Palms

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THE INTERNATIONAL PALM SOCIETY, INC.

The International Palm Society

Founder: Dent Smith

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OFFICERS:

President: Paul Craft, 16745 West Epson Drive, Loxahatchee, Florida 33470 USA, e-mail licuala@earthlink.net, tel. 1-561-514-1837.

Vice-Presidents: Bo-Göran Lundkvist, PO Box 2071, Pahoa, Hawaii 96778 USA, e-mail bglpalms@earthlink.net, tel. 1-808-965-0081.
Leland Lai, 21480 Colina Drive, Topanga, California 90290 USA, e-mail lelandlai@aquafauna.com, tel. 1-310-973-5275.

Corresponding Secretary: Sue Rowlands, 6966 Hawarden Drive, Riverside, California 92506 USA, e-mail palmyview@cs.com, tel. 1-909-780-8771.

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

Treasurer: Randal J. Moore, 15615 Boulder Ridge Ln., Poway, California 92064 USA, e-mail randal.moore@cox.net, tel. 1-858-513-4199.

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Bookstore: Tim Cooke, PO Box 1911, Fallbrook, CA 92088-1911 USA, e-mail books@palms.org

Chapters: See listing in Roster.

Website: www.palms.org

FRONT COVER

A handsome, clustered *Pinanga* with dark brown stems and mottled leaves grew in dense forest on the Rakhine State/Magway Division border, Mayanmar (*Hodel et al. 1930*). See story p. 57. Photo by D. Hodel.

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A *Trachycarpus* (probably *T. martianus*) occurred on very steep, grassy slopes at 2650 meters elevation on Mt. Victoria, Chin State, Myanmar (*Hodel et al. 1929*). See story p. 57. Photo by D. Hodel.

NEWS FROM THE WORLD OF PALMS

The Hawaii Palm Society hosted a successful and memorable IPS Biennial. This year, attendees were treated to tours of spectacular palm gardens, both public and private, pleasant weather, fascinating lectures by palm specialists and delicious meals in the company of IPS members from around the world, all infused with the local "aloha" spirit.

On the island of Oahu, attendees were treated to tours of three spectacular public collections of palms, the Lyon Arboretum, Waimea Valley Audubon Center and Ho'omaluhia Botanical Garden. There were enough jaw-dropping palms and sensational vistas to satisfy even the most jaded of IPS members. After full days of palm viewing, attendees enjoyed evening presentations from an invited slate of palm specialists.

Our time in Hilo commenced with tours of three private collections, the gardens of Pauleen Sullivan, Bo-Gören and Karolyn Lundkvist and Leanne and Lars Swann. Each garden showcased exceptionally well grown palms, and many attendees were astonished at the rapid growth made by palms in volcanic cinder. Biennial activities on the Big Island continued with tours of the palm and cycad garden at the University of Hawaii – Hilo, the palms at the Panaewa Zoo (a collection initiated by the Hawaiian Island Palm Society), the garden of Garrin Fullington and Jeff Marcus' Florabunda Palms nursery. A final day of activity included a visit to Hilo's farmers' market and a tour of the gardens of Howard and Mary Ann Rogers, Bob and Syleste Williams and Charman Akina, all of which were formerly part of the Carlsmith estate. Evenings ended with presentations from palm specialists, including an evening devoted to native *Pritchardia*. This year's Biennial was a resounding success, thanks in large part to the tremendous preparations made by our host society, in particular Karen and Dean Piercy.

The IPS Endowment Fund supports palm research and education through small grants. This year, your society supported the following five projects: 1) Ms. Bee Gunn, Missouri Botanical Garden, received support for travel in the Lesser Antilles, where she will study island to island variation in *Prestoea*. Ms. Gunn's award is this year's Phyllis Sneed Travel Award. 2) Mr. David M. Cole, University of Florida, will study genetic diversity of peach palm (*Bactris gassipaes*) in the Peruvian Amazon. 3) Christine D. Bacon and Dr. C. Donavan Bailey, New Mexico State University, received funding for their project, a study of the genetic diversity of *Chamaedorea tepijilote*. 4) Chris Stührk, a student at the Biozentrum Klein Flottbek und Botanischer Garten, Hamburg, Germany, will undertake a molecular systematic study of *Trachycarpus*. 5) A student at the University of Newcastle upon Tyne, Wiske Rotinsulu, will begin a remote sensing and GIS mapping project of the palms of Sulawesi with IPS support. All grant recipients are asked to submit an article to PALMS describing the results of their research.

The Biennial also saw the installation of new officers and directors of the IPS. The officers are: Paul Craft as president, Bo-Gören Lundkvist and Leland Lai as vice presidents, and Randy Moore as treasurer. Libby Besse continues as administrative secretary, and Sue Rowlands continues as corresponding secretary. A complete listing of the IPS board of directors appears on the masthead.

On 16–19 April the fourth annual meeting of the European Network of Palm Scientists (EUNOPS) was held in the small village of Vallehermoso, La Gomera, Canary Islands. Two days of short talks given by 41 authors and co-authors provided evidence of the vibrancy of palm research in Europe. A fieldtrip was provided one morning to see the tapping of *Phoenix canariensis* in the village of Alojera for the production of palm honey. On the final day of the conference, participants were able to take part in a fieldtrip to see the spectacular scenery and vegetation of this beautiful island. Organized by Carlo Morici and José María Fernández-Palacios, the meeting was a resounding success.

THE EDITORS

Night Train to Mandalay, Part I

DONALD R. HODEL
University of California
4800 Cesar Chavez Avenue
Los Angeles, California 90022
USA
drhodel@ucdavis.edu

1. Old, venerable specimens of *Borassus flabellifer* grace the grounds of the Shwe Dagon Pagoda in Yangon, the largest and one of the most sacred Buddhist pagodas in the world.

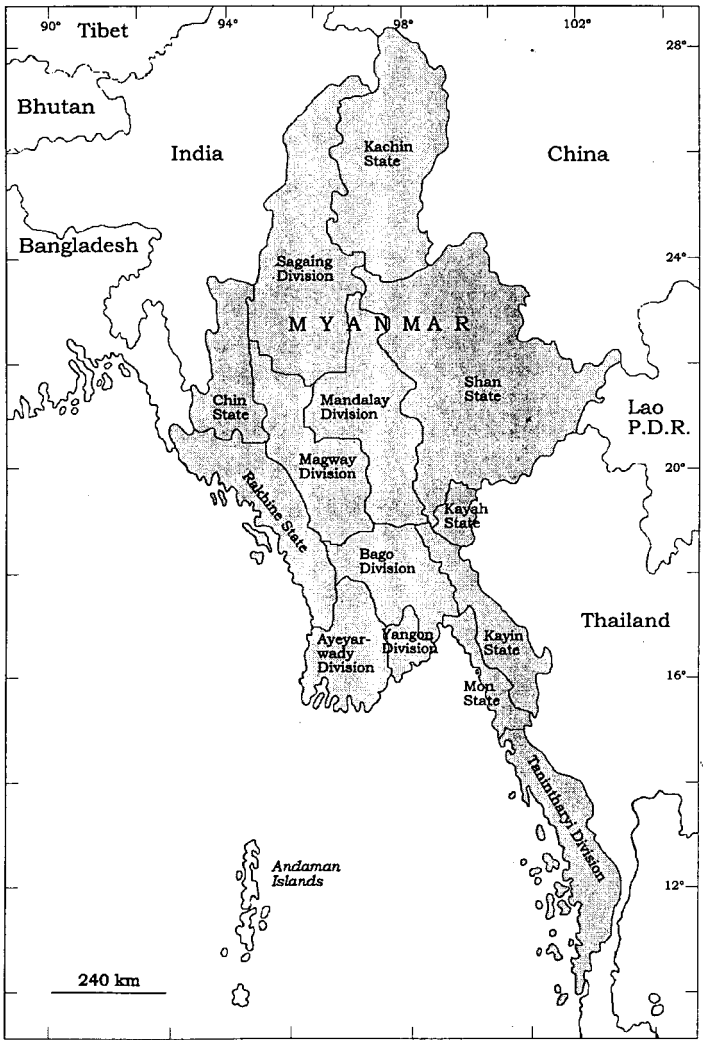
Exploring for palms in Myanmar, formerly known as Burma, is exciting but arduous and sometimes frustrating work. This account, the first of two parts, reports the findings of two expeditions exploring for palms.

The names Mandalay, Rangoon, and Burma easily conjure up images of an exotic, wild and faraway place ripe for adventurous palm exploration. Unfortunately, Burma, now known as Myanmar, is also a place where, up until only recently, it was difficult for foreigners to visit. Even members of the scientific community faced significant obstacles in undertaking work in Myanmar.

There has been little botanical research in Myanmar since the 19th century. Of course, I am especially interested in Myanmar palms, not simply because I have a general fondness for palms but also because Myanmar palms are so poorly known. Indeed, the most recent accounts of Myanmar palms date from the 1870s and are 125 years old. Furthermore, neither Burma nor Myanmar is even listed in the 40-year index to Principes (PALMS). Myanmar is the last large gap in our knowledge and missing piece of the Asian palm puzzle.

Also, Myanmar is especially interesting because, like Thailand, it is at the intersection of the Indian/southern China palm flora to the north and the Malaysian/Indonesian palm flora to the south, and contains elements of both floristic regions. Because of its large size, broad latitudinal spread, varied topography, and diverse climate zones, Myanmar is likely to harbor its own new or unique palm treasures.

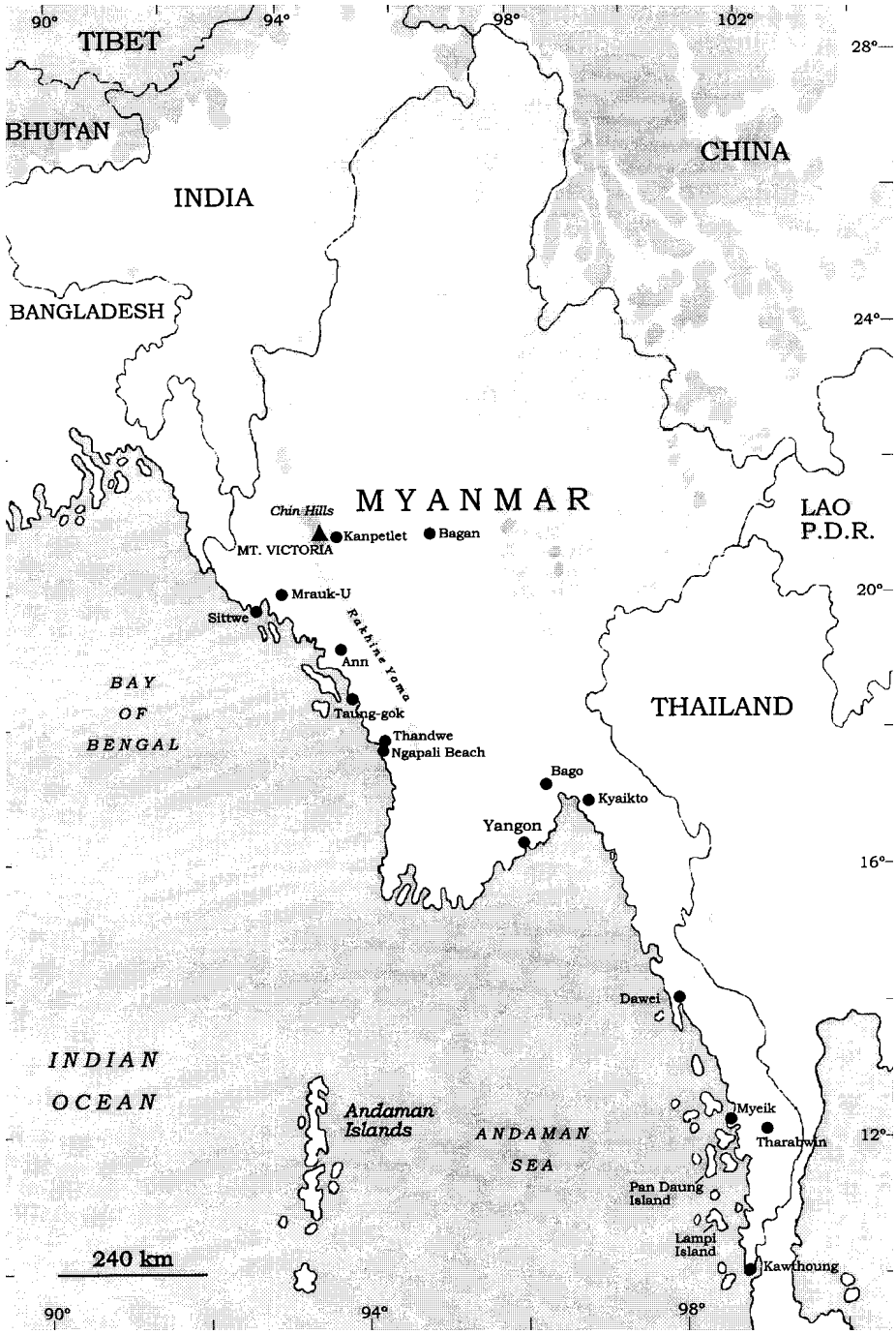
So, I jumped at the chance when the unusual opportunity arose to join the Harrison Institute on two wildlife research expeditions to Myanmar in March and November of 2003. Based in the United Kingdom, the Harrison Institute is a non-profit, scientific organization engaged in zoological research in small mammals, especially bats, and had conducted several previous expeditions to Myanmar. The Institute has a cooperative research program with the extremely capable and resourceful staff of the zoology department at



2 . Map of Myanmar showing political divisions (by Malcolm Pearch).

Yangon University (Yangon, the capital of Myanmar, was formerly known as Rangoon), which contributes scientists and expedition logistical coordination, and arranges for government permits to collect and export specimens for scientific research as well as permits to travel internally in Myanmar. Because I had joined the expedition and would be studying plants, particularly palms, the arrangement with Yangon University was extended to include the botany department.

Myanmar is about 2000 kilometers long and 1000 kilometers wide although it narrows to 60 to 150 kilometers in the southward arm or "panhandle" that extends for nearly 900 kilometers to the south along the western border of Thailand (Figs. 2 & 3). It is bordered on the west by the Indian Ocean and



3. Map of Myanmar showing areas visited in 2003 (by Malcolm Pearch).

4 (top). A woman in Cheung She Village near Bagan, Mandalay Division cooks sap collected from cut and macerated inflorescences of *Borassus flabellifer* for processing into jaggery, a tasty sugar. 5 (bottom). After cooking off the water, the jaggery is formed into balls to facilitate handling for packing and storage.

