

PRINCIPES

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THE INTERNATIONAL PALM SOCIETY, INC.

THE INTERNATIONAL PALM SOCIETY

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

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PRINCIPES

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Front Picture

The Stone Gate Palm (*Trachycarpus princeps*) growing on steep cliffs above the Salween River in northwest Yunnan, China.

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Note from the President

Can you help us to nominate new members to the IPS Board of Directors? We need member input on this! If you wish to nominate a member as a director, please contact Nominating Committee Chairman, Lennie Goldstein in Florida (see Roster), or our Secretary, Lynn McKamey, or me.

The *Palms of Madagascar* book written by Drs. John Dransfield and Henk Beentje, will soon come off the presses in England. Have you ordered your copy (or copies)? The pre-publication sale will end soon, so order now from the Royal Botanic Gardens Kew in the United Kingdom. See the note (p. 64) in this issue for ordering information.

I have received several Email addresses from IPS members and would like to hear from any member on the INTERNET (which includes GENie, Compuserve, AmericaOnLine, Prodigy and other member services). Just provide me with your INTERNET address and I will forward you the list I have (along with periodic updates).

As mentioned in the previous *Principes*, we now offer a full electronic Palm Society Round Table through GENie Information Services. This offers a bulletin board filled with information and discussion items pertaining to palms and cycads as well as a software library and a real time conference facility where you can regularly "chat" with other members and guests. If you need any additional information, please let us know.

I'm sure you are aware that the January 1995 issue of *Principes* ran quite late, as did last October's issue. This issue is still a little tardy, but we hope to be back on schedule with the July and October 1995 issues. I apologize for any inconvenience.

We are looking for suggestions as to how the IPS might further improve our services. If you have any ideas, please let me know. My home address is in the *Membership Roster*. I can also be reached via INTERNET at either PALM.DUDE@GENIE.COM or CAIN@WGCGPS.COM. I have received several letters and Emails and would like to hear from any of you who wish to send comments.

JIM CAIN, PRESIDENT

Editorial

The first article in this number of *Principes* charts the extraordinary story of the discovery of a new species of *Trachycarpus* in China. Martin Gibbons and Tobias Spanner have been chasing *Trachycarpus* for many years and there seems no end to the excitement to be found on "the *Trachycarpus* Trail". As they, together with Chinese palm specialist Dr. Chen San-Yang, describe, this branch of the Trail started by chance with the reading of a statement in a Chinese flora that somehow did not seem right, and ended in a remote corner of China beneath a towering cliff with the unexpected reward of an undescribed and extremely beautiful palm. Martin and Tobias have since been elsewhere in the foothills of the Himalayas and have more *Trachycarpus* stories to tell in the future.

Fred Essig, continuing his long interest in the palms of Papuasias, describes a new and unusual species of *Gronophyllum* from Manus Island in the Bismarck Archipelago.

As readers of the April 1989 number of *Principes* will know, John Dowe made one of the most exciting finds of the late 1980s by rediscovering the almost forgotten palm, *Carpoxydon*, in Vanuatu in the West Pacific. One of the reasons why this genus was so poorly known, was that the very specimen on which the name *Carpoxydon* was based by Hermann Wendland, could not be found in any herbarium. All that was available for palm botanists was the original description and a drawing. While Scott Zona was in London, working at the Natural History Museum, he chanced on a box of fruits that are clearly the original specimen of this beautiful palm. In his article he describes how he found the fruits and discusses their origin. Readers who are interested in obtaining seed of this magnificent palm should look for the classified advertisement on page 74.

Another serendipitous discovery is amusingly recounted by Georgina Zibarras and Flo Liebst, members who live in Dar-es-Salaam in Tanzania. While collecting seed of *Chrysalidocarpus pambanus* on the island of Pemba, they stumbled on a clump of a rattan that has never been recorded for Africa or its offshore islands. Clearly an introduction, *Calamus ornatus* survives in Ngezi Forest Reserve, but how it came there is a mystery.

Paul Ramp and Leonard Thien give a fascinating account of an outlying population of *Sabal* palms in the Mississippi River valley. They discuss historical references to the palms by early explorers and then go on to use careful molecular analysis to investigate the relationships of these isolated palms. They have done this by using protein gel electrophoresis. This is a method that allows descriptive or analytical assessment of the genetic make-up of an organism from its proteins. The proteins are first extracted from material of the plants under study, and then separated in a gel through which an electrical current is flowing. Protein separation occurs within the gel due to differences in the shape, size and electrical charge of the protein. Individual proteins are then made visible by using protein specific dyes, the proteins showing up as bands. Patterns of bands and the distances they have migrated on the gel are then used to identify and characterise the proteins, and the different patterns from samples can be compared, giving clues to similarities between the different samples.

For those interested in economic botany, Henrik Borgtoft Pedersen has written an account of the damage caused by beetles to the vegetable ivory palm, *Phytelephas aequatorialis*, in Ecuador. This palm is the source of a cottage industry in vegetable ivory extraction that is of great local importance, providing a good source of income to villagers. Thus this study on a major pest provides valuable information that could allow yields to be maximized by eliminating the beetle attack as much as possible. Those interested in aspects of seed germination will find Kyle Harms and James Dalling's paper relevant as it describes patterns of timing of germination in *Scheelea zonensis* and discusses their significance.

The Florida First Coast Chapter has a major interest in the development of a palm garden as described by Edwin Brown. Another aspect of palm cultivation in the southeastern USA is provided by Sales Abraham and Alfred Loeblich who describe a fungus that has been found growing at the base of transplanted trees of *Sabal palmetto* in Texas. Chapter News is as usual to be found towards the back of the issue.

Finally, 1995 is shaping up to be a year for new palm books. Andrew Henderson's *Palms of the Amazon* has just appeared, the *Field Guide to the Palms of the New World* (also by Andrew Henderson, together with Gloria Galeano and Rodrigo Bernal) is in press and due out very soon, and *Palms of Madagascar* will be out in June. Don't forget to take advantage of the republication offer for *Palms of Madagascar*.

JOHN DRANSFIELD
NATALIE UHL

PALMS OF MADAGASCAR

by

John Dransfield and Henk Beentje

Published jointly by the Royal Botanic Gardens Kew and the International Palm Society.

Publication update

Publication is expected in June. Don't forget to order your copy at the discounted republication rate of \$59.95 (£40.00) inclusive of postage. Offer closes 30th June when the price will rise to \$82.00 (£54.60). If you have lost your order form and would still like to order a copy, please contact the authors at the Royal Botanic Gardens Kew, Richmond, Surrey, TW9 3AE, UK

Principes, 39(2), 1995, pp. 65–74

Trachycarpus princeps, the Stone Gate Palm, an Exciting New Species from China

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The chance sighting of a single line in a Chinese plant book led to perhaps the most exciting discovery of all along the 'Trachycarpus Trail'. The book in question was the new account of the palms of China in the Flora of China series (Pei and Chen, 1991), published in Chinese so quite incomprehensible to us (MG and TS). However, all the references were in English, or at least using the Roman alphabet, and of course all the Latin plant names were understandable. We were doing research on *Trachycarpus martianus* and, although there was no record of its occurrence in China in any of the other books, old and new, that we consulted, this book listed and described it. This seemed strange to us since it was not known to occur in China, so why should it appear in a book of Chinese plants?

We arranged to have the entry translated into English and when it was done we were able to read what the Chinese authors had to say about it. The entry began with a description of the palm—nothing strange here—and ended rather disappointingly with the paragraph, "The species is native to the central and eastern Himalayas and Burma. According to records there were some found in western and north-western Yunnan, but so far there is no specimen." And that might have been the end of it, but something nagged. What was this 'record' and how could we find out about it? It seemed an impossible task.

Then, some time later, we were re-reading the accounts for the hundredth time when a line in the references caught our eye. Amongst all the Chinese characters was this: "Hand.-Mazz. Symb. Sin. 7(5): 1360. 1936". The numbers were obviously pages or chapters and 1936 the year, but what or who was Hand. Mazz.? And could that 'Sin' stand for 'Sinica', i.e., China? Was this the old record? The answer came, as so many did, from the library at Kew. 'Hand.-Mazz.' turned out to be an abbreviation of Dr. Heinrich Handel-

Mazzetti, an Austrian botanist who made some explorations in south-east Tibet, northwest Yunnan and much of south-west China between 1914 and 1918. He published his findings in a book called "Symbolae Sinicae" in German in 1936, a photocopy of which was kindly lent to us by the Library of the Botanical Museum in Berlin. This again had to be translated, but it was less of a problem:

"*Trachycarpus martianus* . . . N.W. Yunnan. In the subtropical zone of the Burmese monsoonal forest on cliffs of crystalline limestone, in the Salween-gorge above Chamutong until below Nualo, 1725–1900 m, . . . and from here replanted in the village of Sitjitong. Flowers or fruits are not on hand. From my memory and a photograph sent by Dr. J. Rock, these approximately 7 m high trees have stems of at least 20 cm diameter after the leaf bases have fallen, which develop a short tuft only below the fresh leaves. These are wax-white below"

The trail was starting to warm up!

Then, additionally we came across another book by the same man, "Naturbilder aus Südwestchina" ('Portraits of Nature in South West China') and whereas the first was more of a scientific work, this was more of a diary and filled in the gaps in a very readable fashion. On page 242, under the title, "To the Irrawaddy Upper Course", we read:

"In the evening, I reached Nualo, a Lissu village as you can tell by the name, the most northerly of all, and I was welcomed in a friendly manner, with presents. From there it was finally not far any more to the Salween [river]. We descend, reaching the subtropical rainforest just below 2200 m and a distance on bare rock leads us to the slope of the valley itself, from where we quickly descent through sparse pine forest to Sitjitong, a scattered village, 3 km north of Chamutong. The Salween comes here from Wuli in the northeast, breaking through the band of crystalline limestone, through which, in the gorge of Chamutong, it is quickly returned towards the east, making up for this error in its NNW-SSE course. Everywhere, this hard rock shows as steep cliffs, in the lower gorge as enormous pillars, 600m high, one of which forces the path onto an artificial high wall in the river itself. At high water level, this route is flooded, and the only way to reach Chamutong is above, over the ridge. Whereas there are still xer-

ophytes, such as *Schefflera delavayi*, here brownish and felt-like, found on the sandbank stretching along the river below Sitjiong, the gorge itself is characterized by sub-tropical opulence again. Huge lianas, like the new *Mucuna coriocarpa* with thick trunks and 50 cm long pods, climb high up into the *Sloaneas* . . . between them flourishes the definitely tropical *Asplenium nidus*, developing large nests with tongue-shaped, 70 cm long leaves. Rather xerophilic again are the many small epiphytic orchids, none of which unfortunately was in flower any more, and the palm *Trachycarpus martiana*, which grows stately stems, mainly on the other side of the river, almost inaccessible on the cliffs. I crossed the flat scree of Chamutong, around which the Salween is forced towards the eastern slope in a gentle bend, via the shortest way, below the main village, as I was in a hurry, and [being delayed by] the officer there was what I needed least. That he had already gone insane and died from opium and schnapps, of which he consumed 8–10 rice bowls a day. I did not know at the time. And so I came to Dara, a village on the slope, inhabited mainly by Tibetans. . . .”

Exciting stuff! Limestone pillars 600 m high—that would be something to see indeed. After a great deal of searching, the map room at Kew provided the location of Chamutong, indeed we were delighted to find Handel-Mazzetti's original map there. The village turned out to be in extreme north-west Yunnan, almost at the point where China, Tibet and Burma meet, a restricted or 'closed' area of China and certainly not open to the casual tourist. The Salween River itself rises in the Himalayas then flows south just to the east of the north/south border between China and Burma. Finally, a thousand miles later, it discharges itself into the Gulf of Martaban, in Burma, at Moulmein. So far, so good. But what of HM's collections and—intriguingly—that photograph?

Dr. Dransfield suggested that as Handel-Mazzetti was Austrian, his herbarium collections were likely to be in Vienna, and this indeed proved to be the case. Our friend there, Thomas Baumgartner, discovered them, in good condition, at the Institute of Botany where they had been gathering dust for 70 years. An official request kindly made by Dr. Dransfield brought them to England and it was with great excitement that we visited him at Kew to see them for ourselves.

A glance at the leaves was enough to make one thing immediately very clear. Though they were certainly *Trachycarpus* they were certainly not *T. martianus*. Most exciting of all was the photograph, taken by Dr. Rock, and referred to by Handel-Mazzetti. It was a habitat photograph (Fig. 1) and although at first glance it appeared not to show any palms at all, closer examination under a microscope revealed dozens of them growing on a sheer cliff face on the far side of a fast flowing

river—the Salween, or as it is called in China, the Nu Jiang ('Angry River'). They looked like big trees, with thick trunks and with big crowns of fan-shaped leaves, not unlike *T. fortunei* but for one thing—they seemed to have bare trunks, and as they were growing on such inaccessible sites it was inconceivable that they had been stripped by man, as are the vast majority of *Trachycarpus* in China, for their useful fibres. The whole thing was becoming very intriguing indeed, and we began to suspect that we were looking at a new, undescribed, species of *Trachycarpus*. As is so often the case, the only way to solve this puzzle was to visit the palms, and this we resolved to do.

You have to have a good and valid reason to visit 'closed' areas of China, and even then, it's not always possible to get permission to do so. We were told that because our interest was botanical, we would have to apply first to the Institute of Botany in Kunming, who, on our behalf, would apply to the relevant authorities to try to obtain permission to visit the area where our palms grew. Our contact at the University was Professor Chen Sanyang, the self-same person who had written the *T. martianus* entry in the palm volume of the Chinese Flora and something of an authority on the palms of China. He was as intrigued as us by the possibility of a field trip to this remote area with a view to re-locating this 'lost' *Trachycarpus*.

We applied without delay but it took 10 months before the permission finally came through. In the intervening period we exchanged dozens of faxes and letters, and as well sent photocopies of our passports together with full details about ourselves and our purpose. It was arranged that the professor would accompany us, and we would travel to our destination in a rented jeep.

