PRINCIPES

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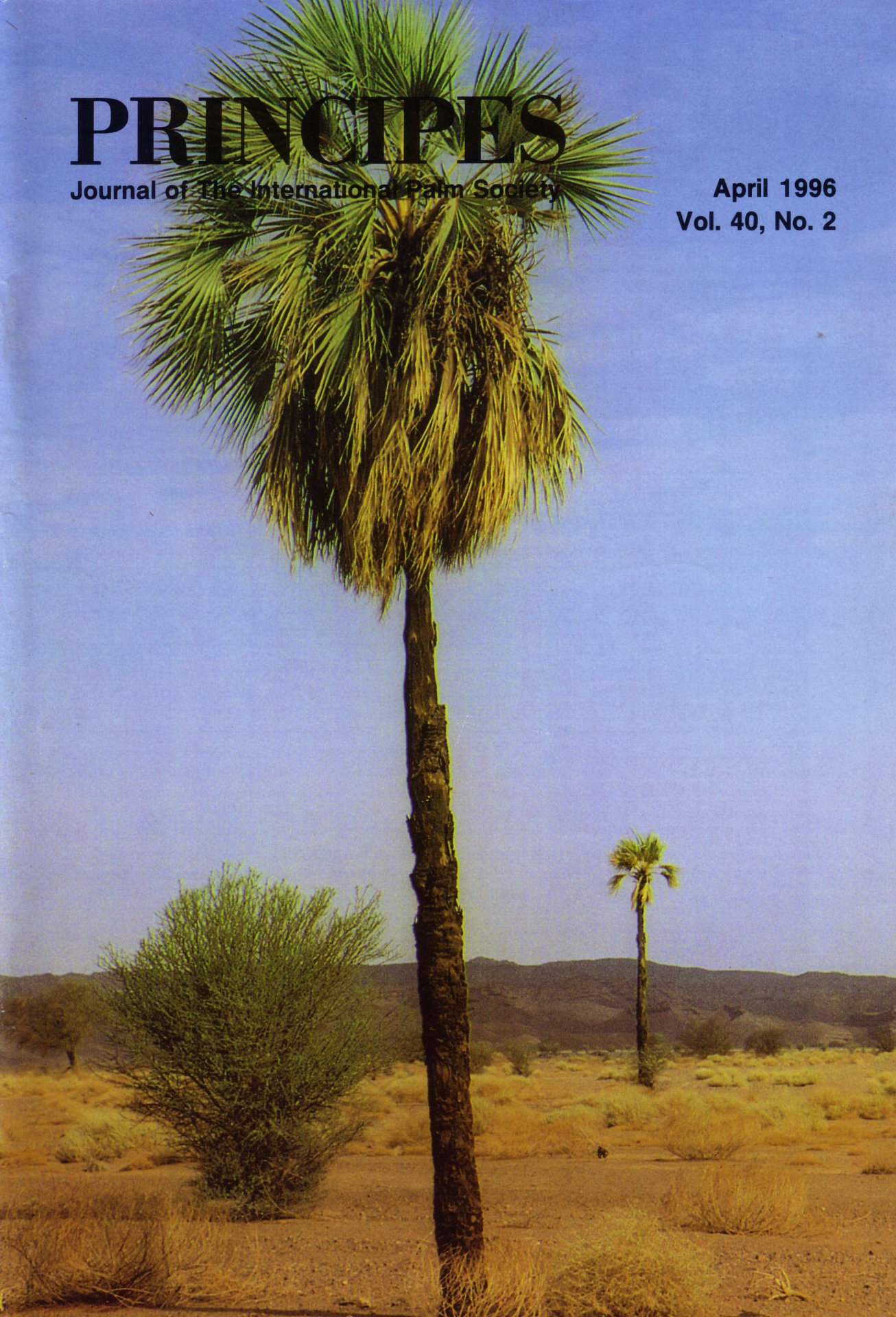

THE INTERNATIONAL PALM SOCIETY, INC.

THE INTERNATIONAL PALM SOCIETY

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PRINCIPES

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Contents for April

Front Cover

Medemia argun in its natural habitat, Nubian Desert, Sudan.

PRINCIPES

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Principes, 40(2), 1996, p. 63

Editorial

In our January editorial we mentioned that the April issue would carry an exciting article on *Medemia*. Here the palm is, gracing the two covers of the journal and beautifully illustrated within. As Martin Gibbons and Toby Spanner describe, *Medemia* had not been seen by botanists since the early 1960s and was presumed by some to be extinct. As one of the rather few desert palms, there has always been intense interest in whether or not the palm could be introduced to cultivation and how it would grow. Other desert palms such as *Washingtonia* and *Livistona carinensis* have proved to be versatile and beautiful ornamentals. What of *Medemia*? We could only speculate until Martin and Toby returned from Sudan in triumph. Not only did they visit and photograph a small but regenerating population of *Medemia argun*, but they also found a tree in full fruit and were able to export seed with permission so others can attempt to grow it. They also discovered new information on the palm; for example, no information had been available about its leaf sheath (perhaps not surprisingly, it turns out to be very similar in this character to *Hyphaene*). It was always assumed that the palm was unarmed but Martin and Toby have shown that as juveniles the petioles are heavily armed with spines, just as in *Hyphaene*; however, as the palm grows older, the petioles on the upper leaves in mature trees lack spines. We think the whole IPS will wish to congratulate Martin and Toby on the wonderful rediscovery of *Medemia*; many members will now be keen to try to grow it.

Elsewhere in this issue we carry an important and useful article on the palms of Bolivia; in it, Monica Moraes catalogues all the palms recorded from the country and gives detailed ecological information. If we compare this list with what was known of the palms of Bolivia 15 years ago, the increase in species is truly remarkable.

Finn Ervik and Rodrigo Bernal have been carrying out observations on the floral biology of *Prestoea decurrens* and its insect and other arthropod visitors in Colombia and present their results here. Of the wide range of arthropods visiting the flowers, only bees visit both male and female flowers, so are implicated as the probable pollinators.

John Dowe, continuing his accounts of the palms of Vanuatu, presents information on the use of palms in the island group. Of particular interest to readers will be data on the utilization of the endemic *Carpoxylon macrospermum*, recently introduced into cultivation outside Vanuatu.

In order to get our readers ready for the 1996 International Palm Society Biennial Meeting in Los Angeles Don Hodel has provided a fascinating history of palms in and around L.A.

A short article from Cuban horticulturalists M. Daquinta and colleagues describes experiments to improve germination rates in *Chamaedorea seifrizii*.

JOHN DRANSFIELD
NATALIE W. UHL

New Horticultural Correspondent for the IPS

Due to conflicts beyond his control, Dr. Kyle Brown has tendered his resignation as IPS Horticultural Correspondent. Our thanks to Kyle for serving the IPS in that capacity, so tirelessly for the past several years.

Paul Craft has agreed to serve as the IPS Horticultural Correspondence Committee Chair, so keep your cards and letters coming. Send your questions to Paul's attention at 16651 Rembrandt Road, Loxahatchee, FL 33470 or send them via electronic mail to PalmNut@mail.icanect.net on the InterNet.

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Note from the President

Thanks to each of you who voted in the IPS Board of Directors election. Results are now in and the votes were pretty close. Hopefully the candidates who were not successful in this election and wish to be active on our board will run again in 1998. Election results are posted elsewhere in this issue.

The reprinted "*Genera Palmarum*" are now off the presses. If you missed out on the original edition, order your paper-bound copy now from the IPS for $49.95, regular post paid. Orders can be filled by airpost for payment of a fee covering suitable excess postage costs.

Much progress has been made in improving electronic communications among various palm enthusiasts worldwide. Over 60 IPS members and fellow enthusiasts participate in an email exchange program, containing much varied palm-related information. It would be particularly useful if each IPS chapter or affiliate had at least one person on email to facilitate communications. Many chapters do, but others do not. For example, I vetted the Chapter News items for six different chapters through local representative members or officers before finalizing the copy—previously, almost all such Chapter News was extracted solely from local chapter publications sent to me.

IPS efforts on the InterNet continue to increase. The latest item is the establishment of a new Palms/Tropicals section within the Gardening Forum of CompuServe, the world's largest electronic subscription service (for more on CompuServe, see p. 118). Maintenance of this section is being assisted by the IPS under an agreement with CompuServe. The CompuServe message forum and library are in addition to the up and running IPS World Wide Web homepages (http://www.palms.org), palm newsgroups (news://palms.org), palm FTP facilities (ftp://palms.org), and several palm email listservers. Commercial advertising on the IPS WWW is now possible. Improvements are planned in each of these services over the next year.

Please send comments and criticisms to me. Sometimes, I find it difficult to personally answer each letter that comes, but I will do my best. All opinions are appreciated and suggestions taken to heart.

JIM CAIN, PRESIDENT
12418 Stafford Springs Drive
Houston, Texas 77077, USA
email: Palm-Dude@GEnie.com

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IPS Board of Directors Election Results

The incoming Directors of the IPS for the term 1996–2000 are the following:

Rolf Kyburz	Australia	Libbe Besse	Florida
Steve Trollip	South Africa	Kyle Brown	Florida
Martin Gibbons	United Kingdom	Paul Craft	Florida
Richard Woo	Canada	Lester Pancoast	Florida
Suzanne Rowlands	California	Scott Zona	Florida
Ross Wagner	California	Lynn McKamey	Texas
Jim Wright	California	Jeffrey Marcus	Hawaii

Welcome to our Board of Directors of the International Palm Society. Many of the above are incumbents. New directors joining the board are Rolf Kyburz, Steve Trollip, Suzanne Rowlands, Paul Craft, Scott Zona, and Jeff Marcus. Congratulations to all.

JIM CAIN

Principes, 40(2), 1996, pp. 65–74

Medemia argun Lives!

MARTIN GIBBONS AND TOBIAS W. SPANNER
The Palm Centre, 563 Upper Richmond Road West, London, SW14 7ED, UK and Tizianstr.44, 80638 München, Germany

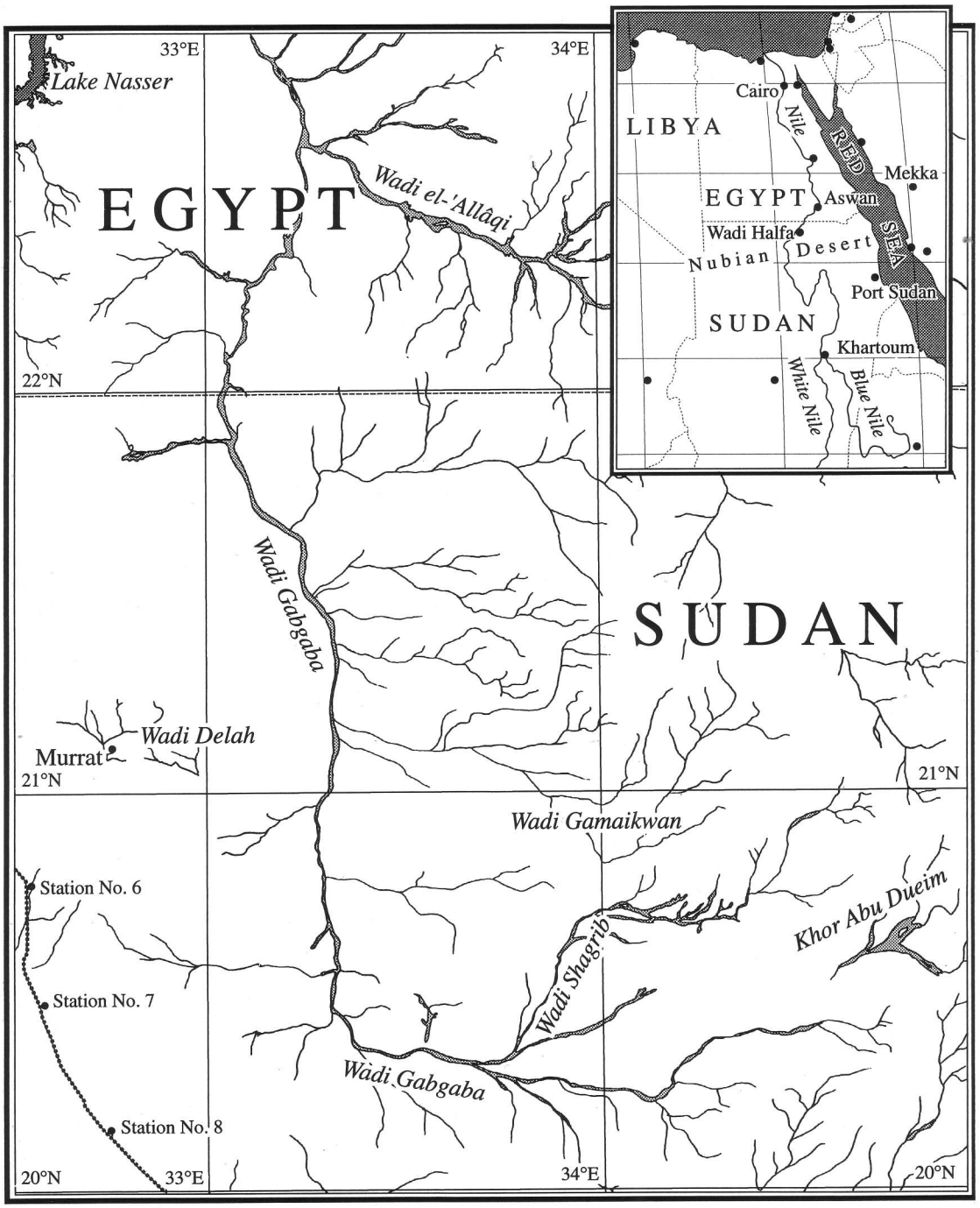
Medemia argun—just the sound of the name, together with the splendid and evocative photographs in Arthur Langlois' 1976 *Supplement to Palms of the World* has captured the imagination of every self-respecting palm enthusiast who has chanced upon them. The fact that it was well known to the ancient Egyptians but recently feared to be extinct, or at best, on the very edge of extinction, added even more mystique to this very special palm's reputation, and set a challenge to plant hunters to prove its continued existence in today's world. It had not been reported since two isolated trees had been discovered in oases in southern Egypt by L. Boulos in the 1960s (Boulos 1968), and the story of their discovery forms the basis of Langlois' account. It makes exciting reading. In its native country, the Sudan, *Medemia* had not been recorded since 1907 and Genera Palmarum (Uhl and Dransfield 1987) reports that ". . . it appears to be on the verge of extinction if not already extinct."

We, doubtless along with many other people, had long been thinking about this challenge and just where to begin the search, but the final push came in mid-1995 when Mr. Jean-Yves Lesouëf, of the Conservatoire Botanique National de Brest, France, contacted us, having read about our earlier adventures with *Trachycarpus*, with an offer to pass on all his research papers concerning *Medemia*, on the condition that we mount an expedition. We needed no persuasion and after reading the information he kindly supplied (in fact photocopies of all the many accounts of this palm that have appeared in print over the years), we were convinced that not only was there a good chance of its continued survival, but of our finding it.

Several locations were listed, but one that cropped up time and time again, was "Wadi Delah," near "Murrat Wells" in Sudan, a huge and by all accounts none-too-friendly country, between Egypt and Ethiopia, and where a civil war has been raging for many years. Missing from all modern maps, Murrat Wells turned out to be in the far north-east of the country, close to the border with Egypt and fortunately well away from the fighting.

Our reception at the airport of the capital, Khartoum, in October 1995 was none too welcoming, what with currency declarations, careful scrutiny of our visas, and even a thorough search of our baggage. It turned out that the officials were looking for nothing more sinister than alcohol, since Sudan is a "dry" country in both senses of the word, and finding none, they simply waved us on, and out into the warm Sudanese night. Fate took a hand then, leading us to the Acropole Hotel, *the* hotel in Khartoum, whose Greek owner, George, took a keen interest in our project and was to prove extremely helpful to us. He was not overly surprised by our goal though; nobody goes to Sudan without a reason. It should also perhaps be added at this point that his friendliness and willingness to help was typical of the many people we met in Sudan, and our fears about "hostile natives" were soon completely dispelled. Many—most—people had so little, but were happy to share even the little they had.

We had imagined that it would take some days to get ourselves and our little expedition organized, but George had other ideas, and sorted out photography permits, registration with our respective embassies, currency exchange, supplies, together with a jeep, driver, and co-driver/mechanic, within a matter of hours, and we were ready to leave almost before we knew it. We thus had a few hours left that day and did a taxi tour of the city, but Khartoum has little for the tourist. We saw the confluence of the two Niles, the Blue and the White, a rather poor botanic garden, and just a few palms: Royals, Washingtonias and some others, but best of all, several multiheaded Doum Palms, *Hyphaene thebaica*, fabulous and wonderful trees with dense blue-green foliage (Fig. 1). The temperature was in the high 90°s (30°C).



Map of area where *Medemia* was found.

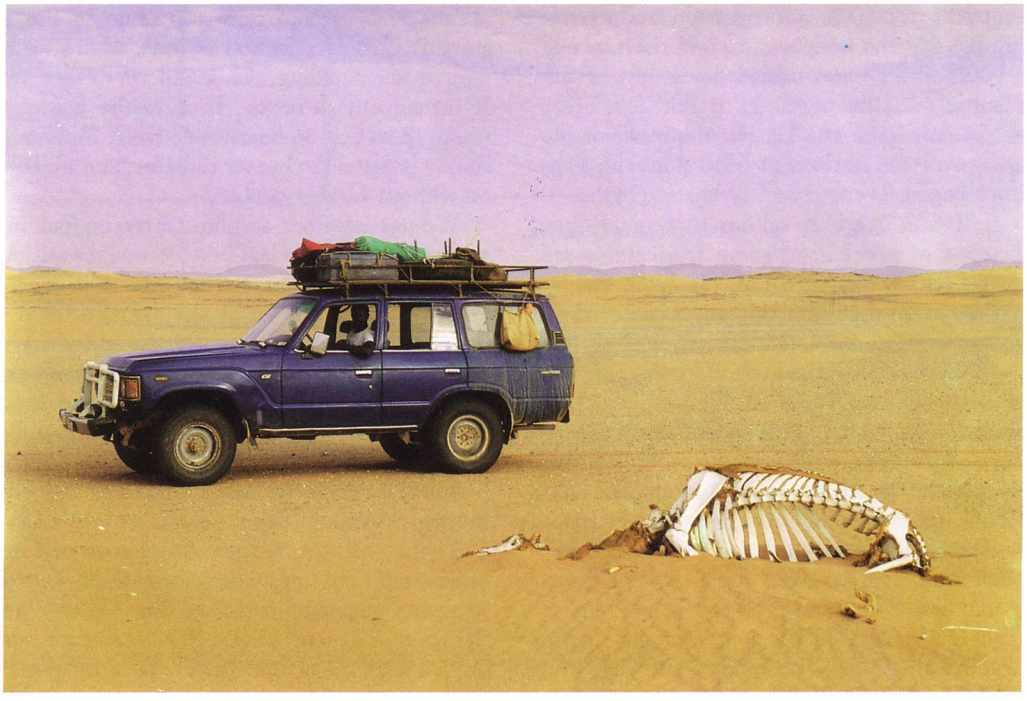
The next morning we set off at 6:00 a.m. while it was still relatively cool. Ramadan the driver, big, black, and with a huge smile and a ready laugh was a real find and we felt in safe hands as we headed north out of the city. Look at any map of the Sudan (see p. 66) and you will see the River Nile running south/north as a narrow, twisting, blue line running through a desert of brown. It was everything we imagined: a broad river lined to a width of 50 m on either side with dense vegetation, mainly Date and a few Doum palms. Beyond this where there is irrigation, there are fields of vegetables and other crops. But farther out there is an arid savannah or thorn scrub and northward, where the climate becomes dryer, only desert. We followed the Nile for many kilometres and many hours, passing through the river towns of Atbara and Berber, hot and dusty places, and at the latter, crossed to the western side on a ferry boat with camels and donkeys as fellow passengers. Several more hours of driving brought us to an area of flat ground away from the river where we stopped for the night, simply spreading out our bed rolls on the desert floor, and sleeping under a canopy of a million stars—no pollution here! During the day the temperature had risen to well over 100°F (38°C) and cooled down only slowly after sunset. In the mornings it felt deliciously "cool" at only 70°F (21°C), but the moment the sun rose over the horizon at 5:30 a.m. the temperature began its rapid and dramatic climb.

By 5:30 a.m. we were on our way again after the briefest of breakfasts, some fruit and some hot, sweet tea. We crossed the Nile again and by midday we arrived at Abu Hamed, a bigger town where we stopped for lunch and to stretch our legs, while Ramadan asked around for anyone who might know Murrat Wells or Wadi Delah. Disappointingly no one did, until a local camel drover was summoned. Yes, he knew them both. We took photocopies of the *Medemia* photographs in Langlois' book and showed them to him. Yes, he knew the palms too, calling them "Dom-el-Delah." Through Ramadan we asked him a hundred questions: how far, how many, how tall. He agreed to take us there for 20 000 Sudanese pounds (≈$30) and within half an hour we were on our way, with our new friend, whose name was Hessen-Ali.

Once out of the town, we left the Nile, which then loops away 320 km (200 miles) to the west, and headed into the desert proper, following a single-track railway that runs all the way to Wadi Halfa, where it again meets up with the river. Sections of the line were so straight they could have been drawn with a ruler on the planner's map, and probably were. The desert itself was not one of soft sandy dunes but rather had a much harder surface, totally dry, very flat, but with distant hills, which we approached and passed from time to time, and outcrops of black basaltic rocks, the very same substance used by the ancient Egyptians for carving their deities, Horus and Hator, which can be seen in many a museum. There was hardly any vegetation and every so often we came across the desiccated skeleton of a camel, the "ship of the desert," a reminder of the uncompromising nature of the climate (Fig. 2). The road, scarcely worthy of the name, was more a collection of tracks in the sand, each driver seeming to make a new set. We were making good time and were just congratulating ourselves on how easy this was all going to be when we began to have problems with the jeep. The daytime temperature was rising to 113°F (45°C) now and the radiator was overheating, caused, we discovered after a look under the steaming bonnet, by a split radiator hose. Roadside repairs were carried out and we limped up the railway line until we came to the next station—just a collection of huts, where we were offered tea, scalding, black and very, very sweet. It turned out to be the hose to the heater that was split so our on-board mechanic, Mohammed, simply isolated the heater radiator, and we carried on without further problems.

We passed other stations, three or four in all, and called in at the last one we would pass. After more tea we left the railway line and drove off into the desert, guided by the camel drover, who seemed to be navigating by the stars and the moon—it was now well after dark—there seemingly being little else to steer by. We spent a second blissful night sleeping in the open and rose at daybreak, racing the sun to be up and away before it cleared the distant horizon and turned the desert into an oven.