Bay of Bengal and Andaman Sea, on the north by Bangladesh and India, and on the east by China, Laos, and Thailand. Myanmar extends from 10°N to 28°N and has primarily a monsoon tropical climate. Its northern and eastern border regions are mainly mountainous but the central part of the country is a broad, dry valley drained by the Ayeyarwady (Irrawaddy) River. A mountain chain composed of the Chin Hills and the Rakhine Yoma extends about half way down the west coast, marking the western boundary of the Ayeyarwady River valley.

Persistent, southwest summer monsoon winds from June through October pick up moisture as they sweep across the warm coastal waters. When these moisture-laden winds strike the coast of Myanmar and not-too-distant inland mountains they release their moisture as rain. Rainfall amounts range up to 3800 mm (150 inches) per year in some areas near Dawei (Tavoy) in Taninthayi (Tenessarim) Division and Sittwe in Rakhine State. In contrast, the mountain-protected Ayeyarwady River valley is exceedingly dry with rainfall averaging only about 300 to 500 mm (12 to 20 inches) per year near Mandalay because it is in the rain shadow of the Chin Hills and Rakhine Yoma. The dry northeast winter monsoon winds originate near Mongolia in the middle of the vast Asian continent and persist from December through May.

Four general regions of Myanmar reflect the distribution of palms and local topography and climate. The west region is rather mountainous but has some low, flat areas near the coast. The north and east border region is also mostly mountainous but has some river valleys. The central region is composed of the broad, flat Ayeyarwady River valley. The south region has low, flat areas near the coast and hills and low mountains along the border with Thailand.

Climate and topography greatly affect the distribution of palms in Myanmar. Generally, the coastal areas and western mountain slopes in the west and south regions are home to moist to wet, evergreen tropical forests because of the high rainfall. The mountainous north and east border regions have less rain but at sufficiently high elevations contain evergreen forests. The central region has semi-deciduous or deciduous forest where many species of trees and shrubs drop their leaves during the pronounced dry period from January through May. The seasonal or monsoon nature of the climate increases from south to north. Also, as one moves higher up mountain

6. *Phoenix loureiroi* was moderately common on the banks of intermittent watercourses or slopes and ridges on sandy substrates in highly disturbed, dryland teak forest in Magway Division and other areas throughout the Ayeyarwady River Valley in Myanmar (*Hodel et al. 1927*).

slopes the monsoon nature of the climate and forest tends to diminish.

Not surprisingly, the moist to wet evergreen forests of the south region are the most palm-rich in Myanmar and share many species with peninsular Thailand and Malaysia. The next most palm-rich areas are the west region and the north and east border region. The central region is the least palm-rich area. The west, north and east border, and central regions share palm species with northern Thailand, southern China, and India.

The 18-day March expedition took us by train to Bagan in Mandalay Division and then by hired 4-wheel drive vehicles westward to Chin State and finally south along the coast of Rakhine State before returning to Yangon. The 20-day November expedition covered Yangon and Bago Divisions before flying to Myeik in Taninthayi Division and taking a boat through the Myeik Archipelago to Kawthoung and finally flying back to Yangon. A final two days were spent exploring for palms in the mountains above Kyaikto in Mon State.

Part I. March: Mandalay Division, Chin and Rakhine States

We spent two days in Yangon making introductions, getting our gear together, buying supplies, and obtaining train tickets and government permits for travel. I had one afternoon free for sightseeing and passed the time at Shwe Dagon Pagoda, the largest and one of the most sacred Buddhist pagodas in the world. Several old, large, magnificent individuals of *Borassus flabellifer* graced the grounds (Fig. 1).

Finally on March 2, after a six-hour delay but still with great fanfare, our group departed from Yangon a little after midnight on the night train for Bagan in Mandalay Division. The 700-kilometer trip would normally take about 14 hours. Unfortunately, our train trip stretched into a 22-hour ordeal with frequent, unscheduled stops and reduced speeds to pass over stretches of poor track and roadbed. On several occasions the train ground to a halt because of rocks or earth slides on the tracks, and crew and passengers had to disembark to clear the rails before the train could continue. The trip was further marred when at dawn our train was pulling into a station and struck and killed a woman who was crossing the tracks.

I began my palm exploration from the train windows at morning's first light. Although we were traveling up the dry central region in the Ayeyarwady River valley and it was the height of the dry season, I observed several species of palms. *Areca catechu*, *Borassus flabellifer*, *Cocos nucifera*, and infrequently *Corypha umbraculifera* were cultivated around homes and farms. I saw *Phoenix loureiroi*, a low, virtually trunkless, shrubby species, along canals, rice paddies and seasonal watercourses. Perhaps the most enduring sight, though, were the vast stands of *Borassus flabellifer* that we passed through during the next evening just before arriving in Bagan at 10 that night. The sight of these palms, standing like ghostly, shimmering sentinels in the Burmese moonlight, is a memory that will forever be etched in my mind.

We spent two days in Bagan, a tourist destination famous for the great number of ancient temples stretching over a large, flat plain on the banks of the Ayeyarwady River. Considered by one travel writer as "the most amazing site in Myanmar, if not Southeast Asia," the 2,000 or so 800-year-old red brick temples and stupas are an overwhelming sight. The bat team spent the days and evenings hunting and trapping bats in the temples. Because the area is so dry, there are few palms there but I again observed *Areca catechu*, *Borassus flabellifer*, *Cocos nucifera* and, infrequently, *Corypha umbraculifera* cultivated around homes and farms. The *Borassus* was extremely common and abundant, forming dense vast stands south of Bagan, where we observed the collection of the sugary sap from cut and macerated inflorescences and its processing into jaggery, a yellow brown, crude but sweet and tasty sugar (Figs. 4 & 5).

From Bagan we drove west on March 5 in hired, 4-wheel drive vehicles through Magway Division heading to Kanpetlet in Chin State. Our objective was to explore Mt. Victoria, or Natma Taung, at 3109 m tall the highest mountain in the southern two-thirds of Myanmar. The drive across the Ayeyarwady River valley and up the eastern slope of the Chin Hills to Kanpetlet was exceedingly rough and dusty. I was surprised at how dry the central region was. Most of the trees were leafless and everything sported a thick layer of fine, brown, powdery dust, including us and our belongings, by the time we arrived in Kanpetlet late that afternoon.

In Magway Division, along the road just before passing into Chin State, I collected *Phoenix loureiroi* on the banks of intermittent watercourses or slopes and ridges on sandy substrates in highly disturbed, dryland teak forest from 50 to 200 meters elevation (Fig. 6). *Borassus flabellifer* was common in fields, homes and rice paddies. I also observed a large, trunked *Cycas*, probably *C. siamensis*, growing in the dry, sandy plains.

Our drivers proved their mettle on numerous occasions. Although young, they were expert,

7 (top left). A large, clustering, climbing rattan in the *Calamus latifolius* complex of species near Kanpetlet, Chin State has pinnae clustered in groups and a cirrus at the leaf tip (*Hodel et al. 1928*). 8 (top right). The leaf sheath of the large, clustering, climbing rattan in the *Calamus latifolius* complex of species has a mixture of short needle-like spines and large, triangular spines; a prominent swollen knee below the petiole; and a short, tan ocrea extending just above the sheath mouth (*Hodel et al. 1928*). 9 (bottom). The Mt. Victoria *Trachycarpus* (probably *T. martianus*) had leaves olive-green above (left) and silvery gray below (right) (*Hodel et al. 1929*).

seasoned drivers and mechanics, very capable and of high quality of character, temperament and spirit. They were good natured, also, always joking and laughing. Several times one or another of our three vehicles would suffer a breakdown, invariably deep in the hinterlands far from any town or village, but they could diagnose the problem immediately and make repairs on the spot, and we would soon be on our way again. They were unusually fond of the vehicles, washing and cleaning them thoroughly at the end of each day's activities, and fussing and otherwise tending over them as if they were a fine team of thoroughbred racehorses.

Upon entering Chin State we had to stop at one of the frequent, internal government checkpoints and produce our identification papers and permits granting us permission to pass through or be in the area. These checkpoints became a familiar routine throughout the remainder of the trip. The typical traveler just visiting the well known and traveled tourist destinations, like Mandalay and Bagan, does not encounter these checkpoints, and tourists visiting these areas nearly always travel by air or chartered bus. But for those who venture off the "beaten track," permits to travel in these out-of-the-way places are required yet difficult to obtain. I saw no tourists once we left the popular tourist areas.

Soon the road began to climb and I again observed *Phoenix loureiroi* in a similar habitat to that seen in Magway Division but here from 200 to 1700 meters elevation. At about 800 meters elevation the deciduous elements of the forest were mostly gone and evergreen trees and shrubs dominated. Unfortunately, much of the forest had been cut and destroyed long ago, and what remained was of a secondary nature, often sparse and open with frequent bamboo. I saw a few, scattered, lonely specimens of *Wallichia disticha*, noted for its plumose leaves arranged in two opposing ranks on either side of the trunk.

We spent three days in Kanpetlet, climbing to the top of Mt. Victoria and exploring its forested slopes. Much of the forest along the road between Kanpetlet and the trailhead to the summit of Mt. Victoria had been destroyed. Some of it was actually in the process of being destroyed and, because it was the dry season, was burning, despite Mt. Victoria being in a national park and under protected status. We frequently found ourselves in swirling smoke generated by not-too-distant fires.

Another unusual and disconcerting sight were gangs of children, some seeming to be as young as eight or ten years of age, engaged in hard physical labor working on the road on Mt. Victoria. They carried or broke up rocks and stones with heavy hammers and set them for the roadbed and, in some instances, were high up on steep slopes pushing off rocks loosened by explosive charges for others down below to gather and transport to the worksite. We were told that their parents permit them out of financial necessity to do this type of labor.

Some, dark green, dense, remnant patches of mixed oak, pine, and *Rhododendron* forest existed on Mt. Victoria, and initially it seemed to hold great promise for harboring palms. I soon realized, however, that the elevation was too high and palms were frustratingly absent. I did observe several individuals of the solitary-stemmed *Caryota maxima*, apparently cultivated in and around Kanpetlet at about 1500 meters elevation. In a remnant patch of gallery forest northeast of Kanpetlet we collected a large, clustering, climbing rattan in the *Calamus latifolius* complex of species (Figs. 7 & 8). This complex, ranging from northeastern India through southern China and into Southeast Asia, contains about a half dozen or so species, primarily of hill and mountain forests, characterized by the presence of a cirrus (a clawed, whip-like climbing organ) at the leaf tip and the pinnae commonly clustered in groups. The characters used to distinguish the various species of this complex are highly variable and further study is needed to define this group adequately.

On our last day on Mt. Victoria a local hunter guided us to a lone specimen of *Trachycarpus* (probably *T. martianus*) on a very steep, grassy slope in a ravine at 2650 meters elevation (Fig. 9; Back Cover). Although we saw only one tree, the hunter said more extensive stands of this species occurred several hours walking to the southwest.

On March 9 we departed from Kanpetlet and descended once again into the dry Ayeyarwady River valley, driving south to overnight in Minbu in Magway Division. Up until that time I had not noticed any fueling (petrol) stations other than the few in Yangon. Indeed, for the nearly three weeks of the trip I did not see one vehicle fueling station when we were outside of the capital. When we needed diesel fuel for the vehicles, we would stop in a village, and our drivers would inquire as to who had fuel for sale. Invariably we obtained fuel from a house where the owner had it stored in plastic barrels, and we loaded it into our vehicles using buckets and funnels.

The next morning we headed west to cross over the Rakhine Yoma, the mountain chain separating the Ayeyarwady River valley from the Bay of Bengal. The road ascends to about 1450 meters

elevation as it crosses over the mountains to the Rakhine Coast. Near the top and as one begins to descend there is excellent evergreen forest with several palms. Even though the road is starting to descend and the valleys and canyons drain to the west into Rakhine State, we learned that we were still several kilometers east of the Rakhine State border, which is marked by incredibly vast stands of bamboo that continue a good way down to the coast.

At about 1425 meters elevation, I observed the multi-stemmed *Caryota mitis* and two juvenile, stemless rattans in the forest just off the road. One rattan had regularly arranged pinnae and whorled spines on the petiole and sheaths while the other had pinnae grouped along the rachis with large, single spines. Perhaps they were juvenile *Calamus longisetus* and a *Plectocomia* species

Farther down the road at about 1400 meters elevation we stopped for lunch at a little family-run restaurant. I eschewed the food and instead took off into the forest to hunt for palms. After descending down a steep slope in dense forest I collected a clustered *Pinanga* with dark brown stems and distinctly mottled leaves (Front Cover), and observed a solitary-stemmed *Caryota* in the *C. obtusa*/*C. gigas* complex of species. This latter species grew to about 15 meters tall and had its leaves tightly clustered near the top of the trunk in a spreading, relatively compact crown. It seemed that in no time I could hear the others up at the restaurant yelling for me to come up, as it was time to continue on with our journey, so I gathered my collections and clambered back up the slope to the road. Several more kilometers farther we again observed the solitary stemmed *Caryota* on very steep slopes just below the road. After entering Rakhine State and descending even more we saw a few solitary individuals of *Wallichia disticha* poking up through the vast bamboo forest that extended as far as the eye could see.

We overnighted in a dilapidated, government guest dormitory in Ann and on the morning of March 11 headed north up the Rakhine Coast for the once great royal capital Mrauk-U, now a lesser known tourist destination famous for its ancient temples.

The road from Ann to Mrauk-U covers rolling terrain from near sea level to about 100 meters elevation, much of it with rather large patches of intact forest. A few kilometers north of Ann we collected the small fan palm *Licuala peltata*. Rather common in the area, this species is noted for its orbicular leaves divided into several, broad, wedge-shaped segments with truncated, toothed tips. Also common were three, usually climbing rattans, *Calamus longisetus*, *C. viminalis*, and *Daemonorops jenkinsiana*. However, with few exceptions, we never observed mature individuals with long, climbing stems because the canes are cut and harvested for use in the rattan industry as soon as they attain even a relatively short length or the center buds are collected for food when the stems are still very short, maintaining the palms in a shrubby, non-climbing, perpetual state of juvenility. Only infrequently did we observe a *D. jenkinsiana* with long, climbing stems.

As in other areas of Myanmar, *Areca catechu*, *Borassus flabellifer*, and *Cocos nucifera* were cultivated around homes and farms. Farther north, as the road runs along coastal plains and skirts estuarine areas, *Nypa fruticans*, the mangrove palm, formed vast colonies in tidal areas. On drier, slightly elevated land *Calamus viminalis* was again common along with an occasional *C. tenuis* and *Daemonorops jenkinsiana*, all again in a juvenile, non-climbing state.