In October 1994 we flew to China, staying in Kunming, the capital city of Yunnan Province. On arrival we checked into an hotel, and the professor and his interpreter ('David') called round to introduce themselves. We were due to leave early the following morning and accordingly we were up and ready at 7 am when we were collected by the small jeep in which we were to spend many hours and to travel many miles. First, however, there were more permissions and travel documents to obtain so we spent an hour or two driving around Kunming from this office to that. Finally, we were off!

We travelled along a good road for about 45 miles (80 kms) to begin with. After that it deteriorated somewhat but was still not too bad. The

driver was fast, but careful and confident and we kept up a good speed. We stopped for lunch (chicken with ginger, noodles, pork and rice) and arrived about 6.30 pm at Xiaguan where we would spend the night. An early start the next morning, lunch at Wayao, then through Liuku, across the Salween bridge where we turned north and on up to Lubenzhuo. Finally we arrived at Fugong as it was getting dark, and we stopped for the night. Early the next morning we set off once more, continuing north along the Salween.

The entire journey was along the river, sometimes high above it, sometimes perilously close to the rushing water, but it was almost never out of sight. We arrived at Gongshan at 10.30 am and stopped for an early lunch. At 1.30 we set off again and by 3 pm had arrived at the village of Binzhongluo, some 600 miles (1,000 kms) from Kunming. On the way we travelled along deep gorges which the river had worn away through the ages. It was quite impressive. We were introduced to the head of the village and with him went on a short walk to the 'Shi Men Guan' ('Stone Gate') (Fig. 2), the local name for what Handel-Mazzetti had called the Chamutong Gorge where he described the river as 'breaking through the band of crystalline limestone'. Within an hour we were there and through binoculars saw our first *Trachycarpus*, just as he had promised!

There were certainly many *Trachy*'s there but there was something of a canyon between our vantage point and the Stone Gate itself so we could not get closer to them without a major detour and, as it was starting to get dark anyway, we decided to call it a day and head back to the village. We celebrated with bottles of the local beer and speculated on what tomorrow might bring.

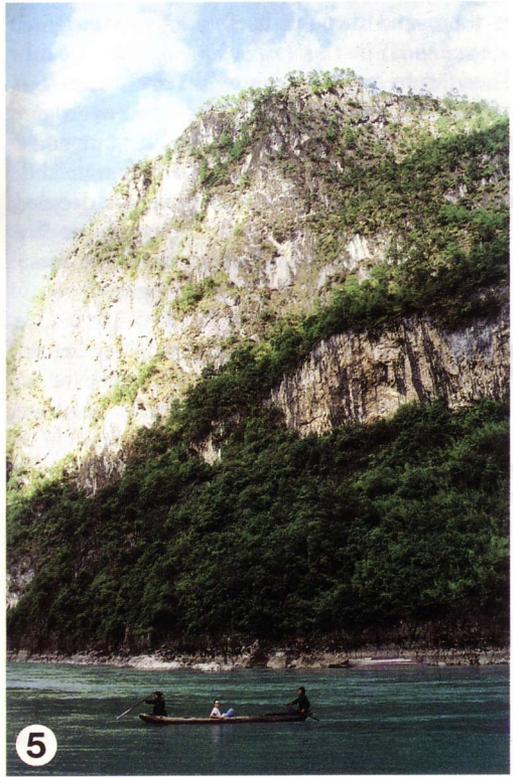
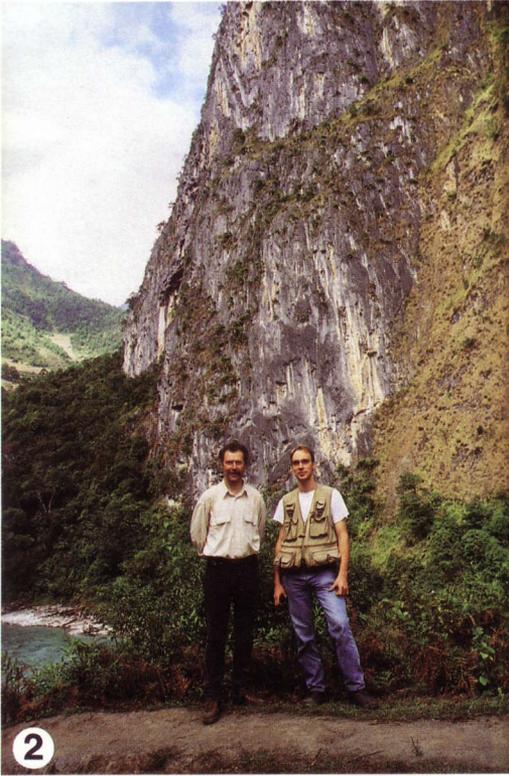
The next morning, we were up at 6.30, before sunrise and even before cock-crow! After breakfast we left with a local guide and headed off in the same general direction as yesterday but then descended to river level, following a clear path through farms. The river itself is jade green in color and quite smooth though rather fast-flowing. Soon we saw *Trachycarpus* growing on the two high, sheer faces of the opposing cliffs which had the river running between them; a thousand foot deep crack in the mountain range, with the river at the bottom, somewhat less than Handel-Mazzetti's '600 m' (2,000 feet) but very impressive all the same. There were hundreds of palms and through binoculars we could see just how beautiful they were. At a distance they seemed very close



1. Joseph Rock's photograph of the Stone Gate, taken around 1914.

in general appearance to *Trachycarpus martinianus*, with erect, slender stems, apparently bare in some of the tall, older plants, and beautiful, spherical crowns, and we could easily understand how Handel-Mazzetti had misidentified them. The tallest seemed to be about 30 ft (9 m). Most were on the opposite bank but soon we had the opportunity to examine a tree at close quarters as one had recently fallen down near our path.

It had about 5 feet (150 cm) of trunk, covered with closely attached, fibrous leaf sheaths of a rather coarse texture. The exposed upper part of the sheath was short and divided into numerous, individual coarse threads, upright at first but strongly reflexed with age, as is the case with the spines formed by the leaf sheaths of *Trithrinax acanthocoma*. Certainly this was very different



from *Trachycarpus martianus*, and even more so from *T. fortunei*. However, perhaps the major difference from all other *Trachycarpus*, and certainly the most stunning, was the fact that the underside of the leaves was pure waxy-white (Figs. 3 and 4). There were no flowers or fruit so more positive identification would have to wait for a while. We took some photographs and measurements, and collected some herbarium material then continued down the path, now close to the river. Our guide told us that no palms were to be found north of here, so they were only growing in just this one tiny area.

Since 95% of the palms were growing on the opposite, west-facing bank we had to find some way to cross the river. Fortune must have been smiling on us as we soon came across a dug-out canoe moored at the river's edge. Our guide was dispatched to the nearby village to negotiate a price to ferry us across. While waiting for him to return, we cooked a simple lunch of packet soup on the pebbly river 'beach', just a stone's throw from hundreds of these beautiful palm trees. The more we looked, the more we saw. What an idyllic spot!

After an hour or so, our guide returned with four or five Lissu men who had agreed to take us across. We went one at a time, with two rowers, one in front and one astern (Fig. 5). It was quite tricky because of the speed of the water, fast-flowing even though it was the dry season. It was a question of paddling slowly until the fast water was reached, then paddling rather quickly so as not to be carried too far downstream. Soon we were assembled, still dry, on the far side and set off towards the palms. The river bank here was composed of pure crystalline limestone, in other words, white marble. Over the centuries the river had smoothed and sculpted it into sensuous curves and shapes worthy of Michelangelo. We struggled around the headland and soon we were among the palms. By far the majority were growing on the sheer cliff face, absolutely vertical and absolutely inaccessible (Fig. 6). Bearing in mind our experiences with other palms in habitat, we were quite delighted by this act; it means that they are quite safe from either man or goat. But where the cliff

moderated into a more gentle scree slope at its base, there were a good number growing in the forest there which could be reached with the minimum of effort, and it was towards these that we made our way, scarcely able to contain our excitement.

For the next couple of hours we went from tree to tree, admiring, photographing, measuring, comparing and generally having a good time. There were many palms to choose from, each more beautiful than the last, the white undersides of their leaves giving them a very special appearance (Fig. 7). We agreed that these were definitely the most beautiful *Trachycarpus* that we had ever seen.

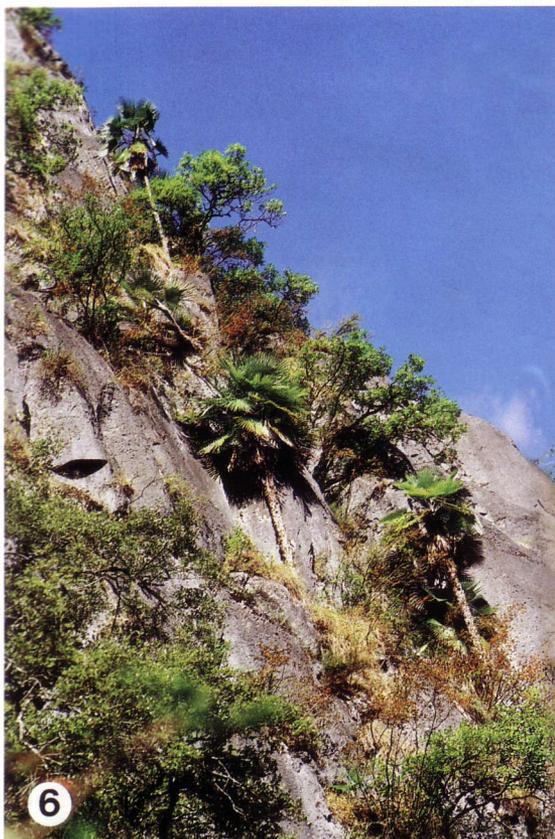
Their rather open, spherical crowns were attractively arranged and consisted of around 22 regularly divided, semi- to $\frac{3}{4}$ circular leaves (Fig. 8). After dying, they form a small skirt below the crown before the blade rots and drops off. The slender petioles often stay attached to the trunk for much longer and this, together with their pale colour, gives the impression from a distance that the trunks are bare. In fact, many of the tall, old plants do shed their leaf sheaths to reveal a ringed, grey trunk.

Many plants carried old, dry inflorescences or infructescences but, to our great disappointment, none of the accessible trees carried either fruit or flowers. Whether they fruited earlier than other *Trachycarpus* or whether it had simply been a bad year (dry?) we did not know, but it was terribly important to find at least some seeds in order to determine if they belonged in the fortunei group (reniform seeds) or the martianus group (oval with a groove). Finally, after grubbing around in the dirt at the base of a tree with a recent infructescence, one of the Lissu came across just two fresh and a couple of empty, old seeds. They were kidney-shaped, meaning that the trees belong in the former group.

We were not really surprised to find that many of the accessible palms had been either stripped of trunk fiber, or had had some of their leaves harvested. A few had even been cut down, the trunks being useful for building purposes, or perhaps the 'cabbage' is edible. But, by and large, we felt that the locals were sympathetic and there

←

2. Eighty years on, Martin Gibbons & Tobias Spanner in the same spot. Nothing has changed. 3 and 4. *Trachycarpus princeps* has stunning and distinctive waxy-white backs to the leaves. The petioles and emerging leaf spear also have a waxy covering. 5. The only way to cross the Salween River was by dug-out canoe, helpfully paddled by Lissu villagers.



6. *Trachycarpus princeps* grows on vertical cliffs on tiny ledges and in small pockets of soil. 7. *Trachycarpus princeps*. The white backs to the leaves distinguish this *Trachycarpus* from all others.

was certainly no wholesale destruction as we had seen in, for example, *Trachycarpus takil* in India. Even if every accessible tree were to be cut down, this would still leave the vast majority of the population, some 400 or 500 mature plants in total. We feel that their future is quite secure.

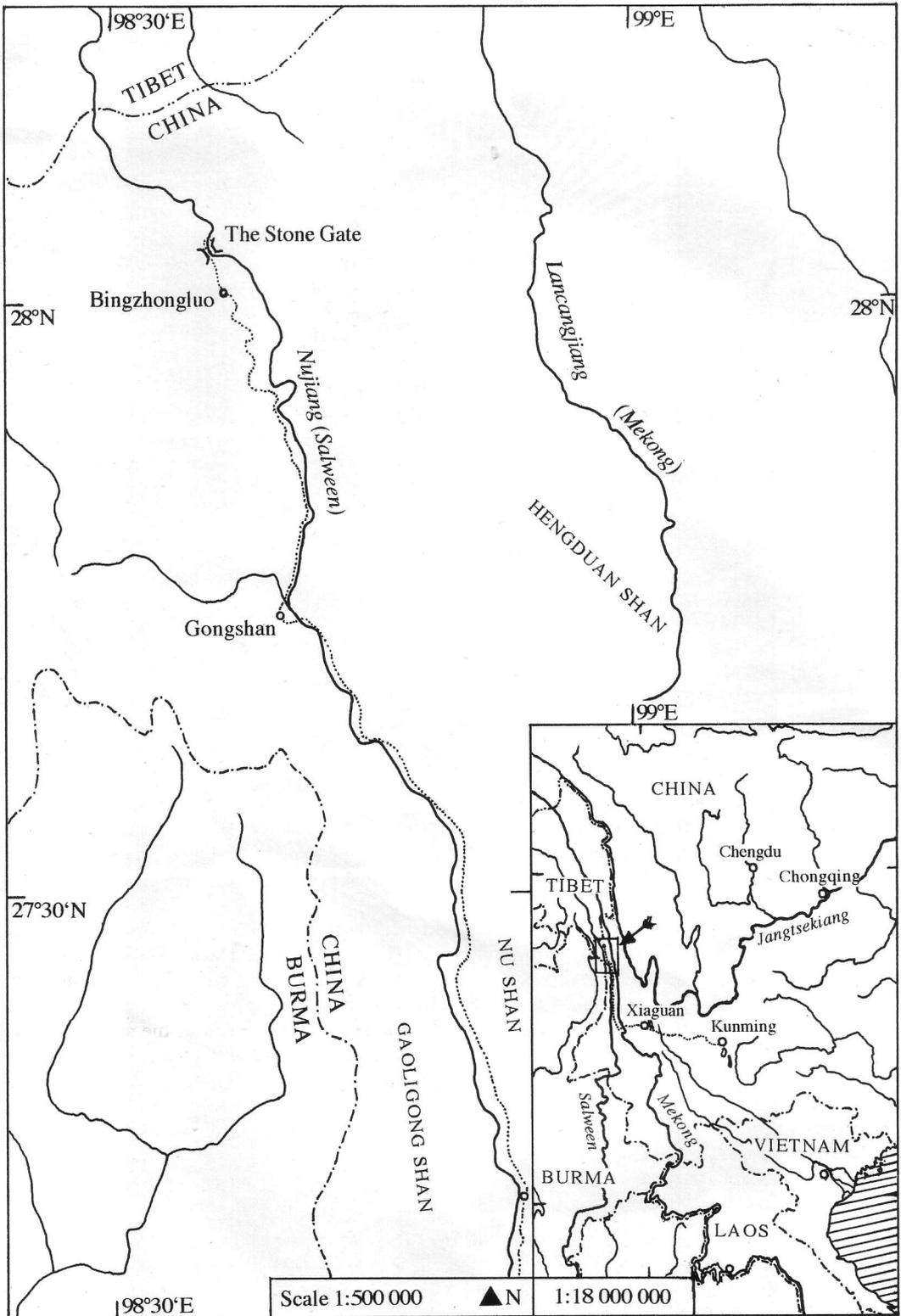
Additionally we were very pleased to see a good number of seedlings, indicating that the trees are reproducing well. This is a very good sign. The seedlings themselves were very pretty with regularly split leaves in the manner of *T. martianus* seedlings which they closely resembled, but with the same waxy-white backs to their leaves as their parents (Figs. 9, 10).