There was now no sign of any road or even of other tracks but our guide seemed to know exactly where he was going and after 2 or 3 h we reached the town of Murrat Wells. The reason it is not on any modern maps immediately became clear: it is a ghost town, once apparently a thriving community based on gold mining, but long since deserted when the gold ran out. Buildings, machinery, great iron pumps, and piles of brand new bricks, much of which was marked "Made In England," lay abandoned as though the population



1. *Hyphaene thebaica* above. The seated figure at its base gives scale to this large palm. 2. Bones in the sun, an indication of the harshness of the climate.

had left yesterday, preserved forever by the dry desert air.

The landscape turned into a broad, flat valley, the floodplain of Wadi Delah, and soon in the far distance, through the shimmering heat, we saw our first *Medemia argun* palm, rapidly followed by a second, apart from some dry grass and a few scanty shrubs, the only vegetation to be seen. About 9 m (30 ft) tall, they had an ancient look about them, as though they had been there for centuries, though, according to Hessen-Ali, they are actually quite fast growing. With great excitement we examined them, noting other, smaller specimens farther down the valley, toward which we then drove.

The valley was shaped like a giant amphitheater, entirely surrounded by small, rocky mountains, which displayed a great multitude of colors, from brown, grey, and black, to yellow and red (Fig. 8). Over the ages, the wadi, a seasonal river supplied from these mountains, has formed a vast, nearly flat floodplain of coarse, slightly alkaline sand (pH 7.5). In the short rainy season in summer, vast areas of the valley can be flooded for a short time while for most of the year there is no visible water. Besides the palms, the scarce vegetation consisted of a few small trees (*Acacia* sp.), shrubs, and small patches of grass.

The very next tree we came to (Fig. 5) was heavy with fruit, thousands of plum-sized dark violet to black fruits both on and under the tree (Fig. 3). The thin fruit layer on these is actually edible but only when dry and has a malty, sweet taste and smell, much enjoyed, we were told, by small rodents of the desert, which may thereby assist in their distribution. Cutting the fruit in half revealed a number of thin, red, radiating lines, as though it had been pierced many times with a rusty needle (Fig. 7). *Medemia* fruits do not fall to the ground until they are completely dry, at which time they are capable of floating and may be carried to other areas by the next flood. Leaving the three men to rest in its shade, we continued down the valley on foot to examine the other trees, about 12 in all, together with quite a few seedlings and young plants.

Medemia argun is most closely related to *Hyphaene* and *Bismarckia*. It was first described by Prince von Württemberg in Martius' *Historia Naturalis Palmarum* in 1838 in the genus *Hyphaene*, which in fact we thought it resembles in many respects. We could see for ourselves, however, the number of unique characteristics, such as the absence of a hastula and the distinctive morphology of the seeds that clearly support its being in a genus of its own.

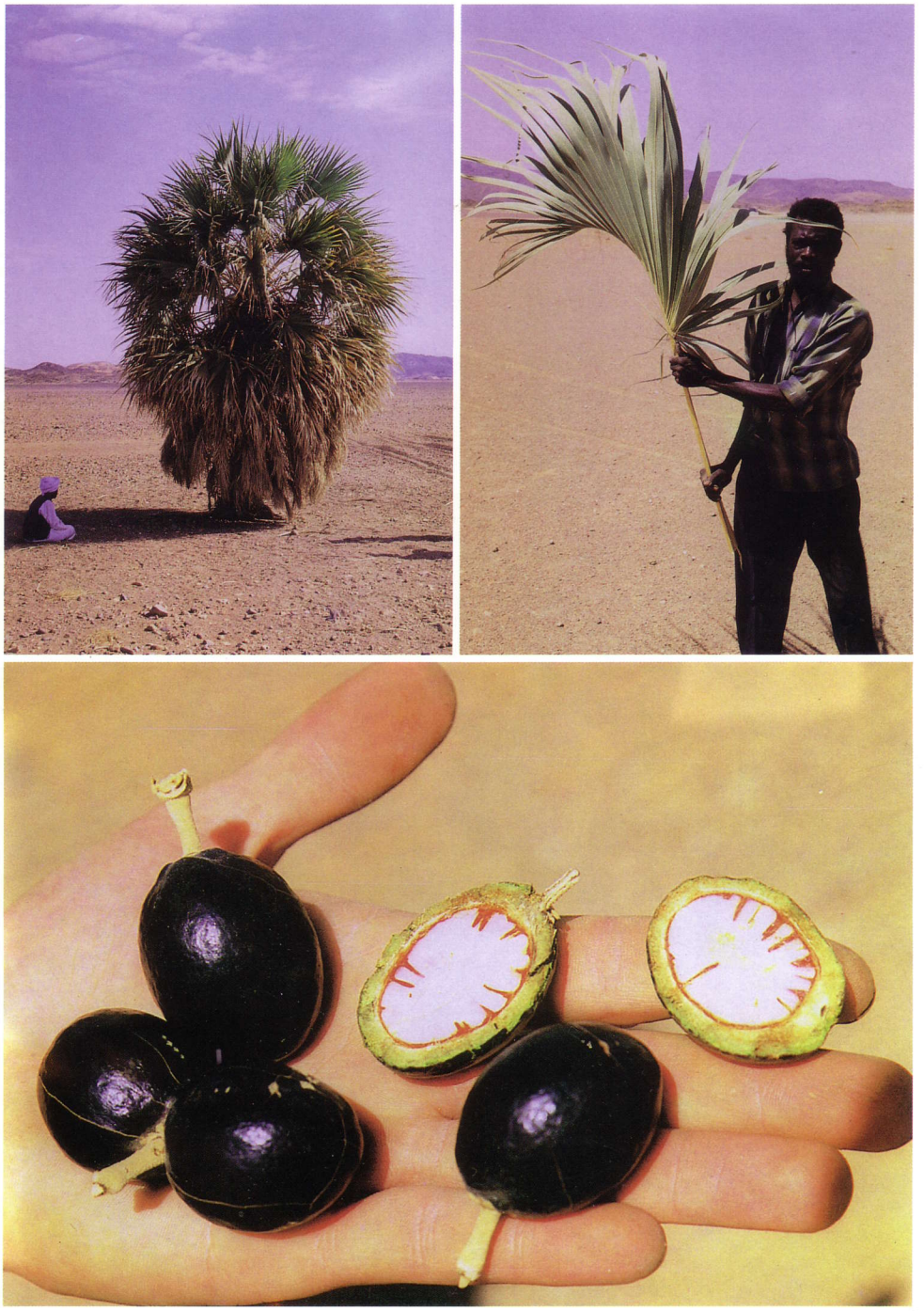
Medemia is a beautiful palm up to 10 m (33 ft) tall, with an erect, solitary trunk and a dense, rounded crown. In young plants, the trunk is covered in split leaf bases; trunks of older plants are bare and ringed. The petioles are a fabulous and distinctive bright yellow (Fig. 4) with black margins that, in younger plants, carry vicious black thorns. This is contrary to the published descriptions of *Medemia*, which describe them as "unarmed." In common with some other genera (*Livistona*, for example) these thorns appear not to be required once the tree gets past a certain stage, and they are missing entirely from the petioles of taller, older specimens. The strongly costapalmate leaf blade is very coarse and leathery (Fig. 6), and the leaves can be heard rattling even in a slight breeze. They are an attractive light green and slightly glaucous on both surfaces and have long, finely drawn out segments, which give the tree a finer and more lax appearance than *Hyphaene*.

We came across a good number of seedlings, perhaps 15 or so, of various sizes, growing quite happily sometimes some distance from the parent tree, indicating that *Medemia* does indeed have a definite, though narrow, grip on survival. We found dozens of stumps and felled trunks. Hessen-Ali, who told us that the leaves are collected for rope-making, etc., added that trees are only felled when they are near the end of their lives, so the remaining leaves can be reached, but it certainly looked as though there had been a major cutting operation within recent years. The trunks themselves seem to have no use whatever, not even as fuel, and were simply left where they fell (Fig. 9).

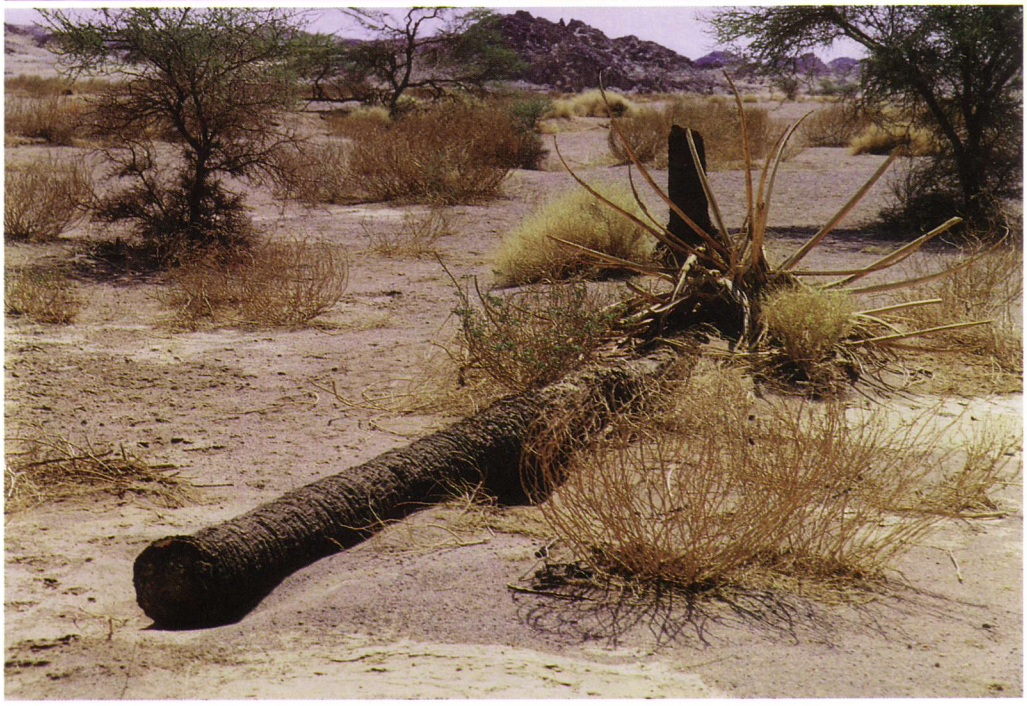
Out in the open, away from the shelter that the jeep afforded, we became even more aware of the intense heat, with the burning sun high overhead, baking the ground and drying the air. The slightest breeze was like a blast from a furnace. It was almost scary, and we were glad to get back to the others after our little excursion. During those desert days we were drinking copious amounts of water, perhaps 8 or 9 L (15 pints) per day, most of which was lost in sweat in the bone-dry air.

After feasting ourselves, metaphorically speaking, on these beautiful palms we set off back the way we had come, pausing every so often to take more photographs. Eventually we again passed

3. *Medemia argun.* Mature trees produce thousands of plum-sized fruits. 4. *Medemia argun.* The bright yellow petioles are stunning against the blue desert sky.



5. Left, *Medemia argun*, a young tree, heavy with fruit. 6. *Medemia argun*. The leathery leaves are strongly costapalmate. 7. Lower, *Medemia argun*. The attractive fruits show radiating lines when cut.



8. The beautiful, colorful valley of Wadi Delah, with a tall, old specimen of *Medemia argun*. 9. *Medemia argun*. Trunks cut down by nomads are left where they fall, having no use.

the first, and biggest one that we had seen, and set off on the long journey back to Khartoum and the real world.

It had been not only one of the most exciting trips we had made, but the landscape, stunningly and starkly beautiful, in combination with the exotic and ancient appearance of the palms, made us feel privileged to have had the opportunity to visit this wonderful country, with its friendly people. Rediscovering *Medemia argun*, which was thought by many to be extinct, and having the opportunity to introduce it to cultivation and safety around the world, was a significant bonus.

Update on Description, Distribution, and Conservation Status of Medemia argun

Medemia argun (Martius) Württemberg ex H. A. Wendland.

A robust, solitary, dioecious tree palm up to 10 m tall. **Trunk** bare, 30–40 cm in diameter, rough and conspicuously ringed, in younger plants covered with the deeply split leaf bases, forming a criss-cross pattern. Crown rounded, of 25–50 leaves. **Leaves:** Petioles are 80–90 cm long and ≈4.5 cm wide at the middle, flattish above, channelled towards the base, rounded below, bright yellow with black margins, armed (in young plants) with widely spaced, coarse, forward-pointing thorns, 1 cm long, also black, mainly toward the base of the petiole; in tall, old plants, the petiole is not armed. The leaf base is flattened, black, deeply split, with a narrow leaf sheath, and an appendage on either side. Hastulae are absent. The leaf blade is very coarse and leathery, light green, slightly glaucous above and below, particularly in seedlings and young plants, ≈110–130 cm long and ±150 cm wide, strongly costapalmate with the costa extending far into the blade, filiferous, divided (around its central portion for two-thirds of its length), into 60–65 singlefold acuminate segments ±5 cm wide, gradually narrower, shorter, and more deeply split toward the center and margins, finely drawn out into a nearly thread-like apex, bifid for ≈20 cm, somewhat lax. Midribs of the folds very conspicuous. **Inflorescences** are interfoliar and arching. Female inflorescences 6–20 on a tree, ≈120 cm long, branched to one order. Peduncular and rachis bracts short, tubular, woolly, apex very finely pointed. First-order branches with sharp margins, carrying a single, catkin-like rachilla, bearing a tight spiral of densely hairy bracts. Male inflorescences 200–250 cm long, similar to female but first-order branches bearing at their tip 1–4 digitately displayed rachillae. **Fruits** on 1–1.5 cm long pedicels, ovoid, 4–5 cm long by 2.7–3 cm in diameter, smooth, shiny, dark violet to black. Mesocarp spongy, swelling significantly when wet. Endocarp thin. Endosperm deeply ruminate with red, later brown, radiating, needle-like ruminations, having a narrow central cavity only when dry. Embryo apical. Plants reach maturity when only 3–4 m tall. Flowers were not found at this time of the year.

Medemia argun has been reported from various places in the Sudan, most of which could only be located with difficulty on present-day maps, others not at all. The essence of our researches is presented below.

—**Wadi Gabgaba** at 21°45′N and 33°E, which is close to the border with Egypt. We have reason to believe that *Medemia* also grows southward on the Wadi Gabgaba to **Wadi Gamaikwan** 20°50′N, 34°E, **Wadi Shagrib** (Shagarib), 20°40′N, 34°E and **Wadi Rabaida**.

—**Wadi Soofur**, 21°30′N, could not be located but is likely to refer to one of the tributaries of Wadi Gabgaba at this latitude.

—**Khor Abu Dueim** (Wadi Dueim or Doum in Etbai) 20°40′N, 34°40′E, in various valleys there, particularly at **Wadi Abu Araga** 20°40′N, 35°E. Atdarfani Oum Dom (Attarfani um Dom, Wadi Terfour, Wadi Terfani) is presumably at or near Wadi Oum Dom, north of Jebel Chigr, which was found in the same area as Wadi Dueim.

—**Wadi Delah**, 21°10′N, 32°45′E near Murrat (Murrat Wells, El Murrat, Mourad, Jebel Murrat).

—Umm Gereifat could not be located but almost certainly refers to a locality in the Nubian desert.

—Ababda Valleys could not be located but also probably refer to a locality in the Nubian desert.

—**Sennar**, a town SE of Khartoum on the Blue Nile at 13°35′N.

—On the **White Nile, An Nil Al Abyad**.

These last two locations refer to *Medemia abiadensis* H. Wendl., which was sunk into synonymy with *M. argun* by O. Beccari, but we believe

this decision may need reconsideration for two reasons: (1) *M. abiadensis* is recorded as growing "on the Nile" as opposed to deep in the desert near seasonal rivers, which are dry for most of the year. The locations for it are also much farther south than *M. argun*, where desert gives way to savannah, thus a very different habitat. (2) The seeds of *M. abiadensis* are much smaller than those of *M. argun*.

L. Boulos (1968) reports on the discovery of two isolated plants of *Medemia* in **Dungul Oasis** and **Nakhila Oasis** in the Nubian Desert of Egypt. It seems likely that these two plants originate from cultivation as their localities are on a trading route, known since the most ancient times, when *Medemia* fruits were imported from Sudan and trees were cultivated in Egypt. *Medemia* fruits were frequently found in Egyptian tombs, dating back as far as the Fifth Dynasty. For an account of *Medemia* in ancient Egypt see Täckholm and Drar (1950).

Although the small reproducing population at Wadi Delah proves that *Medemia argun* is not, after all, on the verge of extinction, it is nonetheless a highly endangered palm. The tough leaves of *Medemia* are still a desirable material for making rope, mats, etc., and harvesting of the leaves of young plants continues. Tall, old trees nearing the end of their lives have been felled for the same reason, the trunk apparently not being of any use. In the few tall old plants remaining, the upper portion of the trunk especially is heavily damaged by the tough desert conditions and it seems as though their days are numbered too. Only the healthy, middle-aged plants are actually left alone. Nevertheless, it is somewhat surprising that the grove at Wadi Delah, which had already been recorded as being in danger of extinction at the turn of the century (Beccari 1924) has survived for such a long time. Judging by the dozens of felled tall trunks we have seen littering the plain, there were many more tall trees around in the recent past. Apparently the grove had a chance to recover over the last few decades when nearby human settlements were abandoned after the gold-rush at Murrat. The closest settlement today is a long distance away, but new pressure may be caused by a popular truck-operated smuggling route to Egypt that passes through Wadi Delah. Drought might also play a role. According to our guide Hessen-Ali, the area has not always been as dry as it is today. However, it is likely that *Medemia argun* still exists at some of the other locations given and *Medemia* will not have to rely solely on cultivation for its continued survival.

Medemia would be a fabulous ornamental for drier subtropical and tropical regions, its requirements and cultivation techniques being probably similar to those of *Hyphaene* and *Bismarckia*.

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Diversity and Distribution of Palms in Bolivia

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ABSTRACT

Bolivian palms include 27 genera and 84 native species, with four of them endemic to Bolivia. They are divided among the following life forms: 46% grow as tree palms, 42% are shrubs, 7% are acaulescent, and 4% are scandent palms. Bolivian palms grow in open vegetation types and also in different forest strata from the understory to the subcanopy in many kinds of forests. Some palm species are found in monotypic stands while others grow associated with other species of palms. Their altitudinal range is from 140 m to 3300 m elevation, covering the major part of the country and the highest diversity is reached between 140 and 500 m. Bolivian palms are found in four main biogeographic regions: Amazonia (54%), the Andes (29%), the Cerrado (7%), the Gran Chaco (2%), and mixed with transitional regions (8%).

RESUMEN

La diversidad de palmas bolivianas está representada por 27 géneros y 84 especies nativas, de las cuales cuatro son endémicas de Bolivia. Las formas de vida presentan 46% de palmas arbóreas, 42% de palmas "arbustivas," 7% de palmas acaules y 4% de palmas trepadoras. Se encuentran en vegetación abierta y se distribuyen en estratos desde el sotobosque hasta el subdosel en varios tipos de bosque, siguiendo patrones monotípicos o mixtos asociados con otras especies de palmas. El rango altitudinal es de 140–3300 m y cubre la mayor parte del territorio boliviano, siendo los niveles de 140–500 m donde alcanzan su mayor diversidad por superficie. Su distribución abarca cuatro grandes unidades biogeográficas: Amazonia con 54%, los Andes con 29%, el Cerrado con 7%, el Gran Chaco con 2% y mixtos transicionales con 8%.

Alcides d'Orbigny was the first botanist who collected and studied Bolivian palms. Thirty-two of his 42 palm collections in Bolivia were considered as new by Martius in 1842. Since then, few palm collections were made in Bolivia up to the 1970s, and these have been made mostly in the montane forests of the Andes. Several authors have referred directly or indirectly to the diversity and distribution of Bolivian palms (Peña 1944, Irmay 1947, Cárdenas 1969, 1970, Meneces 1975, Antezana 1976). In addition, several descriptive works on regional distribution of palms have included checklists of Bolivian palms (Foster 1958, Glassman 1965, Uhl and Dransfield 1987), as well as the treatment of the Amazonian palm flora (Henderson 1994) and the palms of the Andes (Moraes et al. 1995b).

Based on the study of collections of Bolivian palms deposited in Bolivian, North American, and European herbaria, as well as the published literature, Balslev and Moraes (1989) presented a preliminary list of 29 genera and 90 native palm species including thirty-five new species' records for Bolivia. This detailed herbarium study revealed that 30 species had not been recollected since their first report for the country, most of them as new species.

During the last 15 yr, a concerted effort has been made to increase the information available on the distribution of Bolivian palms. Research on palms from botanically poorly known areas has produced several new records for the country. In the humid montane *Yungas* forests in northern La Paz department, *Bactris concinna*, *Chamaedorea linearis*, *Wettinia augusta*, *Wendlandiella gracilis*, and *Socratea salazarii* were registered as new for Bolivia (Parker and Bailey 1991, Moraes et al. 1995a). Rojas (1992) studied the ethnobotany of montane forest palms in the center of the eastern Andean *Cordillera* near the valley of Sacta in Cochabamba Department. Other field trips have been made to the interandean dry forest regions in Santa Cruz and Chuquisaca for more in-depth studies on the genus *Parajubaea* (Moraes and Henderson 1990, Moraes and Vargas 1994, Vargas 1994). The seasonally flooded savanna and riparian forests in northwestern Bolivia have been visited in order to obtain better data on the distribution and habitats of *Mauritiella armata* and *Mauritia flexuosa* (Haase 1990), *Copernicia alba* (Moraes 1991), and *Bactris glaucescens* (Moraes and Sarmiento 1992). Proctor et al. (1993) documented the diversity and uses of palms in the humid lowland rain forests of the Pando; this study

resulted in the collection of *Geonoma paniculigera* and *Bactris sphaerocarpa*, which were new records for Bolivia. In 1992, during an expedition in the eastern sector of the Pando department, four palms, *Chamaedorea pauciflora*, *Bactris trailiana*, *Astrocaryum gynacanthum*, and *Bactris elegans*, were added to the list of species known to occur in Bolivia (Gentry and Foster, unpublished data). Saldias (1991a, b) studied the morphology and economic botany of *Bactris gasipaes* in the humid lowland forests in northern and western Santa Cruz. Finally, several field trips done in the northeastern, western, and central regions of Bolivia have provided additional information on the distribution of many palm species, particularly *Chelyocarpus chuco*, *Mauritia flexuosa*, *Mauritiella armata*, *Astrocaryum jauari*, *A. aculeatum*, *Attalea butyracea*, *Geonoma* spp., *Chamaedorea angustisecta*, and *Euterpe precatoria* (Moraes 1989, 1990, 1993).