Although fewer in number than those in Bagan, the ruins of the once magnificent temples and city walls of Mrauk-U are still an impressive sight. We had planned two days to explore Mrauk-U and its surroundings but our movements were heavily restricted because a Thai princess was visiting the ruins on a goodwill tour and many areas were off limits and roads closed. However, in nearby Paraoak Village we collected two rattans, *Calamus tenuis* (Figs. 10–11) and *C. viminalis* (Figs. 12–13) in low, seasonally wet areas near homes. Like *Calamus longisetus*, these two rattans lack a cirrus at the leaf tip and instead have a flagellum for climbing (a clawed, whip-like organ arising from the leaf sheath that becomes the inflorescence in adult plants). I observed *Corypha umbraculifera* infrequently around temples but still prompting me to consider that it might have some sort of religious importance. In nearby Bulukan Village I saw one individual of *Phoenix sylvestris* although it had green rather than the more typical grayish leaves.

On the morning of March 14 we said good-bye to our dedicated and dependable drivers, who had by now become our beloved companions, and departed Mrauk-U by boat, slowly making our way down the Kalandan River to Sittwe. Perhaps the species of paramount importance for me to see in Myanmar was *Calamus arborescens* because of its unusual, at least for a rattan, erect, non-climbing habit and handsome ornamental features. That it had eluded me in Thailand despite extensive fieldwork there in 1997 only increased my desire to find it in Myanmar. Indeed, I had high hopes of seeing it in low, seasonally flooded areas near

10 (top). Villagers near Mrauk-U, Rakhine State tended clumps of *Calamus tenuis*, harvesting the young vegetative buds for food and maintaining the plants in a perpetual state of juvenility (*Hodel et al. 1932*). 11 (bottom left). Leaf sheaths of *Calamus tenuis* have long, needle-like spines with downward, crescent-shape bases, a flagellum, a prominent knee, and a short ocrea at the sheath mouth (*Hodel et al. 1932*). 12 (bottom right). Villagers near Mrauk-U, Rakhine State also tended clumps of *Calamus viminalis*, harvesting the young vegetative buds for food and maintaining the plants in a perpetual state of juvenility (*Hodel et al. 1933*). In *C. viminalis* the pinnae are clustered in groups rather than regularly arranged as in *C. tenuis*.

13 (top left). Leaf sheaths of *Calamus viminalis* have a dense, whitish, felt-like covering and long, triangular spines, a flagellum, a knee, and a very short ocrea at the sheath mouth (*Hodel et al. 1933*). 14 (top right). *Wallichia caryotoides*, with prominently lobed, jaggedly toothed pinnae dark green above and silvery gray below, occurred on densely forested hills east of Mya Bin Village just south of Ngapali Beach, Rakhine State (*Hodel et al. 1937*). 15 (bottom). A large rattan in the *Calamus latifolius* complex, possibly *C. latifolius*, climbed above the trees in Salu Village on the road from Taung-gok over the Rakhine Yoma to Bago Division. The clustered pinnae and cirrus at the leaf tip, common characteristics of this complex, are clearly evident.

16. The leaf sheaths of *Calamus latifolius* are monstrously armed with partial whorls of large, colorful, yellow, green, and brown, downward-pointing, triangular spines.

the coast, its purported habitat, so I kept a watchful and sharp eye for it around Mrauk-U and during our boat trip to Sittwe. Sadly and frustratingly it was nowhere to be seen on this portion of the trip although we did see vast stands of *Nypa fruticans* along the riverbanks and one specimen each of *Phoenix paludosa* and *Corypha utan*.

We departed Sittwe on the morning of March 15 on a fast, sleek ferry for the four-hour trip south along the Rakhine Coast to Taung-gok. Vast colonies of *Nypa fruticans* were common in tidal areas on the mainland as well as offshore islands. We arrived in Taung-gok late in the afternoon and, after much negotiation, succeeded in hiring a truck to transport us and our burgeoning pile of belongings south to Ngapali Beach, an emerging yet still relatively unknown resort area. After two hours of a jostling, dusty ride in the open back of a truck, during which several times I was literally flying off the bench where I was seated, we pulled into Ngapali Beach after dark and checked into our beach-front bungalows.

Although the lure of the beautiful beach was strong and compelling, the next morning we made arrangements with a local villager who guided us into some forested hills a few kilometers east of Mya Bin Village just south of Ngapali Beach. At about 100 meters elevation we collected *Licuala peltata*, *Daemonorops jenkinsiana*, *Caryota mitis*, and *Wallichia caryotoides*, the last a small, clustering, shrubby, understory palm with jaggedly toothed pinnae, dark green above and silver-gray below (Fig. 14). *Calamus longisetus* and *C. viminalis* were also present but in a juvenile state.

The next morning a group of us took a boat trip to Pearl Island, a few kilometers off the coast of Ngapali Beach, to look for bats and palms. Although we observed a single, juvenile individual of *Caryota mitis* in remnant forest just above the high tide mark, it might have been cultivated because it was not too distant from several dwellings and there were other plants in the vicinity that appeared like they might have been cultivated. I spent the afternoon exploring the coast and extensive beaches fringed with coconut palms that brought back memories of past times spent in similar, idyllic settings in the South and West Pacific.

Happily recharged from the much deserved rest and relaxation, we somewhat sadly departed Ngapali Beach on the morning of March 18 and headed back to Taung-gok, thus beginning the final leg of our trip and return to Yangon. The ride from Ngapali Beach to Taung-gok was just as rough and uncomfortable as it was in the opposite direction two days earlier but, because it was during the day, I had the opportunity to look for palms along the way. In disturbed remnant patches of forest I saw *Calamus longisetus* and *Licuala peltata*, two of the most visible and common wild palms of the Rakhine Coast. I also observed a mostly abandoned planting of *Elaeis guineensis*, the African oil palm.

After arriving in Taung-gok we ate lunch near a handsome specimen of *Phoenix sylvestris,* and with much searching and haggling, were finally able to hire a small bus to take us east up and over the Rakhine Yoma to Pyay in Bago Division. Upon departing Taung-gok the road begins its ascent to cross over the mountains. At Salu, a small village at about 650 meters elevation, I observed *Caryota maxima* and another large, climbing rattan in the *Calamus latifolius* complex, possibly *C. latifolius* (Fig. 15). It had monstrously armed leaf sheaths with partial whorls of large, colorful, yellow and green, downward-pointing, triangular spines (Fig. 16). Farther up the road at about 700 to 1000 meters elevation and perhaps across the border and into Bago Division were *Caryota maxima*, *C. mitis*, *Calamus latifolius*, *C. longisetus*, the very abundant *Wallichia caryotoides*, and a moderate-sized *Arenga*, the latter solitary, to about three to four meters tall overall, and with leaves about two to two and a half meters long with flat, regularly arranged pinnae. This *Arenga* seemed too small and did not carry enough leaves for *A. westerhoutii*, and perhaps it was *A. micrantha*, which is known from northeast India. Descending toward the plains of the Ayeyarwady River valley but still on small hills in disturbed, dryland teak forest I saw occasional individuals of *Phoenix loureiroi*.

We overnighted in Pyay in Bago Division and on the morning of March 19 made our way back to Yangon. The next day we unpacked our gear and equipment and sorted through our collections at Yangon University. I had some more free time for sightseeing around Yangon and noted several commonly cultivated exotic palms, the Cuban royal palm (*Roystonea regia*) being by far the most common. Other species included areca or golden butterfly palm (*Dypsis lutescens*), triangle palm (*D. decaryi*), African oil palm (*Elaeis guineensis*), Chinese fan palm (*Livistona chinensis*), foxtail palm (*Wodyetia bifurcata*) and a *Pritchardia* species, probably *P. pacifica*.

That evening we enjoyed a farewell dinner, reminiscing about our exciting, eventful, and rewarding expedition and formulating plans for a return trip to Myanmar, next time to the more diverse and palm-rich south.

Syagrus cearensis, a Twin-Stemmed New Palm from Brazil

LARRY R. NOBLICK
Montgomery Botanical Center
11901 Old Cutler Road
Miami, Florida 33156 USA
noblick@fiu.edu

1. *Syagrus cearensis* showing its common habit of growing as paired or twinned trunks.

***Syagrus cearensis*, a striking Brazilian palm with twinned stems (Fig. 1), is described for the first time. It is already widely dispersed in cultivation.**

2. *Syagrus cearensis* habitat near Pacatuba, Brazil; note palms on left.

During my early wanderings at Fairchild Tropical Garden, I encountered a two-stemmed palm that had one stem identified as *Syagrus comosa* (Mart.) Mart. and the other as *S. flexuosa* (Mart.) Becc. The palm was first received at Fairchild identified as *Syagrus comosa*, which is a non-clustering palm, but later re-identified as the clustering *Syagrus flexuosa*. However, there were some important attributes that differed from *S. flexuosa* – the leaflets were larger, broader, and more leathery, the fruits larger, rounder, and more flattened at the tip instead of elongated and pointed, and the primary branches were evenly arranged around the rachis of the inflorescence, not turned to one side as in *S. flexuosa*. So, other than the clustering habit, there was very little that this palm had in common with *S. flexuosa*.

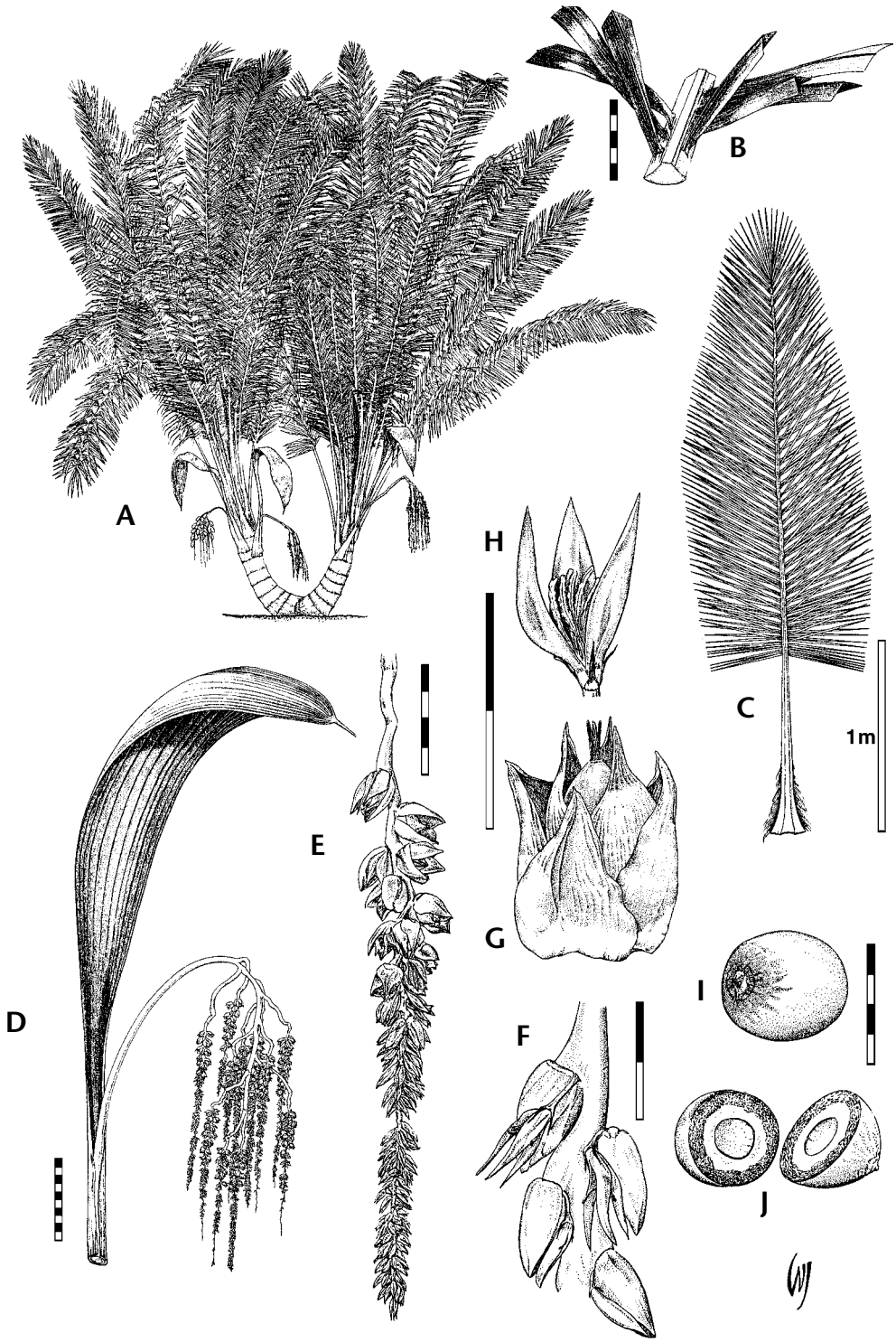
The fruit of the mystery palm resembled a short *Syagrus oleracea* fruit, and so I suspected that perhaps the palm might be a hybrid. However, my hybrid theory died when I learned that the palm was both fertile and produced true from seed. I saw the palm again in other gardens, such as Campinas, São Paulo, Brazil, but since I only knew the plant from cultivation, I was still unwilling to commit to publishing a new species.

Finally in 1993, Luiz Antonio F. Matthes sent me a dried specimen to identify. He had collected it from a cultivated palm in Forteleza, Ceará, identified as *S. comosa*. He was convinced that it could not be that species and had the opportunity to observe the species in its natural habitat in the Municipio of Maranguape at the base of a mountain range near Forteleza. He noted that the palm grew solitarily, in twos, and in clusters. The records at Fairchild Tropical Garden revealed that some of the collections originated from the Brazilian state of Ceará, collected by E. D. Kitzke from the Ratosa Plantation near Forteleza in 1959, and was received as *S. comosa*. My friend's dried collection matched perfectly the living material we had growing at both Montgomery Botanical Center and Fairchild Tropical Garden. As in a good detective novel, the pieces of the puzzle came together.

In August 1994 I went in search of this *Syagrus* and was pleased to find natural populations near the towns of Maranguape, Pacatuba, Baturité, and Araçoiaba, Ceará. The Serra de Maranguape and the Serra de Aratanha (Pacatuba) had especially large populations. We encountered the palm on the lower slopes of the mountains from about 450 to 700 m above sea level (Fig. 2).

Later, Don Evans of Fairchild Tropical Garden joined me, and we explored the interior of the state of Pernambuco, which lies to the south of Ceará. Don and I encountered the same species at Brejos dos Cavalos near Caruaru . The palms were growing in open pastures and sprouting from their bases in the same way as they did in Ceará. South of Garanhuns near the border with the state of Alagoas, we saw still more multiple-stemmed palms of the same species.