After a very happy time amongst these beautiful palms we regretfully took our leave, and one at a time, as before, crossed the Nu Jiang in the dug-out canoe. With many backward glances at the Stone Gate, we departed for the village and the long drive back to Kunming.

The cost of getting up to the site where these palms grow was not insignificant, not only in financial terms, but also in terms of physical effort, time, and patience. Despite this, the pleasure we had in rediscovering Handel-Mazzetti's palm made it all very worthwhile. Unfortunately, because of the remoteness of the site and the paucity of seeds it is unlikely that this beautiful tree will get into

8. *Trachycarpus princeps* has a leaf silhouette unique in the genus. 9 and 10. *Trachycarpus princeps*. The seedlings look identical with *T. martianus* until the waxy-white underside is seen. →





cultivation, but it is there, and will continue to be so, just waiting for other dedicated palm enthusiasts to discover it for themselves.

Although we were unable to find any flowers, the material collected by the three of us is sufficient to show the Stone Gate palm to be clearly distinct from all other species of *Trachycarpus*.

***Trachycarpus princeps* Gibbons, Spanner & S.-Y. Chen sp. nov.**

A ceteris speciebus vagina folii appendicibus tenuissimis ad 10 cm longis ferenti, petiolo valde glauco, lamina infra conspicue albo-ceracea ad medium regulariter in 45–48 segmenta divisa, forma fructus *T. fortunei* similis sed fructu minore mesocarpio glutinoso differt. Typus: China, Yunnan, Nujiang, Chen, Gibbons & Spanner 14440 (holotypus KUN, isotypus K).

Solitary, very lightly armed, dioecious palm to about 10 m tall; trunk erect, slender, densely clothed in closely appressed, persistent, fibrous leaf-sheaths, around 22 cm diam. or bare, ringed, 13–16 cm diam.; leaves 18–26, palmate, marcescent leaves few, sometimes forming a small skirt below the crown, petioles often persisting; leaf-sheath fibrous, relatively coarse, robust, about 45 cm long, abaxially densely covered in pale brown, woolly tomentum; leaf-sheath appendages approximately 10 cm long, very finely divided, upright at first, later strongly reflexed; petiole slender, arching, about 80 cm long, 0.8 cm high and 1.3 cm wide, slightly convex above, triangular below, strongly glaucous, very finely toothed along the margins; hastula shallowly triangular, 1 cm long, regular, crested; leaf-blade, semi- to $\frac{3}{4}$ orbicular, 60–80 cm long from the hastula, 90–115 cm wide, dark green above, wax-white below, regularly parted for about half its length into 45–48 stiff, linear segments, tapering towards the apex from their broadest point; central segments 3–3.5 cm wide at the middle, lateral segments gradually more narrow and shorter, apex acute-notched, shortly bifid. Inflorescences few, solitary, interfoliar, slightly erect to horizontally arranged; male inflorescences about 50 cm long, branched to 4 orders; peduncle short; prophyll about 18 cm long, very broad; peduncular bract one, around 25 cm

long, very broad, slightly tomentose abaxially; rachis bracts 3, similar to peduncular bracts; rachillae 1–3 cm long, fine and very densely branched; female inflorescences about 75 cm long, branched to 3 orders; peduncle about 20 cm long, peduncular bract one, tubular, 30 cm long; rachis bracts 2, similar to ped. bract; rachillae short, 2–10 cm, fleshy. Flowers not seen. Infructescence bright yellow when fruit are ripe; fruit small, on short stalks, slightly reniform to almost oval, wider than long, 0.8 cm long, 1.0 cm wide, 0.75 cm high; epicarp very thin, black, with a white bloom; mesocarp approximately 0.1 cm thick, spongy-fibrous, coated in a very sticky substance; seed reniform, 0.6 cm long, 0.85 m wide, 0.55 cm high; endocarp pale beige, very thin, very slightly crustaceous sand-like layer on a red-brown skin; endosperm homogenous with a deep lateral intrusion; embryo lateral. Germination remote-tubular, eophyll simple, narrow, plicate, wax-white abaxially.

Distribution. China, Yunnan, Nujiang county, 3 km NW of Bingzhongluo on the banks of the Nujiang, on the two almost vertical, bare marble cliffs of the Shi Men Guan (Stone Gate) and below the cliffs in mixed, evergreen monsoonal rainforest on a black, humus-rich, alkaline soil (pH 7.5–8); 1,550–1,850 m a.s.l.

Specimens Examined. China, Yunnan, Nujiang county, Sitjitong, Aug. 1916, *H. Handel-Mazzetti* 9802 (Vienna); Nujiang county, Shi Men Guan, Aug. 1916, *H. Handel-Mazzetti* 9818 (Vienna); idem, Oct. 1994, *Chen, Gibbons & Spanner* 14440 (holotype KUN, isotype K).

The specific epithet (*L. princeps*, a prince) refers to the stately bearing of this palm and the majestic way it looks down from its lofty position on the sheer cliff faces.

Note: The description of the seeds is based on two mature and several empty old seeds only.

As there is no recent taxonomic treatment of the genus *Trachycarpus* (but see Beccari 1931 and Kimnach 1977), relationships of *T. princeps* will be dealt with in a conspectus of the whole genus, which will appear in a later publication.

←

11. Map shows our route along the Salween River and the location of the Stone Gate in north west Yunnan province, China.

LITERATURE CITED

- BECCARI, O. 1931. Asiatic Palms: Coryphea. Ann. Roy. Bot. Gard., Calcutta 13: 272-286.
- HANDEL-MAZZETTI, H. 1927. Naturbilder aus Südwestchina: Erlebnisse und Eindrücke eines Forschers. Pp. 242-243. Österreichischer Bundesverlag, Wien, Leipzig.
- . 1936. *Symbolae Sinicae*: VII. Teil Anthophyta. Verlag Julius Springer, Wien.
- KIMNACH, M. 1977. The Species of *Trachycarpus*. *Principes* 21: 4, 155-160.
- PEI SHENG-JI AND CHEN SAN-YANG (Eds). 1991. *Flora Republicae Popularis Sinicae*. Vol. 13(1). *Palmae*. Pp. 172. The Science Press, Beijing.

Principes, 39(2), 1995, p. 74

CHAPTER NEWS AND EVENTS

News from the South Pacific

Carpoxylon macrospermum, a study in seed distribution and species conservation. The rare palm, *Carpoxylon macrospermum*, is found naturally only in Vanuatu in the South Pacific. It has been deemed "desirable" for hobby collectors and certain commercial landscaping operations by people familiar with its appearance and growth habit. It is familiar in form to *Clinostigma* and *Veitchia*.

The Foundation for the Peoples of the South Pacific has set up a "Profitable Environmental Protection" Project to ensure responsible collection and distribution of the seed as well as species conservation, also serving to feed back some revenues to the local populus. This project is partially funded by US AID.

In a logical first step, the PEP project conducted a study of the locations, fruiting status, natural regeneration status, etc. of all *Carpoxylon* trees on the islands. This report was done by a very well known and respected palm expert from Australia, John Dowe of Townsville Palmetum (who is also an IPS and PACSOA member). The report on the exact locations and numbers of natural populations is being held confidential, because "this

data would be very useful to one wishing to unscrupulously exploit the resource."

It was noted, however, that there was almost no seedling regeneration from cultivated palms. The study concluded that marketing of the seeds from ONLY these cultivated specimens would have no detrimental effect on the species recovery plan. Additionally, some seeds and seedlings from the naturally regenerating populations will be used in a species recovery plan in Vanuatu.

A non-profit business has been established on Vanuatu to market the seeds (from the cultivated plants). These seeds will soon be available through the International Palm Society (IPS) and through PACSOA (the IPS Australian affiliate). They are not cheap—a US-landed price to the IPS of US\$6 per seed has been set. The seeds are large so postage is expected to be between \$0.50 and \$1.00 per seed. The IPS Seed Bank will sell these seeds at US\$7 per seed (see ordering information below).

This is the first year pilot project and these extremely rare seeds will soon be available for shipment from California. Order now to be assured of seed. The quantity of seeds expected by the IPS should be sufficient to meet the demand. However, if this is not so, your payment will be promptly refunded.

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RARE VANUATU PALM SEED! The IPS Seed Bank is expecting a shipment of freshly collected seeds of the rare *Carpoxylon macrospermum*, a palm native only to Vanuatu. Send US\$7 per seed, payable to the International Palm Society, to IPS Seed Bank, c/o Lynn Muir, 33802 Valencia Place, Dana Point, CA 92629.

This very attractive palm is reminiscent of *Clinostigma* and *Veitchia*, and should prove a valuable addition to your palm garden (see *Principes* Vol. 32(2):63-73. (1989) for related articles). These seeds are being supplied to the IPS by the Peoples Environmental Project run by the Friends of the South Pacific.

Principes, 39(2), 1995, pp. 75-76

Carpoxylon at the Natural History Museum, London

SCOTT ZONA

Fairchild Tropical Garden, 11935 Old Cutler Road, Miami, Florida 33156

The rediscovery of a small population of *Carpoxylon macrospermum* H. Wendl. & Drude on the island of Espiritu Santo, Vanuatu, ranks among the most exciting and significant events in palm biology in recent years. In John Dowe's description of his rediscovery (Dowe 1988, 1989), he acknowledged the role that chance and luck played in finding *Carpoxylon*. In his words (Dowe 1988), "*Carpoxylon* had been rediscovered almost by sheer accident."

For over one hundred years, *Carpoxylon* was known only from the original description and illustration of the endocarp and seed. The original publication contains no indication of which specimen was the basis for the description nor details of the collection data. Without a bona fide specimen to examine, subsequent palm systematists had only the description and drawing, however inadequate, upon which to base their conclusions about this strange palm. For want of physical material to study, Moore (1973) and Uhl and Dransfield (1987) left *Carpoxylon* unplaced in their generic schemes. When more material was at last collected, a new and complete generic description was possible and its proper relationships with other genera of the Iguanurinae were revealed (Dowe and Uhl 1989). One intriguing mystery still remained: How did Wendland and Drude know about this unusual palm from a far-off Pacific island? Where was the specimen upon which Wendland and Drude based their original description of *Carpoxylon macrospermum*? Or, in botanical parlance, where was the holotype specimen? It was assumed to be in the herbarium at Göttingen (Dowe and Uhl 1989), where most of Wendland's specimens reside, although no such specimen has ever been found there.

In June of 1994, I had the pleasure of visiting the Natural History Museum, London to examine materials, including holotype specimens, of *Veitchia*. Of particular interest to me was the holotype of *V. spiralis* H. Wendl. collected by MacGillivray

(variously spelled M'Gillivray or McGillivray) from the island of Aneityum (now Anatom), New Hebrides (now Vanuatu) in 1860. Through the perseverance of Dr. Roy Vickery, the holotype of *V. spiralis* was located in the carpological collection, a collection of bulky fruits kept separate from the pressed herbarium specimens. Among the boxes of *Veitchia* fruits was an especially large box. Upon opening it, I was astounded to find 13 endocarps of *Carpoxylon*! This was indeed a serendipitous rediscovery: The holotype has been found at last

The label of the holotype specimen read: "Isle of Aneiteum. Nohoich. Areca! McGillivray 1860." Someone had written "no!" next to the identification as *Areca*, and somehow the collection had been filed with *Veitchia*. The meaning of the word "Nohoich" is obscure. It may represent a common name for the palm, as MacGillivray was known to record such information, although it does not correspond to the common name, *ninuvusa*, given by Dowe (1988).

The collector was John MacGillivray, chief naturalist on the voyage of the *Herald*, a British vessel that surveyed the islands of the South Pacific from 1852-1861 under the command of Capt. H. M. Denham. According to notes of the voyage preserved at Kew (examined by P. S. Green), the islands of Anatom and Futuna, Vanuatu, were visited in November, 1853, a date which does not correspond to the dates on the specimens of *Carpoxylon* and *V. spiralis*. It is possible that the label referred to the date when the specimens were received by the museum, not the actual date of collection. It is also possible that the specimens were collected during a second voyage to Anatom in 1859 (J. Dowe, pers. comm.) and received by the museum in the following year.