Several recent taxonomic studies of a monographic nature have cited numerous Bolivian exsiccatae and have made important contributions to our understanding of Palmae in Bolivia; of particular note are the following taxa: *Chamaedorea* (Hodel 1992), Iriarteinae (Henderson 1990), *Hyospathe* (Skov and Balslev 1989), *Aiphanes* (Borchsenius and Bernal 1996), *Parajubaea* (Moraes and Henderson 1990), *Allagoptera* (Moraes 1996a), and *Attalea* (Wessels Boer 1965).

This paper summarizes the current state of knowledge on species richness, life forms, foliar morphology, ecology, and biogeography of Bolivian palms, information that is included in the *Bolivian Palm Flora* by Moraes (in prep.).

Diversity

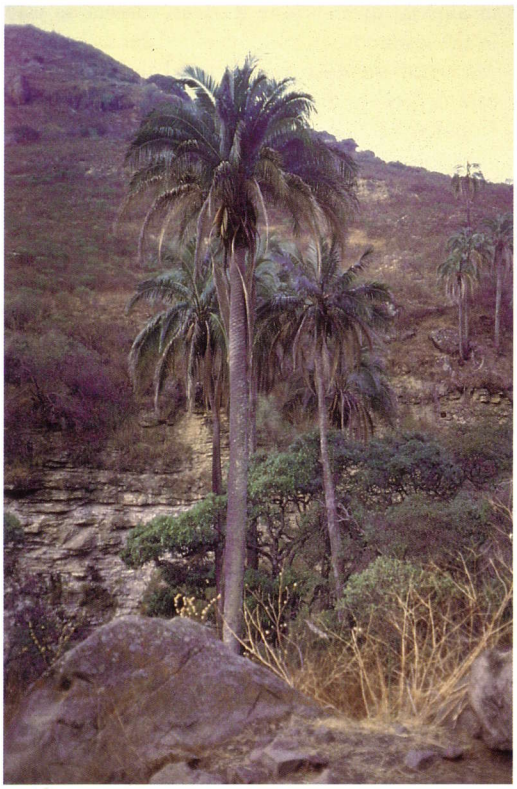
The native palms of Bolivia include a total of 84 species pertaining to 27 genera and five subfamilies (see Appendix I). The most speciose subfamily is the Arecoideae, which encompasses 70 species. The checklist published by Balslev and Moraes (1989) cited 90 species and 29 genera. The apparent reduction in diversity has resulted from a better understanding of the taxonomy of several important groups. *Scheelea*, *Maximiliana* and *Orbignya* were synonimized under *Attalea* (Wessels Boer 1965), while *Jessenia* was united with *Oenocarpus* (Henderson 1994). Nonetheless, two new generic records have been reported for *Wettinia* and *Wendlandiella*, maintaining 27 genera for Bolivia. The total numbers of species were constantly in flux due to the many new records, as well as to a series of synonymizations that resulted from recent monographic treatments.

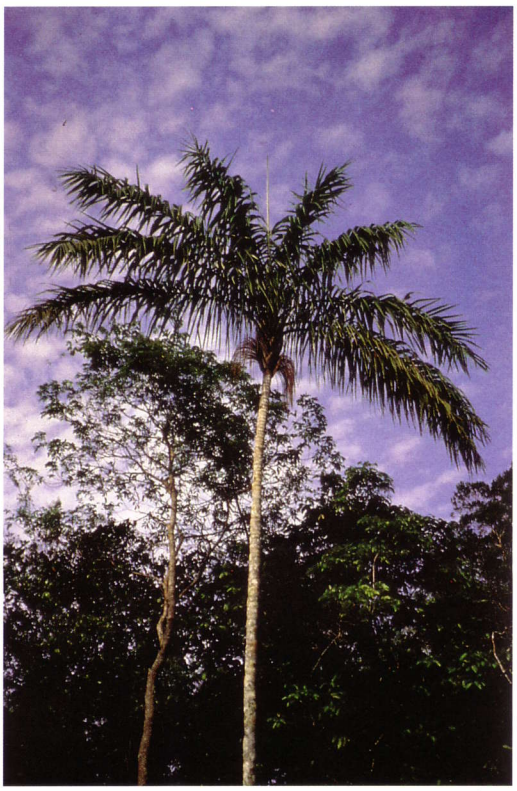
Sixteen genera (56% of the total known to occur in Bolivia) are monotypic. The largest genera are *Geonoma* with 20 species and *Bactris* with 15 species, followed by *Astrocaryum* and *Attalea* with five species each.

Life Form

There are four basic habits within the palms: trees, shrubs, acaulescent forms, and climbers; although the same terminology is used, these growth forms are not comparable with those of dicotyledons (Dransfield 1978). In the present paper, the growth forms of Bolivian palms were related to the forest strata in which they are found and the diameter they have: trees that occupy the subcanopy and canopy, with stems that are more than 5 cm in diameter; shrubs that are found in the understory and have stems less than 5 cm in diameter; acaulescent plants with short aerial or subterranean stems; and climbers with elongate, thin, clumped stems and a cirrus, an extended leaf rachis with reflexed spines, for adhering to the branches or leaves of surrounding plants. Tree palms are the most common life form among Bolivian taxa with 39 species (46%); shrub palms occupy second place with 35 species (42%); acaulescent palms are represented with seven species (7%), and climbing palms occupy fourth place with three species (4%) (see Appendix I). The tallest palm trees found in Bolivia are *Mauritia flexuosa*, *Oenocarpus bataua*, *Iriartea deltoidea*, and *Syagrus sancona* which reaches up to 20–25 m in height, while *Parajubaea torallyi* (Fig. 1) has been recorded up to 27 m in height. The smallest palm species are only 50 cm tall and are *Wendlandiella gracilis* and *Chamaedorea pinnatifrons*.

Trithrinax, *Mauritiella*, *Oenocarpus mapora*, *Hyospathe elegans*, *Desmoncus*, *Bactris*, *Chelyocarpus*, and some species of *Geonoma* and *Astrocaryum* have clumped stems; while the majority of Bolivian palms are single stemmed. According to the basic architectural models of Hallé and Oldeman (1970), Bolivian palms are mostly represented by the unbranched polycarpic or Corner's model; only *Allagoptera leucocalyx* belongs to the dichotomously branched or Schoute's model. Some tree palms, such as *Acrocomia aculeata*, *Dictyocaryum lamarckianum*, and *Iriar-*





1. Upper left, *Parajubaea torallyi*, an endemic tree palm 27 m in height and distributed in dry interandean forests up to 3400 m. 2. Above, a two-ranked crown palm species, *Oenocarpus distichus*, found in northeastern Bolivia. 3. Left, the "sao" palm, *Trithrinax campestris*, a keystone species in extreme dry thorn vegetation from the Gran Chaco region.

Table 1. Generic and specific diversity of Bolivian palms, related to altitude.

Altitude (m)	Genera (% of total)	Species (% of total)
140–500	22 (81%)	66 (79%)
500–1 000	16 (59%)	28 (33%)
1 000–1 500	5 (19%)	10 (12%)
1 500–2 000	4 (15%)	11 (13%)
2 000–2 500	3 (11%)	10 (12%)
2 500–3 000	2 (7%)	7 (8%)
3 000–3 500	2 (7%)	3 (4%)

tea deltoidea are characterized by stems swollen in the medial part. The Iriarteinae and *Wettinia augusta* have stilt roots, which can be either smooth or spiny.

Leaf Types

Pinnate leaves are found in 94% of Bolivian palms (see Appendix I). Among the pinnate-leaved palms, *Hyospathe*, nine species of *Geonoma*, *Wendlandiella*, two species of *Chamaedorea*, and four species of *Bactris* have trijugate leaves. Praemorse and grouped pinnae are found among the Iriarteinae and *Aiphanes aculeata*. *Chamaedorea angustisecta*, *Attalea butyracea*, *A. speciosa*, *Bactris major*, *Parajubaea torallyi*, *Phytelephas macrocarpa*, and the Euterpeinae have regularly spaced pinnae arranged in one plane, while the remaining Bolivian species (66%) have pinnae distributed in groups and arranged in one plane or in all directions. *Oenocarpus distichus* is unique in its crown of leaves arranged in two ranks (Fig. 2).

Three genera, *Copernicia*, *Trithrinax*, and *Chelyocarpus*, have induplicate palmate leaves, while *Mauritia* and *Mauritiella* have reduplicate costapalmate leaves.

Ecology

The preferences of palms for some habitat, microclimate, soil fertility, and water relation features still remain poorly understood (Tomlinson 1979). It is not easy to delimit the distribution of genera and species in Bolivia, but there are geographic tendencies that can be discerned for some palms.

Soil Types

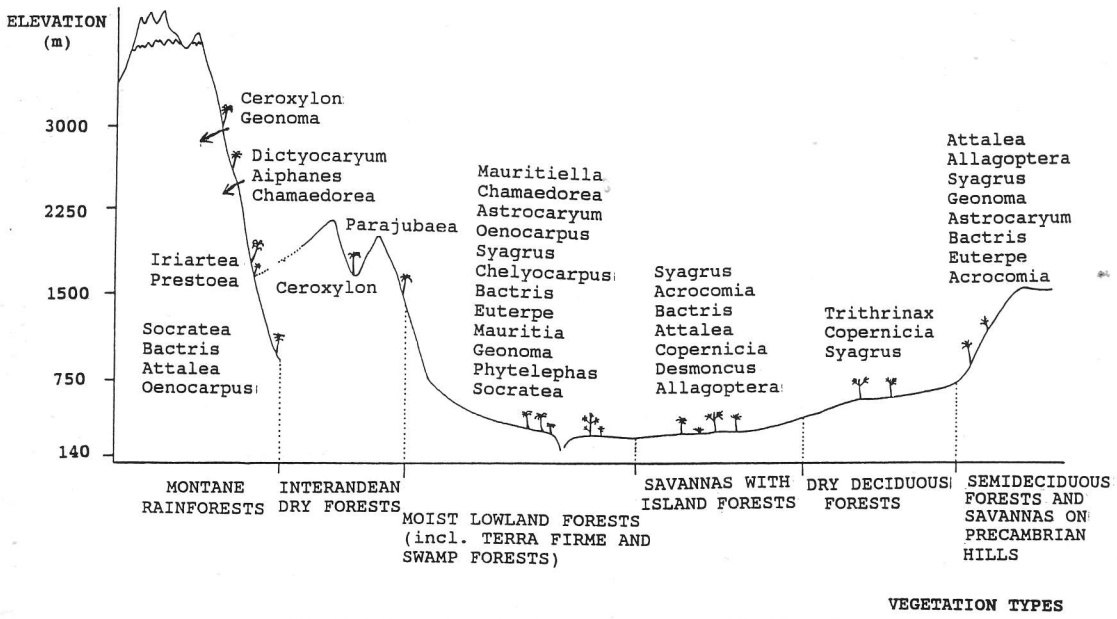
The distribution patterns for certain taxa shows some adaptations that are related to soil conditions, such as drainage and formation (see Appendix I). For example, *Geonoma deversa* is mostly found in alluvial premontane Andean forests as well as in the lowlands with well-drained sandy soils, while *Mauritia flexuosa* is restricted to inundated forests or poorly drained swamps with black water. *Copernicia alba* occurs in seasonally flooded savannas, while *Allagoptera leucocalyx* has been documented only in well-drained savannas. *Bactris riparia*, *Attalea butyracea*, and *Chelyocarpus chuco* are found only in rich soils of humid riparian forests. *Attalea speciosa* is dominant in lowland forests on well-drained and rocky substrates. *Ceroxylon*, *Dictyocaryum lamarckianum*, *Geonoma weberbaueri*, *Oenocarpus bataua*, *Parajubaea torallyi*, *Prestoea acuminata*, and *Syagrus* sp. (*S. yungasensis*, Moraes 1996b) are more adapted to colluvial soils than the majority of other Bolivian palms, which are mostly found on alluvial soils.

Precipitation

Most Bolivian palms grow in humid areas where the annual precipitation is between 700 and 2000 mm. Nonetheless, some species are adapted to extreme arid conditions, as *Trithrinax campestris* (Fig. 3), which is found in xerophytic thorn forests where the rains do not exceed 300–400 mm per year. Similarly, the genus *Parajubaea* is distributed in dry interandean valleys with less than 500 mm per year.

Altitude

The altitudinal distribution of Bolivian palms shows its highest diversity between 140 and 500 m with 22 genera (81% of total) and 66 species (79% of total) which are enriched with Andean and Amazonian elements (Table 1). In the lowland tropics altitude ranges from 140 to 1000 m where the vast majority of forest vegetation has one to several conspicuous palm taxa (Fig. 4, Appendix I). Between 500 and 1000 m *Allagoptera leucocalyx*, *Astrocaryum campestre*, *Attalea speciosa*, and *Syagrus petraea* are found on the Precambrian hills. In the premontane humid forests from 300 to 1000 m are found *Aiphanes aculeata*, *Chamaedorea leonis*, *Oenocarpus bataua*, and *Syagrus sancona*. From 1000 to 3500 m the *Yungas* montane forests are characterized by the presence of *Ceroxylon parvum*, *Geonoma weberbaueri*, while *Parajubaea torallyi* and *Parajubaea* sp. (*P. sunkha*, Moraes 1996b) are found in the interandean valleys between 2700 and 3400 m.



4. Altitudinal distribution related to vegetation types of Bolivian palms.

Vegetation

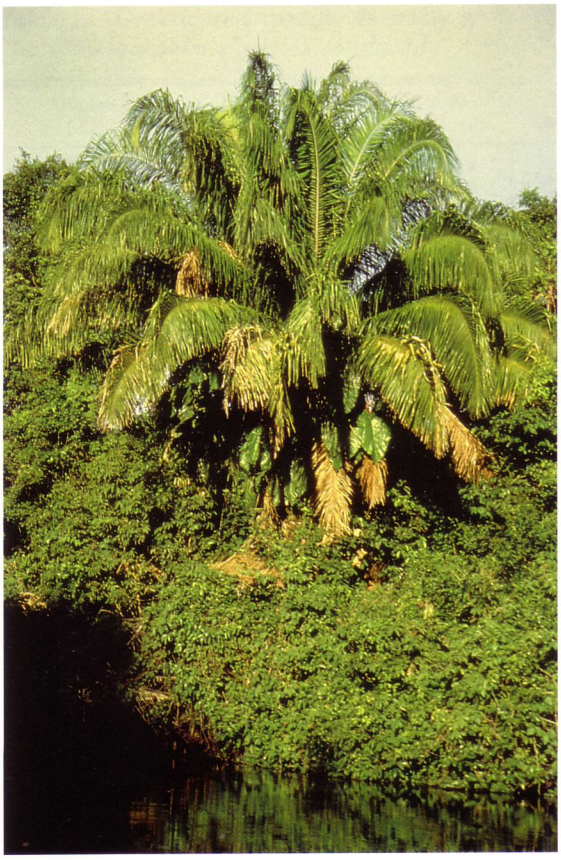
Bolivian palms are present in a wide range of vegetation types, ranging from humid forests to savannas and wetland habitats (Fig. 4, Appendix I). Palms are found in montane rainforests, interandean dry forests, moist lowland forests (including inundated forests, swamp forests, "terra firme" forests), and semideciduous forests on laterite crusts and granite outcrops. Different types of savannas, granite valleys, river borders, and montane scrubs are also among the habitats of Bolivian palms. Twelve genera are represented in the undulating terrain forests; 11 genera in montane forests; seven genera are found in savannas with island forests; two genera in interandean dry forests; while three genera grow in the deciduous forests of the seasonal tropics and subtropical lowlands, and eight genera are found in semideciduous forest and savannas on Precambrian hills.

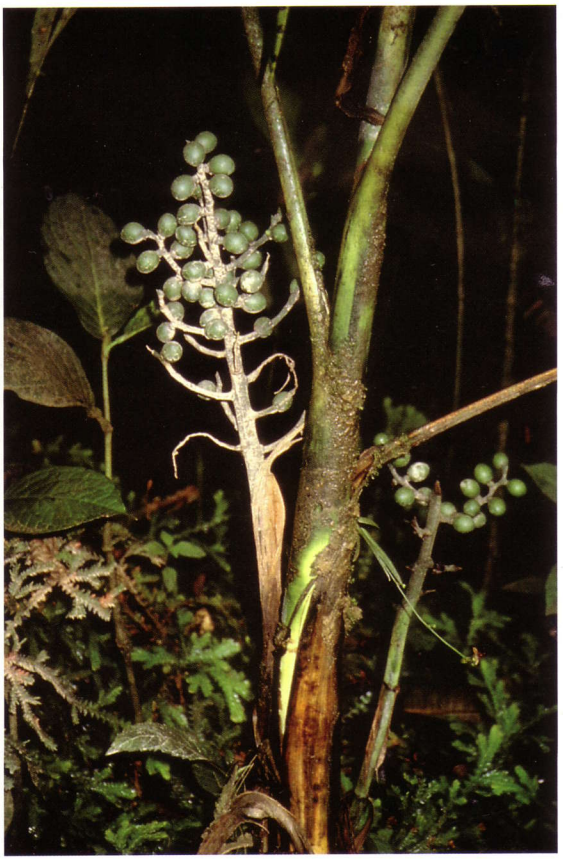
The most common species in the humid lowland forests are *Attalea phalerata* (Fig. 5), *A. speciosa*, *Acrocomia aculeata*, *Astrocaryum murumuru*, *Euterpe precatoria*, *Oenocarpus bataua*, *Socratea exorrhiza*, and *Syagrus sancona*. *Astrocaryum jauari*, *Attalea butyracea*, *Bactris riparia*, *B. major*, *Chelyocarpus chuco*, and *Syagrus sancona* are riparian species. In humid forests of Andean slopes are found *Aiphanes aculeata*, *Ceroxylon* spp., *Dictyocaryum lamarckianum*, *Geonoma lindeniana*, *G. weberbaueri*, *Iriartea deltoidea*, and *Prestoea acuminata*. The forests of the Andean foothills and piedmont are characterized by *Iriartea deltoidea*, *Oenocarpus mapora*, and *Phytelephas macrocarpa*, while *Socratea salazarii*, *Wendlandiella gracilis*, and *Wettinia augusta* are more frequent near the border with Peru.

Parajubaea sp. (*P. sunkha*, Moraes 1996b) and *P. torallyi* are characteristic of interandean dry forests in central mountains from eastern Andean slopes.

Well-drained woody savannas (i.e., Cerrado) and other open areas frequently have *Allagoptera leucocalyx*, *Syagrus cardenasii*, and *S. petraea*. Island forests are dominated by *Attalea phalerata*, although sometimes *Syagrus sancona* is common, and *Desmoncus polyacanthos* is common in the margins of forests islands in savannas subjected to seasonal inundation. *Copernicia alba* dominates seasonally flooded savannas, and sometimes is mixed with *Trithrinax campestris* in flooded low spiny forests in Gran Chaco region.

In general, palm species are found growing in mixed populations in the same general type of vegetation; however, they are distributed within these formations according to their adaptation to specific soil and light conditions. In general, spe-





5. Left. A common and widespread palm species, *Attalea phalerata*, in humid forests. 6. Right. *Chamaedorea linearis*, an understory palm with trijugate leaves.

cies demonstrate a regional pattern of association; for example the Amazonian taxa *Euterpe precatoria*, *Socratea exorrhiza*, *Oenocarpus bataua*, and *Mauritia flexuosa* tend to occur together and their distribution is similar to that observed in Perú (Kahn and Mejía 1990). But in most cases, individual palm species do not show a strict pattern of association among themselves. *Iriartea deltoidea* and *Euterpe precatoria* occur together in humid premontane forests in well-drained soils of the Andes piedmont. With increasing elevation, *Iriartea deltoidea* becomes rare while the montane species *Dictyocaryum lamarckianum* increases in frequency; nonetheless, *Euterpe precatoria* is uniformly dispersed up to ≈ 1000 m.

In some cases monotypic stands of certain palm species are key elements of vegetation types. For example forests occupied by *Attalea speciosa* (locally known as "cusi") are called "cusales" due to the high frequency and density of this species. Other examples of "palmares" or forest habitats with high densities of a particular species are the "siyeyi" (*Chamaedorea angustisecta*), "motacú" (*Attalea phalerata*), "jatata" (*Geonoma deversa*), "palma real" (*Mauritia flexuosa*), "asaí" (*Euterpe precatoria*), "totaí" (*Acrocomia aculeata*), "copa" (*Iriartea deltoidea*), "majillo" (*Oenocarpus mapora*), and "pachiuba" (*Socratea exorrhiza*). *Copernicia alba* or "palma blanca" is a savanna species that occurs in large numbers in the seasonally inundated landscapes west of the Mamoré river in the Beni area.

Stratification

Many vegetation types show distinct strata, which are occupied by different palm species and genera mostly according to the following pattern (see also Appendix I):

Understory (0.3–2.5 m). *Bactris* spp., *Chamaedorea* (Fig. 6), *Geonoma* spp., *Hyospathe elegans*, *Wendlandiella gracilis*, *Astrocar-*

yum campestre, Attalea eichleri, Desmoncus
Intermediate level (3–12 m). Astrocaryum murumuru, A. huaimi, A. jauari, A. aculeata, Aiphanes aculeata, Bactris gasipaes, B. riparia, Ceroxylon spp., *Geonoma weberbaueri, Trithrinax campestris, Chelyocarpus chuco, Oenocarpus, Wettinia augusta, Phytelephas macrocarpa, Prestoea acuminata*
Subcanopy and canopy (13–25 m). Attalea maripa, A. phalerata, A. speciosa, Dictyocaryum lamarckianum, Euterpe precatoria, Iriartea deltoidea, Oenocarpus bataua, Socratea exorrhiza, Syagrus sancona,

In open vegetation, with only one strata, palms that reach 0.4–2.5 m are *Allagoptera leucocalyx, Syagrus petraea, S. cardenasii*; *Acrocomia aculeata, Copernicia alba, Mauritiella armata,* and *Parajubaea* sp. (*P. sunkha,* Moraes 1996b) reach 3–12 m; *Mauritia flexuosa* reaches 13–20 m, and *Parajubaea torallyi* up to 27 m.