Close to Garanhuns, Don and I visited the village of Neves, which is the type locality for the natural hybrid *Syagrus* × *costae* Glassman (1970), a supposed cross between *S. coronata* and *S. oleracea*. We now know that *S. oleracea* of this region has been misidentified and that the hybrid is really a



3. *Syagrus cearensis*. **A** Habit; **B** Section of leaf rachis showing inserted leaflets; **C** Leaf; **D** Inflorescence; **E** Primary branch; **F** Basal portion of primary branch showing staminate flowers with pedicels along side the larger pistillate flowers; **G** Receptive pistillate flower; **H** Staminate flower showing the narrowly lanceolate sepals; **I** Fruit covered with lepidote tomentum; **J** Cross-section of mature fruit showing a distinct central seed cavity. Habit, leaf and fruit drawn from MBC accession number 94654*E and inflorescence and flowers drawn fresh from 94654*Q. All scales are in 1 cm units except as marked. Drawn by Wes Jurgens.

4. Map showing distribution of *Syagrus cearensis*.

cross between *S. coronata* and this new clustering species, *S. cearensis*. While there were many similarities with *S. oleracea* that led botanists to identify it as such, it is sufficiently distinct (see Table 1) to distinguish it as its own species rather than a simple clustering form of *S. oleracea* or even another similar species, *Syagrus picrophylla* Barb. Rodr., which has also been confused with *S. oleracea*.

Syagrus cearensis Noblick, **sp. nov.**

Palma caespitosa vel solitaria trunco conspicue articulato, foliis 2.3–3.5 m irregulariter pinnatis, foliolis centralibus ad 1 m longis 3.5–4 cm latis concoloribus. Inflorescentia ad ca. 1.2 m longa, rachillis ca. 35–45, floribus masculis ca. 12–21 × 5–7 mm, femineis 17–25 × 8–10 mm. Fructus lepidotus longior quam latus ca. 4 cm longus, endocarpio ad 5 mm crasso. Semen cavitatem ferens. Typus: Brazil, Ceará, Municipio de Pacatuba, *Noblick et al. 4951* (Holotypus EAC; isotypi FTG, IPA, NY).

Unarmed, solitary or clustering palm in clusters of usually 2–4 stems growing in one plane, to multi-stemmed clusters. Trunk to 4–10 m tall and 10–18 cm diam., internodes 9–16 cm long at the base and shortening to 2–7 cm long towards the apex, producing a rough trunk with slightly stepped nodes. Leaves 10–15 in crown, leaf sheath together with petiole ca. 90–100 cm long, sheathing leaf base 18 cm long or more, ca. 18 cm wide at the base, fibrous with papery membrane disintegrating between the fine principal warp fibers, persisting along the margins of the pseudopetiole (apparent petiole); true petiole absent or to 2 cm long and 4 cm wide by 2 cm thick, but often smaller, channeled adaxially, often with a raised central ridge, rounded abaxially, pseudopetiole (true petiole plus part of the sheath) ca. 40–50 cm long; rachis 2.3–3.2 m long, a fine light brown to grayish indument covering the abaxial side of the sheath, continuing up the abaxial side of the petiole and sometimes onto the lower portion of the leaf rachis, the upper parts of the leaf rachis becoming glabrous with age; leaflets medium green color becoming lighter when dried, concolorous, adaxial surface with prominently raised transverse veins when dried, leaflets ca. 100–130 along one side, irregularly distributed in loose clusters of 2–5 along rachis and inserted in divergent planes, ramenta absent, tomentum absent at leaflet insertion and along the abaxial midvein; basal leaflets 80–95 cm long by 2–2.5 cm wide, middle leaflets 68–100 cm long and 3–4 cm wide, apical leaflets 31 cm long and 0.4 cm wide, usually one lobe of the asymmetric tip attenuate, the other rounded, occasionally both rounded. Androgynous

Table 1. A comparison between *Syagrus cearensis* and two other closely related species, *S. oleracea* and *S. picrophylla*.

Character	*Syagrus oleracea*	*Syagrus picrophylla*	*Syagrus cearensis*
Habit	Solitary	Solitary	Solitary, but more frequently clusters, usually 2–4 or more
Petiole cross-section	Channeled	Channeled	Channeled but often with a raised mid- ridge on adult leaves
Leaflet margin (as seen in cross-section)	Inconspicuous submarginal vein	Inconspicuous submarginal vein	Conspicuous adjacent submarginal vein
Leaf margin (as seen in cross-section)	Neither notched nor swollen	Neither notched nor swollen	Notched or swollen adaxially
Peduncular bract indument	Glabrous	Glabrous	Often with a fine waxy lepidote
Primary branch subtending bract	Laterally broadened, truncate	Laterally broadened, truncate	Deltoid or sometimes absent
Basal staminate flowers	Sessile	Sessile to rarely short pedicellate	Often short pedicellate
Staminate sepal shape	Short deltoid	Short deltoid	Linear to lanceolate
Pistillate sepal and petal indument	Glabrous	Glabrous	Basal portion often with waxy lepidote, especially on petals
Pistil shape	Cone-like	Cone-like	Ovoid
Staminode length (mm)	1–2	1–2	>3
Staminode shape	Irregular	Irregular	6-dentate
Fruit indument	Apically lepidote	Apically to upper half densely lepidote	Usually entire fruit densely lepidote
Cupule ring length (mm)	2–3	1–2	3 or more
Central seed cavity	None	None	Large, distinct

inflorescences interfoliar, 45–85 cm from the first basal primary branch to the apex; prophyll ca. 30–45 cm long; peduncular bract woody, sulcate, exterior covered with a thin indumentum, ca. 102–115 cm or more long including a beak 4–11 cm long, expanded or inflated portion 50–74 cm long, 13–16 cm diam. and a 14–26 cm perimeter and 1–3 mm thickness; peduncle ca. 40–80 cm long, somewhat flattened in cross-section, 2.5–3 × 1.5–2.5 cm diam., sparsely lepidote; rachis 33–60 cm long, primary branches 35–45, glabrous, 9–17 cm long at the apex, 30–50 (–106) cm at the base, 11–13 mm diam. at the base and 2–3 mm diameter at the tip, each primary branch, especially the lower ones, subtended by a deltoid rachis bract ca. 5 mm long, pistillate portion 12–16 cm long with 10–22 pistillate flowers or fruits per primary branch, staminate portion 16–20 cm long. Staminate flowers yellow, arranged in triads with pistillate flowers on the lower portion or in dyads or singly on the upper portion of the primary

facing page

5. *Syagrus cearensis* in its natural habitat in the mountains near Pacatuba, Ceará.

branch, 12–21 × 5–7 mm, sepals and petals 3; sepals (3–)5–6 × 0.5–1 mm, strongly keeled and slightly connate at the base; petals valvate, 12–20 × 4–5 mm with acute tips, nerves indistinct; stamens 6, 6–8 mm long, anthers 4–6 mm long, filaments 2 mm long; pistillode trifid and less than 0.5 mm long. Pistillate flowers oblong and pyramidal, usually slightly lepidote on the basal portion, 17–25 × 8–10 mm; sepals 3, imbricate, 14–25 × 7–10 mm wide; petals 3, unnerved to slightly nerved, imbricate at the base but (upper 5–7 mm) valvate at the tips, 11–14 × 6–8 mm; staminodal ring about 3 mm high, 6-dentate; pistil lepidote on upper portion, glabrous on lower behind the staminodal ring, 10 × 6 mm, stigmas 3, 2 mm long. Fruit light orange when mature, color often obscured by a thin dark brown indument, about as long as wide, 3.5–4.0(–5) cm long and 3–4 cm diam. with a 7–10 mm thick mesocarp and 3–5 mm thick endocarp, endocarp ca. 4 × 2.3 cm. Seed ellipsoid, ca. 1.8 × 1.2 cm, and with a substantial central cavity ca. 6 mm diam. (Fig. 3).

COMMON NAME: *catolé* or c*oco babão* (*babão* translates as mucus or slobber and refers to the slimy juices of the mesocarp).

ETYMOLOGY: The specific epithet honors one of the states to which the palm is native, Ceará, Brazil.

DISTRIBUTION AND ECOLOGY: Brazil, locally common in mountainous areas and seasonal forests in the states of Ceará, Pernambuco, Paraíba, and Alagoas. Growing at the base of the mountains or in pastures at an altitude of about 100–750 m above sea level (Fig. 4).

PHENOLOGY: Flowering and fruiting probably throughout the year, but collected in flower and fruit during the months of July to September.

SPECIMENS EXAMINED: BRAZIL. Alagoas. União dos Palmares, 19 Nov 1985, *R. P. Lyra-Lemos & A. I. L. Pinhero 1049* (PEUFR); 19 Nov 1985, *R. P. Lyra-Lemos & A. I. L. Pinhero 1050* (PEUFR); São José da Lage, near AL-110, 17 Oct 1986, *R. P. Lyra-Lemos & G.L. Esteves 1240* (PEUFR). Ceará. 1929, *Dahlgren s.n.* (F-613592); Forteleza region, near Mejecana, 1935, *Dahlgren s.n.* (F-620753a); Maranguape, 1940 *Dahlgren s.n.* (F-619724); Maraguape, Serra da Pacatuba (close to Forteleza), top and bottom of the Serra, *Luiz Antonio F. Matthes s.n.* 1993 (FTG); Pacatuba, Serra de Aratanha, 29 km S. of Forteleza, 3°58′S, 38°32′W, 600–700 m, 12 Aug 1994, *Noblick et al. 4951* (Holotype, EAC; isotypes IPA, FTG, NY); Araçoiaba, Olho d'Agua, 8 km N of Araçoiaba, 4°15′S, 39°00′W, 13 Aug 1994, *Noblick et al. 4953* (FTG, IPA). Paraíba. Santa Rita, 20 Aug 1962, *Sérgio Tavares 960* (UFP); Conde, 22 km N of Goiana, Pernambuco on BR-101, 14 km N of the Paraíba/Pernambuco state border, 7°22′40.5″S, 34°57′26.6″W, 1 Jul 1997 *L. R. Noblick & J. T. de Medeiros-Costa 5132* (IPA). Pernambuco. Tapera, 1929, *B. Pickel 1208* (IPA); Pombos, 1966, *Medeiros-Costa 66-0003* (IPA); Goiana, 1966, *Medeiros-Costa 66-0009* (IPA); Triunfo, 27 Mar 1970, *Medeiros-Costa 133* (IPA); Pombos, 1969, *Glassman & Costa 8701* (F); 2 km W of Neves, associated with *S. coronata* and *S. x costae*, 1969, *Glassman & Costa 8706* (F).

USES: This palm has great ornamental potential. The especially attractive character is its tendency to grow in pairs or as twins (Fig. 1 & 5).

In summary, *Syagrus cearensis* merits recognition. Some of the distinct attributes of this species are the common clustering habit with the strong tendency towards twins, fruit nearly as long as wide, evenly covered with a fine dark brown lepidote indument, presence of deltoid rachis bracts, sepals of staminate flowers usually narrowly linear and strongly keeled and a rather large distinct interior seed cavity. I am unaware of any other species of *Syagrus* with such a large seed cavity. Because of its predisposition to form twins, this species is a great ornamental.

Acknowledgments

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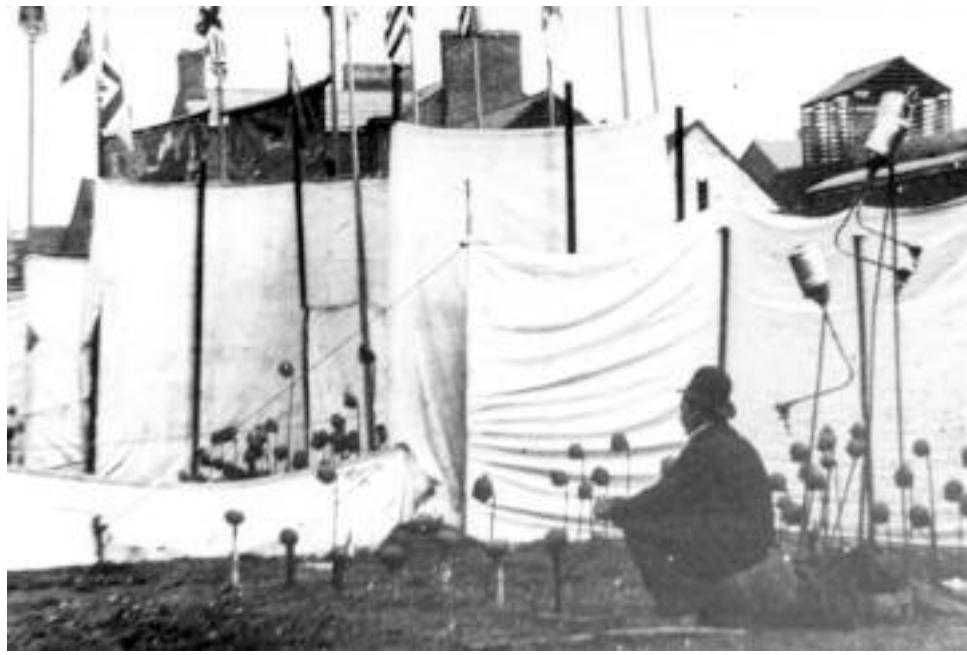
Fun Made The Fair Coconut Shy

HUGH C. HARRIES
Research Associate,
Royal Botanic Gardens, Kew
Richmond, Surrey, TW9 3AE
UK



1. Coconut shy, circa 1890. University of Sheffield National Fairground Archive.

From an internet message board: "You don't have coconut shies? It's a fairground game, where coconuts are set up on posts and one has [to] throw balls at them and knock them off to win them" (BBC America 2003).

Golfers know the phrase "Close, but no cigar" when their putt just reaches the edge of the hole and fails to drop in. Or they may say "Close, but no coconut." These phrases originated in fairgrounds where cigars or coconuts were prizes in the booths where balls were thrown at a clay pipe or the open mouth of an "Aunt Sally" face. As the *Surrey Comet* in England reported on Saturday November 16, 1867, "The Pleasure Fair, held for the first time in the Fairfield [Kingston-upon-Thames] was larger than has been known for years . . . For the small sum of one penny, you could have three throws with sticks with the prospect of getting a cocoa nut, a doll, a pencil case, or some other such useful article . . . Then for a penny you obtain the privilege of trying to throw a ball into a gaping mouth, which when done, would entitle you to receive a cocoa nut, and you were assured you could 'crack it and try it'" (Anon. 1867).

The coconut soon became a popular prize: ". . . in nearly every country fair [Fig. 1], and in almost all the open spaces round London at holiday seasons, the cocoa-nut plays so conspicuous a part that every child is acquainted with it, most children have eaten it, and large numbers have tasted the thin, rather insipid liquor that is the 'milk' in a very deteriorated condition" (Treloar 1884). Treloar drew attention to the coconut's increasing domestic involvement in popular British culture and, in particular, to a novel role: "The origin of the now neglected game of 'Aunt Sally,' also an importation from the tropics, may be attributed to the cocoa-nut; and at any rate the cocoa-nut 'shy' has superseded it by providing not only for the amusement, but the cupidity of the patrons of 'three sticks a penny.' It has also nearly superseded the more ancient 'cock shies' where the prizes were pincushions, knives, toys, and painted tin snuff-boxes – just as these covetable articles took the place of the gingerbread and gilded fowls that in earlier days displaced the live cocks at which the brutal part of the population threw sticks on Shrove Tuesdays" (Treloar 1884). The throwing sticks were themselves displaced by wooden balls and the coconut became " . . . familiar as the reward of the popular English amusement of 'throwing at the coco-nuts'" (Encyclopaedia Britannica 1911). But just exactly when, where and why did the coconut become both the target and the prize? The evidence is not obvious but the clues lie in the proximity of a particular public house to three water mills that made mats, candles and button polish.