Dowe's rediscovery of *Carpoxylon* on Espiritu Santo does lead one to wonder whether Anatom was the source of *Carpoxylon* or the specimen was somehow mislabeled. There is, however, no

error in the label of *V. spiralis*, also from Anatom, nor is there any indication that the *Herald* visited Espiritu Santo, so I see no reason to conclude that the *Carpoxyton* label is in error. Dowe (pers. comm.) believes that the Espiritu Santo palms were planted and perhaps not truly indigenous to Espiritu Santo. Although the palm was not relocated during a brief collecting foray on Anatom (Hodel 1982), areas of the island's interior are still imperfectly explored. Anatom may yet prove to be the home of *Carpoxyton*, just as MacGillivray said over 130 years ago.

Acknowledgements

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LITERATURE CITED

- DOWE, J. L. 1988. The rediscovery of *Carpoxyton macrospermum*. *Palms & Cycads* 18: 6-9.
 DOWE, J. L. 1989. The unexpected rediscovery of *Carpoxyton macrospermum*. *Principes* 33: 63-67.
 DOWE, J. L. AND N. W. UHL. 1989. *Carpoxyton macrospermum*. *Principes* 33: 68-73.
 HODEL, D. 1982. In search of *Carpoxyton*. *Principes* 26: 34-41.
 MOORE, H. E. JR. 1973. The major groups of palms and their distribution. *Gentes Herb.* 11: 27-141.
 UHL, N. W. AND J. DRANSFIELD. 1987. *Genera Palmarum*. L. H. Bailey Hortorium and The International Palm Society, Lawrence, KS.

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A Taxonomic History and Reexamination of *Sabal minor* in the Mississippi Valley

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Sabal displays a high degree of variability, particularly in characters commonly used to delimit species (Bailey 1944, Uhl and Dransfield 1987, Zona 1989). In particular, the presence or absence of a trunk (height) along with spines, and leaf blade folding caused taxonomic confusion for early explorers and biologists in North America. Although *S. minor* (*S. louisiana*) has received great attention for its stem variability, other North American palmettos also exhibit great trunk variability including *S. etonia*, *S. palmetto* and *Serenoa repens* (Hilmon 1969, Bailey 1944, Brown 1973, Zona and Judd 1986). This paper reviews the early observations and taxonomic history of *Sabal louisiana* (the "trunked palm") and utilizes protein electrophoresis to characterize its affinity with *S. minor* (N. J. Jacquin) Persoon.

History of *S. minor* (*S. louisiana*)

One of the earliest European accounts of New World palms was by Le Clercq (1691) who published an account of the explorations of the Mississippi by La Salle. He stated, "the whole country is covered with palms." In light of the present distribution of palms, the species observed was probably *S. minor*. The earliest taxonomic treatment of the palm was apparently by Adanson (1763) who established the genus *Sabal* presumably in reference to *S. minor* without commenting on the name's derivation (Guernsent 1804).

The earliest reference to a species distinct from *Sabal minor* in the Mississippi Valley is attributed to Robin (1807). He described two species. The first, which he placed in the genus *Chamaerops*,

was described as having a trunk that "... scarcely emerges from the ground. . .," leaves (petioles?) that lack spines or teeth and are "... folded in a fan." The common name for this palm was given as "latanier". The description fits *Sabal minor* and certainly not *Serenoa repens* which, although essentially without an upright trunk and occurring in southeastern Louisiana, possesses teeth on the petioles. The second species was not named and received only a short statement concerning the leaves, which were described as divided and folded, "... somewhat like an old-fashioned cravat or collar." No mention was made of the presence or absence of a trunk. The description of the leaves fits the manner in which leaves break in some populations of *Sabal minor* (i.e., Frenier Beach, Fig. 1C) in which the palms do possess trunks.

A decade later, William Darby published an account of his exploration of Louisiana titled "A geographical description of the state of Louisiana . . . being an accompaniment to the map of Louisiana." Appearing in 1816 (second edition in 1817), this book gives a description of the habitat of a palm he named *Chamaerops louisiana*. Darby stated "... there is a specific difference between the *Chamaerops palmetto* [= *Sabal palmetto*] . . . and that of Louisiana. The *Chamaerops serulata* of Muhlenberg [= *Serenoa repens*] is certainly not the same as the palmetto of Louisiana; the latter bears a much greater resemblance to cabbage tree, though much more humble in elevation, than to the saw-leaved palmetto of Georgia." This statement may suggest that some form of trunk was present in the palms he observed. Obviously he was familiar with the species occurring on the east coast, so it is surprising that no comparison of this palm was made with *Sabal minor*. The habitat he described for this species is between "where the land sinks too low for the

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1. Variability in the stature of *Sabal minor*. A. A "dwarf" individual from a population near Blountstown, Florida. B. Typical acaulescent individuals in a population near New Orleans, Louisiana. C. A caulescent individual with leaves folded in a manner fitting the description made by Robin (1807). D. Caulescent individuals growing along the Mississippi River below Venice, La. The exposed trunk of the center individual is approximately 2.4 meters in height.

Arundo . . . (and) . . . where the inundation exceeds in depth 15 to 20 inches." Trees associated with the palm were also given. These include *Quercus phellos* Linnaeus, *Q. rubra* Linnaeus, *Liquidambar styraciflua* Linnaeus and *Celtis crassifolia* (*C. laevigata* Willd.), species commonly found in bottomland hardwood forests.

During the same year, Rafinesque (1817) published a flora of Louisiana based on the earlier work of Robin, although he never visited the region himself (Fitzpatrick 1911). Rafinesque assigned binomials to Robin's palms. He called the first *Sabal adansonii* (= *S. minor*) and the second, a new species, *S. ?adiantum* Raf. The description of the latter species appears to be an embellishment of Robin's description. Rafinesque stated that the new species was acaulescent although Robin made no mention of the plant's stature. Ewan (1967) suggested that *S. ?adiantum* is *Serenoa repens* despite the specific reference Rafinesque made to the unarmed petioles. In the same publication, Rafinesque took issue with Darby's species *Chamaerops louisiana* and considered this to be the same as *Sabal adansonii*. It is unfortunate that Darby failed to give fuller description of the palm other than stating that it differed from *Serenoa repens* and was "much more humble in elevation" than *Sabal palmetto*. It was not possible for Rafinesque nor is it possible now to assign Darby's palm without conjecture.

Over the next 40 years there appeared several references to palms found in the Mississippi Valley. In "The Genera of North American Plants . . .," Nuttall (1818) placed *Sabal adansonii* in Louisiana stating that it is in ". . . troublesome abundance around New Orleans; but less frequent than other species in Georgia and Carolina." The other species referred to were *S. palmetto* and *Serenoa repens*. Darby (1818) maintained the use of *Chamaerops louisiana* in "The Emigrant's Guide, etc." Flint (1828) used the species name *Chamaerops latanier*, a name which must have been derived from Robin's or Darby's work. Martius (1838) described the range of *Sabal adansonii* to include the Mississippi Valley as well as Georgia and Carolina.

Shortly after Martius (1838) another statement was put forward which added to the somewhat confused status of the palms of the Mississippi Valley. Arthur Schott (1857), in a report on the Texas-Mexican border and the lower 80 miles of the Rio Grande, stated "It is also in the lower portion of this belt (where the palm tribe is rep-

resented by the *Chamaerops palmetto*) that the Palmetto attains a growth as gorgeous even as in the lower Mississippi." The palm which he observed would have been either *Sabal texana* or *S. mexicana*. The confusion stems from his reference to a "gorgeous" palmetto in the Mississippi Valley. If "gorgeous" is interpreted to mean as having a large stature, as Small (1926) interpreted this statement, then *Sabal palmetto* would be the most obvious comparison. However, *S. palmetto* does not occur within 300 miles of the area (the western edge of its range is in the Apalachicola Valley). His reference may have been to stands of caulescent palms (*Sabal minor*) now only represented by one known stand below Venice on the Mississippi River (Fig. 1D).

The next known reference to trunked palmettos in Louisiana is by Featherman in 1870. In a discussion of the vegetation of Grand Isle, he stated that "tree palmettos are seen here (behind the beach) and there near the beach."

In 1926, J. K. Small was in a position to address the problem of trunked palmettos in Louisiana. He observed a population of trunked palms south of Point aux Herbes (on the southeastern end of Lake Pontchartrain) which were initially taken for *Sabal palmetto*. However, on closer examination he discovered the palm to resemble *S. minor*. Small named this palm *Sabal deeringiana*. Included in his description of the species were characters that he considered significant in distinguishing it from *S. minor*; it is a tree to 4 meters with a trunk of 1 to 2 meters high with petioles longer than the leaf blades, the leaf midrib extends high into the flat blade and the leaves are filamentous. He also indicated that the petals are slightly broader and longer, the stamens are longer, and that the fruit is more depressed than in *S. minor*. The type specimen is deposited at The New York Botanical Garden.

In 1929 Small made further comparisons of *S. deeringiana* with other species of *Sabal*. The habitat of this palm was said to be bottomless gumbo, and he stated that in Louisiana, *S. deeringiana* was much more restricted and less common than *S. minor*. In this publication, Small provided photographs of two individuals of *S. deeringiana* at Frenier Beach on Lake Pontchartrain.

In Small's discussion of this new species he referred to Schott's (1857) reference to a palm of "gorgeous" growth in the Mississippi Valley but was apparently unaware of the earlier observations of trunked palmettos by Robin (1807) and Darby

(1816). Had he known of these, he surely would have noted the similarity of these descriptions. The similarity can be seen by comparing Small's photographs of *S. deeringiana* with Robin's description of the manner in which the leaves split and break over (Fig. 1C).

Bomhard (1935) reviewed these accounts of trunked palmettos and considered Darby's specific epithet to have priority, thus creating the binomial *Sabal louisiana* (Darby) Bomhard. Bomhard (1937, 1940, 1943) provided photographs and a map of population sites. She extended the range of the species to eastern Texas across to the western portion of the Florida panhandle and north to southern Arkansas. She stated that *S. louisiana* is stemless under some conditions while producing an aboveground trunk under others. Unfavorable conditions that contribute to retarded trunk development include exposure to brackish water, direct sunlight, and the deposition or removal of soil around the plant's base (Bomhard 1943). Bomhard suggested that the largest individuals she observed were in excess of 200 years old.

In his first monograph of the genus, Bailey (1934) recognized *S. louisiana*; however in his second monograph (1944), he combined *Sabal minor* and *Sabal louisiana*. He considered the latter to be the final, emergent stage of the former stating that "no clear definite . . . differences are recorded between the acaulescent and caulescent phases . . ." and that if these are two species, characters other than stature need to be found. Since this time, *Sabal louisiana* has been considered a synonym of *S. minor* (except by Bomhard 1950 and Vines 1960 who maintained it as a distinct species). In a recent monograph of the genus, Zona did not separate *S. louisiana* from *S. minor* (Zona 1990).

Acaulescent populations of *S. minor* occur throughout the species' range while trunked palms occur mostly in the western portion of the range (specifically in LA and TX, Figs. 1C and 1D). Typical, acaulescent populations are composed of individuals with leaves reaching 1.5 to 2 meters in height (Fig. 1B). A population of unusually small individuals was observed on the Apalachicola River flood plain near Blountstown, Florida. Here, the largest reproductively mature individuals scarcely reached 40 cm in height (Fig 1A). A similar population of "dwarf" individuals was described by Bailey (1944) from Angelian County, Texas.

In contrast, it is not uncommon in the western half of the species' range to find populations of

trunked individuals with a stem height of approximately 1–1.5 meters (total height near 4–5 meters). The tallest individuals have trunks greater than three meters (total plant height approximately six meters, Fig. 1D). The largest individual known, tentatively identified as *S. minor*, has a 19 foot trunk (5.8 meters) with a total height of 27 feet is located in Brazoria County, Texas (Landon Lockett, personal communication).

Gel Electrophoresis Methods

Plant material was collected from six taxa representing three species in two genera. *Serenoa repens* (Bartram) Small was collected from a population near Orlando, Florida and *Sabal palmetto* (Walt.) Loddiges ex J. A. & J. H. Schultes was collected near Crystal River, Florida. Four populations of *Sabal minor* were examined. An acaulescent population sampled near Savannah, Georgia (SVGA), a population of "dwarf" individuals near Blountstown, Florida (BTFL), a caulescent population at Frenier Beach, Louisiana (FBLA), one of the sites of *Sabal louisiana* described by Bailey (1944) and Bomhard (1943), and a caulescent population of *Sabal minor* located below Venice, Louisiana actually growing in the Mississippi River (MRLA). This population previously had been found to have the greatest mean genetic distance (Nei's index, 1972) from 13 populations distributed from Georgia to Texas (Ramp, 1989).

Leaf portions were cut into small pieces then ground with mortar and pestle in a 7.5 pH grinding buffer composed of 0.1 M Tris, 1.0 mM EDTA, 10 mM KCl, 10 mM MgCl, 14 mM 2-mercaptoethanol, and 5% polyvinylpyrrolidone-40 (Gottlieb 1981b). This was absorbed onto 3 × 15 mm paper wicks (Beckman) and placed into 12.9% starch gels.

A lithium hydroxide buffer system (Soltis et al. 1983) was used to examine seven enzyme systems; alcohol dehydrogenase (ADH), leucine aminopeptidase (LAP), glutamate-oxaloacetate transaminase (GOT), peroxidase (PER), superoxide dismutase (SOD), phosphoglucosyltransferase (PGT) and malic enzyme (ME). Staining procedures followed Soltis et al. (1983).

