jr. 1978. The genus *Hyophorbe* (Palmae). Gentes Herbarum 11: 212–245.

Swofford, D. L. 1999. PAUP*. Phylogenetic Analysis Using Parsimony (*and Other Methods). Version 4. Sinauer Associates, Sunderland, Massachusetts.

Thompson, J. D., T. J. Gibson, F. Plewniak, F. Jeanmougin, and D. G. Higgins. 1997. The CLUSTAL-X windows interface: Flexible strategies for multiple sequence alignment aided by quality analysis tools. Nucleic Acids Research 25: 15.

Announcement

Please notify the IPS of changes of address: IPS, PO Box 1897, Lawrence KS 66044-8897 USA or palms@allenpress.com.

PALM LITERATURE

THE PALMS AND CYCADS OF THAILAND. Edited by Donald R. Hodel. Kampon Tansacha, Nong Nooch Garden, Thailand, Allen Press, Kansas. 1998. ISBN: 0-935868-98-4. US $50, hard bound. pp. 190.

This book, commissioned by Kampon Tansacha of Nong Nooch Garden in Pattaya, Thailand, was completed rapidly in order to be published in time for the 1998 Biennial Meeting of the International Palm Society held in Thailand. The book covers palms and cycads. The palm account is attributed to Don Hodel and Poonsak Vatcharakorn, one of Kampon Tansacha's employees, while the cycad account was written by Ken Hill of the Royal Botanic Garden, Sydney, an acknowledged expert on the genus *Cycas*. Hodel took overall editorial control. This review covers only the account of the palms. The *Palms and Cycads of Thailand* is the most readily available source of information on the palms of Thailand and, as such, it will be much used. It thus seems important to indicate how reliable it is.

This is a very attractive book, filled with photographs of the palms of Thailand. It is also a remarkable achievement for a mere two years' work. It follows the format of Hodel's *Chamaedorea Palms* – throughout much of the body pages of photographs alternate with pages of text. It deals with 155 indigenous species and several other widely cultivated or naturalised palms. The field work that formed the basis of the book, using the unrivalled knowledge of Poonsak, unearthed some important new records for Thailand and new taxa. Such a spectacular palm as *Caryota kiriwongensis* was a prize indeed (published in the Palm Journal with, unfortunately, a very inadequate diagnosis – the single Latin word, *grandissima*). These additions to the known palm flora of Thailand are much to be welcomed.

The book contains some excellent photographs, including several of species which have probably not been illustrated before. Perhaps the authors have not been best served by their printer as there is a general gloom of slight underprinting throughout the volume, a great shame as there are some very beautiful palm portraits here.

When I first heard about this venture from Kampon himself, I had envisaged that the book might be a popular introduction to the palms of Thailand profusely illustrated with photographs. That it gives equal treatment to all the palms, all apparently confidently identified and named, including the rattans, not immediately of interest to hobbyists, gives a superficial air of completeness to the book – as if it purported to be a complete monograph of the palms of Thailand. In fact that is not the case as the authors are careful to say. They describe in the introduction how they used monographs of genera occurring in Thailand and floras of surrounding countries to name their material, mentioning how many of these works of literature are antiquated or of dubious value but unfortunately there was no time to borrow and examine types. This clear statement of method explains much, for the book is certainly not a complete account of Thai palms, and even more unfortunately, several of the palms described and illustrated are misidentified (see below). The correct naming of palms requires careful work involving comparison with type specimens in herbaria, often in more than one country. This book is based almost entirely on Hodel's own field work, supported by Kampon, limited to a mere two year period, and on the extensive field knowledge of his co-author. Work on just the historic collections in the herbaria at Kasetsart University (BK) and the Royal Forest Department (BKF) in Bangkok would have added further species to his list. It is surprising that these, at least, are not included.