According to records in the Local History Room of the North Kingston Centre in Kingston-on-Thames, Surrey, near to London, there were water mills from the earliest recorded (Saxon and Doomesday) times on the river Hogsmill, a tributary of the Thames. Originally these mills ground flour from local crops but the Middle Mill, which was operating on the banks of the Hogsmill River at least as early as the 1600s, ceased flour production in the early 19th century and became a "cocoa fibre works" where "coarse fibres from the outer shell of coconuts were made into mats and brushes" (Biden 1852, Sampson 1985). According to Sampson, Middle Mill started to use coconut fiber (coir) to make matting in the 1840s, a period now identified with the start of the coconut plantation industry in Ceylon (Sri Lanka) and elsewhere (Child 1974). Before the end of the 19th century, Treloar could write "There are a good many people still living who can remember when a Cocoa-nut was a comparative rarity in some parts of England. In a few old country mansions, or on the mantel-shelves of retired sea-captains, and occasionally in London curiosity shops, might be seen strangely-figured goblets, with rims and feet of silver, and so wrought that here and there they were thin and almost translucent, that there was a gleam upon their rich, dark surfaces which gave them the appearance of being formed of some rare stone. These were made of the shells of the great cocoa-nuts, wrought in graceful or grotesque patterns by some patient native, or by an ingenious sailor on the long homeward voyage" (Treloar 1884). These shells were from both the coconut and the coco-de-mer (*Lodoicea maldivica*).

Beautifully engraved coconut shells had indeed reached Britain in the 11th and 12th centuries, often mounted in silver or gold and set with precious gems (Fritz 1983). According to the Metropolitan Museum of Art the "exotic coconut, or 'Indian nut' as it is called in Renaissance inventories, had been collected and displayed as an object of 'miraculous powers' in the treasuries of pagan temples since Greek and Roman antiquity . . . The coconut's curious form and obscure origin in faraway lands supported the idea of using the odd shell of the nut as a medicinal antidote. For instance, poisoned wine could be neutralized by drinking it from a coconut used as a cup . . ." (Anon. 2003). In the 16th century, when Queen Elizabeth I encouraged her naval captains to capture Spanish ships laden with treasure from the East, one such vessel, the *Madre de Dios*, had a cargo of: " . . . elephants teeth, porcellan vessels of China, coconuts, ebenwood as black as jet . . ." (Gleeson 1998). Yet the coconut was still a rarity in England in the 17th century (Grew 1681) and when, in the 18th century, the "Cocoanut Tree" became the meeting place for Tory politicians (Colley 1977) and a tax was levied on the "cocoa-nutts" that were imported at Christmas (National Archives 1786), the "cocoanut" in question was, in fact, the bean from the pod of *Theobroma cacao*. Dr. Johnson's *Dictionary of the English Language* confused the issue by combining entries for the nut (sic) from the chocolate tree (Spanish = cacao) with the nut from the palm tree (Portuguese = coquos) to give "cocoa" (Johnson 1755).

However, from the middle of the 19th century onwards the "cocoa-nut or coker-nut" (Coker-nut was in commercial use in the Port of London to avoid confusion [Child 1975]) as the fruit of the coconut palm (*Cocos nucifera* L.) was variously known, began to be imported in quantity. "Mr Poole stated [in Statistics of British Commerce] that in 1850 the imports were 1,575,000 nuts, or the enormous weight of 1575 tons; and be it remembered the cocoa-nut is merely used as a luxury, chiefly by children, and is not imported for any other economic purpose . . ." (Archer

1854). Unbeknown to Archer, writing at that time, there were already other economic purposes for the coconut as the source of valuable raw materials for the Industrial Revolution in Britain. But these uses were scarcely a dozen years old when those words were written. Within a few more decades, the coconut palm was included in popular science treatises, such as the *Dictionary of the Economic Products of India* (Watt 1889), *The Uses of Plants: a Manual of Economic Botany with Special Reference to Vegetable Products Introduced During the Last Fifty Years* (Boulger 1889) and *Commercial Botany of the Nineteenth Century* (Jackson 1890). As Treloar explained, "Writers who expatiate on the enormous growth of importations and the development of trade in various foreign commodities during the last sixty or seventy years, point, among other illustrations, to the immensely increased consumption of the oil extracted from the cocoa-nut, of which an enormous number of tons reach this country from Ceylon; but few of them refer to the consumption of the cocoa-nut itself, as an indication of the advance of commercial enterprise" (Treloar 1884).

The emerging economic interest in coconut was reflected by two social events at the very start of the 1840s – the marriage of Queen Victoria to Albert Saxe-Coburg-Gotha and the christening of their first child. In 1840 Price's Candle Company introduced a cheap candle "For the purpose of the general illumination on the occasion of Her Majesty's marriage . . . that should require no snuffing, composed of a mixture of stearic acid and cocoa-nut stearine. The public . . . received the new composite candles with great favour, and the manufacture rapidly grew" (Jackson 1890). The christening of Victoria's first child Albert Edward (Prince of Wales, later King Edward VII) was remarkable for the fact that the floor of the hall of St. George's Chapel at Windsor ". . . was covered first with a matting made of the husk of the cocoa-nut" (*The Times* 1842). These two events would have helped stimulate the Kingston mills' commercial involvement with coconut.

Good, cheap candles were essential before homes were lit with gas or electricity "To the men of the mid-nineteenth century, the improvement was a major one" (Asimov 1964) and "So rapid did the utilisation of cocoa-nut oil become after the establishment of the company just referred to [Price's], that they turned out in the month of October, 1849, twenty tons of cocoa-nut candles, of the value of £1,590, and about twelve tons of stearic and composite candles, valued at £1,227. In October 1855, the quantity of stearic and composite candles made by the firm amounted to 707 tons, of the value of £79,500" (Jackson 1890). Price's Patent Candle Company was located at Battersea in 1840, and it had been from Battersea in 1776 that an oilman, Stephen Wedge, converted the upstream Chapel or Leatherhead Mill at Kingston into an oil mill to process linseed (Sampson 1985). Even if the Battersea connection is coincidental, the Kingston oil mill would appreciate the commercial possibilities of using coconut oil to make candles.

Following the interest in coir matting that was stimulated by Prince Albert Edward's christening, the Great Exhibition in 1851 was "the means of giving a further impetus to the trade" (Jackson 1890) when the general public could see for themselves the qualities of these mats displayed amongst the colonial exhibits. Coconut matting factories appeared in many parts of Britain. "The Patent Cocoa Fibre Company (Limited) the only cocoa-nut fibre manufactury in Surrey. All description of Cocoa Fibre MATTING, plain, bordered and [f]ancy in stock and made to order wholesale. Cocoa Fibre, Bass, and Whisk Brushes of [all] descriptions" (Anon. 1877).

It seems likely that at the very beginning of the coir matting trade in the 1840s it would have been the whole coconuts that were imported. "Only the nuts themselves were articles of commerce, and they were scarce. There was but a limited demand for a luxury, a little of which, even among schoolboys went a long way" (Treloar 1884). Subsequently, as trade developed, "Cocoa-nuts have become an ordinary article of commerce in markets and many fruiterers' shops, but still the outer husks and shells are comparatively out of sight. Probably many people may still fancy that they are not brought here with the nuts in any considerable quantity, nor would the majority even of Londoners easily estimate the enormous consumption of the nut itself" (Treloar 1884). In the 1840s, whole coconuts, consisting of the nut inside the fibrous husk, would have been easy to load on board sailing ships or steam ships returning to Britain from the tropics and easy to transfer to barges or lighters going up the river Thames from Fish Street Hill in the City to the confluence with the Hogsmill River at Kingston. However, it seems that Middle Mill may have ceased to process coconuts in 1880 when it was sold to Kelly & Co, printers (Kelly's subsequently became well-known for producing very comprehensive trade directories). The Chapel Mill is certainly recorded to have made candles with whale oil before becoming part of Price's in 1895 (Sampson 1985). Superficially it might seem that the coconut connection was broken; perhaps by the end of the 19th century the imports of coir fiber and copra and coconut oil from the colonies

no longer made it economic to carry out the primary processing with local labor. Even the final product was threatened and the Society of Cocoanut Fibre Mat and Matting Weavers met in February 1875 to protest about the use of prison labor to make cheap mats. "Although the Kingston works turned out a greater variety of goods than could be produced in prisons, the Company felt it was being put at an unfair disadvantage with regard to mats and matting. By the end of that year, the Cocoa Fibre Company was seeking to wind up its business, although permission was not, at that time, granted" (Anon. 1901).

To begin with, the coconut fiber factory in close proximity to an oil mill processing linseed would have been able to incorporate flax fibers, a waste product from the linseed plants, into some of its products. Likewise, the oil mill could have extracted coconut oil from copra (the dried kernel) of coconuts if these were available from the coconut fiber works. Moreover, the 1842 tithe apportionment showed that the Chapel Oil Mill and the Middle Mill were both owned by one man, Joshua Lockwood (LHR 2003). In July 1872, following Lockwood's death, the premises were put up for sale with an existing tenancy "let to Messrs Hardcastle & Wilson, Cocoa Fibre Manufacturey on lease 20 years . . . ." The matting mill manager, William Wilson, was a local man (LHR 2003), and it would be a further coincidence if he was related to the Wilsons of Price's.

If Lockwood, Hardcastle or Wilson ever did import whole coconuts and process the husks to coir fiber at Middle Mill and the kernels to copra and coconut oil at the Oil Mill there would still be residues that, unlike flax fibers, could not be incorporated into existing products. These were the coir dust that accumulates when the fibers are beaten from the husk, the copra meal that remains after the oil is extracted and – above all – the bone-hard coconut shells – split into two cup-like halves when extracting the copra.

Today, the Royal Botanic Gardens at Kew (and not far from Kingston) encourages the use of coir-based soil amendments to reduce the exploitation of peat-moss reserves from endangered wetland locations. Yet this material was available to the Kew gardeners as long ago as 1877, when "Cocoa-nut fibre refuse for garden purposes" could be "Fetched from mill in carts or vans at 4d. per bushel; in quantities of 50 bushels or over, 3d. per bushel" and "Sent to all parts of the kingdom by rail in bags or by truck" (Anon. 1877). The copra meal would also have found a ready sale to local farmers for chicken and animal feed.

That would leave only the coconut shell "cup" which would be of no value in industrial Britain. In tropical communities they are burnt in the very process of making copra, but there is always a surplus of shells. To this day, even when activated carbon from coconut shell charcoal is economically valued as a purifying and absorbing agent for pollutants, great piles of coconut shells accumulate wherever copra and coconut oil are produced. The Middle Mill manager might have found ready outlets for coir dust and copra meal but the unused piles of shells would have remained as mountainous monuments for many years because the impermeable material would survive in a cold climate even better than it already does in the tropics.

When the Middle Mill ceased to make mats the Oil Mill could still import copra for crushing and in 1895 it is recorded to have used whale oil for making candles (Sampson 1985). It was at about that time that a third mill on the Hogsmill river at Kingston, the Hogs Mill itself, may have become involved with coconut. The last firm to work Hogs Mill, in the 19th and early 20th centuries, was Johnston and Co., who advertised corn flour on the same page as the cocoa-nut fiber advertisement in the 1877 issue of the *Surrey Comet*. From 1895 the Hogs Mill began production of "Yewsabit" (Fig. 2) – a polish that was said to be putting a shine on most of the British Army during the Boer War (Sampson 1985). The firm's trademark was a drummer boy of the British Guards – an appropriate choice, considering that the War Office was the firm's biggest customer (Sampson 1985). According to an article the Surrey Comet for 1901, "Yewsabit" was a paste made from "five secret ingredients" and advertised as the "King of Metal Polishes." Needless to say, the secret ingredients were not revealed, but the detailed article stated that the principal ingredient, which "does the trick" in cleaning the metal, "is first put through a powerful mill and ground to powder, and then run through a trough into water tanks and allowed to settle. The water is run off and the finest powder it retained and dried, the remainder being ground down again" (Anon. 1901). Coconut shell can be ground to a fine powder this way and, although today grinding and refining is done with hammer mills, phosphor-bronze sieves on rotary shakers and cyclone separators, the coconut shell flour that is produced is still used to clean metal – but the turbine blades of high performance jet engines rather than soldiers' buttons. So one of the secret ingredients in "Yewsabit" could be coconut shell flour – using the piles of coconut shells left behind years earlier.

The ingredients were also claimed to be "local materials" which would confuse competing polish

makers but would be true if the coconut shells came from the neighboring mill site. What other material, local to the Kingston area, could be processed as described above? Corn flour would not require such fine grinding although it might, perhaps, have been another ingredient, cooked to give a paste-like consistency (as described in the newspaper article). The third and fourth ingredients could have been coconut and linseed oils from the oil mill because a surface film of oil will protect metal from corrosion. Finally, soap could be the fifth ingredient because the high lauric content of coconut oil makes it ideal for soap production. Was soap also a product of the Oil Mill? Perhaps it is no coincidence that from 1872 to 1936 the Kingston "Steam Laundry" was located (under various names) in Oil Mill Lane (now Villiers Street).

By 1910, Johnston's and Yewsabit had vanished from Kingston (Sampson 1985). But military "spit and polish" did not vanish when khaki replaced the bright red uniforms with shiny buttons that made the British troops in the Boer War too visible a target for the somberly attired Boer guerillas. More prosaically, perhaps the mountains of unused coconut shell at Middle Mill had dwindled to nothing by 1910.