The unbiased estimate of mean heterozygosity per locus (H) for each taxa and the unbiased genetic distances were calculated (Nei 1978). Although sample sizes are small for *Sabal palmetto* ($n = 5$) and *Serenoa repens*, ($n = 10$) empirical studies have found that samples of 8–

Table 1. *Allozymes observed for three American palmettos. Sabal minor populations are given in text.*

Locus	<i>Sabal palmetto</i>		<i>Sabal minor</i>			
	<i>Serenoa repens</i>		SVGA	BTFL	FBLA	MRLA
PGI-1	1.0 1.0		—	1.0	1.0	1.0
PGI-2a	0.50	—	0.0	0.0	0.0	0.0
b	0.50	—	0.0	0.0	0.0	0.0
c	0.0	—	0.07	0.20	0.89	0.50
d	0.0	—	0.93	0.80	0.11	0.50
PER-1	1.0	—	—	—	—	—
PER-2a	0.0	1.0	1.0	1.0	1.0	1.0
b	1.0	0.0	0.0	0.0	0.0	0.0
LAP-1a	1.0	0.0	0.0	0.0	0.0	0.0
b	0.0	1.0	1.0	0.0	1.0	1.0
LAP-2a	1.0	0.0	0.0	0.0	0.0	0.0
b	0.0	1.0	1.0	1.0	1.0	1.0
GOT-1a	1.0	0.0	0.0	0.0	0.0	0.0
b	0.0	1.0	0.0	0.0	0.0	0.0
c	0.0	0.0	0.83	0.73	0.53	0.50
d	0.0	0.0	0.17	0.27	0.47	0.50
ME-1a	1.0	0.0	1.0	1.0	1.0	1.0
b	0.0	1.0	0.0	0.0	0.0	0.0
SOD-1a	1.0	0.0	0.0	0.0	0.0	0.0
b	0.0	—	1.0	1.0	1.0	1.0
SOD-2	1.0	1.0	1.0	1.0	1.0	1.0
SOD-3	1.0	—	1.0	1.0	1.0	1.0
SOD-4a	0.0	—	1.0	1.0	1.0	1.0
b	1.0	—	0.0	0.0	0.0	0.0
ADH-2a	—	0.0	0.98	0.85	0.41	0.33
b	—	1.0	0.02	0.15	0.89	0.67

12 individuals usually give heterozygosity estimates within 1% of estimates based on much larger samples and that samples even as small as two individuals generally give estimates within 2.5% (Gorman and Renzi 1979). There is even a smaller effect of sample size on genetic distance. Results

indicate that for interspecific comparisons, a sample size of one is sufficient to estimate genetic distance within 0.1 in over 90% of the cases studied and that the error is to systematically overestimate D (Nei 1978, Gorman and Renzi 1979). Both heterozygosity and genetic distance estimates are much more severely affected by the number of loci sampled. Gorman and Renzi (1979) found that a sample of two individuals scored for all loci studied (23) gave a better estimate of heterozygosity than all individuals (20–41 per species) scored for a subset (up to 20) of the loci in eight species of *Anolis*.

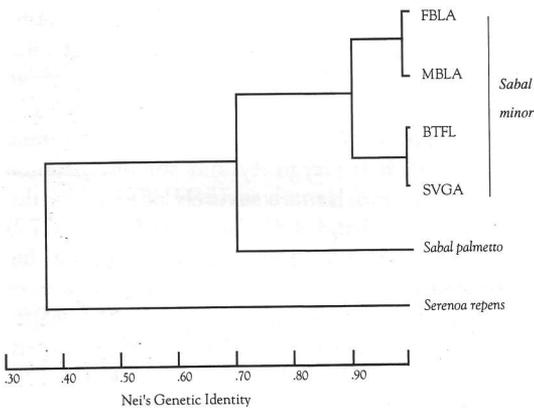
Results and Discussion

Thirteen loci were resolved (Table 1). Mean heterozygosity values for these loci (on the diagonal of Table 2) were similar for all taxa ranging from $H = 0.081$ in BTFL (*Sabal minor*) to $H = 0.000$ in *Sabal palmetto*. Mean heterozygosities for these palms are low compared to the average of $H = 0.156$ found in plants (Hamrick et al. 1979) but are similar to those calculated for *Washingtonia filifera*, $H = 0.009$ (McClenaghan and Beauchamp 1986). When values for these palms are compared with other long-lived perennials (average heterozygosity, $H = 0.27$), the difference is striking. It would be interesting to know if low heterozygosity is characteristic of palms in general or if the low heterozygosity observed here is the result of similar evolutionary histories (e.g., populations undergoing similar bottlenecks).

The smallest genetic distances were between the four populations of *Sabal minor*, ranging between 0.011 and 0.132. Genetic distances and identity are given in Table 2 and a phenogram of genetic identity in Figure 2. The high genetic identity within the populations SVGA, BTFL,

Table 2. *Nei's (1978) unbiased estimates of genetic identity (above diagonal), genetic distance (below diagonal), and heterozygosities (on the major diagonal).*

	<i>Serenoa repens</i>	<i>Sabal palmetto</i>	<i>Sabal minor</i>			
			SVGA	BTFL	FBLA	MRLA
<i>Serenoa repens</i>	(0.043)	0.372	0.376	0.388	0.386	0.381
<i>Sabal palmetto</i>	0.989	(0.000)	0.578	0.619	0.725	0.684
<i>Sabal minor</i> (SVGA)	0.978	0.548	(0.038)	0.989	0.910	0.876
<i>Sabal minor</i> (BTFL)	0.947	0.480	0.011	(0.081)	0.924	0.924
<i>Sabal minor</i> (FBLA)	0.952	0.322	0.094	0.079	(0.076)	0.980
<i>Sabal minor</i> (MRLA)	0.965	0.380	0.132	0.079	0.020	(0.075)



2. Phenogram of Nei's (1978) unbiased genetic identities for *Serenoa repens*, *Sabal palmetto* and three populations of *Sabal minor*.

MBLA, and FBLA indicated that *Sabal louisiana* is probably not genetically isolated from *S. minor* and supports Bailey's (1944) conclusion that *S. louisiana* should not be separated from *S. minor*. Studies of other species have found that genetic identity between intraspecific populations are usually quite high, nearly always 0.90 or above (Gottlieb 1977, 1981a, Crawford 1983).

Between congeneric species, most studies have found that genetic identity are much lower than within species (Gottlieb 1981a, Crawford 1983). For 13 species pairs in 8 genera, Gottlieb (1977) found a mean genetic identity of $I = 0.67$. Identities between the three populations of *Sabal minor* and *S. palmetto* certainly fall in this range ($I = 0.662$).

Between *Serenoa repens* and the two species of *Sabal* sampled, the mean genetic identity is 0.379. However, for comparisons between genera and higher taxonomic levels, the utility of allozyme data is increasingly limited. This is due to underlying assumptions in data interpretation. To interpret two different electromorphs from different genera as representing genetic divergence equal to two different electromorphs within a genus distorts the data, forming closer genetic affinities between taxa than may exist. Also, the assumption that electromorphs with identical mobilities represent identical proteins when derived from widely separated taxa is undesirable (Crawford 1983). The results of these taxonomic comparisons indicate that the use of electrophoretic techniques to detect genetic differences should be a valuable tool in unraveling the systematics of *Sabal*.

LITERATURE CITED

- ADANSON, M. 1763. Familles des Plantes. Vincent, Paris.
- BAILEY, L. H. 1934. American palmettoes. *Gentes Herbarum* 3: 275-339.
- . 1944. Revision of the American palmettoes. *Gentes Herbarum* 6: 365-459.
- BOMHARD, M. L. 1935. *Sabal louisiana*, the correct name for the polymorphic palmetto of Louisiana. *J. Wash. Acad. of Sci.* 25: 35-44.
- . 1937. What palms grow in Louisiana. *Louisiana Conservation Review, Autumn*, pp. 37-42.
- . 1940. What palms grow in Louisiana. *Louisiana Conservation Review, Autumn*, pp. 43-47.
- . 1943. Distribution and character of *Sabal louisiana*. *J. Wash. Acad. Sci.* 33: 170-182.
- . 1950. Palm trees in the United States. U.S. Department of Agriculture, Agriculture Information Bulletin No. 22.
- BROWN, K. E. 1973. Ecological life history and geographical distribution of the cabbage palm, *Sabal Palmetto*. Ph.D. Thesis, North Carolina State University at Raleigh.
- CRAWFORD, D. J. 1983. Phylogenetic and systematic inferences from electrophoretic studies. In: S. O. Tanksley and T. J. Orton (eds.), *Isozymes in plant genetics and breeding*, Part A. Elsevier, Amsterdam.
- DARBY, W. 1816. A geographical description of the state of Louisiana, the southern part of the state of Mississippi, and territory of Alabama . . . Together with a map, from actual survey and observation . . . of the state of Louisiana, and adjacent countries. James Olmstead, publisher, New York.
- . 1818. The emigrant's guide to the western and southwestern states and territories: comprising a geographical and statistical description of the states . . . Accompanied by a map of the United States. Kirk and Mercein, New York.
- EWAN, J. 1967. *Classica Botanica America*. Vol. 5: C. S. Rafinesque; *Florula Ludoviciana*; or, A Flora of the State of Louisiana. Hafner Publ. Co., New York.
- FEATHERMAN, A. 1870. Report of botanical survey of southern and central a Louisiana made during the year 1870. New Orleans.
- FITZPATRICK, T. J. 1911. Rafinesque. A sketch of his life with bibliography. The historical Dept. of Iowa, Des Moines. 241 pages.
- FLINT, T. 1828. A condensed geography and history of the Western States, or the Mississippi Valley. E. H. Flint, Cincinnati.
- GORMAN, G. C. AND J. RENZI, JR. 1979. Genetic distance and heterozygosity estimates in electrophoretic studies: Effects of sample size. *Copeia* 1979(2): 242-249.
- GOTTLIEB, L. D. 1977. Electrophoretic evidence and plant systematics. *Ann. M. Bot. Gard.* 64: 161-180.
- . 1981a. Electrophoretic evidence and plant populations. *Prog. Phytochem.* 7: 1-46.
- . 1981b. Gene numbers in species of Asteraceae that have different chromosome numbers. *Proc. Nat. Acad. Sci. USA* 78: 3726-3729.
- GUERNSSENT, L. B. 1804. Observations sur le *Sabal* d'Adanson. *Bulletin Société Philomatique de Paris* 2: 206.
- HAMRICK, J. L., Y. B. LINHART AND J. B. MITTON. 1979. Relationships between life history characteristics and electrophoretically detectable genetic variation in plants. *Annu. Rev. Ecol. Syst.* 10: 173-200.

- HILMON, BRISTO, JR. 1969. Autecology of saw palmetto (*Serenoa repens* (Bartr.) Small). Ph.D. Thesis, Duke University.
- LE CLERCQ, C. 1691. Premier etablissement de la foy dans la Nouvelle France. A. Auroy, Paris.
- MARTIUS, C. F. P. 1838. *historia naturalis palmarum*, Vol. 3. T. O. Weigel, Lipsiae.
- McCLENAGHAN, L. R., JR. AND A. C. BEAUCHAMP. 1986. Low genetic differentiation among isolated populations of the California fan palm (*Washingtonia filifera*). *Evolution* 40: 315-322.
- MOORE, H. E., JR. 1971. Notes on *Sabal* in cultivation. *Principes* 15: 69-73.
- NEI, M. 1972. Genetic distance between populations. *Am. Nat.* 106: 283-292.
- . 1978. Estimation of average heterozygosity and genetic distance from a small number of individuals. *Genetics* 89: 583-590.
- NUTTALL, T. 1818. The genera of North American plants, and a catalogue of the species, to the year 1817. Philadelphia.
- RAFINESQUE, C. S. 1817. *Flora ludoviciana; or, A flora of the state of Louisiana*. Wiley and Co. New York.
- RAMP, P. F. 1989. *Natural history of Sabal minor: Demography, population genetics and reproductive ecology*. Ph.D. Dissertation. Tulane University, New Orleans, LA.
- ROBIN, C. C. 1807. *Voyages dans l'interieur de la Louisiane* . . . Suivis de la Flore Louisianaise, vol. 3. F. Buisson, Paris.
- SCHOTT, A. 1857. Substance of the sketch of the geology of the lower Rio Bravo Del Norte. In: William H. Emory (ed.). *Report on the United States and Mexican Boundary Survey*. 1(2): 28-48.
- SMALL, J. K. 1926. A new palm from the Mississippi Delta. *Torreya* 26: 33-35.
- . 1929. Palmetto-with-a-stem—*Sabal deeringiana*. *J. N.Y. Bot. Gard.* 30: 273-284.
- SOLTIS, D. E., C. H. HAUFLE, D. C. DARROW AND G. J. GASTONY. 1983. Starch gel electrophoresis of ferns: A compilation of grinding buffers, gel and electrode buffers, and staining schedules. *Am. Fern. J.* 73:9-27.
- UHL, N. W. AND J. DRANSFIELD. 1987. *Genera Palmarum*. A classification of palms based on the work of Harold E. Moore, Jr. Allen Press, Lawrence, Kansas.
- VINES, R. A. 1960. *Trees, shrubs and woody vines of the Southwest*. University of Texas Press, Austin, Texas.
- ZONA, S. 1989. A monograph of *Sabal* (Arecaceae: Coryphoideae). Ph.D. Dissertation, Claremont, California.
- . 1990. A monograph of *Sabal* (Arecaceae: Coryphoideae). *Aliso* 12(4): 583-666.
- AND W. S. JUDD. 1986. *Sabal Etonia* (Palmae): systematics, distribution, ecology, and comparisons to other Florida scribe endemics. *Sida* 11: 417-427.