Perhaps the most unfortunate aspect of the book is that it appears to have been written without any contact being made with the very active palm botanists Saw Leng Guan and Lim Chong Keat who live just over the border in Malaysia. Neither was any attempt made to match up species with the historic types in European herbaria, where the most significant collections of Thai palms are housed. The taxonomic account that Hodel and his co-author provide is thus flawed by incompleteness (there are several species missing) and poor taxonomy (several taxa are incorrectly named). The authors claim implicitly that any such shortcomings are the result of time constraints, but they nevertheless show a certain irresponsibility and disregard of taxonomic convention. A popular introduction to the palms of Thailand written along the lines of Whitmore's *Palms of Malaya* and filled with beautiful photographs illustrating genera and distinctive common species, would have been the correct approach to have taken for this commission. It could have been written honestly and rapidly without compromising taxonomic method, would not have resulted in the publication of superfluous names and would have filled an important gap in

the market. Accumulated material could then have been written up in a spirit of collaboration with co-workers with access to all herbarium material in the region and providing an excellent additional taxonomic resource for the Flora of Thailand.

Fortunately, some herbarium collections are cited, so where there is cause for doubt over the identity of some of the palms, it will be possible to check. In order to assist the user I include below a list of the omissions and errors. Some of these are well documented, and there are other areas where, because I have not yet seen all the collections cited, I can only suggest tentatively how the authors may be mistaken.

The following taxa are missing from the book:

Salacca secunda, a stemless palm, unusual in the genus for several reasons, occurs in Mae Hong Son. It is represented by several collections in the Bangkok Forest Herbarium and Kew Herbarium. It also occurs in Burma and China.

Calamus acanthophyllus, a remarkable stemless rattan that is resistant to fire (it appears to be able to lose all its foliage, surviving the fire as a bulbous subterranean shoot), occurs in eastern Thailand near the Mekong River. It is represented by a few collections in Kasetsart Herbarium, Bangkok Forest Herbarium and Kew Herbarium, collected in the 1920s and more recently. Elsewhere it occurs in Laos.

Calamus acanthospathus is represented by collections made by Kerr from Doi Pu Ka.

Calamus pandanosmus, also missing, is always a rare species throughout its range in Borneo, Sumatra and the Malay Peninsula; it is also known from Thailand, being represented by a few collections from the peninsula, made by Kerr and others, in Kew, Bangkok Forest and Kasetsart herbaria.

Calamus harmandii has recently been collected in Nan province (Maxwell, pers. comm.). If the identity is confirmed, then this represents the first record for Thailand of a palm otherwise known only from Laos.

Arenga hastata is known in Thailand from a single collection made by Charan, Chamlong and Whitmore from Labu Mine in the Peninsula, represented in BKF and K. This species is otherwise widespread in Peninsular Malaysia and Borneo.

There are also several species of *Calamus*, represented as herbarium collections in Bangkok and Europe, that remain undescribed. While Hodel has described species collected by himself, he has made no attempt to name all the existing available collections.

The following taxa are, in my opinion, misidentified.

Calamus blumei as illustrated in the book is not that species but a subspecies of *Calamus bousigonii* (see Dransfield in press). The type subspecies of *C. bousigonii* is known from Vietnam, Cambodia and the extreme south-east of Thailand, the Thai record being based on a collection in BK and K made by Kerr in the 1920s. There is no mention of this species in the book

Calamus tomentosus in the book appears, in fact, to be true *C. blumei*. (If I am right, *C. tomentosus* remains unrecorded for Thailand).

Other taxonomic comments:

The book records two species of *Ceratolobus* in Thailand. *Ceratolobus subangulatus* has been known to occur in Thailand for a long time, being represented by several collections from the Peninsula. The other species, *C. glaucescens*, represents a new record for Thailand. What is astonishing is that this particular species was known previously from a very small number of populations in West Java where it is critically endangered. It has been planted in the Kebun Raya, Bogor, where it fruits and seeds have been distributed relatively widely. The plant illustrated by Hodel is one in cultivation in Nong Nooch itself, rather than a wild population, said to have come from wet forest near Yala. There is no doubt about its identity. However, without a herbarium collection actually made in the wild, I am reluctant to accept that the species genuinely occurs in Thailand, remarkable as that would be. It could all too easily have been introduced from Bogor along with other seeds.