Biogeography

The majority of the palms (54%) are native to the Amazonian region (Fig. 7, Appendix I). This region is followed in importance in diversity by the Andes where 29% of all Bolivian palm species are known to occur. The Cerrado is represented with 7% and the Chaqueñan with 2% of all species. Species occurring in mixed transitional regions with widespread ranges that have affinities with more than one region are represented by 8% of all species. *Euterpe precatoria,* for instance, is distributed in the lowland Amazonian forest, as well as in the mountains of the Andes.

Many palms reach the southern limit of their distribution in Bolivia. This is the case for Amazonian species, such as *Bactris glaucescens* (Moraes and Sarmiento 1992), *Chelyocarpus chuco,* and *Geonoma deversa,* as well as for some Andean taxa, such as *Ceroxylon, Dictyocaryum,* and *Aiphanes.* Chaqueñan species like *Copernicia alba* meet in Bolivia their northernmost limit of distribution (Moraes 1991), as well as *Trithrinax campestris.* Also some species from the Cerrado, such as *Allagoptera leucocalyx* and *Syagrus petraea,* have their westernmost range of distribution in Bolivia.

Endemism

Four species are known to be endemic to Bolivia (see Appendix I). Both *Parajubaea* sp. (*P. sunkha,* Moraes 1996b) and *P. torallyi* grow in moist ravines in the dry interandean valleys of the eastern Cordillera of northwestern Potosí, southwestern Santa Cruz, and northeastern to southwestern Chuquisaca Departments. *Syagrus cardenasii* is distributed over a wider area in dry thorn vegetation in the subandean belt from Santa Cruz towards the south. *Syagrus* sp. (*S. yungasensis,* Moraes 1996b) is restricted to a narrow rocky valley in the montane vegetation near La Paz.

Discussion

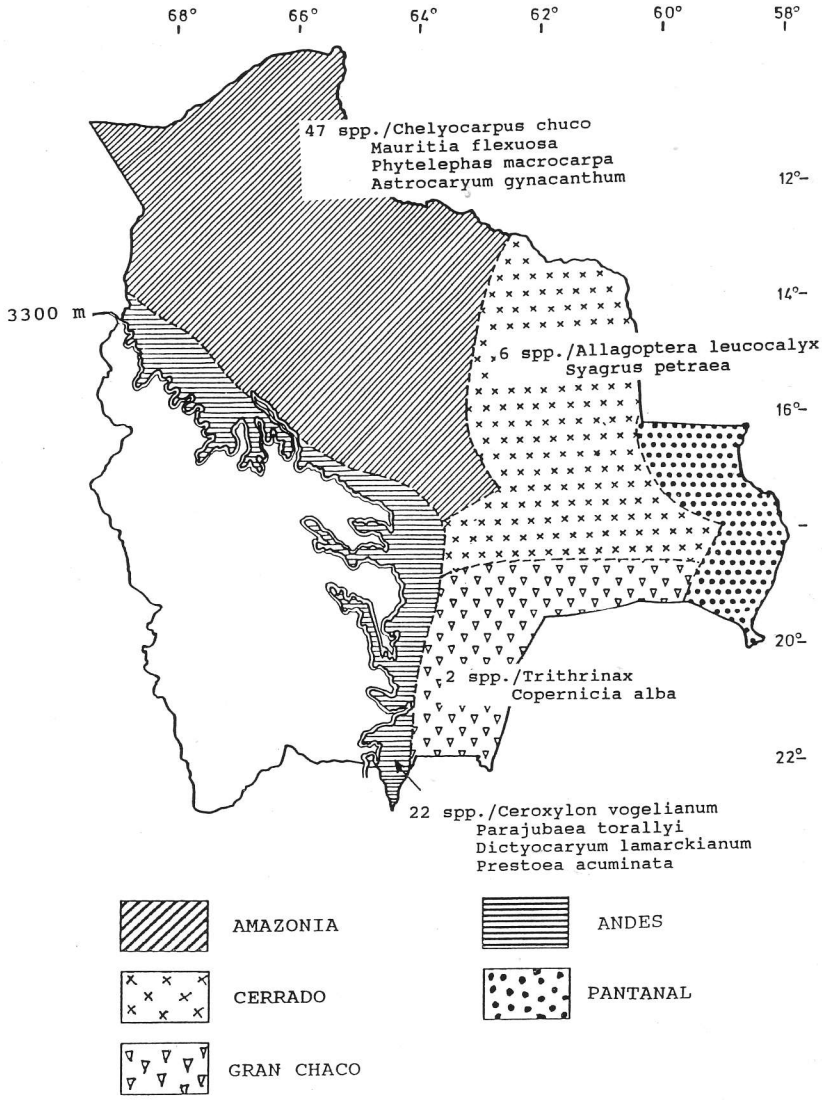
Bolivia is one of the most diverse countries in the Neotropics; this diversity is reflected in the presence of 27 genera, which represents 40% of all South American palm genera according to the inventory of Henderson, Galeano, and Bernal (1995).

The total of 84 palm species is not comparable to other richer Neotropical palm floras such as Colombia with 247 species (Galeano 1992), Ecuador with 124 species (Balslev and Barfod 1987) and Peru with 140 species (Kahn and Moussa 1994). It is slightly richer than palm flora of the Guiana, which has 82 palm species (Granville 1992).

Whether present in mixed palm forests or in monotypic stands, palms are one of the most useful floristic elements in the physiognomic recognition of ecosystems in Bolivia. Their geographic range occupies the majority of the territory of Bolivia. The variety of life forms and other vegetative characteristics enrich the structural diversity of Bolivian forests.

Bolivian palms are found in several types of forests and open vegetation, as well as in the "marginal" habitats described by Granville (1992) and in transitional zones between different types of vegetation. Their abilities to colonize disturbed habitats and unstable conditions provide them with opportunities to become established in ecologically limited spaces sometimes not available to other plant groups.

The limits of species distribution are not strictly correlated with the four major phytogeographic units of Bolivia; nonetheless, the Bolivian palms tend to be distributed in one of the major units. The most species-rich altitudinal range is between 140 and 500 m with 22% of the genera and 66% of the species. Most Bolivian palms (54%) have affinities with the Amazon region and with the



7. Map of phytogeographic units of Bolivia, based on the presence of palms with the altitudinal limit of 3300 m elevation.

Andean (29%), while fewer species have originated in the Chaqueñan, or Cerrado regions.

Many regions in Bolivia remain poorly known and further surveys are needed to get a more complete and integrated view of the biology of the palms. The conservation of this important natural resource is a priority for Bolivian natural resource managers.

Acknowledgments

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Appendix I. Checklist of Bolivian palms with their biogeographic affinities, stem, life form, leaf type, and their distribution related to altitude, soil, stratification, and vegetation types.[a]

Taxa	BG	Stm	Lf	Lt	Elev.	Soil	Str.	Veg.
Subfamily Coryphoideae								
Tribe Corypheae								
Subtribe Thrinacinae								
Trithrinax campestris (Burmeister) Drude	CH	S-C	T	Pa	250–800	A/Fs	M	Df
Chelyocarpus chuco (Mart.) H. E. Moore	AM	S-C	T	Pa	140–200	A/Fp	Cn	Mlf
Subtribe Livistoninae								
Copernicia alba Morong ex Morong	CH	S	T	Pa	250–400	A/Fs	M-Cn	Sv-Df
Subfamily Calamoideae								
Tribe Lepidocaryeae								
Mauritia flexuosa L.f.	AM	S	T	Cp	140–900	A/Fp	Cn	Az
Mauritiella armata (Mart.) Burret	AM	C	T	Cp	140–500	A/Fp	M	Mlf
Subfamily Ceroxyloideae								
Tribe Ceroxyleae								
Ceroxylon parvifrons (Engel) H. Wendl.	AN	S	T	Pi	2 000–3 000	C/Wd	M	Mf
Ceroxylon parvum Galeano	AN	S	T	Pi	2 000–3 000	C/Wd	M	Mf-If
Ceroxylon vogelianum (Engel) H. Wendl.	AN	S	T	Pi	1 800–3 200	C/Wd	Cn	Mf
Tribe Hyophorbeae								
Chamaedorea angustisecta Burret	OT	S	Sh	Pi	250–800	A/Wd	U	Mf-Mlf
Chamaedorea linearis (Ruiz & Pav.) Mart.	AN	S	Sh	Pt	300–600	A/Wd	U	Mlf
Chamaedorea pauciflora Mart.	AM	S	Sh	E	150–400	A/Fs	U	Mlf
Chamaedorea pinnatifrons (Jacq.) Oerst.	AN	S	Sh	Pt-E	250–2 500	A/Wd	U	Mlf
Wendlandiella gracilis Dammer	AN	C	Sh	Pt-E	250–400	A/Wd	U	Mlf
Subfamily Arecoideae								
Tribe Iriarteinae								
Dictyocaryum lamarckianum (Mart.) H. Wendl.	AN	S	T	Pr	1 000–2 000	C/Wd	Cn	Mf
Iriartea deltoidea Ruiz & Pav.	AN	S	T	Pr	200–1 200	C-A/Wd	Cn	Mf-Mlf
Socratea exorrhiza (Mart.) H. Wendl.	AM	S	T	Pr	150–900	A/Fp-Fs	Cn	Mlf
Socratea salazarii H. E. Moore	OT	S	T	Pr	300–500	C/Wd	M	Mlf
Tribe Wettininae								
Wettinia augusta Poepp. & Endl.	AN	S-C	T	Pi	300–500	A/Wd	M	Mlf
Tribe Areceae								
Subtribe Euterpeinae								
Euterpe precatoria Mart.	OT	S	T	Pi	140–2 000	A-C/Fp	Cn	Mf-Pf
Prestoea acuminata (Willdenow) H. E. Moore	AN	S	T	Pi	800–1 000	C/Wd	M	Mf
Oenocarpus bataua Mart.	OT	S	T	Pi	140–1 200	C-A/Fs	Cn	Mf-Mlf
Oenocarpus distichus Mart.	AM	S	T	Pi	140–250	A/Wd	Cn	Mlf
Oenocarpus mapora H. Karst.	AM	C	T	Pi	140–800	C-A/Fs	M	Mf-Mlf
Hyospathe elegans Mart.	AN	S-C	Sh	Pt	250–600	A/Wd	U	Mlf
Tribe Cocoeae								
Subtribe Butiinae								
Syagrus cardenasii Glassman (*)	CE	S-C	Ac	Pi	250–600	A/Wd	U	Df
Syagrus petraea (Mart.) Becc.	CE	S-C	Ac	Pi	300–800	C/Wd	U	Ps
Syagrus sancona H. Karst.	OT	S	T	Pi	200–1 000	C-A/Wd	Cn	Mf-Mlf
Syagrus (*S. yungasensis*, Moraes 1996b) (*)	CE	S	T	Pi	700–1 000	C/Wd	M	Mf
Syagrus 1 cf. *S. oleracea* (Mart.) Becc.	CE	S	T	Pi	?	C/Wd	M	Ps
Syagrus 2 cf. *S. comosa* (Mart.) Mart	CE	S	Sh	Pi	?	C/Wd	M	Ps
Parajubaea torallyi (Mart.) Burret (*)	AN	S	T	Pi	2 700–3 400	C/Wd	Cn	If
Parajubaea sp. (*P. sunkha*, Moraes 1996b) (*)	AN	S	T	Pi	1 700–2 200	C/Wd	Cn	If
Allagoptera leucocalyx (Drude) Ktze.	CE	S-C	Ac	Pi	250–800	A/Wd	U	Sv-Ps
Subtribe Attaleinae								
Attalea butyracea (Mutis ex L.f.) Wess. Boer	AM	S	T	Pi	140–400	A/Fp	M-Cn	Mlf
Attalea eichleri (Drude) Henderson	AM	S	Ac	Pi	300–500	A/Wd	U-M	Pf
Attalea maripa (Aubl.) Mart.	AM	S	T	Pi	200–400	A/Wd	Cn	Mlf
Attalea phalerata Mart. ex. Spreng.	AM	S-C	T	Pi	250–900	A-C/Wd	M-Cn	Mf-Mlf-Sv
Attalea speciosa Mart. ex Spreng.	AM	S	T	Pi	300–500	A/Wd	Cn	Pf

Appendix I. Continued.

Taxa	BG	Stm	Lf	Lt	Elev.	Soil	Str.	Veg.
Subtribe Bactridinae								
Acrocomia aculeata (Jacq.) Lodd. ex Mart.	OT	S	T	Pi	250–400	A/Fs	M	Sv
Aiphanes aculeata Willd.	AN	S	T	Pr	200–800	C-A/Wd	M	Mf-Mlf
Bactris acanthocarpa (Mart.) Henderson	AM	C	Sh	Pi	200–300	A/Fp	U	Mlf
Bactris brongniartii Mart.	AN	C	Sh	Pt	140–250	C/Wd	U	Mlf
Bactris concinna Mart.	AM	C	Sh	Pi	140–500	A/Fp	U	Mlf
Bactris elegans Barb. Rodr.	AM	C	Sh	Pi	140–250	A/Fp	U	Mlf
Bactris faucium Mart.	AN	C	Sh	Pt	400–600	A/Fp	U	Mlf
Bactris gasipaes Kunth	OT	S-C	T	Pi	200–400	A/Fp	Cn	Mlf
Bactris glaucescens Drude	AM	S-C	Sh	Pi	200–300	A/Fp	U-M	Mlf
Bactris hirta Mart.	AM	S-C	Sh	Pi-E	140–250	A/Fp	U	Mlf
Bactris macana (Mart.) Pittier	AN	S-C	Sh	Pi	300–800	C/Wd	U	Mf-Mlf
Bactris major Jacq.	AM	C	T	Pi	140–500	A–C/Fs	M	Mlf
Bactris maraja Mart.	AM	S-C	Sh	Pi-E	140–500	A/Fp	U	Mlf
Bactris riparia Mart.	AM	C	T	Pi	140–250	A/Fp	M	Mlf
Bactris simplicifrons Mart.	AM	S-C	Sh	Pt-E	200–400	A/Fp	U	Mlf
Bactris sphaerocarpa Trail	AM	C	Sh	Pt	400–600	A/Fp	U	Mlf
Bactris trailiana Barb. Rodr.	AM	S	Sh	E	140–200	A/Fp	U	Mlf
Desmoncus mitis Mart.	AM	C	Cb	Pc	200–500	A/Fs	U-M	Mlf
Desmoncus orthacanthos Mart.	AM	C	Cb	Pc	300–500	A/Fs	U-M	Mlf
Desmoncus polyacanthos Mart.	AM	C	Cb	Pc	140–600	A/Fs	U-M	Mlf
Astrocaryum aculeatum G. Mey.	AM	S	T	Pi	140–200	A/Fs	M-Cn	Mlf
Astrocaryum campestre Mart.	AM	C	Ac	Pi	350–450	A/Wd	U-M	Pf-Ps
Astrocaryum gynacanthum Mart.	AM	C	Ac	Pi	140–200	A/Fp	U	Mlf
Astrocaryum huaimi Mart.	AM	S-C	T	Pi	250–400	A/Wd	M	Mlf
Astrocaryum jauari Mart.	AM	C	T	Pi	140–200	A/Fp	M	Mlf
Astrocaryum murumuru Mart.	AM	S-C	T	Pi	250–900	A/Wd-Fs	M	Mf-Mlf
Tribe Geonomeae								
Geonoma brevispatha Barb. Rodr.	AM	S-C	Sh	Pi-Pt	150–1 000	A-C/Wd	M	Mf-Pf
Geonoma brongniartii Mart.	AM	C	Ac	Pi-E	200–750	A/Wd	U	Mf-Mlf
Geonoma densa Linden & H. Wendl.	AM	C	Sh	Pi	1 800–2 500	C/Wd	U	Mf
Geonoma deversa (Poit.) Kunth	AM	C	Sh	Pt	200–500	A/Wd	U	Mf-Mlf
Geonoma dicranospadix Burret	AN	C	Sh	Pi	1 400–1 900	C/Wd	U	Mf
Geonoma interrupta (Ruiz & Pav.) Mart.	AM	C	Sh	Pi-Pt	200–750	A/Wd	U	Mf-Mlf
Geonomas jussieuana Mart.	AN	C	Sh	Pt	1 800–3 000	C/Wd	U	Mf
Geonoma laxiflora Mart.	AM	C	Sh	E	140–200	A/Wd	U	Mlf
Geonoma leptospadix Trail	AM	C	Sh	E	140–200	A/Fs	U	Mlf
Geonoma lindeniana H. Wendl.	AN	S-C	T	Pi	350–600	A-C/Wd	M	Mlf
Geonoma macrostachys Mart.	AM	C	Ac	Pt-E	200–400	A/Wd	U	Mlf
Geonoma m vima (Poit.) Kunth	AM	C	Sh	Pi-E	200–350	A/Wd	U	Mlf
Geonoma megalospatha Burret	AN	S	T	Pt	1 500–2 200	C/Wd	M	Mf
Geonoma orbignyana Mart.	AN	C	Sh	Pt	1 300–3 000	C/Wd	U	Mf
Geonoma pachydicrana Burret	AN	C	Sh	Pt	1 000–1 600	A-C/Wd	U	Mf
Geonoma spixiana Mart.	AM	C	Sh	Pi	140–400	A/Wd	U	Mlf
Geonoma stricta (Poit.) Kunth	AM	C	Sh	Pt	250–600	A/Wd	U	Mlf
Geonoma undata Klotzch	AM	C	Sh	Pi	1 400–2 400	C/Wd	U	Mf
Geonoma weberbaueri Dammer ex Burret	AN	S	T	Pi	1 800–3 200	C/Wd	M	Mf
Subfamily Phytelephantoideae								
Phytelephas macrocarpa Ruiz & Pav.	AM	SC	T	Pi	200–500	A/Fs	M	Mlf

Abbreviations: Columns: BG = Biogeographic origin†; Stm = stem; Lf = Life form; Lt = Leaf type; Elev. = Altitude; Soil = Formation/drainage; Str. = Strata; Veg. = Vegetation type; * = endemic to Bolivia.

† Based on Henderson (1994), Moraes (1990), Moraes and Henderson (1991), and Moraes et al. (1995).

The options for each column are the following: BG: AN = Andes; AM = Amazonia; CH = Gran Chaco; CE = Cerrado; OT = Others, mixed. Stm: S = Solitary; C = Caespitose. Lf: T = Tree palms; Sh = "Shrubs," Ac = Acaulescents; Cb = Climbers. Lt: Pa = Palmate leaves; Cp = Costapalmate; Pi = Pinnate leaves; Pr = Praemorse or grouped leaves; Pt = Pinnate, trijugate; E = Entire, Pc = Pinnate with cirrus. Soil: A = Alluvial; C = Colluvial / Fp = Permanently flooded; Fs = Seasonally flooded; Wd = Well drained. Str.: M = Medium; Cn = Subcanopy to canopy; U = Understory. Veg.: Az = Azonal, swamp forests and savannas; Df = Dry lowland forests; If = Interandean dry forests: Mf = Montane rainforests; Mlf = Moist lowland forests; Pf = Semideciduous forests on Precambrian hills; Ps = Semideciduous savannas on Precambrian hills; Sv = Savanna with island forests.

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Floral Biology and Insect Visitation of the Monoecious Palm Prestoea decurrens on the Pacific Coast of Colombia

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ABSTRACT

We studied the floral biology and insect visitation of the monoecious, protandrous palm *Prestoea decurrens* H. Wendl. in Chocó, Colombia. The palm has staminate and pistillate phases of 18 and 7 d duration, respectively. Flowers open in the late morning and staminate flowers abscise in the afternoon the same day. Pistillate flowers apparently are at anthesis for 2 d, and if not pollinated, abscise on the 3rd d. Both staminate and pistillate flowers are whitish-yellow, with no perceptible scent. Staminate flowers offer pollen and both flowers produce nectar. Flies, bees, wasps, beetles, and one species of crab visit the inflorescences regularly during staminate anthesis. Only a few insects visit the inflorescences during pistillate anthesis. Due to their foraging at both morphs and high pollen loads we conclude that halictid bees play the principal role in pollination followed by trigonid bees and small flies.

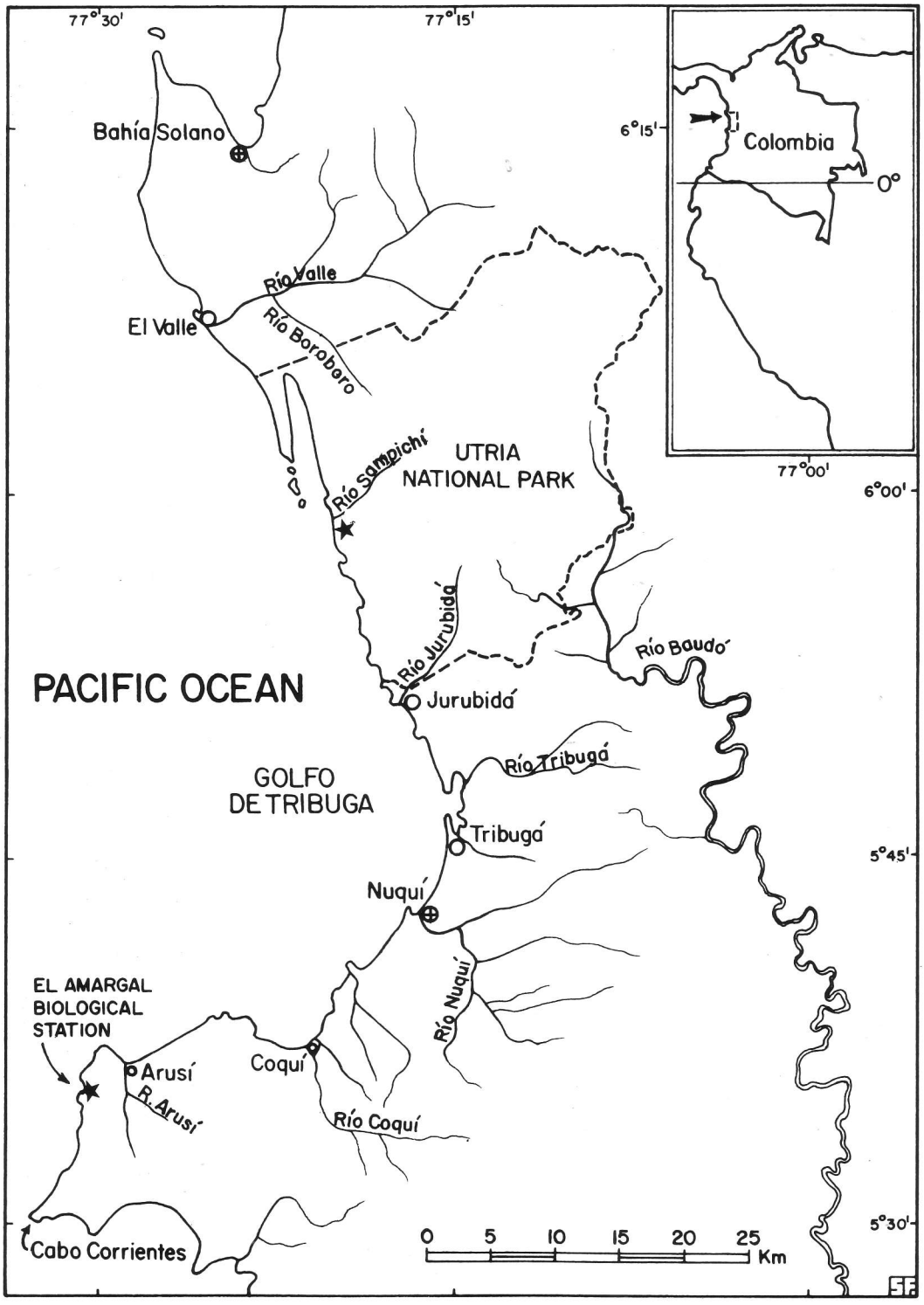
Prestoea is a genus of small to medium-sized, monoecious palms. The genus belongs to the subtribe Euterpeinae of tribe Areceae in subfamily Arecoideae, and consists of 10 species of neotropical distribution (Henderson and Galeano, in press). One species, *P. acuminata* (Willd.) H. E. Moore has economic importance for Ecuador because its palm hearts are canned for export (Balslev and Henderson 1987, Borgtoft Pedersen and Balslev 1992 as *P. trichoclada* (Burret) Balslev and Henderson). Most of the other species have narrow ranges and none of them is much used or cultivated. Few notes exist on the pollination of *Prestoea* despite of the accessibility of the inflorescences in this genus (Bannister 1970, Bullock 1981). This paper seeks to fill this gap by providing data on the floral biology and insect visitors of *P. decurrens* H. Wendl. in Colombia.