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Principes, 39(2), 1995, pp. 84-88

Gymnopilus palmicola a Lignicolous Basidiomycete, Growing on the Adventitious Roots of the Palm Sabal palmetto in Texas

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Several species of palms are planted in Texas for ornamental purposes; *Sabal palmetto* (Walter Loddiges ex J. A. & J. H. Schultes) is one of the most popular. Almost all plantings of this species are carried out by removal of mature trees (3 m or greater) from natural populations in Florida. Menge and Brown (1992) discuss in detail the transplanting techniques, habitat destruction, and palm losses associated with the removal of this palm species for landscape purposes. Due to the faster seedling growth of *Washingtonia* species, the nursery industry prefers to grow these palms rather than the slower growing *Sabal* species which they transplant from natural stands when needed. Unfortunately many of these *Washingtonia* palms are killed by the brief but severe freezes that coastal Texas experiences (e.g., 1983 and 1989). All of the *Sabal* species tolerate these freezes. The nursery industry should use the more cold-tolerant species of *Sabal* and this species should be grown from seed rather than remove large trees from natural stands in Florida. These palm transplantings result in numerous trees dying as a result of careless practices associated with moving them, prolonged periods in temporary plantings in nurseries, and poor care after planting.

In January 1993 we observed an unusual agaric, *Gymnopilus palmicola*, producing mushrooms (basidiocarps) on the adventitious roots erupting from the lowest portion of the trunk of one of these transplanted palms. Over the last 15 years that we have observed palms on the Upper Texas coast, we have never seen basidiomycetes produce mushrooms on the trunks of any palms. The palm literature (e.g., Carpenter and Elmer 1978) on fungal-palm associations mainly concerns disease-causing species and does not list *Gymnopilus* species associated with palms. The

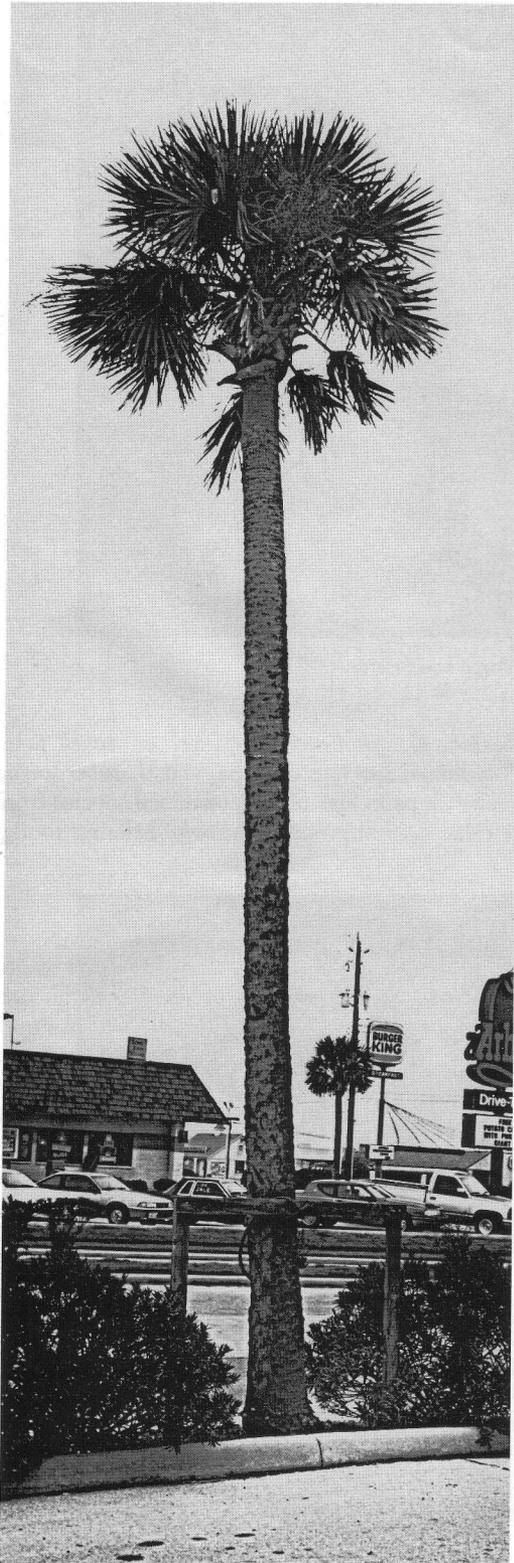
mycological literature (e.g., Hesler 1969) lists *Gymnopilus* spp. associated only with dead palms (palm logs).

A description of this fungus, *Gymnopilus palmicola*, collected from a *Sabal palmetto* in Galveston, Texas on January 5, 1993 and December 3, 1993 is given below.

Gymnopilus palmicola Murrill, *Mycologia* 5: 23 1913. Figs. 1-4.

The basidiocarps are in clustered groups, emerging from the adventitious roots (roots that arise secondarily above the soil line from the palm trunk or stem, see Figs. 1,2). The mushroom cap or pileus 25-55 (-70) mm, campanulate (bell-shaped) to becoming expanded convex, disc obtuse or sunken, margin upturned or straight, sometimes looks like striate, bright-yellow to orange-yellowish sometimes saffron colored or darker with age, flesh of the mushroom leathery, zoned scaly or flocculose (wooly or fluffy); disc with spiny appendages especially when young, scales rust-brown, sometimes with olive green hue (probably due to superficial occurrence of algae or other fungi, e.g., *Alternaria* sp., trapped by the scales) (Figs. 3,4a), and has an unpleasant odor. Gills or lamellae of mushroom are sinuate, crowded, saffron-yellow becoming darker rusty-yellow with age, and turn magenta in 5% KOH. Stipe 10-35 (-55) × 5-8 (-12) mm, excentric, rarely central, tapering towards the base, yellowish with saffron hue, leaving apical ring zone, persistent, (similar to *Cortinarius armillatus* (Fr.) Fr.), cortina-like (curtain-like) fibrils present at stipe apex (or top of stalk) especially when young. Spore print is rust brown.

The fungus' reproductive spores or basidio-



spores are $(7.2-7.8-11(-11.7) \times 4.5-6.5(-7.2) \mu\text{m}$, ellipsoid, honey-yellow to brown in 3% KOH, thick-walled, punctate-warted (Fig. 4b). Basidia, the cells on the gills producing basidiospores are 4-spored, $20-27 \times 5-7 \mu\text{m}$ (Fig. 4c). Cheilocystidia short clavate to capitate or narrowly lageniform (flask-shaped), $20-60 \times 6-10 \mu\text{m}$, hyaline, thin to moderately thick-walled (Fig. 4d); pleurocystidia more cylindrical-clavate to capitate, similar to cheilocystidia, but thick-walled, honey-yellowish or darker in alkali. Pileipellis is composed of interwoven hyphae or chains of fungal cells (Fig. 4e); end cells squamulose (covered with small scales), cystioid $4.5-8.1(-11) \mu\text{m}$ in width, often in chains, darker yellowish, most of them highly incrustated with spiral thickenings. Stipitipellis of thick-walled parallel hyphae ($2.7-8.1 \mu\text{m}$ width); oleiferous (oily in appearance) hyphae present in pileus trama are thick-walled, dark chrome yellowish septate and less than $5 \mu\text{m}$ in width. Clamp connections present.

Material studied: the mushrooms emerging from adventitious roots above the soil level of *Sabal palmetto* in clustered group. Galveston, Texas 1-5 January 1993 and 3 December 1993. Specimens collected January 1993 are deposited at Department of Biology, Virginia Tech, Blacksburg, Virginia and those collected December 1993 are deposited as BPI No. 802362, Systematic Botany and Mycology Laboratory, ARS, USDA, Beltsville, MD 20705.

The collection agrees macroscopically and microscopically with the description of *Gymnopilus palmicola* given by Hesler (1969, p. 26), although the magenta coloration of the gill in KOH differs from the pallid color reported by Hesler who also failed to include pileocystidia. This is the first report of *G. palmicola* from Texas (see Metzler and Metzler, 1992) and the unusual occurrence of this fungus suggests it was introduced with the palm from Florida. The habitat is unusual as *Gymnopilus* spp. are known only to attack palm logs not living palm trees; however this mushroom may be growing on the damaged and possibly decomposing roots of this living palm. Hesler (1969) reported six wood rotting (lignicolous) *Gymnopilus* spp. growing on dead palms out of the 73 species of *Gymnopilus* he recognized: *G. aerolatus* Murr. on palm logs of undetermined

1. This *Sabal palmetto* has basidiocarps at base.



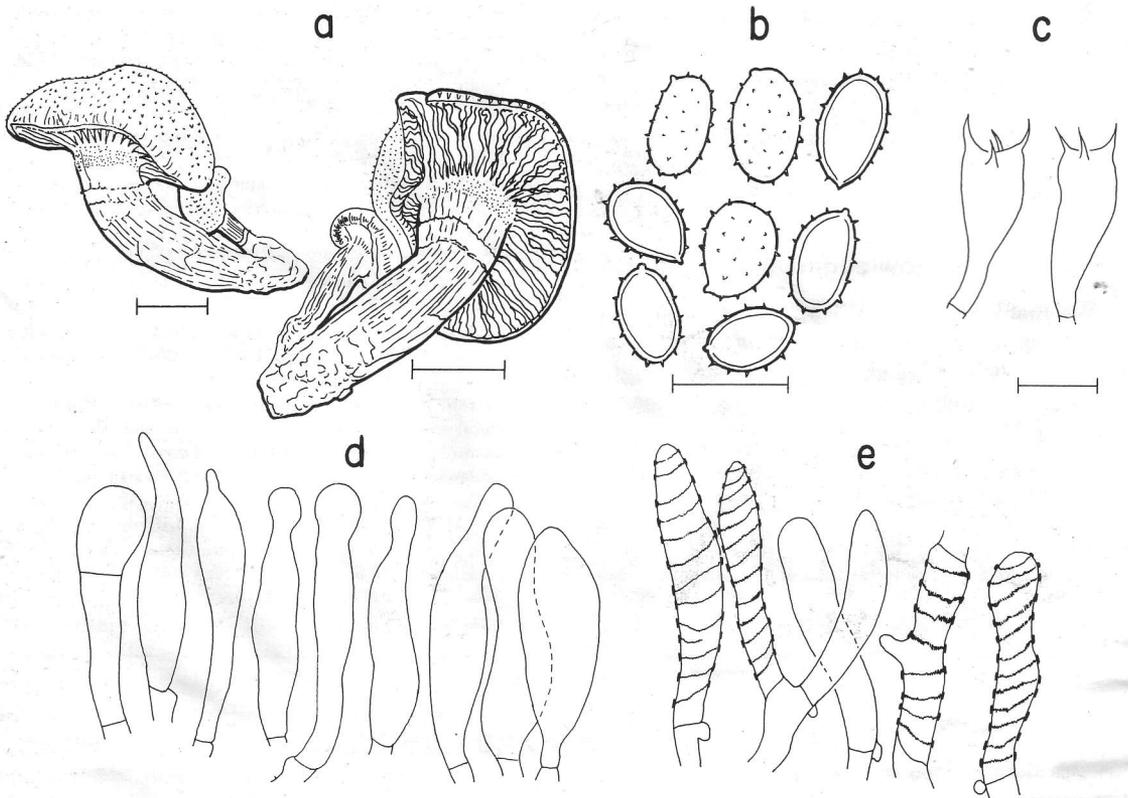
2. Base of palm trunk with aged basidiocarps.

species in Cuba, *G. chrysotrichoides* Murr. on coconut logs in Cuba, *G. earlei* Murr. on coconut logs in Jamaica, *G. palmicola* on palm logs of undetermined species from Cuba, Florida, and

Mexico, *G. pholiotoides* Murr. on royal palm (*Roystonea* sp.) logs in Cuba, and *G. subtropicus* Hesler on palm logs of undetermined species from Florida. *Gymnopilus palmicola* belongs to the



3. Basidiocarps removed from palm to reveal gills.



4. a. Habit. Scales 1 cm. b. Basidiospores. Scale 10 μm c. Basidia. d. Cheilocystidia and pleurocystidia. e. Pileipellis with spiral thickenings. 10 μm scale at right applies to Figures 4c-e.

Section Annulati of the genus and three of the above fungi that grow on palm logs belong to this section (*G. chrysotrichoides*, *G. pholiotoides*, and *G. palmicola*); the other three species belong to the Section Gymnopilus. The basidiospore size of *G. chrysotrichoides* is in the range of our specimens; *G. aureolatus* and *G. subtropicus* have smaller basidiospores and the basidiospores of *G. earlei* and *G. pholiotoides* are narrower.

Palms are known to have fungi penetrate and live symbiotically in their root cells (endomycorrhizal). The fungi in the palm root cells form vesicles on a branched tree-like series of cells [vesicular-arbuscular (VA) mycorrhiza]. The first report of palm mycorrhiza was that of the VA mycorrhiza of *Cocos nucifera* and the oil palm, *Elaeis guineensis* by Rayner (1939). Barry, Jr. (1962) encountering seedling mortality of tropical palms strongly suspected that absence of mycorrhizal fungi was the cause of seedling mortality. Nadarajah (1980) found what he believed to be the mycorrhizal fungus *Glomus* sp. in the root

cortex but not the vascular system of *E. guineensis*. de Awis and Abeynayake (1980) found endomycorrhiza in *Caryota urens* but not *Areca catechu*. In spite of the limited reports of palms with mycorrhiza and other non-pathogenic fungi these associations may be more frequent than previously thought and strongly support Barry, Jr's hypothesis that tropical palms may have need of mycorrhizal associations for survival.

The *Gymnopilus-Sabal* association appears to be parasitic or decomposer in nature (and lignicolous) rather than benign or symbiotic (mycorrhizal) as the lignicolous habit is common in the genus (and there are no prior reports of this fungal genus being mycorrhizal) and no other reports exist of fungi of this genus growing on living palms. We suggest that microbial flora along with *Gymnopilus* is associated with the decomposition of the palm root cell walls thus producing a suitable substrate among the adventitious roots for this basidiomycete (the mushroom forming fungi) to form mushrooms. No apparent damage to the

palm tree by the agaric (a group of basidiomycetes) has been noted which also suggests that this fungus is a decomposer living on damaged roots rather than a parasite. It is very possible that the palm trunk was damaged and this provided a substrate for a fungus which rots wood. No adjacent *Sabal* palms had these mushrooms.