For *Phoenix*, two species are accepted – *P. paludosa* and *P. loureiri*. In so doing the authors follow the latest monograph of the genus by Barrow, whose work predates the book. One has to dig into the Acknowledgements to see any reference to Sasha Barrow's intellectual property and there are no explicit references to her monograph.

The absence of photographs and the brevity of the commentary for some species suggests that the authors have not seen for themselves all the taxa included in the book. For example, under *Calamus spectatissimus* it says "is reported from south Peninsular Thailand from 400–600 m altitude". This very rare rattan is known from only a handful of herbarium collections from Sumatra, Borneo, Peninsular Malaysia and Thailand. As far as I am aware, in Thailand it is known from a

single collection made by T.C. Whitmore. Unfortunately no source of information is cited – is the record based on a specimen, on a record in literature or in a database?

A note on species epithets – *Daemonorops leptopa* should be *D. leptopus*. While *Daemonorops* is feminine, *leptopus* is a Greek compound noun in apposition rather than an adjective. *Eugeissona triste*, although originally cited by Griffith as *triste*, should be *tristis* – *Eugeissona* should be treated as a feminine latinisation (W.T. Stearn pers. comm.) as did Beccari when he described most of the remaining taxa in the genus.

Prior to the publication of the book, Hodel described *Areca recurvata*. I have examined the type of this taxon in BK and can see no significant difference from *A. latiloba*. It is at any rate questionable whether *A. latiloba* itself should be recognised as distinct from *A. triandra*, let alone *A. recurvata*. In the same precursory paper he described a second new species of *Areca*, *A. bifaria*. Fortunately Hodel had drawn to his attention the fact that the taxon was already described (by Lim Chong Keat and myself) from Peninsular Malaysia (in Principes), before the book went to press, so the palm was illustrated correctly as *A. tunku*. Sadly other putative new taxa in *Pinanga*, *Iguanura* and *Licuala* were also published in several precursory papers, without the author realising that they had already been described from Peninsular Malaysia. Some of these names were formally included in synonymy in a paper published by Lim Chong Keat before the book appeared but presumably too late for the authors to make the necessary changes.

So, where does this leave us? Although this is a beautiful book that will undoubtedly raise enthusiasm for Thai palms, the user must be aware that it is seriously flawed. It was produced to a tight schedule in time for the IPS Biennial, but does not include all or correctly name many of the palms that grace the country. For that we need to continue to work towards a critical account of palms for the Flora of Thailand, a task requiring much more time and effort. When that account appears, the authors of it may well be accused of meddling with names entrenched in the minds of palm enthusiasts due to the publication of this book!

JOHN DRANSFIELD
ROYAL BOTANIC GARDENS, KEW

THE PALMS OF NEW CALEDONIA (LES PALMIERS DE NOUVELLE-CALÉDONIE). By Donald R. Hodel and Jean-Christophe Pintaud. English and French texts. Kampon Tansacha, Nong Nooch Garden, Thailand, Allen Press, Kansas. 1998. ISBN: 0-935868-99-2. US$50.00, hard bound. pp. xi + 118.

This beautiful book has an unusual format, each page having English text in the left column and French opposite in the right column. In keys and legends a French rendition directly follows each English statement. The book presents a popular account of the palms of New Caledonia, an island renowned for a flora with more than 75% of its plants endemic. A brief introduction provides details about the island and explains how the 16 genera and 37 species relate to other palms. The introduction also discusses distribution, ecology and conservation, gives a short history of palm botany and horticulture in New Caledonia, outlines experiences and recommendations on growing the palms, and provides a useful guide as to how best to see palms on the island.

The main part of the book begins with separate keys to genera, one based on leaves and stems and a second on inflorescences and fruits. A section on each genus follows with an introduction and key to the species if more than one, and is followed by a short descriptive part giving details of habit, stem, leaves, inflorescences, fruits, distribution and ecology. The main headings are in bold with the diagnostic features for each palm in italics, making the characters easy to find and assess. Finally notes about each genus explain how the species may be distinguished and inform us about their current status in cultivation. Each palm is beautifully illustrated with several color photos. The book ends with a list of accepted names and synonyms.