The census for 1871 shows that Middle Mill employed 34 men and 17 boys. What would be more likely than that the men should relax over a drink at the local public house? Before 1840 this was called "The Joiner's Arms" (1840 tithe record), but it had become the "The Cocoanut" by 1858 (LHR 2003). At the present time it is the only public house in Britain with this name (there are two called "Cocoanut Grove or Coconut Grove," three called "Palm Tree," and thirty-five called "Joiners Arms" [Conroy 2004]). The pub on Mill Street in Kingston lies between the Hogsmill river and the area known as Fairfield which, as its name implies, is a green space where, to this day, the people of Kingston are entertained by circuses and have fun in fairgrounds. When the Middle Mill boys played games on the Fairfield perhaps they threw sticks at coconuts. And when the fun-fair came to town perhaps the management of Middle Mill, the nearest industrial producer and employer, supplied coconuts at cost as a gesture of goodwill. Sometime, between the 1867 Pleasure Fair and the 1880 mill closure, the coconut shy as we know it today came into existence. The University of Kingston now stands on the banks of the Hogsmill river and only the public house commemorates the earlier tropical connections of the location. But the popularity of the coconut shy has spread throughout Britain and can still show a profit "One of our regular tenants, Albert, gets his sole

2. Yewsabit polish tin lid (reproduced from www.tinshop.co.uk).

living from a sheet [the banner displayed by the proprietor]. He dresses the part and calls them in. His mother ran the sheet, back in the 1930s and it has been earning a living since. It is not unusual for Albert to lose over 4 bags of nuts at a fair, and to give the ladies a fair chance he has a ladies line. The more nuts you lose the more money you take" (pers. comm. Malcolm Perrett; All the Fun of the Fair 2003).

Are there too many coincidences? A public house with an unusual name, once situated between a fairground and a matting factory? An oil mill and a neighboring coconut fiber works owned by one man? Two people called Wilson involved with coconut stearine candles and a third Wilson involved with coconut mats? The method of grinding a secret ingredient for a metal polish that could have removed the last tangible evidence of coconut (Perhaps, in the future, some archaeologist will find coconut shell fragments under the foundations of the University)? Or, if they are on target like wooden balls thrown at coconuts, perhaps we can say "You have hit the bull's-eye, rung the bell, and gathered in the cigar or cocoanut according to choice" (Wodehouse 1910).

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3. The Cocoanut public house sign. Photo: Tim Tempest, Griffin Brewery, Fuller, Smith & Turner P.L.C.

house; to Richard Holmes (particularly for finding many of the details and for making positive suggestions) and Annita Barbieri, volunteers, Jill Lamb, archivist, and Emma Rummins, local history officer, at the Local History Room of the North Kingston Centre, for locating specific items of information; to Vanessa Toulmin, University of Sheffield National Fairground Archive; to Tim Tempest of Fuller, Smith & Turner PLC, Griffin Brewery for Figure 3; and to the Royal Botanic Gardens, Kew for access to the Centre for Economic Botany library.

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Production of a Second Set of Stilt Roots in Arborescent Palms: A Solution to the Puzzle

GERARDO AVALOS
Escuela de Biología
Universidad de Costa Rica
2060 San Pedro
San José, Costa Rica
avalos@fieldstudies.org
and
The School for Field Studies
Center for Sustainable Development Studies
10 Federal St.
Salem, Massachusetts 01970
USA

1. Second set of stilt roots emerging from the trunk of an *Iriartea* palm at 1–2 m above the ground at the point of litter accumulation caused by a leaning tree.

Iriartea **and** ***Socratea*****, stilt-rooted palms of the Americas, sometimes develop a second cone of stilt roots. This paper addresses what the significance, if any, of this second cone may be.**

Arborescent palms are abundant canopy components of tropical lowland and montane forests up to 1000–1500 m (Kahn & de Castro, 1985, Peres 1994, Kessler 2000). Their distribution reflects fine environmental gradients that affect the diversity of tropical plants. These gradients are the result of differences in successional status, soil type and nutrient content, and topography (Kahn & de Castro 1985, Chazdon 1995, Clark et al. 1995). As a consequence, palms have developed diverse mechanical features that favor their establishment over a wide range of environmental conditions (Kahn 1986, Rich 1986, Swaine 1983).

Among arborescent palms, Iriarteoid palms are characterized by the production of stilt roots, which form a cone around the stem. In *Iriartea deltoidea* the stilt roots are clustered at the base of the stem, have prominent lenticels, lack thorns, and can grow 1.5–2 m above the ground. Individual palms may reach 35 m in height (Gentry 1993) and are characteristic canopy elements of lowland and mid-elevational tropical forests up to 1000 m. In *Socratea exorrhiza* the stilt roots are well separated, can be very tall (up to 4 m) and are covered by small (0.5 cm) thorns. *Socratea* is more abundant in lowland rainforests; its density decreases with elevation more rapidly than in the case of *Iriartea* (Kessler 2000).

Stilt roots provide support for palms that grow to reach canopy height and are located in very steep topographic conditions. I have found a close relationship between the cone volume of stilt roots and the height of the palm in both species (r^2 = 0.85, P = 0.0001, N = 37 for *Socratea*, and r^2 = 0.82, P = 0.0001, N = 31 for *Iriartea*, pers. obs.) New stilt roots sprout at the top of the cone and are projected down. Old stilt roots die either inside the cone (the first ones that were produced) or in the lower periphery of the cone, and are replaced by new roots emerging from the topmost part of the cone. Stilt roots favor resprouting when the palm has been flattened by falling branches or trees (Bodley & Benson 1980). In addition, the root cone develops early in the life cycle permitting a rapid height increase without loss of stability, which allows an early exploitation of gaps and occupation of canopy space relative to species in which stilt roots are absent (Swaine 1983).

Although most palms produce only one set of stilt roots located at the base of the stem, I have observed several palms developing a second set of stilt roots at significant heights above the ground, sometimes as massive as the root cone produced at the base of the stem (Fig. 1). Why do these palms develop a second set of roots, which obviously do not reach the ground or are useful in providing support or access to nutrients? The solution to this puzzle became evident at Poco Sol Biological Station, Children´s Eternal Rainforest (800 m in elevation), where I observed two individuals 20–25 m in height of *I. deltoidea* each developing a second set of stilt roots 1–2 m above the first root cone. The first individual had a small tree, still alive but leaning on the palm trunk at an approximate angle of 45° touching the point where the new set of stilt roots were produced. The crown of the leaning tree surrounded the palm trunk and favored the accumulation of leaf litter and dirt, and colonization by hemiepiphytes such as *Asplundia* sp. (Fig. 1). The second individual had a well developed second set of still roots 2 m above the first one with none of the roots making contact to the ground. There were evident signs of litter accumulation around the top part of the cone (soil, dead branches, leaf litter and epiphytes established around the top of the cone). It is likely that the accumulation of litter (and eventually soil) induced the production of still roots through their interaction with plant growth regulators such as auxins. In horticulture, it is common practice to induce the production of new stems and roots of ornamental plants by surrounding and tying the stem with an aluminum pocket containing soil mixed with rice husks and other plant material, a technique known as air-layering. This practice is implemented in the propagation of *Dracaena americana* and other monocotyledonous ornamentals exported to international markets. As a result of the exposure to the soil and organic matter mixture, the plant develops new stems and roots at the point in contact with the pocket contents. Similarly, leaning trees or fallen branches that make contact with palm trunks favor litter accumulation, as well as colonization by large epiphytes that also enhance organic matter accumulation, influencing the production of this peculiar second set of stilt roots above the ground at that point in the stem.

Although the development of a second set of stilt roots is not common, I have observed two individuals of *S. exorrhiza* with this second set of aerial stilt roots at considerable height above the ground in Corcovado National Park, Costa Rica, close to San Pedrillo Park Ranger Station (0–15 m in elevation). The individuals were 25–35 m in height and had a well-developed set of stilt roots 10–15 m above the ground similar to the ones forming the cone at the base. In Braulio Carrillo National Park, Costa Rica (Quebrada González, 450 m), I observed one 4 m tall *Cryosophila guaguara* palm developing a second set of stilt roots 50 cm above the first set. In contrast to the *Iriartea* and *Socratea* cases mentioned above, it was

likely that being so close to the ground, this second set of stilt roots will replace the first one.

The ability to produce a second set of stilt roots could be of benefit when the palm is overtopped by vegetation around the trunk base, and when plant debris has the potential to interfere with root gas exchange. A second set of stilt roots would favor the palm to grow out of the accumulation of vegetation after a disturbance, even if the palm is knocked down (i.e., Bodley & Benson 1980). This ability may have resulted in the capacity to produce stilt roots above the first set, even when the ground is considerably far below. Although under certain circumstances it bears no advantage, this phenomenon is a reflection of the significant growth plasticity found in tropical palms.

Acknowledgments

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Vegetative Transformation of Inflorescences in *Socratea salazarii*

JEAN-CHRISTOPHE PINTAUD
IRD
Whimper 442 y Coruña
Ap. 17.12.857
Quito, Ecuador

AND

BETTY MILLAN
Herbario USM,
Museo de Historia Natural
Av. Arenales 1256
Lima 14, Perú

1. A young, sterile inflorescence of *Socratea salazarii* showing reduced, brown, scale-like prophyll and first peduncular bract.

An unusual transformation of inflorescences in *Socratea salazarii*, in which the inflorescence tips develop into stolons, is described for the first time.

Vegetative transformations of inflorescences occur relatively commonly in Monocotyledons. A well-known example is the production of bulbils on inflorescences of *Agave*, *Furcraea* or *Chlorophytum*; the production of bulbils represents an efficient mechanism of vegetative dispersal. Within palms, specialized inflorescences with vegetative functions occur in subfamily Calamoideae. The flagellum is a modified, sterile inflorescence acting as a climbing whip in some species of *Calamus*. A few species such as *Calamus pygmaeus* and a form of *Calamus nematospadix* from Sarawak (Dransfield 1992) produce vegetative shoots at the tip of long, flagelliform, fertile inflorescences, and if these reach the ground they can root and develop into new vegetative shoots. This sometimes also occurs in the massive acaulescent *Daemonorops ingens* (Dransfield 1997). In *Salacca flabellata* (Furtado 1949), the staminate inflorescences are very long and grow over the surface of the soil and then root at their tips and produce vegetative shoots. Elsewhere in the palm family, vegetative modifications of inflorescences are rare and abnormal. Oil palms (*Elaeis guineensis*) producing multiple heads originating from modified inflorescences occur sporadically in plantations. Moreover, vegetative development of inflorescence

2 (top) & 3 (below). Stolons developing from inflorescences.

tissues can be induced in vitro by growth hormones (Y. Duval, pers. comm.), a phenomenon suggesting that modified inflorescences can develop due to metabolic alterations. This may explain why such abnormal expression of characters is often limited to isolated individuals. While teaching a field course on palms for students of San Marcos University in the region of Iquitos and the lower Ucayali river, Peru, we serendipitously found a very peculiar, stoloniferous plant of *Socratea salazarii*, a species that is normally solitary.

We observed *Socratea salazarii* in Jenaro Herrera (Loreto, Peru), where it is abundant, with a density of more than 200 individuals (juveniles and adults) per hectare in forest on *tierra firme* (Kahn & Mejia 1991). It also occurs on hydromorphic soils in the area. Although *Socratea salazarii* is reported to be occasionally caespitose (Henderson 1990), we have seen only solitary individuals in Jenaro Herrera. A single plant showed, however, a very unusual morphology, producing stolons from inflorescences. The young inflorescences are externally similar to normal inflorescences (with peduncle, prophyll and peduncular bracts) although the bracts are reduced (Fig. 1), but the rachis is transformed into a vegetative shoot that promptly grows as a thin, flexuous stem with elongated internodes and reduced leaves (Fig. 2 & 3). When the stolon reaches the ground, it produces adventitious roots and then grows vertically, establishing a new stem (Fig. 4). Although this process seems very abnormal and exceptional in this species, it looks like a highly evolved adaptation, not very different from the flagelliform rooting inflorescences found in the Calamoid palms mentioned above, and very efficient in establishing a clonal individual (Fig. 5).

This behavior may be related to the inherent vegetative plasticity of species belonging to the Iriarteeae tribe, in relation to the generalized ability of producing stilt roots on any part of the trunk (Bodley & Benson 1980 and Fig. 6). The tribe does include stoloniferous species (*Iriartella* spp., *Wettinia drudei*), but this process derives from the common caespitose habit and is unrelated to the production of inflorescences. The atypical specimen of *Socratea salazarii* encountered is still juvenile and so far has just established its first stolon in the ground. The production of these unusual inflorescences occurs at only 1 or 2 m above ground, a height at which this species does not normally produce inflorescences. It would be interesting to see if this plant produces functional

4. An inflorescence stolon established in the ground.

5 (above). A trunk of *Socratea salazarii* showing a double cone of stilt roots, indicating the ability of the plant to produce roots on various parts of the trunk. 6 (right). View of the stoloniferous *Socratea salazarii*.

fertile inflorescences when it reaches the adult size.

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The White Powder *Dypsis*: A New Species from Cultivation

DONALD R. HODEL
University of California
4800 E. Cesar Chavez Ave.
Los Angeles, California
90022 USA
drhodel@ucdavis.edu

AND

JEFF MARCUS
P.O. BOX 635
MOUNTAIN VIEW, HAWAII
96711 USA

1. *Dypsis albofarinosa*: habit, nursery of Jeff Marcus, Hawaii, (plant from which the type collection, *Hodel 1944*, was made). (Photo by Bill Langer)

A highly ornamental *Dypsis* with powdery white crownshafts has flowered and fruited in Hawaii and has been widely distributed. It is named and described here as a new species.

Growers and collectors have long recognized that several undescribed and unnamed species of cultivated palms originating from Madagascar, mostly *Dypsis*, were not included in John Dransfield and Henk Beentje's monumental work, *The Palms of Madagascar*, when it was published in 1995. Hawaii palm grower Jeff Marcus was aware of one of these unnamed species growing in a private garden in Hilo, Hawaii and he had dubbed it *Dypsis* 'stumpy'. Marcus and others had distributed seeds and seedlings of *Dypsis* 'stumpy' and, because it had become fairly well known to palm collectors, Dransfield and Marcus described and named it *D. carlsmithii* in 2002 in honor of the late Donn Carlsmith in whose garden it was growing.

Now Marcus has brought to the attention of palm collectors another new *Dypsis*, this one growing in his own nursery near Hilo, Hawaii. It is an especially attractive and highly ornamental *Dypsis* with clustering stems and powdery chalky white crownshafts. Because Marcus has widely distributed seeds and seedlings, it is appropriate to describe and name this handsome new species.

Dypsis albofarinosa Hodel & J. Marcus, **sp. nov.** *D. baronii*, *D. lutescenti* et *D. onilahensi* affinis sed vaginis foliorum pulveraceis cretaceo-albis petiolis longis differt. Typus: Hawaii, in horto Jeff Marcus, *Hodel 1944* (ex J. Marcus) (Holotypus K). Figs. 1–4.