Study Sites and Observation Periods

The present study was conducted at two localities of slightly disturbed primary wet forest (*bosque muy húmedo tropical*, according to IGAC 1977). Both were located at 0–20 m elevation in the Department of Chocó, on the Pacific coast of Colombia (Fig. 1). Rainfall in the area ranges between 5 023 mm at Bahía Solano in the north (HIMAT 1993) and 8 080 mm per year at El Amargal in the south (Fundación Inguedé 1994). Investigations were carried out on scattered individuals in a 1.5-ha "tagual" (periodically inundated vegetation dominated by the palm *Phytelephas seemannii* O. F. Cook.) and nearby hills near the mouth of Río Sampichí in the Parque Nacional Utría through March and April 1994. Additional insect collections and observations were made at El Amargal Biological Station in May 1994.

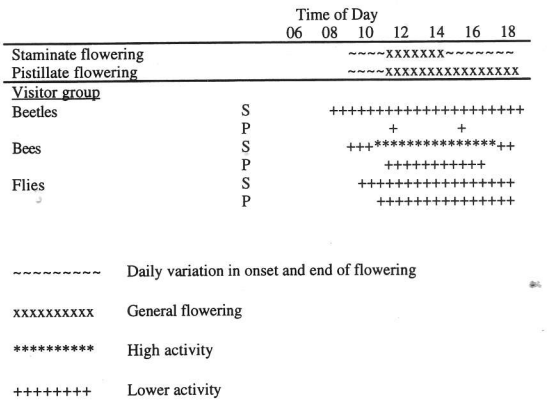
Methods

Seven palms bearing 10 inflorescence buds and exposed inflorescences were tagged for observations. Individual pistillate flowers were marked with a water-based marker pen in order to study their development. The flowering sequence and insect activity were recorded on daily visits. Insect visitors to the staminate flowers were observed for 6 h and to the pistillate flowers for 5 h. The presence and position of nectaries were tested using glucose testing paper (Clinistix℠). A solution of neutral red that stains fatty substances (includ-



1. Location of the Gulf of Tribugá. Study sites are marked with stars.

2. Inflorescence of *Prestoea decurrens*.



3. The diurnal pattern of visitation of the different insect groups to inflorescences of *Prestoea decurrens* in relation to flowering. S: visitation to staminate phase inflorescences. P: visitation to pistillate phase inflorescences.

ing oil-containing cells) was used to test for the presence of pollen kitt and scent-producing floral parts (Vogel 1990). The temperature of a selected inflorescence was measured before and after splitting of the peduncular bract. A digital thermometer with a 2 mm diameter probe was inserted in the center of the bud or flower-bearing parts. In order to reveal the specificity of the visitors to *Prestoea decurrens*, insects were also collected on several co-existing palm or palm-like species, including *Cocos nucifera* L., *Phytelephas seemannii* O. F. Cook, *Welfia regia* H. Wendl. ex André (Palmae), *Asplundia* sp., and *Carludovica palmata* Ruiz and Pav. (Cyclanthaceae). Vouchers of the palm have been deposited at AAU, COL, and FMB. Insect vouchers have been deposited in the entomological collections at Instituto de Ciencias Naturales, Universidad Nacional de Colombia, at INDERENA, Bogotá, at the Zoological Museum, University of Aarhus, and at the respective institutions of the specialists that helped with identifications. Numbers are given to some of the species and one genus in order to make possible comparisons with other publications of the specialists (see Acknowledgments) or the authors.

Results

Prestoea decurrens is a medium-sized cespitose palm with 2–7 stems up to 7 m tall and 12 cm in diameter. It is common along rivers and streams in lowland wet forests from Nicaragua to western Ecuador. Inflorescences of *P. decurrens* are branched to one order with 36–68 rachillae ($\bar{X}$ = 50.3, N = 7) (Fig. 2) that are enclosed in bud by a single, slender peduncular bract. Flowers are unisexual and generally grouped in triads of two lateral staminate and one central pistillate flower. The development of the pistillate flowers is often suppressed at the distal end of each rachillae, resulting in staminate dyads. Each rachilla bears from 206 to 320 triads ($\bar{X}$ = 268.3, N = 4) and from two to 18 dyads ($\bar{X}$ = 6.5, N = 4). Flowers of both morphs are whitish-yellow with no perceptible odor. The filaments and the connectives stained weakly red with neutral red. This may indicate that these tissues produce a very weak scent. No other tissues in the inflorescence changed color. Staminate flowers offer pollen and both staminate and pistillate flowers produce nectar. Pollen of *P. decurrens* is sticky. It stained when treated with neutral red, which indicates presence of pollen kitt.

The individuals studied flowered throughout the period of observation; and the presence of buds

Table 1. Visitors to the inflorescences of Prestoea decurrens. *Relative abundances are indicated as follows: very common (***), common (**), uncommon (*), and not observed ( ). Localities at which the insects were observed: A = El Amalgal, S = Sampichí. Insects observed on other hosts were marked with a number and letter (s = staminate, p = pistillate) referring to host plant species and its phase.* Cocos nucifera *(1)*, Phytelephas seemannii *(2)*, Welfia regia *(3)*, Asplundia *sp. (4), and* Carludovica palmata *(5)*.

Order/Family Subfamily or tribe	Visitor	Staminate Phase	Pistillate Phase	Locality	Other Hosts
Coleoptera					
Chrysomelidae					
Alticinae	*Brasilaphthona* sp. 2	**		A	
	Near *Centralaphthona* sp. 1	**		S	
	Near *C.* sp. 3	**		S	
	Hypolampsis sp. 3	**		A	
Galerucinae	*Monolepta* sp.	**		A	
Curculionidae					
Baridinae, Centrinini	*Bondariella* sp. 3	**		S	
Cholinae	*Cholus cananchensis* Heller	**		A, S	
Erirhininae, Derelomini	*Phyllotrox* sp. 27	**		S	4s, 5s
	P. sp. 28	**	*	S	5s
	Genus 2, sp. 1	**		S	5s
Staphylinidae					
Aleocharinae	*Amazoncharis?*	*		S	
Diptera					
Cecidomyidae	Cecidomyidae sp. 1		**	S	
	C. sp. 2		**	S	
	C. sp. 3		**	S	
Chloropidae	Chloropidae sp. 1	*		A	
Drosophilidae	*Drosophila* sp.	**	**	S	
Milichiidae	Milichiidae sp. 1	*		A	
Mycetophilidae	Mycetophilidae sp. 1		**	S	
Hymenoptera					
Apidae					
Meliponinae	*Plebeia* aff. *minima* (Gribodo)	**		A, S	
	Trigona spinipes	**	*	S	
	T. williana Friese	**		S	2s/p
Halictidae	*Dialictus* sp.	***		A, S	
	Neocorynura sp.	***	**	A, S	
	Undet. sp. 1	***		A, S	
	Undet. sp. 2	***		S	
	Undet. sp. 3	***		S	
Decapoda					
Grapsidae	*Sesarma* cf. *miersii* Rathbun	**		S	

of different degrees of development suggests that this species flowers throughout the year, a fact confirmed by G. Galeano (personal communication). *Prestoea decurrens* is protandrous with no overlap between staminate and pistillate phases. All flowers are closed at the splitting of the bract and no insects are present. This situation may last for up to 1 d until 9:00 to 11:30 a.m. when the first staminate flowers open and anthers dehisce (Fig. 3). Individual staminate flowers are only at anthesis for a few hours and abscise in the afternoon the same day. The staminate phase of the inflorescence lasts 18 d, with daily pulses of up to 1 000 flowers per inflorescence. Then there is a pause lasting two days which is followed by a pistillate phase seven days long. Pistillate flowers also open between 9:00 and 11:30 a.m. The stigmas remain humid and whitish-yellow for 2 d and are probably receptive this long. On the 3rd d they turn brownish, and the flowers either drop

off or start to develop into fruits. No rise in temperature was recorded before or during anthesis.

At least 26 species of insects and one species of crab regularly visited the inflorescences of *P. decurrens* during the staminate phase (Fig. 3, Table 1). Halictid bees came in tens and were the most conspicuous and numerous insects. They moved along the rachillae and busily collected pollen. We observed that at least one species stored pollen grains on the ventral side of its body. Each insect usually foraged for several minutes before leaving. Also meliponid bees collected pollen, but they were usually fewer than the halictids. Small flies (*Drosophila*, Chloropidae, Milichiidae, Otitidae) often visited the staminate flowers by the tens. They were all observed to forage on nectar. Whether they also eat pollen is unclear. Less than 30 individuals of small chrysomelids and curculionids visited the inflorescences particularly during daytime. They fed on pollen grains and nectar and used the inflorescence as a site for copulation. Usually a few individuals (<5) deviated by staying over night on the inflorescences, mostly resting inactive along the rachillae. The most conspicuous of the beetles was *Cholus cananchensis*, a 10 mm long, yellow and black curculionid. A few of them (<10) stayed on the rachillae for hours, often with the purpose of copulating. All beetles were passive and rarely arrived and left the inflorescences compared with the bees and most of the flies. A nectar-eating crab (*Sesarma* cf. *miersii*) visited the staminate flowers during daytime. Typically two or three individuals at a time clung to the rachillae while feeding on nectar using their claws. These crabs mostly ascended in the morning and descended in the afternoon the same day.

There were fewer visitors to the inflorescences in the pistillate phase in terms of both individuals and species (Fig. 3). During a 5-h period of observations at a particular inflorescence during pistillate anthesis, the following insects were recorded as visitors: ≈50 Cecidomyidae and Mycetophilidae, 15 Drosophilidae, five Halictidae, three small unidentified Diptera, two Meliponidae, one Otitidae (?), one *Phyllotrox*, and one small unidentified beetle (Table 1). They all foraged on nectar. The bees moved from flower to flower and often touched these with their mouthparts, their legs, and their abdomen. They typically visited two or three rachillae before leaving.

We have no data on fruit set, but we observed that a Madarini weevil (Baridinae, Curculionidae) frequently bored holes in unripe fruits, which subsequently dried out. This fruit predator was common at both localities.

Discussion

Inflorescence phenology of *P. decurrens* in Colombia follows the pattern described by Bullock (1981) for the same species in Costa Rica, where however, the staminate phase lasted only 10–14 d, and the pistillate phase only 3 d. The pause between the two phases was similar at both localities. Fertilization of a flower by another from the same plant (geitonogamy) in this species is probably a rare phenomenon. First, there is no overlap of staminate and pistillate phases of one inflorescence. Second, consecutive inflorescences on the same stem usually have a great difference in developmental stage; thus when an inflorescence enters the staminate phase, the pistillate phase of the previous inflorescence has passed several weeks ago. Third, the probability of simultaneous staminate and pistillate phases on different stems of the same cluster is low because there are few stems in each cluster (mostly 1–4), and flowering appears to occur throughout the year.

Wind pollination of *P. decurrens* is probably insignificant because pollen apparently has pollen kitt and therefore is sticky, and because winds in the habitat of this palm are rarely of any strength. We also rule out the importance of beetles in pollination, although a few of them were present both at staminate and pistillate anthesis. First, they were typically staying passive for hours and rarely visited the flowers to feed on nectar and pollen. Second, they rarely moved between inflorescences. Also the crab was sedentary and therefore probably did not contribute to pollination.

Diptera were the most common visitors to female inflorescences in terms of number of individuals. However, none of them belonged to the groups known as efficient pollinators, as, e.g., Syrphidae. For various reasons we consider the role of flies visiting *P. decurrens* less important than the bees. To begin with, the flies were more passive than the bees when visiting an inflorescence. Next, compared with the bees, flies rarely traveled between inflorescences. Also, all the flies visiting *P. decurrens* were very small and usually sparsely haired, and therefore incapable of transporting large loads of pollen grains. Additionally, the flies were rarer than the bees on staminate inflorescences. Schmid (1970) cited the same reasons to rule out small flies as pollinators of *Asterogyne martiana* (Mart.)

H. Wendl., and different studies have actually demonstrated that drosophilids did not carry any or only little pollen when visiting pistillate flowers of the palms *Aiphanes erinacea* (Karst.) H. Wendl. (Borchsenius 1993), *Aphandra natalia* (Henderson & Balslev) Barfod (Ervik 1993), and *Phytelephas seemannii* (Bernal and Ervik, in press).

The meliponids usually collect pollen on many different taxa of plants (Heithaus 1979) (i.e., they are polytropic, see Grant 1949, Faegri and van der Pijl 1980) and *Trigona williana* was much more abundant at the inflorescences of the nearby and abundantly flowering *Phytelephas seemannii* (Bernal and Ervik, in press). The probability was therefore high that the meliponids brought more foreign than co-specific pollen when visiting pistillate flowers of *P. decurrens*. The halictids, in contrast, were oligotropic (visiting some related taxa of plants only) or apparently even monotropic (visiting one single or some closely related plant species only). We never observed them on any other plant species. There is therefore a high chance that they bring exclusively co-specific pollen. Both the behavior and abundance of the halictids (Table 1) and their potentially large pollen loads suggest that they were the most important pollinators of *P. decurrens*. Populations of bees are, however, often varying in both composition and size during the year. This phenomenon is correlated with the degree of sociality: eusocial bees are less seasonal than solitary bees (Heithaus 1979). The family Halictidae exhibits a wide range of social systems. We do not know the degree of sociality or seasonality of the Halictidae visiting *P. decurrens* and therefore cannot rule out the possibility that the fauna of bees pollinating *Prestoea decurrens* changes during the year. Bullock (1981) observed a whole set of different species of bees visiting *P. decurrens* flowers in Costa Rica from December to September. These included two species of *Trigona*, one *Neocorynura*, one *Lasioglossum*, and one unidentified Halictidae. Bullock suggested that bees were the pollinators, but did not point to any species as being particularly important.

The general morphology and phenology in *Prestoea* agree well with the syndrome of bee pollination (melittophily) in palms suggested by Henderson (1986). Melittophily is likely to be a widespread pollination syndrome in *Prestoea*. A study by Bannister (1970) supports this assumption. She reported that *Prestoea acuminata* (Willd.) H. E. Moore (as *Euterpe globosa* Gaertn.) was protandrous with a very short overlap between staminate and pistillate phases in Puerto Rico. She considered "honeybees and small flies" to be pollinators.

In the palm family melittophily along with cantharophily and myiophily are considered the major pollination syndromes (Henderson 1986). Later studies have added new documentation to this statement (Zona 1987, Bøgh 1996). Halictid bees, however, have not been addressed any special attention, although they often visit palms (Olesen and Balslev 1990) and also participate in the pollination of at least some palms including *Sabal* (Zona 1987 and references therein).

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CHAPTER NEWS AND EVENTS

(By Jim Cain unless otherwise noted)

News from North Queensland

The North Queensland Palm Society (NQPS) met on February 5 at Tumbetin Lodge, The Palmetum, Townsville. Bob Smyth, from the Chemical Department, James Cook University, spoke to the group on chemicals in the garden.

The group met again on March 4 and scheduled further 1996 general meetings for April 1, May 6, June 3, July 1, August 5, September 2, October 7, and November 4, all at Tumbetin Lodge starting at 7:30 p.m. In addition there will be a Palm Lovers' Weekend held during the Queen's Birthday weekend celebration on June 8–9, since last year's celebration was such an overwhelming success.

There will also be a PACSOA weekend on October 11–13, in conjunction with the Townsville Branch and Friends of the Palmetum. This will feature Don Hodel from California, author of "*Chamaedorea Palms,*" Ray Osborne from Africa, John Dowe, and two others yet to be confirmed.

Year 1996 will culminate on December 2 with the Society Christmas Party. NQPS Officers for 1996 are: Lorraine Tooth, President and Treasurer; Jill Whatley, Vice President; Kerry Robertson, Secretary.

News from Mackay and Rockhampton (Queensland, Australia)

Six members of The Palm and Cycad Society of Mackay (branch of PACSOA) traveled to Rockhampton on December 2-3, 1995, as guests of the Rockhampton Palm and Cycad Society. Visits were made to the garden of Allan and Jenny Moorhead, followed by the Rockhampton Botanic Gardens. In addition to viewing the many plants, members were given a taste of a rare fruit, Grumichamas. Palms featured in the Rockhampton Botanic Gardens included lovely specimens of

(*Continued on p. 111*)

Principes, 40(2), 1996, pp. 93–102

Uses of Some Indigenous Vanuatu Palms

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The first European to record the uses of Vanuatu plants was the Portuguese voyager Pedro de Quiros who visited Espiritu Santo in 1606. In the journals of his voyage there are many references to the coconut palm (*Cocos nucifera* L.), and how it was locally used for thatch, utensils, and food (Zaragoza 1876, Markham 1904, Yen 1973). Subsequent naturalists and explorers, such as Forster (1777, 1786), MacGillivray (1853), and Angas (1866) also noted the uses of palms, in particular semidomesticated species such as the coconut and sago palms (*Metroxylon* and *Caryota* spp.), and the betel nut (*Areca catechu* L.). In recent times, researchers have presented detailed studies of a few indigenous domesticated palms (Barrau 1958, 1959; Gowers 1976, Walter and Bourdy 1987; Yen 1982, 1985), though the first comprehensive account of the use of both wild and domesticated Vanuatu palms was provided by Cabalion (1989), who based his studies on his own extensive field work.

Background

Vanuatu is a long, narrow y-shaped archipelago of volcanic origin situated south-east of the Solomon Islands, west of Fiji and north-east of New Caledonia, in the south-west Pacific Ocean, between longitudes 166°45′E and 170°20′E and latitudes 13°05′S and 20°20′S. Permanent settlement by Melanesian peoples is estimated to have begun ≈3 500 yr ago (Spriggs 1984). Presently, only 12 of Vanuatu's 80 islands (total area of ≈12 300 km^2) have significant populations (altogether 142 000 people, cf. 1991 census), most of whom live in rural villages with limited economic development. Average population density is 11.6 persons/km^2 while rural population (≈85% of total) is 9.5 persons/km^2 (AIDAB 1992). The only significant urban area is the capital city, Port Vila, which has ≈17 000 inhabitants, many of whom are expatriates employed in government, tourism, or business. The rural population consists primarily of traditional multicrop subsistence farmers who also maintain small holdings of permanent cash crops (Weightman 1989). By necessity, they use the local forests as essential sources of building material, food, and medicine.

The larger islands are mountainous with average elevation above 300 m, and account for 60% of Vanuatu's land-surface area. The highest peak is Mt. Tabwemasana (1 887 m) on Espiritu Santo. There are five active volcanoes throughout the country. Rainfall is above 1 800 mm/yr in most localities, and exceeds 5 000 mm/yr at high elevations. Four to five cyclones affect severely some part of the archipelago every year.

Vegetation is dominated by moist forest. Primary and secondary forest account for ≈35% of land area, while ≈25% is used for settlement and agriculture (AIDAB 1992). There are estimated to be ≈2 000 species of higher plants occurring in Vanuatu. Floristically the vegetation is most closely related to that of Fiji and secondarily to that of the Solomon Islands. The endemism rate for species is ≈16%, for genera ≈0.5%, and there are no endemic families. The palm flora displays a much higher rate of specific endemism (≈74%) than do most other families. Indeed Vanuatu's only endemic genus (*Carpoxylon*) is a palm.

The palm flora, as treated by Dowe and Cabalion (1996), includes 21 species in 15 genera, of which 14 species and one genus are endemic. Affinity of the palm flora lies predominantly with that of Fiji.

Observations

This paper treats five species of palms (*Carpoxylon macrospermum*, *Clinostigma harlandii*, *Licuala grandis*, *Veitchia macdanielsii*, and *V. spiralis*), which were incidentally encountered during field work involving the '*Carpoxylon* Population Survey' conducted over 5 wk in Novem-

ber–December 1994. In addition to use, custom stories were also recorded for two taxa. Voucher specimens (deposited in BRI) were taken for most species. Information herein presented was obtained from numerous informants who were approached and interviewed in villages during the survey. Photographs were taken as an additional record.

Carpoxylon macrospermum H. Wendl. & Drude (Voucher, *Dowe 0129* [BRI])

Description: single-stemmed, arecoid palm to 28 m tall and trunk to 25 cm DBH. Leaves 10–12 in the crown, to 4 m long, strongly arched; pinnae linear, held erect to form a steep "v." Inflorescences infrafoliar, to 1 m long, with spreading branches. Fruit large, to 6 cm long by 3.5 cm in diameter, dark red at maturity, ovoid-ellipsoid with an obliquely orientated subapical cone of stigmatic residue (Fig. 1). Fruit may mature at any time in the year, though there is a climax during February to June.

Distribution: natural populations are confined to Aneityum, Futuna, and Tanna in lowland rain forest; otherwise sporadically cultivated in villages on other islands.