There is no question as to the value of this book for locating and identifying the palms of the island. Unfortunately the large size and glossy paper will make it difficult to handle in the mountainous terrain and frequent rain to be encountered in New Caledonia. A book the size of the Henderson et al. "Field Guide to the Palms of the Americas," or perhaps even smaller would have benefited the traveler. English and French versions might have been separated; it is difficult to imagine needing both at once.

The comments about cultivation are certain to be greatly appreciated. Here is a unique group of palms, all restricted to New Caledonia. Only the

genus *Cyphosperma* has any species elsewhere. The palms are especially sought by growers for their elegance and resistance to cold. Some have not been easy to grow and others have yet to be tried.

The production of this guide has required years of work by several people. A number of new discoveries have resulted. The last complete treatment of the palms of the island was that of Moore and Uhl (1984). For a Ph. D. project at Toulouse University during the mid-1990's, Jean-Christophe Pintaud carried out an extensive reassessment of the palms of the island. Independantly Don Hodel, who began collecting palms in New Caledonia in the 1970's, was working toward a popular book on the palms of the island. The two decided to collaborate and were assisted by several enthusiastic and knowledgeable members of the Association Chambeyronia, an organization formed in 1990. Pintaud's thesis provides the latest scientific treatment and the basis for this popular book. The following changes from the Moore and Uhl evaluation should be noted. *Mackeea magnifica*, described by Dr. Moore in 1978 to honor Hugh S. and Margaret E. Mackee for their dedication and extensive collaboration, was found to be intermediate between *Kentiopsis oliviformis* and two newly discovered species of that genus, *K. piersoniorum* and *K. pyriformis*. The placing of *Mackeea* in synonomy has reduced the number of genera from 17 to 16. The number of species, however, has increased as the new research also resulted in three new species of *Burretiokentia*, bringing the total number from 32 to 37.

Many details of the palms are not included in this preliminary guide. For example, line drawings of endocarps, especially those bizarre ones found in *Pritchardiopsis*, *Cyphosperma*, *Veillonia* and *Burretiokentia* would have been useful. A complete treatment of these palms will be essential to a further understanding of the biogeography and evolution of palms as a whole and especially to a revision of the classifcation. We can look forward to seeing Jean-Christophe's full monograph.

Nevertheless for those currently growing the palms and especially for all who will attend Biennial 2000, the book will provide a splendid introduction to the palms of this beautiful island

Natalie W. Uhl
Cornell University

Horticulture Column

Bernie Peterson
2410 Stanford Street
Cocoa, Florida 32926 USA
Bernard.Peterson@gte.net

Q. I understand that the root structure of most plants is not as hardy as the other structures. Is this true of palms also? Would palms in containers prove less cold hardy than ones planted in the ground? I am growing primarily *Trachycarpus*, *Rhapidophyllum* and *Sabal*. Kerry Williams, Huntsville, Alabama.

A. I am not sure about other plants, but the roots of palms are definitely more cold sensitive than the above-ground parts. Research on the cold susceptibility of various palm parts was reported in an article in Principes 25: 143–152, by Larcher and Winter. Their experiments included both adult and juvenile *Trachycarpus fortunei* and one-year old seedlings of *Washingtonia filifera* and *Phoenix canariensis*. The roots, particularly the root tips, were found to be very sensitive to freezing temperatures. Roots that are exposed to cold can be damaged by temperatures only one or two degrees Celsius below freezing. The roots of the very cold hardy T. fortunei began to show cold damage at -6.5°C. *Phoenix canariensis* and *W. filifera* had more sensitive roots that began to exhibit damage at -1°C. Growing palms in containers, or even having them planted in the ground with portions of their roots exposed , does make it more

likely that their roots will be subjected to freezing temperatures, which in the case of young palms, could easily result in death or severe setback.