Acknowledgments

We thank Orson K. Miller, Jr. for thoroughly examining our material and offering his observations that helped to identify this fungus as *G. palmicola* as well as critically reading the manuscript.

LITERATURE CITED

- DE AWIS, D. P. AND K. ABEYNAYAKE. 1980. A survey of mycorrhizae in some forest trees of Sri Lanka. *In*: Peitsa Mikola (ed.). Tropical mycorrhiza research. Clarendon Press (Oxford Univ. Press), Oxford, pp. 146-153.
- BARRY, JR., DAVID. 1962. The possibility of mycorrhizae in palms. *Principes* 6(2): 87-90.
- CARPENTER, J. B. AND H. S. ELMER. 1978. Pests and diseases of the date palm. U.S. Dept. Agric., Agric. Handbook No. 527: 1-42.
- HESLER, L. R. 1969. North American species of *Gymnopilus*. Mycological Memoir No. 3: i-iii, 1-117. Hafner Publ. Co., NY & London.
- MENCE, J. T. AND K. E. BROWN. 1992. Commercial transplanting of wild cabbage palms, *Sabal palmetto*, in Florida. *Principes* 36(2): 94-98.
- METZLER, SUSAN AND VAN METZLER. 1992. Texas mushrooms. A field guide. pp. 1-viii, 1-350. Univ. Texas Press, Austin, TX.
- NADARAJAH, P. 1980. Species of Endogonaceae and mycorrhizal association of *Elaeis guineensis* and *Theobroma cacao* *In*: Peitsa Mikola (ed.). Tropical mycorrhiza research. Clarendon Press (Oxford Univ. Press), Oxford, pp. 232-237.
- RAYNER, M. C. 1939. The mycorrhizal habit in crop plants with a reference to cotton. *Empire Cotton Growing Corporation Rev.* 16: 171-179.

CHAPTER NEWS AND EVENTS

Southern California News

The Southern California Chapter of the International Palm Society met in Ventura on March 18, 1995. The event featured three speakers. Don Tollefson spoke on his experiences during the IPS Post-Biennial Tour in Venezuela, run by Lost World Adventures and the IPS; Don Hodel provided an update on the *Chamaedorea* genus since publication of his book on *Chamaedorea* palms; and, Ralph Velez gave a presentation on the reverse osmosis process he uses to water his palm garden. Following the lectures, members and guests toured the Palm Garden at Ventura College.

The next meeting of the Southern California Chapter is scheduled for May 20 in Malibu, California, at the home of member Dave Anawalt. For information on subsequent 1995 meetings of

the California Chapter, please contact any of the officers listed in your roster.

Lynette Wood has taken over from Bo-goran Lundkvist as Editor of the Palm Journal of the Southern California Chapter. We wish Lynette the best in this new assignment.

As mentioned in the January issue of *Principes*, subscription rates have increased for The Palm Journal of the Southern California Chapter, IPS. The rate for six issues per year for active IPS members is now as follows: US\$20 chapter dues for U.S. residents, US\$27 per year for residents of Mexico or Canada, and US\$30 for overseas subscribers, plus US\$10 additional for optional airmail delivery. Send checks in US funds payable to the Southern California Chapter and mail to IPS, So. Cal. Chapter, 1601 Via Sage, San Clemente, CA 92673.

Principes, 39(2), 1995, pp. 89-94

Predation of *Phytelephas aequatorialis* seeds ("vegetable ivory") by the bruchid beetle *Caryoborus chiriquensis*

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Phytelephas aequatorialis Spruce is endemic to western Ecuador, where it is found from sea-level to 1,500 meters altitude. The palm is one of the principal producers of "vegetable ivory" or "tagua," as its hard seed-endosperm is called. The present boom in the demand for vegetable ivory has once again turned it into one of the most important non-timber forest products in Ecuador, with an annual export worth more than four million US\$ (Borgtoft Pedersen 1993). For information on past and present use of vegetable ivory see Acosta-Solis 1944, 1948; Barfod 1989, 1991a, b; and Barfod et al. 1990.

Phytelephas aequatorialis is often found in dense natural or semi-natural stands. Although the palm often occurs in high densities, which may favor serious pests, there are no observations of any such pests in the lowlands below 650 m altitude. However, on the Andean slopes above 650 m the bruchid beetle *Caryoborus chiriquensis* Sharp. is a common and very efficient seed predator. The beetle may damage 60% of the seeds collected from palms in pastures and consequently it represents a serious constraint to "tagua" exploitation on the Andean slopes. This paper presents observations on the natural history of the beetle and suggests how to reduce the problem.

Study Areas and Methods

Field work was conducted in western Ecuador during a number of visits between 1990 and 1992 as part of a study of the management and economic uses of *Phytelephas aequatorialis*. Seed samples collected as part of this overall study turned out to contain many infested seeds. Considerations of how to avoid infested seed-samples led to the pilot study discussed in this paper.

Seeds were sampled in three plots. Two of these were established in pastures and one in a disturbed old-growth forest. One of the pasture plots and the forest plot were situated next to each other at 1,400 m altitude, near Palo Quemado in the Province of Cotopaxi (00°22'S; 78°55'W). The other pasture plot was situated at 1,325 m altitude, near the village of San Francisco de Las Pampas, 10 km away. Data from the two pasture plots are treated together.

Seed samples (20 seeds in each sample when possible) were collected in the plots throughout the study period whenever seeds were found. All seeds were collected within three meters from the stem of a palm. Samples were checked for beetle eggs in the umbo (the hard button at the base of the endocarp), and for number of larvae, pupae and imagines (adult beetles) in the endosperm. In some cases pores in the umbo were too obscured by mud to be examined properly for presence of eggs. Also, in the first three samples (totalling 57 seeds) the only data recorded were presence or absence of infestation of endosperm, since the samples originally were taken as part of the study on "tagua" productivity.

A cage-trial was made to investigate whether fresh seeds enclosed in endo- and mesocarp could become infested. Thirty-three seeds with endocarp, but with the mesocarp removed manually, and 20 seeds with both endocarp and mesocarp, were arranged in a bird-cage and placed in a *P. aequatorialis* palm in a pasture for three weeks (Fig. 1). The cage was used to keep rodents from eating the mesocarp. Another 20 seeds were brought back to Quito as control. All 73 seeds were harvested from the same infructescence. Infested seeds from the cage-trial were afterwards used to establish development time for the beetles.

A total of 889 seeds were examined in the present study. All seed samples were left at least two months after collection before being checked for infestation in order to allow eggs to hatch and larvae to start their development, facilitating their location.

Numeric data are generally presented as mean values (\pm standard deviation) and with indication of sample size (n). Range is given when relevant. When the data are included in Table 1 only mean value is given in the text. Mean and average values signify arithmetic mean.

Results and Discussion

Host-species and Distribution. *Caryoborus chiriquensis* is a bruchid beetle, app. 10 mm long, belonging to the subfamily Pachymerinae. The genus consists of three species (Nilsson pers. comm.), and is grouped by Lepesme (1947) among palm bruchid genera which depend exclusively on palms for at least one of their life-stages (larva or imago).

Five palm genera have been listed as hosts for species of the genus *Caryoborus*: *Astrocaryum*, *Dictyocaryum*, *Jessenia*, *Mauritia* and *Phytelephas* (Nilsson, pers. comm., Couturier and Kahn 1992, Lepesme 1947). The species *Caryoborus chiriquensis*, however, has only been recorded from *P. macrocarpa* (Lepesme 1947) and *P. aequatorialis* (pers. obs.), but since it has been collected from a species of *Phytelephas* in western Panama (Johnson, pers. comm.), *P. seemannii* may be included in the host-list, because it is the only species of *Phytelephas* known from Panama (Barfod 1991b). The total distribution of the beetle appears to include Venezuela, Panama, Colombia, and Ecuador (Lepesme 1947, Johnson and Nilsson, pers. comm.).

In Ecuador I have found seeds infected by *C. chiriquensis* in the provinces of Pichincha, Cotopaxi, Cañar, and Loja, and, according to Nilsson, the bruchid has been collected in the province of Carchi, i.e., it is distributed throughout the western Andean slope from north to south in Ecuador. The altitudinal range was registered along a 40 km transect in the Provinces of Pichincha and Cotopaxi (on the road from Santo Domingo de Los Colorados to Las Pampas de San Francisco). It showed the bruchid to be present from 650 m to 1440 m altitude (observed at 650, 850, 1,025, 1,210, 1,290, 1,310, 1,330, and 1,440 m. altitude). This distribution matches the distribution



1. *Phytelephas aequatorialis* palm with a bird cage. *Phytelephas aequatorialis* seeds with and without mesocarp, all with endocarp, were placed in the cage and later examined for infestation by the bruchid beetle *Caryoborus chiriquensis*.

of *P. aequatorialis* (see Barfod 1991b) above 650 m.

Phytelephas aequatorialis is common throughout the western lowlands up to an altitude of 1,500 m. Because of its many uses the palm often escapes the axe when forest is converted to pasture or agricultural land, and in this way it becomes part of various land use systems (Fig. 2a).

The seeds on which the larvae feed are almost entirely made up of the extremely hard endosperm. Seeds are 5–7 cm long, average weight (dry weight) in the study area is 36.3 ± 12.3 g ($n = 610$), and average density is $1.35 \text{ g/cm}^3 \pm 0.08$ ($n = 36$). One infructescence contains 25.1 ± 5.3 ($n = 39$) fruits, each with an average of 4.9 ± 1.5 seeds ($n = 447$) (Fig. 2b). Each of the seeds is surrounded by its own, one millimeter thick, endocarp. In the endocarp an oval button-like structure, about 1–1.5 cm long, can be seen

Table 1. Infestation of *Phytelephas aequatorialis* seeds by the bruchid beetle *Caryoborus chiriquensis*.

	Infested endosperm	Individuals per seed ¹	Cocoons per seed ²
Seeds cleaned by rodents			
Pasture	61% (n = 262)	22.1 ± 15.6 (1-71, n = 85)	25.6 ± 16.6 (1-71, n = 56)
Forest	12% (n = 197)	16.6 ± 18.4 (1-78, n = 21)	19.7 ± 13.6 (10-54, n = 9)
All	40% (n = 459)	21.0 ± 16.2 (1-78, n = 106)	24.8 ± 16.2 (1-71, n = 65)
Seeds cleaned manually			
Pasture	0% (n = 227)	—	—
Forest	1% (n = 130)	—	—
All	0% (n = 357)	—	—
Cage trial			
Seeds without mesocarp:	100% (n = 33)	29.4 ± 14.9 (1-55, n = 33)	29.6 ± 14.2 (2-55, n = 27)
Seeds with mesocarp:	0% (n = 20)	—	—
Control:	0% (n = 20)	—	—

¹ Average number ± standard deviation of individuals (larvae, pupae, imagines) per seed. Range and sampling size is given in parenthesis.

² Average number ± standard deviation of cocoons per seed. The data include both cocoons with pupae and with fully metamorphosed imagines. Range and sampling size is given in parenthesis.

(Fig. 3a). The umbo, as the structure is called, is formed by the funicle and the adjacent endocarp and mesocarp tissue (Barfod, pers. comm.), i.e., the umbo penetrates the endocarp. The umbo itself is penetrated by numerous pores.

Oviposition: As long as the seeds remain in the dense globular infructescence, they are well protected against the bruchid beetle. However, once the mature infructescence disintegrates and the fruits fall to the ground (Fig. 2b), the protective yellow fruit-mesocarp is quickly consumed by rodents such as squirrel (*Sciurus aestuans*) and guatusa (*Dasyprocta* sp.,—a rodent the size of a large rabbit, often hunted for its tasty meat), leaving the seeds protected only by the endocarp. The hard endocarp may offer protection against many potential predators, but *Caryoborus chiriquensis* lay its eggs in the pores of the umbo, and once the eggs hatch, the larvae penetrate to the endosperm through the pores.

Eggs, or parts of eggs, in the umbo are a useful indication of the endosperm being infested: 74% of the seeds examined with eggs in the umbo (n = 129) were found to have an infested endosperm. Among those collected without mesocarp and with no detectable eggs in the umbo, only 19% turned out to have infested endosperm (n = 118). In the cage-trial it was found that all 28 seeds with eggs in the umbo had infested endosperm, while 5 seeds with infested endosperm had no recognizable parts of eggs left in the umbo. Generally the eggs are easily observed (Fig. 3a), and their presence may be used by farmers or dealers to predict infesta-

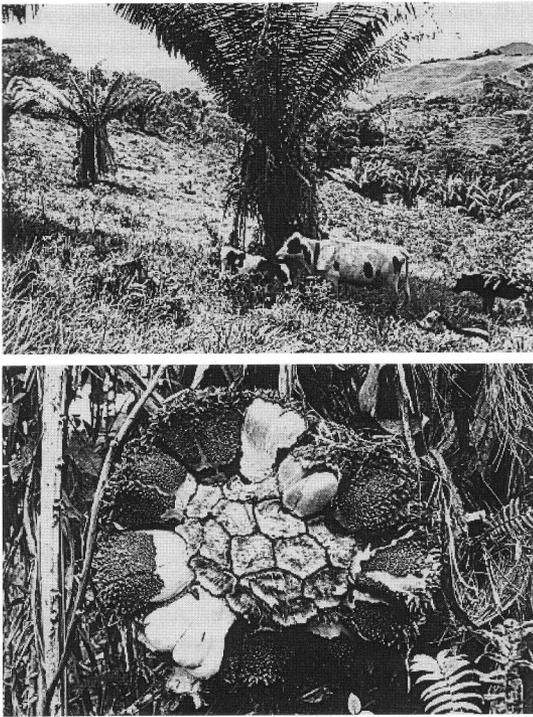
tion. Later, as the endosperm is consumed and turned to powder by the larvae, the seeds lose weight. In dry seeds the change is significant and may be also used to detect infestation.