Carpoxylon macrospermum is presently the subject of a conservation inquiry (Dowe, in prep.) and is listed as Endangered by the IUCN's Palm Specialist Group (WCMC 1993). According to the 1994 survey, the known population stands at ≈150 mature palms of which ≈30 occur in primary forest (Dowe 1994).

The main uses of *Carpoxylon* include consumption of the fruit, fabrication of brooms from the leaves, and the fashioning of carrying and storage vessels from the prophyll (first inflorescence bract) and leaf sheath. Degree and style of use vary from area to area. In the southern islands, the primary use is consumption of the fruit. Only the endosperm of immature green fruit can be eaten as it becomes extremely hard at maturity. To extract the edible endosperm, the fruit is cut longitudinally with either a knife or with the teeth. The endosperm is of a dense jelly-like consistency (Fig. 2). The nutritive content is undescribed, though it would be expected to be high in protein, digestible carbohydrates, and fats as in typical palm endosperm. "Navara," the sweet flavored developing haustorium and nonfibrous plumular tissues of the germinating seed, is also eaten, particularly by children. Consumption of the fruit and "navara" takes place in all areas where the palm occurs, from both natural populations and cultivated plants.

The making of brooms from the leaves was recorded from cultivated plants on Malakula where *Carpoxylon* is known as *bungool* (Atchin language) or *bunglu* (Tautu language). To make a broom, a dying or recently fallen leaf is obtained. The petiole, which eventually becomes the handle, is cut about midway, while the rachis is also cut about midway and discarded. In some areas, the entire petiole is removed and the rachis itself is smoothed for use as the handle. The pinnae, which are rigid and coriaceous, are cut about one-quarter of the way in from their apices (Fig. 3). The brooms made from *Carpoxylon* leaves are favored over other palm species because of their superior strength and longevity. Old infloresences are also used as brooms in south Espiritu Santo.

Carrying vessels for various purposes are made from the prophyll and the leaf sheath in all areas visited. Most of the vessels are made for daily use—for the preparation and storage of food, as baby-baths, animal feeding troughs, etc. In some parts of Malakula (e.g., Brenwei area) the leaf sheath is made into ceremonial drinking bowls for the consumption of kava (a narcotic beverage extracted from the rootstock and lower stems of *Piper methysticum*) (Fig. 4). Both the bowl and the palm are known as *parkel* (Unmet language) in the Brenwei area. To make these bowls, a leaf approaching senescence is carefully cut from the tree at the point of attachment. Most of the petiole is removed but leaving enough for a handle 30–50 cm long. The sheath is turned inside out, the petiole folded back behind the auricles of the upper sheath and fastened with a root or strong twig. The pressure of the petiole on the root or twig ensures that the leaf sheath remains taut. Following this, the lower half of the sheath is cut off and all the edges smoothed. Oils and resins (from unknown plant species) are liberally applied to all surfaces of the vessel, which is then placed above a smoking fire to be "cured." The surface turns a distinctive dull black color. Use of these particular drinking vessels is reserved for ceremonial occasions. Enough kava is prepared in a single bowl for ≈30 communal drinkers. Some of these bowls were reported to be have been in continual use for over 30 yr. During preparation of the kava, the vessel is supported upon a group of y-shaped branches pushed into the ground inside the Nakamal (kava drinking house).

Carrying vessels made from the prophyll are

much simpler. The shape of the prophyll naturally lends itself to such use and the only adaptation is to tie a piece of *barao* twine (*Hibiscus tiliaceus*), which functions as a handle, between the two ends (Fig. 5).

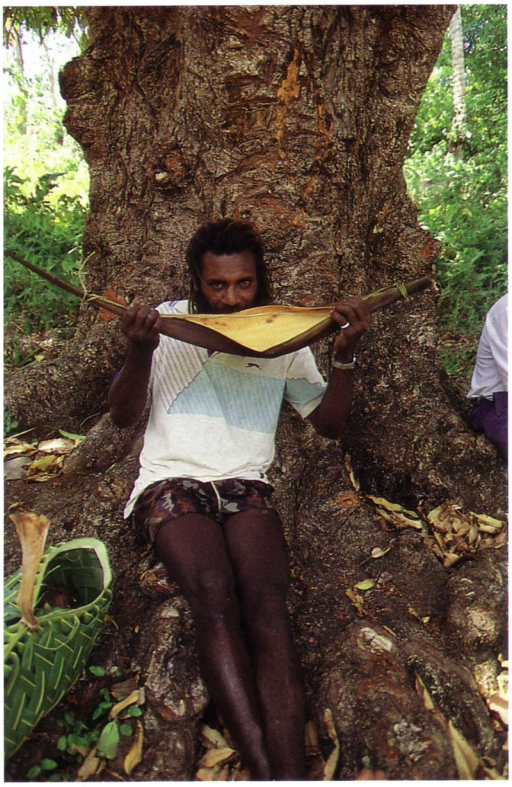
Minor uses of *Carpoxylon* include the making of pipe bowls from the dried endosperm, on Futuna Island where *Carpoxylon* is known as *napuan'savi* (Futuna language); using the fruit (while still attached to the palm) as a lure to assist in the catching of flying foxes, at Norsup, Malakula; and the use of the leaf sheath for a sleeping mat and as a shovel for hot ashes and charcoal in southern Espiritu Santo.

In addition to these uses, it is also grown as an ornamental in some villages.

A custom story relating the supposed arrival of *Carpoxylon* on Aneityum was recorded as follows:

←

1. A cultivated group of *Carpoxylon macrospermum* on a hillside above the village of Umetch, Aneityum. These palms were originally collected from an area nearby where the species occurs in primary forest. 2. Fruit of *Carpoxylon macrospermum*, showing immature endosperm. Fruit are cut longitudinally to reveal the edible portion.



"A long time ago, a tribe of tall light-skinned, wise people came to Aneityum from the east to settle on the south coast of the island. They brought with them the palm which is now known as *nohoich* (Anatom language). From the palm they made a stringed musical instrument, though from which part of the palm and what the instrument looked like are now forgotten. The instrument made a very loud sound which soon began to annoy the local people. Eventually the local people could not tolerate it any longer and so drove the newcomers from the island. All that the newcomers left behind

3. Above left. *Carpoxylon macrospermum* brooms at Lalep village, Malakula. These brooms are favored over those made from other plants because of their strength and longevity. 4. Above right. Ceremonial kava bowl made from *Carpoxylon macrospermum* leaf sheath at the village of Brewei, Malakula. The leaf sheath is turned inside-out and the petiole held taut by a twig or root placed through the auricles. The distinctive dull black color is the result of curing over a smoky fire following dousing with oils and resins. 5. Drinking vessel made from the prophyll of *Carpoxylon macrospermum*. A handle is made by tying *Hibiscus tiliaceus* twine around both ends. →

6. Left. *Clinostigma harlandii* at 500 m elevation in mossy forest east of Anwaitch, Aneityum. 7. Right. *Licuala grandis* in lowland secondary forest, central Malakula.

were the palm and round carved stones, both of which can still be seen today."

A traditional contraceptive was reported to be made from *Carpoxylon* in the village of Elia, west Espiritu Santo: "A small portion of 'bark' is removed from the lower trunk of the palm known as *olo-olul* (Valpei language) with a sharp knife, and the exposed cortex tissues scraped to form a cotton-wool like mass. This is mixed with water and the juice squeezed into a drinking vessel. A woman seeking contraception drinks the mixture, at least one cupful over four consecutive days to ensure infertility occurs. An antidote to reverse the effect and induce fertility is available. The bulb of *Proiphys amboinensis* (tapon-lapa) is dug up and the inner portions removed or loosened to develop space for the insertion of ≈150 seeds of *Coix lacryma-jobi* (Job's tears or wasil). This article is buried under the path that the woman walks over most frequently when visiting the toilet. After some time, fertility should return."

In the "smol nambas" community of Malakula, the palm is found only on "tabu" sites and planted at valuable taro patches. Informants related that it is "tabu" to give information on the palm and that only certain persons have customary rights to such activities. In this area, the fruiting of the palm is associated with the maturation and harvest of yams.

Clinostigma harlandii Becc. (Voucher *Dowe 0133* [BRI])

Description: stilt-rooted, single-stemmed arecoid palm to 25 m tall and trunk to 25 cm DBH. Leaves to 4 m long, gracefully arched; pinnae linear, narrow and pendulous. Inflorescence infrafoliar, large and spreading. Fruit globose, crimson at maturity, to 1.5 cm in diameter, stigmatic remains subapical (Fig. 6).

Distribution: confined to altitudes above 400 m; common in cloud forest throughout Vanuatu.

This palm is of particular significance on Aneityum as a "tabu" plant involved in ritual and magical activities. The following story concerning the "power" of *Clinostigma*, was recorded: "If any part of this palm, known as *naprae* (Anatom language), is brought into a village or a house, either a marriage break-up or family disturbance will result. The cause of abandonment of some villages can be attributed to this palm. If someone wants to spoil another person's garden or plantation, parts of the palm are placed down-wind so that the "fumes" of the palm will drift through the other person's plants, thus causing sterility, lack of pollination, or even for plants to die. In addition, a negative spirit known as *paralelgrhé* (Anatom language), which affects women, can be forced from an inflicted woman by the application of the sap from the pinnae to the woman's skin by rubbing."

Use of the palm in the "smol nambas" community on Malakula, where it is known as *neglep*, is confined to a temporary thatch and the leaf sheath is adapted as a utensil in the cooking of "laplap."

Licuala grandis H. Wendl. ex J.J. Linden

Description: small fan-leaved palm to 4 m tall and stem to 15 cm DBH. Leaves suborbicular, entire, to 1 m in diameter, on thin basally spined petioles. Inflorescence interfoliar, to 2 m long. Fruit globose, orange/crimson at maturity, to 2 cm in diameter (Fig. 7).

Distribution: confined to lowland and moderate-elevation rain forest, from the Santa Cruz Group in the southern Solomon Islands through the northern islands to Efaté.

A previously unrecorded use for *Licuala grandis* was noted on Malakula (Norsup area), where the species is known as *nbunebune* (Tautu language). The leaves are used in roof construction as an additional measure for water-proofing. The leaves are collected from wild plants. They are placed consecutively one upon the other so that the abaxial side of the petiole of the one above interlocks with the adaxial petiole of the one below, thus forming a relatively close fit (Fig. 8).

Veitchia macdanielsii H.E. Moore [Dowe and Cabalion (1996) now consider *Veitchia winin* H.E. Moore to be a synonym of this taxon.]

Description: single-stemmed arecoid palm to 30 m tall and trunk to 20 cm DBH. Leaves to 4.5 m long; pinnae semipendulous, with praemorse apices. Inflorescence infrafoliar, to 1.2 m long. Fruit to 3.5 cm long, bright red at maturity, ovoid, stigmatic remains apical to slightly subapical (Fig. 9).

Distribution: lowland rain forest on Malakula, Espiritu Santo, and Pentecost. On Malakula it is an exceptionally common and dominating species, but on the other two islands is only of limited occurrence.

The primary use of this species is in house construction, for beams, walls, benching, and ridging. In western Espiritu Santo, the distinctive verandaed houses, which are most common in villages between Olpoi and Tasariki, very often have the corner ridges held down by split and hollowed-out trunks (Fig. 10). *Veitchia macdanielsii* is known as *niniu takariki* at Olpoi and *matutu* at Vasalea (Valpei language), and *urur* at Nukuku and Penouru (Nukuku language). Doors and some walls are made of split trunks. In east Malakula, where the species forms extensive populations, attractive walls (Fig. 11) and solid benches (Fig. 12) are made from split trunks. The species is known as *winin* (Tautu language), *nini* (Wala language), and *bangul varvin* (Lepaxsivir language).

In drier areas where irrigation has by necessity been developed, hollowed trunks are used as aqueducts (Fig. 13). Some of these "primitive" irrigation systems, which convey water tens of kilometres from the source, have been in use for many centuries and are a feature of several villages in west Espiritu Santo.

As with most other species of arecoid palms in Vanuatu, the leaf sheath is used to make carrying and storage vessels. Of particular interest is the making of "regular-use" kava drinking bowls in Brenwei (Malakula) (Fig. 14), where the palm is known as *ndidi* (Unmet language). In contrast to the ceremonial bowls made from the leaf sheath of *Carpoxylon macrospermum*, the bowls made from this species are much smaller, have a limited life and are constructed as a "throw-away" item.

Veitchia spiralis H. Wendl. (Vouchers, *Dowe 0122* and *0131a* [BRI])

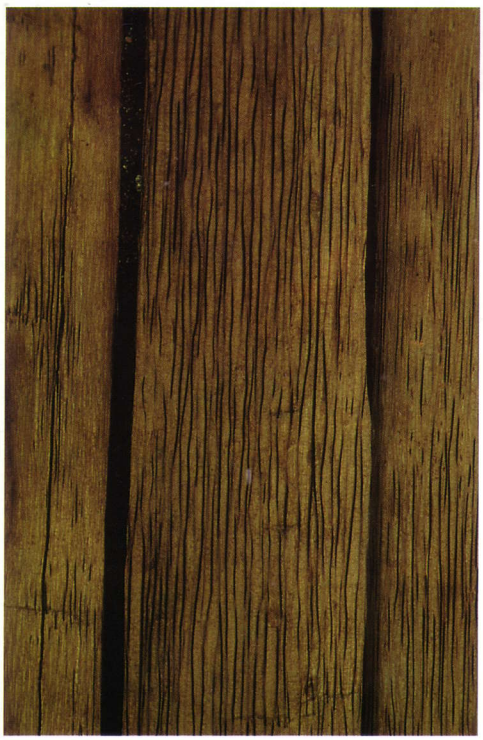
Description: single-stemmed arecoid palm to 25 m tall and trunk to 20 cm DBH. Leaves to 5

m long; pinnae semipendulous with praemorse apices. Inflorescence infrafoliar, to 1 m long. Fruit subglobose to ellipsoid, to 4 cm long by 3 cm in diameter, red at maturity, stigmatic remains apical (Fig. 15).

Distribution: confined to Aneityum and Futuna, in lowland rain forest on volcanic soils.

The split trunks of this species are commonly used on Aneityum as part of the roof structure of houses (Fig. 16). The fruit are sought after as bush-food by villagers working away from home. The endosperm of green fruits only is consumed. The palm-heart from juvenile palms is also commonly eaten. Ceremonial custom spears are made from the dense outer cortex of the trunk and carrying and storage vessels are made from the leaf sheath. The palm is known as *nakoi* (Anatom language) on Aneityum and as *na'puau* on Futuna (Futuna language).

8. Roof ridge in which leaves of *Licuala grandis* have been used as an additional measure to ensure water-proofing, Norsup, Malakula. 9. *Veitchia macdanielsii* in a patch of remnant forest, west Espiritu Santo. →



10. Upper. Roof corners are held in position with hollowed-out trunks of *Veitchia macdanielsii*, Olpoi village, west Espiritu Santo. 11. Lower left. Detail of house wall constructed of split trunks of *Veitchia macdanielsii*; the black sclerotic fibers within the cortex of the trunk make an attractive pattern (Lakatoro, Malakula). 12. Lower right. Roadside food stall bench constructed of split trunks of *Veitchia macdanielsii* (Wormet, Malakula).

13. Upper left. Aqueduct made from hollowed-out trunk of *Veitchia macdanielsii*; water is conveyed many kilometres from the source to irrigate taro ponds and other gardens (Tasiriki, Espiritu Santo). 14. Upper right. Kava bowl made from the leaf sheath of *Veitchia macdanielsii*, Brenwei village, Malakula. These bowls are roughly constructed, are not treated with oils or resins, and are considered throw-away items of limited life. 15. Lower left. *Veitchia spiralis*, Anetchininbeke, east Aneityum. Extensive stands of this palm occur in the valleys and adjacent slopes in east Aneityum. 16. Lower right. Roof construction using split trunks of *Veitchia spiralis*, Anelghowhat, Aneityum.

Acknowledgments

I would like to thank Mr Japeth Hidson who acted as translator and guide in the field, and to Suliana Siwatibau for her helpful comments on the manuscript. This account was in part made possible with support provided by USAID under the terms of Co-operative Agreement No. 879-0023-A-1241-00 supporting the Profitable Environmental Protection Project of the Foundation for the Peoples of the South Pacific.

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Error in Notice of Membership Dues

Annual membership dues for IPS have not increased but remain $25.00 in USA and $30.00 in other countries, NOT $30.00 and $35.00, respectively, as listed on the inside front covers of *Principes* in October 1995 and January 1996!

1996 Biennial Meeting in California

Please make your plans for the 1996 Biennial Meeting of the IPS to be held at the Hyatt Newporter Hotel in Newport Beach, CA in August 1996. Official events will be held on August 3–9, with other related events before and after. Tentative tour sites are Huntington Gardens, Sherman Garden, Los Angeles Arboretum, Lotusland, and many private gardens.

The meetings in Southern California will be followed by post-biennial trips to Ecuador. The post-biennial trip to Ecuador will tentatively start on Saturday, August 10, and probably run ten days/nine nights. The post-biennial tour will be offered on an all inclusive basis (including round trip airfares from Los Angeles). More later as details are finalized.

Principes, 40(2), 1996, pp. 103–111

Palms Over L.A.: Conspicuous by Their Nature, Not Their Numbers

DONALD R. HODEL
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Attendees at the 1996 International Palm Society Biennial Meeting in the Los Angeles area may be curious about the palms conspicuously gracing the skyline and seemingly found everywhere in the region. Many people, especially IPS members, are aware that there are no native palms occurring naturally in Los Angeles, a fact that surprises the uninformed since palms are so closely associated with and emblematic of this teeming and diverse metropolis and its irrepressible lifestyle. Whether it is tall fan palms silhouetted in the sunset, lining a beach, framing the Hollywood sign on the hills in back of the city, or even going up in flames when torched in a civil uprising, palms are the symbol of the city where image is everything and reality is often nothing. The reality in this instance is that the nearest naturally occurring palms are ≈ 160 km (100 miles) east of Los Angeles, around seeps and springs in desert canyons and arroyos at such well-known places as Palm Springs, Palm Desert, and Twentynine Palms. Here are some little-known facts about palms in and around Los Angeles, which, I hope, will help to increase the appreciation of these plants by visitor and resident alike.

Prevalence of Palms in L. A.

Despite this close association of palms and Los Angeles, how really common are palms in this vast metropolis? Surprisingly, palms are not that common in the greater Los Angeles area. Using aerial, color-infrared photographic images obtained from a NASA U-2 overflight and corroborated with ground sampling, researchers at the University of California were able to map and determine the extent and composition of the urban vegetation of the Los Angeles basin, an area of 4 504 km² (1 760 square miles) stretching from west Los Angeles, Malibu, and the San Gabriel Valley through much of Orange County to the south. Miller and Winer (*Urban Ecology* 8:29–54. 1984) determined that urban vegetation covered over half (58%) of the area, while natural vegetation (33%), agricultural land (2%), and nonvegetated areas (7%) covered the remainder.

After random sampling of 20 plots in the area covered by urban vegetation, Miller and Winer estimated that palms accounted for only 2% of all species, a figure that would be even less if naturally vegetated areas were included. The most common palms were the Mexican and California fan palms (Fig. 1) (*Washingtonia robusta* and *W. filifera*), the queen palm (*Syagrus romanzoffiana*), and the Canary Island date palm (*Phoenix canariensis*). Shrubs (66%), trees (21%), ground covers (10%), and turfgrasses (1%) composed the remainder of the species.

Palms did not fare better in a follow-up study, either. Using data from the same sources as the earlier study, Brown and Winer (*Photogrammetric Engineering and Remote Sensing* 52:117–123. 1986) estimated that palms accounted for 0.7% of the areal cover in the urban vegetated area, a figure that shrinks to a minuscule 0.4% if the entire Los Angeles basin is included. Turfgrasses covered nearly half (48%) the urban vegetated area, followed by trees (35%), shrubs (11%), and ground covers (6%).

With palms accounting for only a minor portion of the urban vegetation in Los Angeles, one wonders how they have attained such worldwide notoriety and lofty status as the unofficial emblem of the city and its trend-setting, much imitated lifestyle. The reasons are many and related, and perhaps are connected to the alluring and enduring nature of the palms, their exotic, bold, dramatic foliage that quickly and conspicuously sets them apart from all other plants. In fact, the statements palms make in the landscape and the images they elicit are the same ones that attracted many, if not most, of us to these princesses of plants and their attendant society of devotion and worship.

Los Angeles' fascination with palms really began

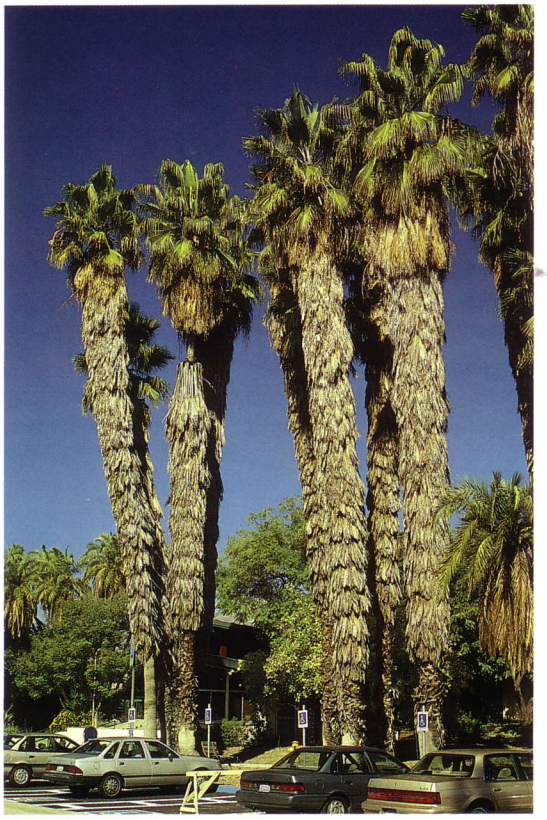
in the late 19th century when land speculators and developers recounted tales of year-round sun and warmth, orange groves, and palm-lined streets to residents of cold, snowy midwestern and eastern U.S. in a successful attempt to lure legions of buyers to newly developed subdivisions. There was some truth to the developers' wild claims; they did plant hundreds of thousands of palms, mostly fan palms, lining the boulevards of their otherwise empty subdivisions. Some of these 100-yr-old plantings still exist and the lofty palms are now 30 m (100 feet) tall or more.

Of course, it has helped more than just a little that Los Angeles developed into the center of our solar system for television and movies, the most influential and image-shaping media in the history of mankind. What better vehicles to trumpet and herald one's perception of how a city or culture is or should be than the little and big screens. Reality could take a back seat. Hollywood needed an emblem, something exotic and alluring yet natural, a picture worth a thousand words, to showcase to the world the image of Los Angeles it wanted to present. Conspicuous by their nature (not their numbers) and already in place, palms fit the bill perfectly. Lights! Camera! Action! The rest is history.