An interesting conclusion of Larcher and Winter's study is that the distribution of palms around the world is rather strictly limited by the inability of their roots to survive being frozen, and that both cultivated and naturally occuring palms, even very cold hardy ones, can be expected only in areas of the world where the soil does not freeze.

It is easy to protect palms in containers, at least for short cold spells. If the containers are small enough they could be brought inside, or laid on their sides in a sheltered spot, where they would not be elevated off the ground, and covered with cloth, plastic or similar material that can hold in the heat of the earth. For very large containers one could wrap insulating material around the container from the ground up to the trunk of the palm. Undoubtedly other methods of protection could be found once one is aware of the sensitivity of palm roots to cold.

Q. Recently Hurricane Irene, which was not a very strong storm, nearly toppled both my specimens of *Copernicia alba*. These two trees are 5–6 m tall and have just begun producing seeds in the past few years. They are around 14 years old. I had planned to plant more of these palms since they grow well in the beach-side community where I live, but now I am not so sure. I have already started many of these palms from seeds, and I have noticed that when I sow them directly into the ground, the resulting plant initiates its roots from a deeper position than those that I have geminated in containers. Would the seeds sown directly in the ground and left to grow produce a more wind tolerant palm? Is it advisable to plant more deeply a palm that has been grown for a number of years in a container? Charlene Palm, Satellite Beach, Florida.

A. I think it may well be true with at least some species that seeds sown in place would produce a more wind tolerant palm. Many people have had problems with container-grown *Bismarckia nobilis* toppling in moderately severe storms, but the *Bismarckia* in my garden was sown in the ground and has never fallen and is noticably sunk into the ground. I still do not advise you to plant a palm deeper in the ground that it was growing in its container.

As your *Copernicia* specimens mature, they should become more firmly rooted. Hurricane Andrew, which struck Miami in 1992, was a much more powerful storm than Irene. Andrew struck Fairchild Tropical Garden (FTG) almost directly and provided us with information on which species of palms are the most wind resistant. After Andrew, we found that in most cases palms that were native to oceanic islands and coastal areas withstood the winds better than those from inland continental habitats. *Latania*, *Thrinax*, *Coccothrinax* and *Veitchia* were among the species that fared pretty well, while many *Syagrus*, *Livistona* and *Bismarckia* were lost. One of the exceptions was *Copernicia alba*. Although its native range is inland South America, the specimens at FTG were barely damaged, even though some were inundated by the waters of the storm surge. Those *C. alba* specimens are much older than yours, and I can say from the experience of having dug (with a shovel) palms of all ages that older palms have much denser, more solid root systems than younger, albeit mature, palms like yours. It also seems that in many cases a palm that has been toppled by wind, properly set upright and then braced forms a more solid root system than it had before, perhaps in response to wind stress.

Q. How useful is the "float test" for determining the viability of palm seed? I have sometimes had seed that sank when put in water but which never germinated, specifically *Archontophoenix cunninghamiana*. What does one look for when dissecting a seed to check for an embryo? Dave Witt, Orlando, Florida.

A. The "float test" works well most of the time. The idea is that cleaned, viable seeds will sink while non-viable seeds will float. We know of course that some palm seeds, such as coconut or *Hyphaene*, can float when viable, and its also true that sinking is no guarantee of viability only an indication of it. The presence of an embryo within the seed is a better indication of seed viability.

The embryo should appear fresh and fill the space provided for it within the seed. In other words, it should not be dried or shriveled. Finding the embryo can be a problem since it is almost always very tiny in relation to the size of the seed itself, about a thousandth of total seed volume. Another problem is cutting through the very hard shells (endocarps) that surround many palm seeds. Aside from some efficient cutting instruments and a magnifying lens, the best tool for finding embryos in palm seeds is a copy of *Genera Palmarum*. This useful reference has drawings of dissected seeds of nearly every palm genus and tells you exactly where to look for the embryo, which is important since some embryos are found at the bases of the seeds, some at the tops and some at the sides. The embryos of most palm seeds are cylindrical or conical. The embryo of *Archontophoenix* is at the base, or stem end, of the seed.