Clustered, shrubby palm forming clumps to 5 × 2–3 m (Fig. 1). Stems 4–5 cm diam., ringed, internodes 6–15 cm, greenish but initially covered with chalky powdery white indument, occasionally dichotomously branching as in *Dypsis fibrosa* and *D. lutescens*. Leaves 4–6 per stem, ascending, spreading, arching, tips slightly pendulous and sometimes twisted; sheath ca. 58 cm long, lime green, densely covered with chalky powdery white indumentum (Fig. 2), tubular, with blackish scales distally briefly extending on to

2 (left). *Dypsis albofarinosa*: crownshaft covered with powdery white indument. 3 (right). *Dypsis albofarinosa*: inflorescences and infructescences . Both photos are of the plant from which the type collection, *Hodel 1944*, was made. (Photos by Bill Langer)

petiole, a slight auricle or ligule at either side of petiole at mouth; petiole ca. 75 cm long, ascending, ca. 1.3 cm diam. at base, ca. 1 cm diam. at apex, initially covered with chalky powdery white indument, concave or channeled adaxially, convex abaxially, margins sharp; rachis ascending to spreading, ca. 1.35 m long, channeled adaxially near base soon becoming flat with a sharp vertical costa extending to tip, convex abaxially and initially covered with chalky powdery white indument, arching, sometimes twisting in distal half to ca. 200º; pinnae ca. 44 per side, ca. 50 × 1.1 cm proximally, ca. 50 × 1.5 cm in midleaf, ca. 17 × 0.4 mm distally, green, arising from rachis at angle to form v-shape blade, forward-pointing, lanceolate, long acuminate, ± with long drip tip, tips drooping, 2 marginal nerves and one prominent midrib raised adaxially, 1–2 secondaries between midrib and marginals, tertiaries numerous, faint, a few dark brown medifixed ramenta on abaxial midrib. Inflorescences infrafoliar (Fig. 3), spreading in flower, drooping in fruit, branched to three orders; peduncle ca. 35–45 cm long, ca. 3.5 cm wide at base, ca. 2.5 cm wide at apex, ca. 1.5 cm thick, flattened adaxially, convex abaxially, glabrous; prophyll attached ca. 9 cm above base of peduncle, ca. 16 cm long, bicarinate, the two keels extending proximally below the point of attachment on to the peduncle as faint wings, tubular, apex bifid, lobes ca. 3.5 cm long, longitudinally striate-nerved, thick, ± coriaceous; 1st peduncular bract attached ca. 16 cm above base of peduncle, probably fallen away and not seen, only a truncated base 0.5 high remaining, this exceeded and concealed by prophyll, 2nd peduncular bract attached ca. 25 cm above base of peduncle and about 1 cm proximally of tip of prophyll, triangular, 1.5 cm long, just exceeding prophyll, 3rd peduncular bract attached ca. 27.5 cm above base of peduncle, rudimentary, 2–3 mm high; rachis 35–45 cm long, glabrous, with 14 branched and 7 unbranched 1st order branches, the proximal branches the largest and most complex with subpeduncle or base to 7 cm long, 1–1.5 cm wide, flattened adaxially, convex abaxially, subrachis to 15 cm long, 2nd order branches with base to 3.5 cm long, 5 mm diam., flattened; rachillae over 100 per inflorescence, 5–20 cm long, 3–5 mm diam., glabrous; rachis and rachilla bracts 1–3 mm high, acute. Flowers in triads of a center later-opening pistillate flanked on either side by earlier-opening staminate or in dyads of 2 staminate or a staminate and a pistillate, triads or dyads 5–7 mm distant proximally, 1–2 mm distant distally, sunken in cleft-like pits 4 mm wide, 2.5–3 mm high, 2 mm deep, subtended proximally by a thin, raised, knife-like lip, 2–3 bracteoles subtending triads or dyads in proximal side of pit, these imbricate, thin, membranous, 0.5–0.8 mm high. Staminate flowers in bud 5 × 3 mm, bullet-shaped, at anthesis 5 × 5 mm (Fig. 4); calyx cupular-triangular, 1.5 × 3 mm, sepals broadly rounded, imbricate nearly to apex, keeled, hooded, 2.25 × 2.75 mm; petals connate for 2 mm to receptacle, free for 3 × 2.75 mm, valvate, ovate, acute, faintly nerved (strongly nerved when dry); stamens 6, equaling or slightly exceeding petals, filaments 3.5 mm long, slightly enlarged at base, anthers 1.5–2 × 0.5 mm, dorsifixed; pistillode 2.5–3 × 1 mm, columnar, longitudinally angled or fluted. Pistillate flowers in bud 4 × 3 mm, broadly ovoid or dome-shaped; calyx 3 × 3 mm, sepals broadly rounded, imbricate in proximal 2 mm, keeled, hooded, 2.5–3 × 2.5 mm, margins thin, ± transparent; petals 3–3.5 × 2.5 mm, imbricate in proximal 2.5 mm, broadly ovate with short apicula, acute; staminodes 6, 0.4 mm high, tooth-

4. *Dypsis albofarinosa*: staminate flowers (plant from which the type collection, *Hodel 1944*, was made). (Photo by Bill Langer)

like; ovary 3 × 2 mm, bullet- to dome-shaped, stigmas not distinct at this time. Fruits 2 × 1.5 cm, ± ovoid. Seeds 17 × 14 mm, endosperm homogeneous; embryo sub-basal.

Measurements for the description were taken from non-dried, fresh or pickled material Marcus had collected and sent to Hodel. *Dypsis albofarinosa* is similar to *D. baronii*, *D. lutescens* and *D. onilahensis,* but these last three lack the powdery chalky white crownshaft and have shorter petioles and smaller fruits and seeds. *Dypsis baronii* and *D. onilahensis* also differ in their inflorescences branched only to two orders. The specific epithet is from the Latin *albus*, meaning white, and *farina*, meaning powder, and refers to the powdery white crownshafts. The white indument covering the leaf bases is of a waxy nature and is not readily apparent on dried material.

Dypsis albofarinosa is in Group 3 (page 127, species 25–46) of *Dypsis* species in *The Palms of Madagascar*. This group, consisting of solitary or clustered subcanopy palms with six equal stamens, includes such well known and popular species as *D. baronii*, *D. cabadae*, *D. lutescens*, and *D. onilahensis*. Indeed, *D. albofarinosa* keys out to *D. lutescens* in couplet f23 of Key 6 (page 143) in *The Palms of Madagascar*. Because its wild origin in Madagascar is obscure, ecological and habitat information about *Dypsis albofarinosa* is unavailable.

Dypsis albofarinosa originated in a commercial lot of seeds of *D. baronii* exported from Madagascar to Australia in the late 1980s or early 1990s. Several growers and collectors, among them Curt Butterfield of Queensland, Australia and Marcus, recognized that some of the resulting plants differed substantially from *D. baronii*. They selected out these different plants and grew them on, eventually distributing seeds and seedlings. The species has been erroneously grown under the name *D. onilahensis* in Australia and *D. baronii* and *D. baronii* var. *compacta* in Hawaii. Marcus has widely distributed this species as *Dypsis* 'white petiole.'

A striking ornamental, the white powder *Dypsis* grows vigorously to form handsome, rather open clumps of a dozen or more slender stems to five meters tall topped by elegant, gracefully arching, long-pinnate leaves. Long petioles enhance the gracefully arching effect. Most conspicuous and exceptional are the chalky powdery white crownshafts. The powdery white material also initially covers the petiole, rachis, and stems but, unlike the crownshafts, weathers away from these organs. Relatively easy to grow, *Dypsis albofarinosa* fruits abundantly in cultivation and is easily propagated from seeds. It tolerates shade to nearly full sun in Hawaii.

Status of the Bankoualé Palm, *Livistona carinensis*, in Djibouti

HENRY FORD
77 Great Pulteney St.
Bath BA2 4DL
UK

AND

CLIVE BEALY
English Nature
1 Southampton Road
Lyndhurst, Hampshire
SO43 7BU
UK

1. *Livistona carinensis* grove at Didinto, Agorogouba. This site, at a spring (note the water pipe crossing the wadi), shows a range of heights of adults (and therefore age), rosettes (to the left of the site) and the associated *Phoenix caespitosa*.

The Bankoualé Palm, *Livistona carinensis* (Chiov.) J. Dransf. & N. Uhl, is the only member of the genus *Livistona* found in Africa and it is found in three areas – the Yemen in the Arabian Peninsula and in Somalia and Djibouti in the Horn of Africa.

The palm is currently classed as 'vulnerable' in the IUCN/WCMC World List of Threatened Trees (1998). It is a statuesque fan palm growing to a height of 25 m with a grey brown trunk somewhat enlarged at the base and bearing some slight leaf scars (Figs. 1, 2). The crown bears up to 40 stiff fan leaves on armed petioles over 1 m long. Inflorescences are axillary and may be 2m in length with hundreds of creamy yellow flowers. The fruits are hard and pea-like (Monod 1955). It grows in or by water. Water is not only crucial for germination, but it also seems crucial for establishment as young palms (Fig 2) are always found where the ground is wet, though the adults may live in areas now quite dry. It is restricted in its distribution to springs, oases and wadis. Both in the Yemen and in Djibouti the Bankoualé Palm is associated with a wild Date Palm, *Phoenix caespitosa* (Lebrun et al. 1989, Welch & Welch 1998).

Growth rates of adults have been measured in the field over a 13 year period (Welch & Welch 1998), and vary from between 17 and 33 cm per year, and it has been estimated that a 16.9 m palm was about 93 years old. With maximum heights of 25 m, the oldest palms would be at most 150 years old. The growth of rosettes was reported to have been more variable (Welch & Welch, 1998).

The status of the populations in the Yemen and Somalia are uncertain. It has been reported that in Somalia the population may be fewer than 38 trees (Thulin, M., in Welch & Welch 1998) and there is evidence that the population in the Yemen is under threat from cutting (in Welch & Welch 1998), where, as well as a substantial population of 1340 plants, they reported over 1800 stumps remaining as evidence of cutting. The status of the palm in its stronghold in Djibouti has been investigated several times between 1985 and 1998 (Welch & Welch 1998) and the reports show a steady decline in numbers. This study was undertaken to determine the current status of the populations in Djibouti.

Over half of the palms are reported to be in mature, even-aged stands. This has implications for the future survival of the species. Firstly, it can be inferred that not only is establishment rare but that it occurs in singular events. The Welchs estimated that there has been little or no establishment during the last 60 years, except for a number of rosettes in Bankoualé established during the 1990s. Secondly, this portion of the population is likely to senesce and die in a short period of time, with catastrophic results for the future survival of the species, removing the majority of the reproducing adults in a short period of time with all the consequences of the reduction of the gene pool that this will entail.

The Welchs reported several threats to the survival of this palm. The creation of gardens in the palm's favored habitat has resulted in habitat loss for establishment. This creation may have resulted in the removal of adults, though there is no evidence of recent removal of living trees. However, when young, the palm retains its old leaves and forms a substantial bush and may be an obstacle to the gardeners. More insidiously, the establishments of these gardens will result in a change of hydrology both locally, particularly affecting the rosette stage, and over a wider area. These effects are not understood. Cattle and goat grazing is universal, and the young leaves are palatable and certainly seedlings will be quickly removed. The final threat is that of flash floods. It is known that these sweep away seedlings on a regular basis, and adults in more catastrophic events (Abdoulmalik, in Welch & Welch 1998).

As part of a wider study of the wildlife of Djibouti Welch and Welch (1998) produced a comprehensive report with recommendations. They suggest that the palm was everywhere in a

Table 1. Status of the Bankoualé palm (*Livistona carinensis*) worldwide in 1998 (Welch & Welch 1998)

	Djibouti	*Somalia*	*Yemen*	*Total*
Adults 1998	351	38	1357	1753
Extent of occurrence (km^2)	100	1600	1050	2750
Area of occupancy (km^2)	20	6	12	38
Number of Sites	9	3	3	15
Rate of Decline	23–30% in 13 yrs	51% in in 10 yrs	59% in 10-20 yrs	

2. The base of an adolescent *Livistona carinensis* showing leaf scars.

slow decline and that because of a lack of regeneration in the major sites, its status should be upgraded form vulnerable to critical. In this study we report the current status of the major sites of this palm around Bankoualé and Ditilou.

Results and Discussion

Livistona carinensis is extremely limited in its worldwide distribution (Table 1). Welch and Welch (1998) report that the populations in Somalia and the Yemen were under threat and the population in Djibouti slowly declining. Whilst the population in the Yemen was 1357 individuals, they reported that there were over 1800 cut stumps in the main population and over 100 in the second population. They report that is seems likely that the majority of trees have been cut down within the last 20 years and that the trees were still being felled.

Table 2 illustrates the decline in some sites in Djibouti to from 1985 to 1998, and Table 3 shows the population status in those sites in Djibouti that were surveyed in February 2004. There was a 26% decline in adults between 1985 and 1998. In Bankoualé, between 1985 and 2004 there was a 37% decline in adults, and where measurable elsewhere, a 26% decline in adults in the same period.

Population Structure and Regeneration

The population structure of most of the populations appears to be heavily biased towards mature individuals with few young (Fig 4). This is typical of the age structure of populations where the population is fully stocked in the first year of recruitment resulting in an even aged stand with "doomed" juveniles (Harper 1977). However the population reduction is clearly seen in Fig 5 that illustrates the decline in adults between 1985 and 2004, without any overall compensating increase in juveniles or rosettes.

Regeneration is apparent in most populations observed, though not in all sub-populations.

Seedlings:

Welch and Welch (1998) report abundant seedlings in several sites, but though seedlings were observed on this expedition in several sites they were never seen without the presence of *Phoenix caespitosa* and therefore we were unable positively to identify these seedlings as belonging to *Livistona*. The presence of *Phoenix caespitosa* is typical of the *Livistona* sites, but in the past the *Phoenix* leaves have been cut on a regular basis for weaving and roofing. This practice is less common than in the past, and the sites are generally crowded with *Phoenix*. However, without knowledge of the ecology of the seedlings, it is not possible to say whether the *Phoenix* is out-competing the *Livistona* for resources. The *Livistona* rosettes are robust and the adults easily overtop the adult *Phoenix*.

Rosettes:

In Randa, with 41 rosettes, the total population increased by over 80% though the adults decreased by 26%. It will be important to re-visit this site as soon as possible to establish the current status of these rosettes. Elsewhere the picture is variable; the populations at Ribta and Toha and Ditilou have no rosettes, Satabou, Agorogouba and Bankoualé have a few, though only in some sub-populations, and Wêr and Disay have reasonable numbers of rosettes.

Juveniles:

Juveniles were not apparent in many sites. In particular, the major sites at Bankoualé were without juveniles. At Agorogouba and Disay, however, the population structure appears more normal with a balance of mature adults, juveniles and rosettes.

Conclusions – The Future of the Bankoualé Palm

It is clear from the report of Welch and Welch (1998) that the Bankoualé palm is in danger of extinction worldwide.

3. Rosette of *Livistona carinensis* showing armed petioles.

Table 2. Numbers of Adults(A), Juveniles (J) , Rosettes (R) and the Total number of individuals of *Livistona carinensis* in sites around the Forêt de Dai, Djibouti, between 1985 and 1998 (Welch & Welch 1998).