However, all is not just glittering tinsel in Tinseltown. It is not all hype; the facts and figures about palms' minor role in urban vegetation aren't reality. In a city where it is more important whom you are seen with and where you are seen, palms take a back seat to nobody. By their very bold, exotic, dramatic nature, palms have easily commanded the most visible, high profile, strategic locations in the city and landscape.

Palms line the streets and grace the residences from Beverly Hills and Malibu to south-central L.A. Palms decorate the entrances to shopping malls, restaurants, movie theaters, and the important public and private buildings. Palms are conspicuous in parks, near parking structures, and even by freeways. When a statement needs to be made in the landscape, everyone knows where to turn—not a maple, sycamore, ash, or birch, or eucalyptus, bottlebrush, paperbark, or pine, but rather a palm. And palms are not about to relinquish their soapbox and be relegated to the back lot, alley, or other low profile, less visible area.

The full story of palms' prominent role in urban vegetation is not told in the numbers and figures of the aerial photography and ground sampling. However, I cannot help but wonder what the results would have been if the researchers had the home and garden of an avid palm collector or two, like that of Ralph Velez for example, in their sampling plots. Talk about data going off the curve!



1. The Mexican fan palm, *Washingtonia robusta*, is the most common palm around Los Angeles, and graces the skyline just about everywhere.

Flower Market Palms

Palms can be found in the most unusual places and times in Los Angeles, like downtown at the flower market in the predawn hours. The Los Angeles wholesale flower market complex is the largest exchange of its kind in the Western Hemisphere. Only the world-famous Aalsmeer Flower Market in the Netherlands surpasses it in size. The Los Angeles Flower Market District, the official name for the flower market complex located in the 700 block of Wall Street, is composed of over 100 businesses handling potted and cut flowers and foliages and related products.

The Los Angeles Flower District is the hub of

Table 1. Palms in the Los Angeles Flower District.

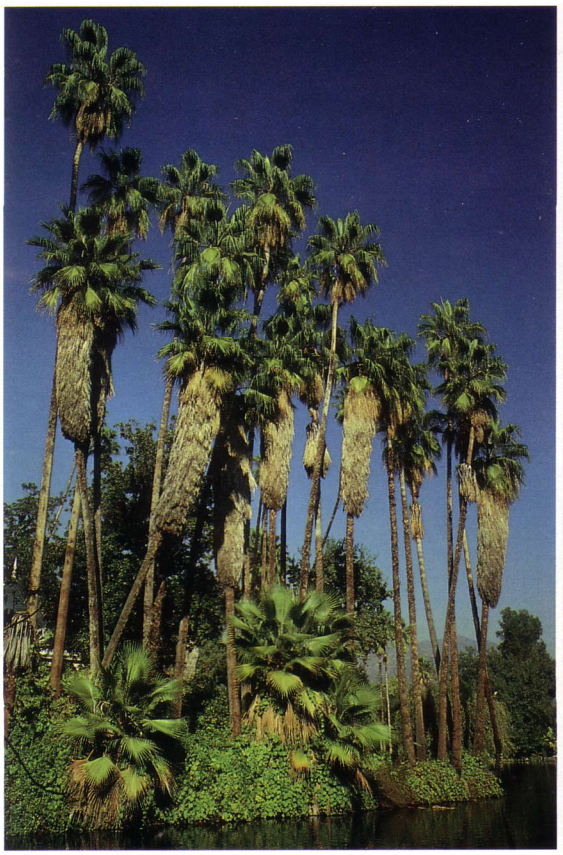
Botanical name	Flower market name	Use
Archontophoenix cunninghamiana	king palm	2, 3
Brahea armata	blue fan palm	2
Brahea edulis	palm fiber	3d
Butia capitata	pindo palm	4
Calamus spp.	cane curl, cane spring, cane core	3d
Caryota mitis	fishtail palm	3, 4
Caryota urens	fishtail palm	3, 4
Chamaedorea elegans	neanthe bella, jumbo	3, 4
Chamaedorea hooperiana	mayan	3
Chamaedorea metallica	metalica	4
Chamaedorea oblongata		4
Chamaedorea oreophila	commodore	3
Chamaedorea radicalis	tepe, commodore	3
Chamaedorea sartorii	commodore, jade, emerald	3
Chamaedorea seifrizii	bamboo palm	4
Chamaedorea tepejilote	commodore, teepee, premium	3
Chamaerops humilis	Mediterranean fan palm	3
Dypsis lutescens	areca palm	3, 3d, 4
Cocos nucifera	coconut palm	3, 4
Heterospathe sp.		3, 3d
Howea forsterana	kentia, sentry palm	4
Licuala grandis	licuala	4
Licuala spinosa	licuala	4
Livistona chinensis		2, 4
Oncosperma tigillarium		4
Phoenix canariensis	date palm	2, 3
Phoenix dactylifera	date palm	2
Phoenix reclinata	date palm	3d
Phoenix roebelenii	pygmy date palm	3, 4
Phoenix rupicola	date palm	3
Phoenix sp.	date palm	3d
Pinanga sp.		2, 5
Raphia farinifera	raffia, palm fiber	3d
Rhapis excelsa	lady palm	3, 4
Sabal sp.	palmetto	3d
Serenoa repens	palmetto	3d
Trachycarpus fortunei	bronxe palm	1d, 3d
Washingtonia filifera	fan palm	2, 3
Washingtonia robusta	fan palm	5

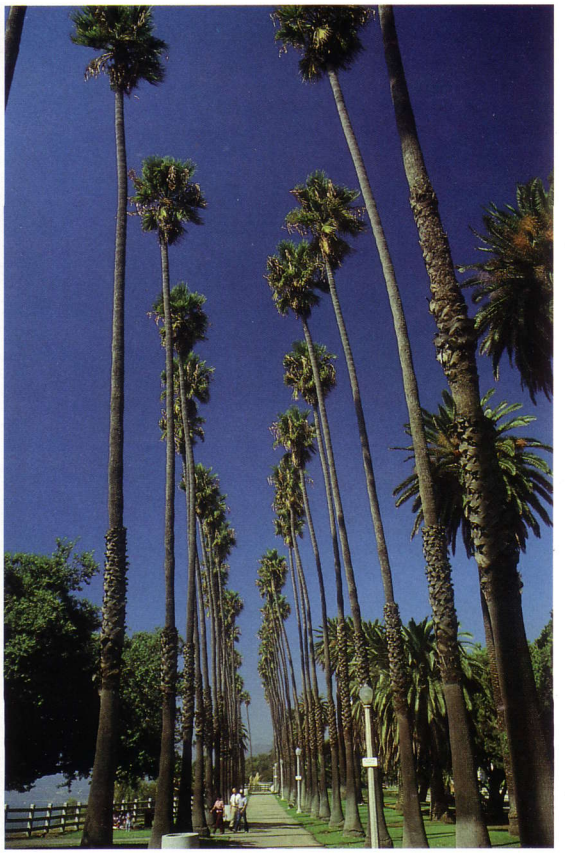
Use codes: 1 = cut flowers or fruits
2 = cut branches with foliage, flowers, and/or fruits
3 = cut foliage
4 = potted foliage
5 = preserved dried whole plant
d = dried

an annual $250 million flower and foliage wholesale movement in southern California. It is estimated that the flowers, foliages, and related products moved through the Wall Street complex have an annual value of nearly $150 million. The bulk of market activity occurs between 2 a.m. and 8 a.m. on Monday, Wednesday, and Friday mornings. Cut flowers and foliages originate from around the world, including California, continental USA, Hawaii, Mexico and Central America, South America, Europe, Australia, southeast Asia, and South Africa. Potted flowers and foliages come mainly from California, Hawaii, and Florida.

Several years ago I surveyed flower and foliage movement in the Los Angeles Flower District (*A Survey of Commodity Movement on the Los Angeles Wholesale Flower Market.* 1985. Los Angeles: University of California Cooperative Extension). I updated the information last year. The survey showed that palms accounted for 39

2. This double *grand allée* of California fan palms, *Washingtonia filifera*, in Azusa is the largest grouping of these trees outside their native habitat. 3. These California fan palms at Rosedale Cemetery were planted in 1885.





4. The tallest Mexican fan palms in the Los Angeles area are at the Arboretum in Arcadia. They are 110 yr of age and well over 30 m (100 feet) tall. 5. These exceptional Mexican fan palms sway and lean in the ocean breezes in Santa Monica.

of the nearly 750 different plants exchanged on the flower market, or ≈ 5% of the total. While not large in quantity on the market, palms and their products are certainly conspicuous nonetheless. The intrepid palm adventurer, not satisfied with only seeing palms around the city during the day, will surely be rewarded with a very early-morning visit to the Los Angeles Flower District. Table 1 shows the palms appearing in the Los Angeles Flower District and in which form or use they were exchanged.

Most palms appeared on the market as cut foliage and/or potted plants. Cut leaves, usually offered in bundles of a dozen or more, mainly originated locally except for those of *Chamaedorea*, which were imported from Mexico, Guatemala, and Honduras. Some rather novel offerings were the cut entire or partial inflorescences or infructescences of palms. Spectacular items in this category included inflorescences of *Archontophoenix cunninghamiana*, *Brahea armata*, *Livistona chinensis*, and *Washingtonia filifera*, and infructescences of *Phoenix canariensis* and *P. dactylifera*. These last products all originated locally. Perhaps the most unusual items were the whole preserved, dried plants of *Pinanga* and *Washingtonia robusta*. In some cases, preserved, dried stems of *Pinanga* were found topped with preserved dried leaves of *Dypsis lutescens*, while similarly treated stems of *Heterospathe* were topped with *Pinanga* leaves.

Remembering that Los Angeles has no native, naturally occurring palms, it is remarkable that of the 39 species of palms (or their products) exchanged in the Los Angeles Flower District, 27 (nearly 75%) originated locally from cultivated plants. This figure underscores the importance of cultivated palms in the urban landscape and the creativity and resourcefulness of sellers who economically and ingeniously exploit them.

6. Planted in the 1880s, these Canary Island date palms, *Phoenix canariensis*, in Elysian Park were part of the first arboretum in Los Angeles. 7. This exceptional pygmy date palm, *Phoenix roebelinii*, at Mt. St. Mary's College has more than 100 heads.

Exceptional Palms

Palms have also played a prominent role in specific historic and cultural events and places around Los Angeles. In 1988, I authored a book, *Exceptional Trees of Los Angeles* (Arcadia, CA: California Arboretum Foundation), which identified and documented individual trees or mass plantings of the same tree, which, due to their age, size, esthetic quality, and historic or cultural value, were exceptional. Palms comprised 12 of the total of 185 trees designated as exceptional in the book. Not surprisingly, the Mexican and California fan palms, with three specimens each, had the most listed as exceptional, followed by the Canary Island date palm with two, and the king palm, Guadalupe fan palm, fountain palm, and pygmy date palm with one each.

↑

8. This row of fountain palms, *Livistona*, lends a formal atmosphere at the Huntington Botanical Gardens in San Marino. 9. Over 200 mature king palms, *Archontophoenix cunninghamiana*, in a dense grove at the Virginia Robinson Botanical Garden in Beverly Hills are a spectacular sight.

10. This intriguing Mexican fan palm is not far from Cal Tech in Pasadena.

Perhaps the two oldest California fan palms in the Los Angeles area survive behind a residence in San Marino, not far from the Huntington Botanical Gardens. Dug by a prospector as seedlings from a native stand in a desert canyon behind Palm Springs, and after surviving an arduous journey by burro, they were planted in the late 1840s at their present location near a spring providing water for the San Gabriel Mission. In the early 1900s, a train station was built at the site and named Palms in honor of the twin landmarks. Left standing as a residential area developed around them, the two palms still tower over a home and are landmarks to this day.

A spectacular planting of more than 200 old mature California fan palms in a double *grande allée* at the entrance to Monrovia Nursery Company in Azusa (Fig. 2) is the largest grouping of these trees outside their native habitat. A similarly impressive planting of the same species and dating to 1885 is at Rosedale Cemetery in central Los Angeles (Fig. 3).

The largest Mexican fan palms in Los Angeles are 100 yr of age and well over 30 m (100 feet) tall. E. J. "Lucky" Baldwin planted them on his estate, Rancho Santa Anita in Arcadia, today known as The Arboretum of Los Angeles County (Fig. 4). A dramatic planting of Mexican fan palms is along the promenade on the bluff overlooking the Pacific Ocean in Palisades Park, Santa Monica (Fig. 5). The double-row planting sways and bends with the brisk, prevailing ocean breezes.

Santa Monica is also home to an astounding, mile-long, parkway planting of Canary Island date palms, situated along Ocean Avenue in Palisades Park above the ocean. Another exceptional planting of Canary Island date palms is at Elysian Park just northeast of downtown Los Angeles (Fig. 6). Planted in the 1880s, this *grand allée* is unsurpassed in number, age, and size of trees, and is a remnant planting of the historic Chavez Ravine Arboretum, the first in Los Angeles.

Not to be overshadowed by its larger relatives, an exceptional pygmy date palm with more than 100 distinct but closely packed heads (Fig. 7) is on the grounds of the Doheny Campus of Mt. St. Mary's College in the West Adams district of Los Angeles.

Two plantings of palms at the Huntington Library, Art Gallery & Botanical Gardens in San Marino are but a small part of the numerous trees designated there as exceptional. A row of fountain palms (Fig. 8) lines the formal north vista from the Art Gallery, and a stunning double-row grouping of Guadalupe fan palms stands watch along a drive.

An exceptional grove of king palms, perhaps the largest planting of this species outside its native Australia, surrounds the main house at the Virginia Robinson Botanical Garden in Beverly Hills (Fig. 9), an affiliate of The Arboretum of Los Angeles County. Robinson, an heiress of the Robinson's department store fortune, planted the grove in 1915 around her home, then the first big estate in Beverly Hills. Specimens of all ages and sizes comprising successive generations intermingle with the parent trees. The dense grove is much as one would find it in its native rain forest habitat.

In closing, I offer a most peculiar but exceptional Mexican fan palm. Although it took some time, this rather avant-garde specimen, near Cal Tech in Pasadena and seemingly with a mind of its own, finally did respond correctly to geotrophic forces and grew upwards (Fig. 10).

CHAPTER NEWS AND EVENTS (*Continued from p. 92*)

Chamaedorea tepijilote, *Laccospadix australasica*, *Bentinckia nicobarica*, *Arenga englerii*, *A. pinnata*, *Borassus flabellifera*, *Livistona mariae*, *L. chinensis*, *Elaeis guineensis*, *Rhapis excelsa*, *Phoenix canariensis*, *P. roebelenii*, *Washingtonia* sp., and *Roystonea* palms. The visit to the gardens was followed by a BBQ, tea and sweets, then by a raffle. A nice *Pigafetta filiaris* brought from Mackay was the first plant to be auctioned.

Sunday, December 3, started with a visit to David Faces to view his cycads and palms. Then to the garden of Jill Stanke, by way of the Rockhampton markets. The Stanke garden has lovely mature palms in the rear of the garden, with lots of foliage plants underneath. From here to the gardens of Jan McCart and Lou Randell, plus stops at a few local nurseries to gather even more plants for the return to Mackay.

Farleigh Mill Palm Gardens were the scene for the December 10 break-up party, jointly held with the Mackay Woodturners. There was a very interesting plant raffle with several "mystery parcels."

News from Southern Queensland

The Southern Queensland Group (SQG) of PACSOA has changed its venue for 1996, now meeting in United Church, New Farm. The venue was recognized as a great improvement. At the January meeting, there was a fine selection of about 25 plants on the raffle table, ranging from large *Encephalartos*, four species of *Dioon*, and species of *Zamia*, *Pinanga*, *Ravenea*, and *Areca*, just to name a few. There was also a seed of the forest coconut, *Voanioala gerardii*, from Madagascar, recently described in the *Palms of Madagascar* book published by Kew Gardens and the International Palm Society. Local SQG elections were also held at the January meeting: President, Vic Wilkins; Treasurer, Nick Craig; and Secretary, Rudy Meyer. A meeting to plan the Annual show was held on February 19.

The Annual Show at Mt. Coot-tha Botanical Gardens was held on March 2 and 3. As usual, thousands of palms and cycads were on show and sale. Note that the Department of Environment and Heritage prohibited the sale of a number of plants, including the foxtail palm, *Wodyetia bifurcata*, and most, if not all, of the Queensland cycads, unless they had the department's sale-approval tags. This action was designed by DEH to limit traffic in endangered native species.

The March 18 Meeting was held at the United Church. Further meetings planned so far for 1996 include May 20 and June 15. An outing to the Sunshine Coast was planned for April 21 as was a June 16 outing at a venue to be advised.

News from Gold Coast–Tweed (Australia)

The Gold Coast–Tweed Palm & Cycad Society of PACSOA met on December 10 at Mt. Tam-

(*Continued on p. 113*)

Principes, 40(2), 1996, pp. 112–113

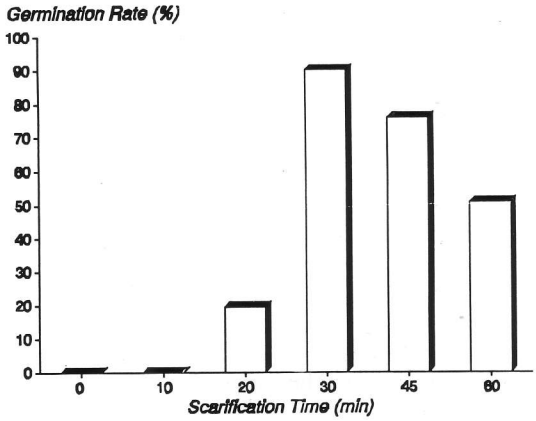
In Vitro Germination of Chamaedorea seifrizii

M. DAQUINTA, O. CONCEPCION, IRIS CAPOTE,
ISABEL COBO, MARITZA ESCALONA, AND C. BORROTO
Bioplant Center, Agricultural Institute of Ciego de Avila, CP 69450 Cuba

Chamaedorea seifrizii Burret is an elegant Mexican palm, which has been something of a collector's item but in recent years has become more common. It is indeed an attractive palm and one well worth growing in the garden or as an indoor plant (Jones 1984).

Ornamental palms are slow-growing plants and consequently, require more time and effort in their production than other plants. Difficulty and poor germinating rate in many species of ornamental palm seeds can delay this production. Germination of palm seed is a gradual process, occurring over a period of weeks or even months. In *Chamaedorea* the time for germination varies from 1 mo to more than 6 mo, depending on species and freshness of the seed. For *Chamaedorea pinnatifrons* it fluctuates between 115 and 125 d (Braun 1968). *Chamaedorea seifrizii* according to our experience in Cuba is similar. On the other hand, *Chamaedorea* palms bear seeds that remain viable for ≈4–6 wk (De Leon 1958). Several methods have been employed to increase the percentage of germination; bottom heat, scarification, and pretreatment with growth regulators are some (Nagao et al. 1980). This work points out the value of scarification of *C. seifrizii* seeds in reducing the germination time.

Mature fruits were collected during September and October, in the Moron Tree Nursery (Ciego de Avila, Cuba). The fleshy outer coats of the fruits (epicarp and mesocarp) were removed by hand friction under flowing water. These coats are an irritant to skin, so the use of gloves is recommended. Fresh seeds were treated with sulphuric acid (96%) for 3, 5, and 10 min. A control was established. Another group of seeds were allowed to dry at laboratory temperature for 7–10 d. Later they were treated with the same procedure but for different times (control, 10, 20, 30, 45, and 60 min). In both cases, after acid treatment, the seeds were washed with sterile water several times. The control seeds were disinfected with $HgCl_2$ (0.1%) for 3 min and washed with sterile water. All seeds were put under sterile conditions into glass flasks with MS (Murashige and Skoog 1962) solid medium. No growth regulators were used. The pH of the medium was adjusted at 5.6–5.7 before adding agar (0.8%) and then sterilized in an autoclave at 121°C for 15 min. Cultures were incubated in the light at 27°–28°C in the chamber. The percentage of germination was evaluated after 30 d. Fresh seeds did not germinate independently of treatment with sulphuric acid. The germination of *Chamaedorea seifrizii*, as in other palms, is delayed by moisture in fresh seeds. Rabechault et al. (1969) showed the embryo germination was found to be greatly influenced by seed-moisture content, previous duration of seed storage, and relationship between seed dormancy and water content. Figure 1 shows the germination percentages of treated seeds with sulphuric acid during several periods. Dry seeds in the 10-min treatment and the control seeds did



1. Percentage of germination of dry seeds, scarified at different periods with sulphuric acid (96%) at 30 d of cultures.

2. *Chamaedorea seifrizii* Burret plantlets under sterile conditions, at ≈60 d of culture.

not germinate. The best results were obtained when dry seeds were scarified with sulphuric acid for 30 min, washed several times with sterile water, and then put in the culture medium (Fig. 1).

Merlo et al. (1993) obtained 90% germination in *Chamaerops humilis* L. when manually scarified seeds were treated with concentrated sulphuric acid for 4.5 h and then put in a germination chamber. Germination percentages were lower when the time in acid was increased to 60 min, which could be explained because scarification leaves the embryo exposed to damage by strong acid. A longer exposure to acid could probably also destroy the embryo. The coats (mesocarp) of many species of palms contain substances that inhibit germination. *Chamaedorea seifrizii* is one of them. The scarification of the outer coat of the seeds with acid eliminates substances that delay the germination, gaseous exchange, and water imbibition. Plantlets were cultured in vitro (Fig. 2) for 60 d after seed scarification, until they reached ≈8–10 cm long, at first leaf stage.

From this study we can conclude that it is possible to shorten the germination time of *Chamaedorea seifrizii* seeds by a drying period followed by scarification with concentrated sulphuric acid.

Acknowledgments

The authors thank Moron Tree Nursery's administration for providing the seeds.

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CHAPTER NEWS AND EVENTS (*Continued from p. 111*)

borine in southern Queensland. A brief business meeting was held. The group also enjoyed a year end break-up party. The weather was perfect and members were able to view the grounds and many interesting plants featured in Bill's garden.

News from the Sydney Branch, PACSOA, Chapter

The Sydney Branch of PACSOA and Chapter of the IPS met on January 16 at the Maiden

Theatre, Royal Botanic Gardens, Sydney. The Branch also had recent separate visits from Louis and Carol Hooper and Don Hodel, all from California.