Palm Spines and Safety

Recently, this interesting and important topic was raised on the IPS e-mail list. Subscribers were asked by IPS President Phil Bergman if they knew whether palm spines, especially those of the genus *Phoenix*, might have any toxic substance on them, aside from infectious bacteria or fungi, that might cause palm spine wounds to be especially painful. It seems as though everone who works with palms has had at least one bad experience with palm prickles, petiole teeth or spines, so there was a large and varied response. No conclusion was reached about the presence of toxins on the spines, but several respondents expressed the belief that there must be something about these spines that produced pain and inflammation beyond that which would be caused by a similar puncture from metal or glass. Others thought that indeed bacterial infections were the cause of the inflammation and slow healing.

Of the many cases of painful injury reported in the e-mail discussion, perhaps the most serious was that of Eric Schmidt, curator of palms and cycads at Leu Botanic Gardens in Orlando, Florida. Eric received a severe puncture wound near the index finger of his left hand while pruning *Phoenix canariensis* at Leu Gardens. As far as he knew at the time of the injury, there was no portion of the spine remaining in his hand. Eric thought it was just a simple puncture wound for which he was given a tetanus shot.

Before long, however, the area around the puncture swelled and developed a "knot-like consistency" that the attending physician said was scar tissue. Eventually the "scar tissue" grew to more than two centimeters in diameter, and finally, nearly a year after the injury, it became infected, at which point Eric became convinced that more than a simple puncture was involved and insisted on seeing a surgeon. A few days later the knot, or growth, was removed from his hand along with a 2.5 cm long portion of a *Phoenix canariensis* spine that was imbedded in bone near the base of his left index finger. Interestingly, x-rays taken prior to surgery failed to show the spine in Eric's hand. Eric healed quickly after surgery, and now only a small scar remains.

Eric's case is similar to two case histories reported in the *Medical Journal of Australia* (154: 627, 628. 1991) by Ian R. Barrett, entitled "Palm Needle Induced Pseudo-Tumours of Bone." These unrelated cases involved two five-year old children. In each case, the child suffered a puncture wound from a *Phoenix canariensis* spine. There were no doctor visits immediately after the injuries, and each child eventually forgot, or was unable to say, what had originally caused his injury. In each case, after some months, the child complained of pain, and swelling was apparent. One young boy's forearm was affected; the other youngster's lower leg was the site of the problem. Both children went through various diagnostic imaging procedures including x-ray, CT scan, ultrasound and magnetic resonance imaging, all of which were inconclusive but suggestive of a condition as serious as bone cancer. Exploratory surgery on each child revealed a palm spine. In one case the spine was more than three centimeters long. in the other case the spine was enclosed in a "firm rubbery mass" and was discovered by a pathologist who was sectioning the mass. Happily, both children recovered quickly after surgery and suffered no lasting ill effects.

Although many organic materials do not produce a reaction within the body, apparently at least some palm spines do, especially when lodged near bone. It is not too surprising that all three cases involved *Phoenix canariensis* spines. *Phoenix* is, perhaps, the most commonly cultivated spiny palm in the world.

All of this points out the need for safety when working around spiny palms. Long-handled tools can be of some help in avoiding prickles, petiole teeth and spines. Eye protection is a must when working with any of the large *Phoenix* species, and gloves may also prevent some injuries. My own palm spine experience involved a direct hit by – you guessed it! – a *Phoenix canariensis* spine on the Achilles tendon of my right foot resulting in a permanent impairment, so I can say that sturdy boots should be added to the list of safety gear to be worn while pruning palms. It might also be wise to promptly ask for an x-ray of a pucture wound if you suspect that any portion of the palm spine might have broken off inside the wound. In Eric Schmidt's case and the cases of the two Australian children x-rays were not made until many months after the injury when tissue had formed around the imbedded palm spines.

The question of whether the spines of *Phoenix* species contain a toxin or have a toxin on them is unresolved but is, perhaps, worthy of research.

Thanks to Mark Wuschke of Melbourne, Australia, for his assistance and suggestions, and to Dr. Scott Zona, for making me aware of the *MJA* article.