		1985				1987				1998			
		A	J	R	T	A	J	R	T	A	J	R	T
Randa	1	1	0	0	1					1	0	0	1
	2	2	0	0	2					1	0	0	1
	3	2	0	0	2					0	0	0	0
	4	7	2	3	12					7	4	35	46
	5	2	0	0	2					1	0	0	1
	6	9	0	4	13					7	0	6	13
	7	3	0	0	3					2	0	0	2
Subtotal		**26**	**2**	**7**	**35**					**19**	**4**	**41**	**64**
Ribta (upper)	1	30	0	0	30					29	0	0	29
Ribta (lower)	2									7	0	0	7
Subtotal										**36**	**0**	**0**	**36**
Toha	1					14	0	20	34	12	0	0	12
	2					1	0	0	1	1	0	0	1
Wadi Eouali	1	1	0	0	1								
	2	10	0	0	10								
	3	1	0	0	1								
	4	1	0	0	1								
	5	4	0	0	4								
	6	1	0	0	1								

In the Yemen the population is reported to be endangered from felling, though we have no data since 1998. However, the steady decline of the Bankoualé palm described by Welch and Welch is confirmed by the current study of the majority of the populations in Djibouti. The populations at Bankoualé seem to be in particular danger as there is little regeneration. The two main sub-populations are without rosettes or seedlings and one population of 47 adults is in the middle of the wadi and is therefore in particular danger from flash floods. However, one new sub-population of six rosettes does give hope and a possible way forward for saving the palm in Djibouti.

The gardens occupy the most important sites for the regeneration of the palm and have been in existence for some 50 years. The lack of regeneration seems to have started from this time. Though the gardens may be the cause of the recent decline of the Palm, they may also be a possible means of regeneration. Palms grow well in the soil, and the gardens are protected from the worst of the floods. The irrigation is ensured and the gardens could be used as nurseries for the palms and as sites for adults. Compensation for this will have to be provided as the palms will require time and space which would otherwise be devoted to the production of food. It is hoped that we can initiate a rescue plan to ensure the survival of the palm for the future

Acknowledgements

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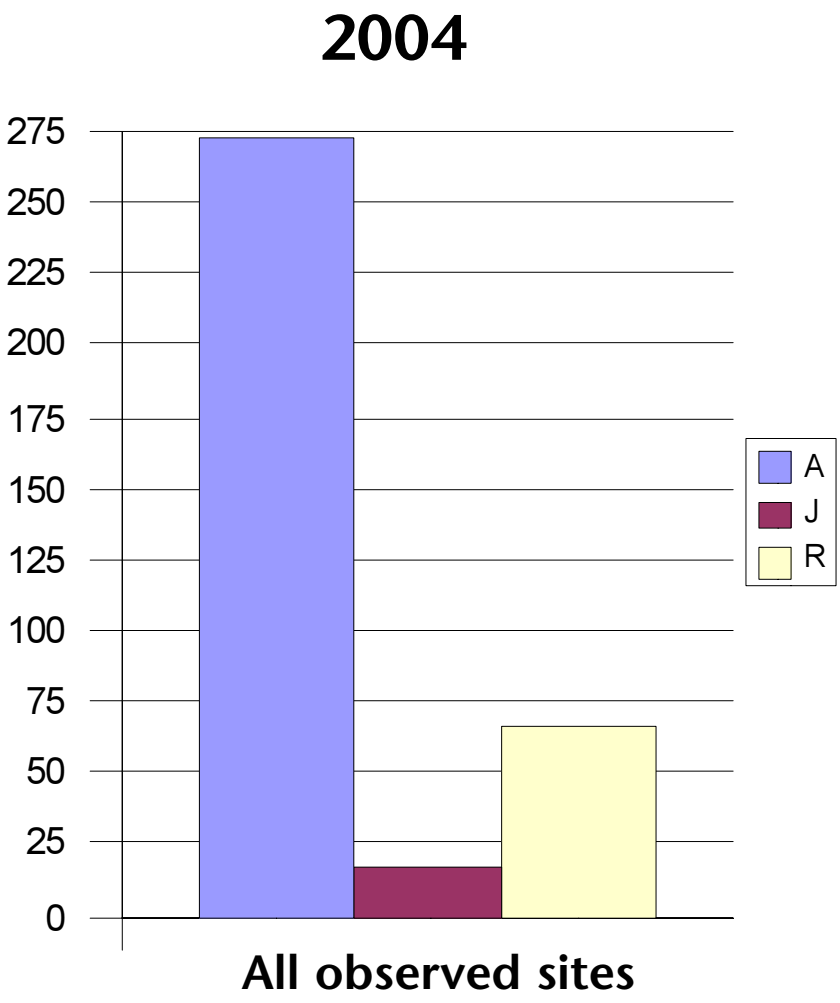
Table 3. Numbers of Adults(A), Juveniles (J) , Rosettes (R) and the Total number of individuals of *Livistona carinensis* in sites around the Forêt de Dai, Djibouti, between 1985 and 2004.

	1985				1990				1998				2004			
	A	J	R	T	A	J	R	T	A	J	R	T	A	J	R	T
Bankouale																
1	32	1	0	33					19	0	12	32	17	0	10	27
2	16	4	0	20					11	2	41	54	11	1	2	14
3	6	1	0	7					0	0	0	0	0	0	0	0
4	0	3	0	3					0	1	0	1	1	0	0	1
5	1	0	0	1					0	0	0	0	0	0	0	0
6	13	0	0	13					10	0	0	10	8	0	0	8
7	15	0	0	15					9	0	0	9	7	0	0	7
8	65	0	0	65					48	0	0	48	42	0	0	42
9	19	0	0	19					14	0	0	14	13	0	0	13
10	5	0	0	5					4	0	0	4	4	0	0	4
11	34	0	76	110					29	0	50	79	28	0	0	28
12	1	0	0	1					0	0	0	0	0	0	0	0
13	1	0	0	1					1	0	0	1	0	0	0	0
15	3	0	0	3					0	0	0	0	0	0	0	0
16													0	6	0	6
Satabou, Bankoualé																
1,14	12	0	19	31									8	2	6	16
Subtotal	**223**	**9**	**95**	**327**					**145**	**3**	**103**	**252**	**139**	**9**	**18**	**166**
Satabou																
1	12	0	19	31					9	2	2	13	8	2	6	16
* 2									6	0	4	10	13	0	3	16
* 3									9	0	23	32	8	0	0	8
* 4									2	0	0	2	2	0	0	2
Subtotal									**26**			**57**	**31**	**2**	**9**	**42**
Disay	39	0	2	41					27	6	26	59	25	4	18	47
*alternative nos!													23	20	25	68
Wêr	51	2	15	68					48	7	22	77	42	2	6	50
Ditilou													11	0	0	11
													1	0	0	1
Agorogouba																
1					12	3	16	31	12	3	18	33	12	0	12	25
2					13	0	0	13	10	0	0	10	11	1	1	13
3					2	0	0	2	2	0	1	3	1	0	0	1
4					1	0	0	1	1	0	0	1	0	0	0	0

Note: * : Satabou sites 2, 3 and 4 were first visited in 1999.



4. Life history class structure of all populations visited in 2004.

Management in Djibouti, without whose field knowledge and organizational skills the project would not have been a success, and Houmed Ali, Bankoualé whose knowledge and abilities in the field crucial to our success. The project was funded in part by a grant from the World Pheasant Organisation, Fordingbridge, Hampshire, UK

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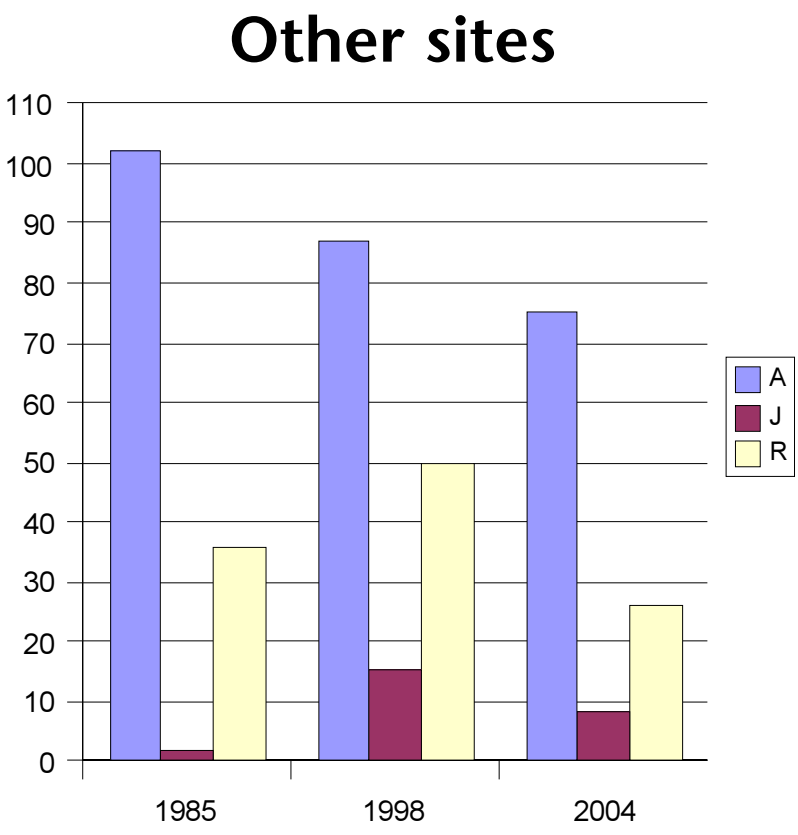

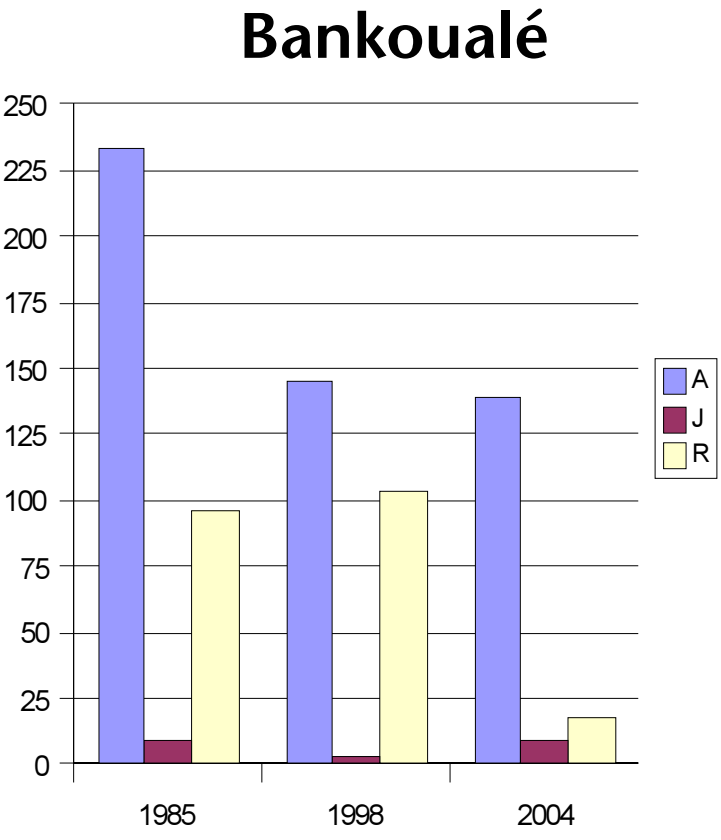

5. Life history class structures of populations visited in 1985, 1998 and 2005.

PALM LITERATURE

A POCKET GUIDE TO PALMS.Martin Gibbons. Chartwell Books, Inc, Edison, New Jersey, USA. 2003. ISBN: 0-7858-1562-7. US $18, hard bound, color dust jacket. Pp 254.

This is an interesting little book with a curious title. At about 6 inches square, it certainly would fit in a backpack and would be useful to the world traveler who wished to carry a guide to identify the palms most likely encountered in public gardens. However, it is a highly personal selection of palms that omits many commonly seen species in favor of more unusual ones.

And that's a good thing.

The book is lavishly illustrated with generally good quality color photographs of about 200 palms and 24 cycads, although the title doesn't mention cycads and the dust jacket provides only a cursory mention. A brief introduction and a few pages on general cultivation tips do not provide any new information but considering the great variety in local growing conditions and availability of potting material across the globe, this section does provide a nice overview for the beginning palm enthusiast.

This book seems to be a collection of photos and descriptions of species favored by the author who has traveled extensively in search of palms. Approximately one quarter of the species illustrated are palms rarely seen in cultivation anywhere outside their native country, if at all. And at my count, 63 of the 200 palms in this book aren't illustrated in color elsewhere. That is what makes this book particularly valuable for palm enthusiasts. Where most books focus on the most commonly grown or best known species, the author boldly steps off that trail to describe and illustrate such interesting palms as *Bactris ferruginea, Ceroxylon quindiuense, Chamaedorea linearis, Desmoncus orthacanthos, Dictyocaryum lamarckianum, Geonoma orbignyana, Jubaeopsis caffra, Livistona jenkinsiana, Oenocarpus mapora, Pholidostachys dactyloides, Plectocomia himalayana, Syagrus duartei, Syagrus macrocarpa* and others. I particularly like the photos of the palms in habitat, because they can provide growers with visual clues regarding cultivation or landscape use.

Some of the common names for the palms shown exhibit a certain "tongue in cheek" element: *Calamus erectus* = the Viagra palm?

There are a few errors here:

Guihaia argyrata grows well in South Florida because our limestone does indeed mirror the high pH, limestone-rich soils of its native habitat. However, our soils are limestone-derived soils but coral rock is found only in the Florida Keys, where *Guihaia* is rarely grown.

Nypa fruticans occurs across the Indo-Pacific and is naturalized in West Africa and Panama.

Pinanga coronata is not cold hardy, at least in South Florida. Plants show the effects of cold damage and seedlings are prone to fungal infection at 50ºF.

Pritchardia is a genus of about 25 species, not the approximately 40 mentioned by the author.

Roystonea oleracea is misspelled *R. oleracae.*

The common names for Florida's thatch palms don't take into account the nursery trade's naming of *T. morrisii* (Silver Thatch Palm) and *T. radiata* (Green Thatch Palm) which are based on easily observable leaf characteristics.

Trachycarpus martianus photo has a distinctly magenta tint – perhaps the result of an early pressing of my copy of the text.

The section on cycads is less successful overall because all the species featured can be found in other books on cycads and the vast majority of the species shown are rarely seen in public gardens or even in most botanic gardens. I would have preferred to see more pages on palms.

This book admirably fills in the gaps created by the growing number of palm books on the market. I would like to see a Pocket Guide II with an even greater emphasis on additional palms not described in other books. This book is reasonably priced and is a worthy addition to the palm collector's library.

CHRIS MIGLIACCIO
Miami Dade College
Miami, FL, USA