Principes Minor, the magazine of the Sydney Branch, is now focusing on a genus per issue, similar to the feature begun some time ago by the Southern California *Palm Journal*. The January 1996 issue focused on *Sabal* and the May 1996 issue will concentrate on *Brahea*, with emphasis on Australian members' growing experiences.

News from Western Australia

The Palm & Cycad Society of Western Australia (PACSOWA) met on January 15 at the Leederville Town Hall to view a collection of short videos taken by Neil Jones and others while vacationing in far northern Queensland. A brief talk was presented by Cliff Britto on his experiences with the genus *Arenga* in the Perth metropolitan area.

The February 19 meeting featured unusual or unidentified palms that members brought in for identification. Ken Adcock gave a brief talk.

Gascoyne Park workdays were held on January 20 and February 25. The main work was mulching. Joy cooked up an excellent BBQ to serve the workers.

Open days are planned for April 28 at Ken Adcock's place and for June 16 at John Banasiewicz's place.

European Palm Society (U.K.) News

Richard Darlow and Greg Plenty are planning a "Northern Get-together" in the Batley/Barnsley area of England for Society members, partners, and friends. The tentative date for this event is May 5 (bank holiday weekend). There will be opportunities for plant sales and swaps and a chance to visit Richard's wonderful exotic garden, recently featured on TV and in several magazines.

Clarification on Nomenclature of Palm Societies in Europe

There are several different palm societies in Europe, two of which are currently affiliated with the International Palm Society. These two are the "European Palm Society," a primarily mail-order society based in the United Kingdom and the "Fous de Palmiers," an active society in France. I understand that there are also other national Palm Societies in Europe, which are not now affiliates of the IPS. It is my hope that these other groups will elect to affiliate with our organization sometime in the future. Each such organization is completely independent from the others, to the best of my knowledge.

Confusion arises because the name of the UK-based organization is "The European Palm Society" and members want to know exactly what that means and how this organization relates to the other national palm societies located in Europe. I have received letters from confused IPS members and others on this subject. The confusion that I wish to put to rest is the incorrect belief by some that the "European Palm Society" is an umbrella organization of which the various national palm societies in Europe are simply "divisions" or "section." That is not the case.

The "European Palm Society," spearheaded by Martin Gibbons in the UK, has many subscription members from various European countries, and from many other nations as well. So does the Pacific Northwest Palm & Exotic Plant Society in Vancouver, Canada, and the Southern California Chapter of the IPS. Such cross-memberships are encouraged by the IPS and offer members several different palm-related journals prepared by the individual chapters or affiliated societies. The confusion in the present case occurs only because of the name. I wish to reaffirm that the "European Palm Society" is not an association like PACSOA in Australia, with member sections in individual countries.

News from the Southeastern USA Chapter (non-Florida)

The Southeastern Palm and Exotic Plant Society met on February 24 in Anniston, Alabama, jointly hosted by Gene Cooper and Hayes Jackson, former President of the society. A tour of Gene's garden was first on the agenda, followed by a visit to Hayes' "homegrown rain forest." About 30 members were in attendance. Discussions at the meeting were focused on the recent cold wave (February 3–5) that sent temperatures below 10° Fahrenheit (−12°C) over much of the area. Native palm species generally fared well, as did various *Trachycarpus* species. Less hardy exotic species such as *Washingtonia*, *Phoenix*, and *Livistona* sp. all suffered some degree of damage. However, few plants seemed to have been killed outright and most of those attending thought their plants would recover by next summer.

The Spring 1996 Meeting will be held April 20

at Brookgreen Gardens, near Myrtle Beach, South Carolina. This meeting will feature extensive tours of the gardens and lunch. The Summer 1996 meeting will be held in Raleigh, North Carolina on August 11 at Plants Delight Nursery, hosted by Michelle and Tony Avent. Several gardens will be visited and unusual plants offered for sale. Details of a Fall 1996 meeting will be announced soon.

This group was organized to promote the cultivation of palms and other subtropical plants in the southeastern U. S. (outside of Florida). In addition to local meetings, the Chapter also publishes a quarterly newsletter, *Rhapidophyllum*. The January 1996 issue of *Rhapidophyllum* contained a nice article on "*Rhapidophyllum hystrix* (Needle Palm) and Its Culture in Marginal Climates" as well as interesting information on growing several bananas and *Hedychium* gingers in the area. Chapter membership is open to the public and annual dues (covering from July 1 through June 30) are US$10, which includes the newsletter and other Chapter publications. Interested persons should contact the Southeastern Palm and Exotic Plant Society, c/o Tom McClendon, 1581 Fuller Road, Greensboro, Georgia 30642 USA or post a note to Will Roberds at his email address: Gypsy@mindspring.com if you prefer.

News from the Palm Beach (Florida) Chapter

The Chapter held a meeting on January 3 at the Mounts Botanical Garden. Dr. Scott Zona, Fairchild Tropical Garden palm biologist, spoke on "Recent Expeditions in two Hemispheres." Areas covered included New Guinea, Indonesia, and Mexico. On February 7, George Fitzpatrick from IFAS taught us all a little about palm frond weaving. Many got hands on experience and we now have a use for all the dead fronds from the cold weather we had an abundance of this winter. Our March meeting featured a talk and slides from De Hull on his recent travels to China and the Seychelles. Our meeting on April 3 will feature a talk on "Introduction to Cycads" by Paul Craft. It will include a little history, some horticulture, and information on some of the species that grow best in our area.

On April 13 and 14 we will have our Seventh Annual Spring Sale with about 25 vendors and 400 species of palms and cycads available. It will be held at Morikami Park in Delray Beach from 9:00 a.m. to 5:00 p.m. on Saturday and 9:00 a.m. to 4:00 p.m. on Sunday. Books, T-shirts, and palm special fertilizer will also be available.

With the World Palm Symposium behind us, we are beginning work on a new project this year. It will be a booklet on the dos and don'ts of palm horticulture in the landscape, including proper pruning techniques, fertilization, and placement of the right species in the right area so they do not conflict with things like power lines, buildings, and such. We will be gearing this toward landscape architects, landscapers, tree trimmers, and management companies as well as the general public. If anyone has any information they would like to share on this subject, contact Paul Craft at 407-793-9029 or fax to 407-790-0174 or email to Palmnut@icanect.net.

Paul Craft

News from the South Florida Chapter of the IPS

A South Florida Chapter general meeting was held on February 27 at the Garden House of Fairchild Tropical Garden. The speaker was Dr. Alan Meerow, presenting "The Licury & Lears" or "The Palm & Parrot" or "Palms of Brazil." Dr. Meerow is the author of *Betrock's Guide to Landscape Palms.*

A field trip and zoo work day was held on March 30, with members fertilizing the Society's palm plantings at Metro Zoo. Lunch was served.

News from Broward County, Florida

The Broward County Palm & Cycad Society (BCP&CS) met on January 25 to hear Dr. Scott Zona, Palm Biologist for Fairchild Tropical Gardens. Scott has been to the Solomon Islands, Fiji, and Indonesia to collect specimens he can use on his current research on the genera *Veitchia* and *Drymophloeus*. He also traveled to New Zealand to give a presentation to the New Zealand Palm Society. Scott's most recent expedition was to Mexico collecting *Crysophila nana*. His talk, entitled "Recent Palm Collecting Expeditions in Two Hemispheres," was a pictorial review of his travels and the palms and people he met along the way.

The Chapter's January 1996 newsletter had a nice article describing the October 1995 visit of 37 members of the French Palm Society, Fous de Palmiers, to South Florida.

News from Central Florida Chapter

The Central Florida Palm Society held its spring meeting on January 28 at the Coconut Grove Palmetum of the Montgomery Foundation. Located a mile south of Fairchild Tropical Gardens, the 160-acre grounds were purchased by Robert Montgomery, founder of Fairchild Gardens. Not surprisingly, there are a large number of impressively old and large specimens of many different palms. For example, the sole *Borassus*, while not massive in bole or crown, noticeably exceeds in height the two mature specimens at the edge of the "rain forest" at FTG and thus may qualify as the state's largest specimen of this palm. Many other genera are present with some of the more unusual being thriving specimens of *Nypa*, *Raphia*, *Nannorrhops*, and a soon-to-be-named fruiting specimen of a clustering *Syagrus*, which Dr. Larry Noblick, Collections Development Manager at the Palmetum, said that he had only recently found growing in the wild in Brazil. There is also an extensive cycad collection.

April 20 marks a meeting of the CFPS at the campus of the Florida Institute of Technology in Melbourne. The host will again be Dr. Jerry Keuper, founder of the university and past president of the International Palm Society. The meeting features a tour of the Dent Smith Trail with palms and cycads also being offered for sale at the entrance to the trail. Lunch is served in the University President's Dining Room for a nominal charge.

A meeting is scheduled for June 1 in Pinellas County. Plans are to start at 10 a.m. at Taylor Park in Largo to view the 16 most impressive *Copernicia alba*, a handful of exotic *Sabal*, *Butia* × *Syagrus* (*Arecastrum*) cross, and others. This will be followed by a guided tour of the young but impressive palm collection at the Pinellas County Extension Service Office. After lunch, Dr. Kyle Brown will speak on "Adventures in Sabals."

McKee Botanical Gardens Become a Reality

On December 2, 1995, McKee Botanical Gardens in Vero Beach were officially opened in a ceremony that marked the completion of payments totaling 1.6 million dollars for the 18-acre (plus 80 more of wetlands) site. Jim Haeger, who assisted the 1994 Central Florida Palm Society meeting in the Vero Beach area, was the ribbon cutter.

In a follow-up to the March 1994 meeting at McKee, several specimen plants at the gardens have been designated by the State Forestry Office as "State's Tallest," including an *Acrocomia* and the *Arenga pinnata* first noticed in the dense canopy by John Bishock of Sarasota.

News from Southern California

The 20th Annual Banquet of the Southern California Chapter of the IPS was held on January 20, 1996 at the Hyatt Newporter, 1107 Jamboree Road, Newport Beach. Dr. John Rees, Professor of Geography and Urban Analysis, UCLA, gave members a preview of the palms to be seen on the Post-Biennial Tour in Ecuador in August, 1996. Brad Carter, Horticulturist and Assistant Director of the UC Irvine Arboretum, presented slides on "Palms and Cycads of South Africa." These presentations followed a garden tour of the Hyatt Newporter, conducted by Bill Dickenson. This hotel will also be the host hotel for the 1996 IPS Biennial Meeting to be hosted by the Southern California Chapter on August 3–9, 1996 (see additional information elsewhere in this issue).

The March 23 meeting was held at the estate of Arnie Newman. Arnie, founder and executive director of the Society for the Preservation of the Rainforest and author of the critically acclaimed book, "*Tropical Rainforest*," gave a lecture on the depletion of the tropical rainforest. Rainforest depletion is rapidly removing the habitat that supports many of the world's palms, so Arnie's topic was of tremendous interest and concern.

The January, 1996, issue of *The Palm Journal* published by the Southern California Chapter was devoted to the genus *Syagrus*. In addition to various *Syagrus* growing experiences, the journal featured an excellent article describing all known species by the noted *Syagrus* expert Dr. Larry Noblick of The Montgomery Foundation in Florida. The March 1996 issue of the Palm Journal was devoted to the genus *Hyophorbe*. It contained an article by Don Hodel about the different species of *Hyophorbe* and Kent Houser's review of the book "*Palms of Madagascar*."

Pacific Northwest Chapter News

Several members of the Pacific Northwest Palm & Exotic Plant Society (PNWP&EPS) attended

the Northwest Flower and Garden Show in Seattle on February 7–11. Next year, hopefully, the Chapter will have a strong contingent from the Seattle area to organize and man a booth at the show.

The first meeting of the PNWP&EPS society in 1996 was held at VanDusen Gardens on March 25, 1996. The plant sale, open to the public, was held on Palm Sunday, March 31, at 1 p.m. at VanDusen Gardens.

The Vancouver Parks board will be having another spring planting of 10 large palms in English Bay. Again the palms are donated by the local palm society.

Additional general meetings planned for 1996 will be May 27, July 22, September 23, and November 25 (elections). All these meetings will be held at VanDusen Gardens and will get underway at 7:30 p.m. The Society will participate in the Pacific National Exhibition in Vancouver, August 17–September 3, 1996.

Many Society members have gained local recognition for their gardens over the past several years. A list of ten such gardens was included in the February issue of Hardy Palm International.

News from the French Palm Society, Fous de Palmiers

Please note the following corrections to the information printed in the 1995 IPS Membership directory. Chapter Officers are: President, Alain Hervé; Vice Presidents, Jacques Deleuze and Violette Décugis; Treasurer, Bruno Cara; and, Secretary Alain Jamet.

Le Palmier, the French-language newsletter of the French Palm Society, Fous de Palmiers, appears twice a year. It is a mixture of association information and reports, as well as articles on palm themes and related items of interest. Since December 1993, the chapter adopted the 5.5 by 8.5 inch format, 24–32 pages, in sepia colors. It is available only through Fous de Palmiers chapter membership, open to all interested persons for a fee of 200 French Francs. Those interested are invited to send a bank draft to IPS Chapter Correspondent Steve Swinscoe, Manatte, 32460 Le Houga, France.

There has been little news of the Fous de Palmiers printed in recent issues of *Principes*, due to a breakdown in communications within the IPS. A recap of the 1995 events is provided to bring everyone up to date.

The 1995 activities began with a stand at the annual Fêtes du Citron (Lemon Festival) in Menton, on the French–Italian border, in March. Mauricette Cottard took charge of the stand with her customary efficiency and signed up several new members.

In early April, Fous members were invited to Bordighera, across the border on the Italian Riviera, by Ferruccio Carrassale for a day of initiation in the art of weaving with palm fronds. Fifteen Fous members admired the talents of their Italian friends and appreciated their warm welcome.

Pierre-Olivier Albano organized one of the highlights of the year the last weekend of April, labeled "Palmiers: Princes des Tropiques," held at the Botanical Institution in Montpellier. Open to the public and well publicized, it drew a big crowd and included a palm history and products exhibition, a sale of plants, and several slide shows and talks.

May was a busy month with activities all over the country. Yann Corbel represented the association in Roscoff, Britanny, while Fous Jean Gourier, Jan Duclos, and Yves Le Guen had a stand at the plant expo on the grounds of the Château de Courson, near Paris, a horticultural must in France. Fous reached a new public in southwestern France when Patrick Marty and Steve Swinscoe set up a stand at the Château de Gaujacq in the Landes. At the same time, 30 members visited the gardens of the Domaine du Rayol on the Riviera. Also in May, Claude Bruno shared his stand with the Fous de Palmiers at the Hyéres Plant Fair.

In early June of 1995, René Hebding welcomed 30 members on a five-hour guided tour of the gardens of the Villa Les Cedres, perhaps the finest private garden on the Riviera in St. Jean-Cap Ferrat. This has become an annual event that continues to grow in popularity. One of the treats there is a mature specimen of *Trachycarpus martianus*, which is extremely rare in Europe.

The end of June included two days of Franco-Italian entente in Bordighera. Professor Campadonico took members on a tour of the Hanbury garden at La Mortola. A part of the Alain Moinie palm collection will be planted there.

A summary of Fous events held during the second half of 1995 will appear in the next issue of *Principes*.

Principes, 40(2), 1996, p. 118

IPS extends palm-lined electronic highway into CIS (CompuServe Information Service)

LYNN MCKAMEY
Secretary of IPS, P.O. Box 287, Gregory, TX 78359
E-mail address: 70413.2030@compuserve.com

The Gardening Forum on CompuServe Information Service has opened a "Palm Section" for on-going bulletin board discussions about our favorite subject—PALMS! In addition to the message section, members can browse files in the Gardening library which holds articles about our society and digitized pictures of palms, plus they can enter a special PALM conference room which is available for "real time" meetings and conversations between IPS members.

CompuServe is the world's most extensive interactive information service and can be accessed in many countries by members who have a computer, modem, and telephone. In addition to Gardening, it has hundreds of Forums dealing with every type of information imaginable such as finances, hobbies, news and sports, global weather, the American Airlines "Easy Sabre" Reservations System, and reference sources. CompuServe also has a very active, informative Travel Forum which should be of interest to our members who travel far and wide in search of palms and plants. It has an excellent E-mail system which can be used to send electronic letters to any of our members who have internet or CIS access.

CompuServe also provides a "gateway" to the internet for our members who would like to visit the IPS World Wide Web Home Pages and it has Web browsers, such as Spry Mosaic and NetScape, to reach our private NEWSGROUP service available on the IPS InterNet server.

For more information about rates, how to join CompuServe, and a free communications program for PC or MAC computers, call CIS Customer Service at the following numbers:

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BOOKSTORE UPDATE

APRIL 1996

☞ *A GUIDE TO PALMS AND CYCADS OF THE WORLD.* (L. Stewart, 1994, 246 pp..full color, line drawings and maps for each genus **$35.00**

A GUIDE TO THE MONOCOTYLEDONS OF PAPUA NEW GUINEA, PART 3, PALMAE (R.J. Johns and A.J.M. Hay, Eds., 1984, 124 pp.) **$8.00**

BETROCK'S GUIDE TO LANDSCAPE PALMS *(A.W. Meerow, 1992, 153 pp. - all color.)* ***$29.00***

☞ *CHAMAEDOREA PALMS (D. Hodel, 1992, 350 pp., 127 pp. of superb color) EXCELLENT!* ..... ~~***$69.95***~~
LIMITED TIME (P.S. members) ***$49.95***

COCONUT RESEARCH INSTITUTE, MANADO (P. A. Davis, H. Sudasrip, and S. M. Darwis, 1985, 165 pp., 79 pp. color).... **$35.00**

CULTIVATED PALMS OF VENEZUELA (A. Braun, 1970, 94 pp. and 95 photographs.) **$7.95**

DESERT PALM OASIS (J. W. Cornett, 1989, 47 pp., 41 pp. color) **$8.95**

DISEASES AND DISORDERS OF ORNAMENTAL PALMS (A. R. Chase and T. K. Broschat, 1991, 56 pp., color on each page) ... **$29.00**

☞ **EUADORIAN PALMS FOR AGROFORESRY** (H.B.. Pedersen and H. Balslev, 1990, 105pp.) **$15.00**

☞ **FIELD GUIDE TO THE PALMS OF THE AMERICAS** (A. Henderson, G. Galeano and R.. Bernal, 1995. A guide to the 67 genera and 550 species of palms found in the Americas. 256 color photos, 42 line drawing, 553 maps.) **$75.00**

FLORA OF TROPICAL EAST AFRICA, PALMAE(J. Dransfield, 1986, 52 pp.) **$23.00**

FLORES DES MASCAREIGNES (La Reunion, Maurice Rodrigues, 1984, 31 pp.) **$8.00**

FLORIDA TREES AND PALMS (S. A. Rose, A. A. Will, Jr., T. B. Mack, 1984, 30 palm species, 120 pp.) **$6.00**

KEY GUIDE TO AUSTRALIAN PALMS (L. Cronin, 1989, 180 pp., 85 pp. color) **$21.95**

☞ **LAS PALMAS CULTIVADAS** (A. Braun, 1994, 64 pp., color, Spanish, The cultivated palms of highland Andean cities in South America) **$10.00**

☞ **LAS PALMAS DE LAS SABANAS DE VENEZUELA** (A. Braun, 1995, Spanish, 59 pp.) **$12.00**

MAJOR TRENDS OF EVOLUTION IN PALMS (H. E. Morre, Jr., N. W. Uhl, 1982, 69 pp.) **$6.00**

OIL PALMS AND OTHER OILSEEDS OF THE AMAZON (C. Pesce, 1941, translated and edited by D. Johnson, 1985, 199 pp.) **$24.95**

☞ **PALM COLLECTION OF THE DURBAN BOTANIC GARDENS** (A. Lambert, 1994, 118pp., color photos..... **$17.00**

☞ **PALM ENTHUSIAST - Journal of The S. African Palm Society** - Jubaeopsis caffra feature (1988, 39pp.)..... **$5.00**

PALEM INDONESIA (in Indonesian) (Sastraprdja, Mogea, Sangat, Afriastini, 1978, 52 illustrations, 120 pp. For English translation add $3.00) **$5.50**

☞ **PALMS AND CYCADS AROUND THE WORLD** (J. Krempin, 1990, 267 pp., 267 pp. color) REVISED EDITION..... **$52.50**

PALMS AND CYCADS BEYOND THE TROPICS *(Keith Boyer, 1992, 160 pp. 120 color photos.)* ***$20.00***

PALMS IN AUSTRALIA (David Jones, 1984, 278 pp., over 200 color photographs) **$40.00**

☞ *PALMS OF MADAGASCAR (John Dransfield and Henk Beentje, 1995) EXCELLENT! (Dec.. 95)* ***$82.00***

☞ **PALMS OF THE AMAZON** (A. Henderson), 1995, 362pp. many line drawings)..... **$100.00**

PALMS OF THE NORTHERN TERRITORY (AUSTRALIA) (A. White, 1988, 41 pp., 21 photographs, some color)..... **$5.95**

PALMS OF THE WORLD (Formerly - **PALMS**, A. Blombery & T. Rodd, 1982, 192pp., 212 color photographs)..... **$35.00**

PALM SAGO (K. Ruddle, D. Johnson, P. K. Townsend, J. D. Rees, 1978, 190 pp.) **$10.00**

PALMS OF THE SOLOMON ISLANDS (Dowe, Dennis, McQueen, Birch, 55 pp., 39 pp. photos, 8 in color) Four excellent chapters. **$9.95**

PALMS OF THE SOUTH-WEST PACIFIC (J. L. Dowe, 1989, 198 pp., 33 pp. color) **$29.95**

PALMS OF SUBEQUATORIAL QUEENSLAND (Robert Tucker, 1988, 91 pp., 12 pp. color, many black and white photographs and maps)..... **$20.00**

☞ **PALMS THROUGHOUT THE WORLD** (David Jones, 1995, 410 pp., over 200 color photographs) **$50.00**

SECRET OF THE ORIENT DWARF RHAPIS EXCELSA (L. McKamey, 1983, 51 pp.)..... **$5.95**

THE GENUS PTYCHOSPERMA LABILL (F. B. Essig, 1978, 61 pp.) **$6.50**

THE INDIGENOUS PALMS OF NEW CALEDONIA (H. E. Moore, Jr., N. W. Uhl, 1984, 88 pp.)..... **$12.00**

☞ **THE PALMS OF RIO'S JARDIM BOTANICO** (1992, 15pp., some color)..... **$5.00**

THE STRUCTURAL BIOLOGY OF PALMS (P. B. Tomlinson, 1990, 477 pp.)..... **$120.00**

TROPICA (A. Graf, 7000 color photos, 1138 pp.)..... **$175.00**

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