Infestation: Examination of 357 seeds from fresh fruits, from which the mesocarp was removed manually, revealed only one seed with infested endosperm, while 40% of the seeds collected on the ground without mesocarp had infested endosperm. The cage-trial showed 100% of seeds placed without mesocarp to be infested, while 0% of the seeds with mesocarp were infested (Table 1). These data suggest that intact mesocarp is an efficient protection against the beetle.

Infestation rates from forest and pastures are given in Table 1. In the forest only 12% of the seeds collected without mesocarp were infested, while the corresponding percentage for pasture was 61%.

Though sample sizes are rather small, this suggests that the forest offers some kind of protection of the seeds, e.g., it may be more difficult for the beetle to localize individual palms and/or seeds in the forest, or the beetle may have more predators in the forest than in the pasture.

Each infested seed may contain from 1 to 78 individuals (larvae, pupae, imagines), averaging 21.0. The corresponding data from the cage-trial showed a range from 1 to 55 and an average of 29.4 individuals. Number of cocoons (excluding data from seeds with one or more larvae) are 24.8 for seeds collected on the ground and 29.6 for seeds from the cage-trial (see Table 1 for details).

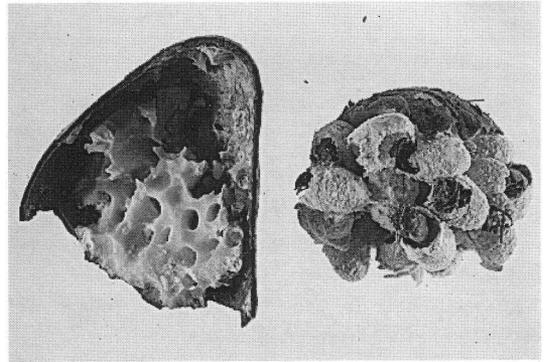
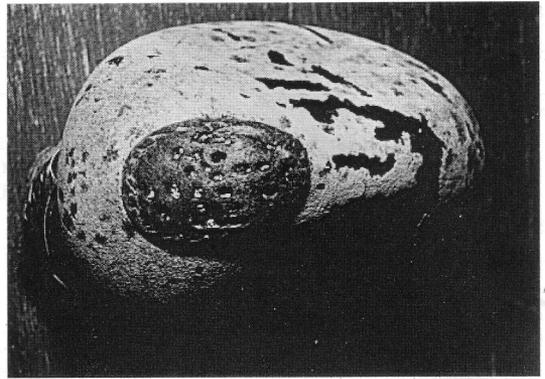


2. A. (Upper photo) *Phytelephas aequatorialis* is often spared when forest is converted to pastures. B. (Lower photo) Mature disintegrating infructescence of *P. aequatorialis*. The infructescences contain about 25 fruits, each with an average of 5 seeds. The yellow (white on the photo) mesocarp is a favored food for both wild and domestic animals.

Since the numbers of cocoons are as high as or higher than the overall average of individuals (which includes larvae), they suggest a high survival rate for larvae. The maximum number of living imagines found in one seed is 44, but it is likely that seeds with higher numbers of larvae would have resulted in up to 78 imagines, had the endocarp not been broken in order to examine the seeds. The average number of individuals per seed in the pasture is higher than the average number in the forest (21.8 as compared to 16.6), but the difference is not statistically significant (Students *t*-test: $t = 1.3$, $p = 0.2$).

In most cases (154 out of 182) the larvae consumed only part of the endosperm (Fig. 3b), suggesting that food rarely is a limiting factor. Not surprisingly seeds which have their endosperm consumed completely generally contain a high number of individuals (47.4 ± 11.2 , range 26–78, $n = 28$).

Seed mortality due to infestation has not been



3. A. (Upper photo) A seed of *Phytelephas aequatorialis* still enclosed in the endocarp. *Caryoborus chiquensis* lays its white eggs in the pores of the umbo. B. (Lower photo) Left, the remaining endosperm of an infested seed is seen attached to part of the endocarp. To the right a number of cocoons with imagines are seen.

studied, but it is most likely very close to 100%, even when just a single or a few larvae are present. The embryo is embedded in the endosperm near the umbo, and since this is where the larvae enters, that area is the first to be consumed.

Development Time. Development time for the beetles under natural conditions is unknown. Table 2 shows data from beetles reared in the laboratory (room temperature) from 33 infested cage-trial seeds.

Cocoon formation had started after 100 days, after 130 days most of the pupae in their cocoons could move and a few imagines were observed. At 145 days only imagines, still in their cocoons, were found. Checks at 160 and 175 days showed most cocoons to contain live imagines, while checks at 190 and 225 days showed mainly dead imagines. Mortality during the pupal stage (from when cocoons had been formed until metamorphosis had

Table 2. Development time for *Caryoborus chiriquensis* at room temperature.¹

Days ²	Development stage	Number of seeds examined
80	Larvae	5
100	Cocoons being made, larvae in cocoons still mobile	5
115	Cocoons, mainly with immobile pupae	5
130	Cocoons mainly with mobile and almost completely metamorphosed pupae	5
145	Cocoons with imagines, 96% alive (49 out of 52)	4
160	Cocoons with imagines, 96% alive (74 out of 77)	2
175	Cocoons with imagines, 100% alive (30 out of 30)	1
190	Cocoons with imagines, 25% alive (24 out of 96)	3
225	Cocoons with imagines, 4% alive (5 out of 116)	3

¹ Seeds used when determining development time had their mesocarp removed manually and were placed for three weeks in the field for infestation.

² Days are counted from the middle of the three week infestation period, i.e., days are ± 10 days.

been terminated) was 4.5% ($n = 3720$). All imagines remained in their cocoons during the whole study period, and no exit holes were encountered at any time. Among all infested seeds examined (182 collected and 33 from the cage-trial) only six have been found with exit holes in the endocarp. It is not known whether the imagines await some environmental trigger such as rain before they make the exit holes (see e.g., Wilson and Janzen 1972), or whether they are unable to make holes in the dry endocarp (caused by the dry conditions under which they have been stored).

It is also possible that, under natural conditions, they wait for a partial breakdown of the endocarp, or for the umbo to fall off. The latter seems to happen more quickly, since many endocarps without umbo have been found in the field. Another possibility is that the beetles depend in part on rodents or other animals to break the endocarp in search for larvae. Janzen (1971) suggests the foraging for larvae of *Caryobruchus buscki* as a possible explanation why rodents chew holes in the endocarp of *Scheelea rostrata* seeds. In the present study most live imagines quickly became very active, trying to escape, when the endocarp and cocoons were broken during checks.

Conclusion

Phytelephas palms are the only known host for *Caryoborus chiriquensis* and the beetle certainly appears to be a well adapted and highly specialized predator on the seeds of this genus: it lays its eggs in the pores of the umbo and, in this way, it gains access through the hard endocarp.

Furthermore it is able to consume the extremely hard endosperm of the seeds.

The present work, though only a pilot-study, gives some suggestions on how to reduce the problem which the beetle causes to "tagua" exploitation on the Andean slopes. Since seeds become infested only after the mesocarp has been removed, farmers may collect the fruits as they fall, remove the mesocarp manually and transport the seeds with endocarp out of the area as quickly as possible. This method is somewhat laborious, but it provides an additional benefit since the mesocarp can be used as fodder for pigs and chickens (Koziol and Borgtoft Pedersen 1993). Alternatively seeds with endocarp and mesocarp may be dried on location. Once dry, the mesocarp and endocarp is easily removed with a single blow from a hammer or stone, leaving only the seed (which command a higher price). Drying however may be difficult, especially during the rainy season, and the fruits must be protected against rodents that remove the mesocarp. Therefore, a better suggestion may be to ship seeds with endocarp and mesocarp to the Province of Manabí and dry them near the "tagua" processing industries in Manta, where dry almost desert-like areas exist.

This study also suggests that infestation rates are much lower in the forest than in open pastures. Thus if "tagua" is collected without mesocarp it is best collected in the forest. Because of this, increased exploitation may give farmers economic reasons to maintain more land as forest or at least with diverse agroforestry systems rather than turning the land into pastures.

Further studies may provide other and more

attractive ways of solving the problem than those suggested here, since a number of questions remain unanswered. Does the imago depend on other host plants (possibly not since infestation rates are so high in pastures with a long distance to other species of plants apart from the grasses)? Are there any seasonal variations in infection rates? Is the beetle only found close to *Phytelephas* palms (how close to the extraction areas can the seeds be stored safely)? Which natural predators do the beetles have (how can their number be increased)?

Acknowledgments

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LITERATURE CITED

- ACOSTA-SOLIS, M. 1944. La Tagua. Publicaciones MAS, Quito. 38 pp.
- . 1948. Tagua or vegetable ivory—A forest product of Ecuador. *Econ. Bot.* 2: 46–57.
- BARFOD, A. 1989. The rise and fall of vegetable ivory. *Principes* 33: 181–190.
- . 1991a. Usos pasados, presentes y futuros de las palmas Phytelephantoidées. In: M. Ríos and H. Borgtoft Pedersen (eds.). *Las plantas y el hombre*. Abya-Yala and Herbario QCA, Quito, pp. 23–46.
- . 1991b. A monographic study of the subfamily Phytelephantoideae. *Opera Bot.* 105: 1–73.
- , B. BERGMANN, AND H. BORGTFT PEDERSEN. 1990. The vegetable ivory industry: Surviving and doing well in Ecuador. *Econ. Bot.* 44: 293–300.
- BORGTFT PEDERSEN, H. 1993. Extractivism in Ecuador with special emphasis on management and commercial exploitation of native palms (Arecaceae). Unpublished Ph.D. Dissertation, Institute of Biological Sciences, University of Aarhus, Denmark.
- COUTURIER, G. AND F. KAHN. 1992. Notes on the insect fauna on two species of *Astrocaryum* (Palmae, Coccoaceae, Bactridinae) in Peruvian Amazonia, with emphasis on potential pests of cultivated palms. *Bull. Inst. Fr. Études Andines* 21: 715–725.
- JANZEN, D. H. 1971. The fate of *Scheelea rostrata* fruits beneath the parent tree: predispersal attack by bruchids. *Principes* 15: 89–101.
- KOZIOL, M. J. AND H. BORGTFT PEDERSEN. 1993. *Phytelephas aequatorialis* in human and animal nutrition. *Econ. Bot.* 47: 401–407.
- LEPESME, P. 1947. Les insectes des palmiers. Lechevalier, Paris. 903 pp.
- WILSON, D. E. AND D. H. JANZEN. 1972. Predation on *Scheelea* palm seeds by bruchid beetles: Seed density and distance from the parent palm. *Ecology* 53: 954–959.

CHAPTER NEWS AND EVENTS

News from the Texas Chapter

The Texas Chapter of the IPS participated in the Houston Home and Garden Show at George R. Brown Convention Center on February 15. Members handed out chapter newsletters and solicited memberships for both the local chapter and for the IPS.

The group met on April 8 for a tour of Moody Gardens in Galveston. The tour started with the Rainforest Pyramid and also took in the many excellent palms planted outside at Moody Gardens. In addition to the Moody tour, members and guests visited the garden of member Henry Homrighaus and the home of Alfred Loeblich and Wendy Ann Aldwyn in Galveston.

Cycad Society Sponsors Trip to Mexico

The Cycad Society sponsored a tour to Mexico for March 6-13, 1995 to visit Mexican cycads in their native habitat. This first of a kind tour was led by Bart Schutzman, of the University of Florida. Bart is one of the leading authorities on the cycads of the New World. This was a special opportunity to see *Dioon edule* in its mountain forest habitat, *Ceratozamia mexicana* in cloud forest, and *Zamia loddigesii* and *Dioon spinulosum* in lowland forest. Of course, participants were able to view many other kinds of plants and animals in the Vera Cruz area, including palms.

Principes, 39(2), 1995, pp. 95–99

Looking for *Chrysalidocarpus pembanus* and Finding *Calamus ornatus* in Ngezi Forest, Tanzania

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Migombani Botanical Garden, Zanzibar*

Towards the end of February 1993, just before the onset of the rains, we set off with great enthusiasm and anticipation to visit Ngezi Forest Reserve, Pemba, Tanzania. We had been asked by Erol Harrison of the South African Palm Society to try to collect *Chrysalidocarpus pembanus* seeds for trade purposes. Members of the International Palm Society will perhaps recall the well researched and informative article in *Principes* 35(2) 1991 pp. 83–85 by Dennis V. Johnson about the endemic Ngezi palm, Mpapindi, which is also mentioned by R. O. Williams (Some Useful and Ornamental Plants in Zanzibar and Pemba 1949 p. 190).

Anyone who has ever tried to travel to Pemba will know it is not an easy task! Although Pemba forms part of the twin offshore Tanzanian Islands of Pemba and Zanaibar, air and sea schedules are unreliable to the point of non-existence. Getting there was a challenge in itself. Ngezi Forest lies in the north-western part of the island and is reached by road—a very good one—but fuel for any kind of transport is elusive. Fortunately, we do have understanding and generous friends, one of whom owns a light aircraft and was willing to make it available to us. In a weak moment, after promises of a champagne lunch, he agreed to fly us to Pemba himself in search of *C. pembanus*.

Most safaris in Africa start at first light and this was no exception. We were ready very early that morning and arrived at the Dar es Salaam Airport No. 2 Terminal Building in good time for our flight. Chake Chake airport, Pemba Island, is rarely overused and certainly not on Sundays. It did not take long to complete formalities—though passports are required in Zanzibar and Pemba even if you are a Tanzania resident. Outside the airport we were pleasantly surprised to find a brand new Toyota four-wheel drive vehicle whose driver was ready to take us to Ngezi Forest. After sup-

plementing our picnic with some choice, huge and succulent Pemba mangoes—a rare treat—we were ready to face the forest—well almost. There was only enough fuel in the vehicle to get us to the capital city, Chake Chake (Fig. 1). After some hard bargaining for fuel on the part of our resourceful pilot, one hour later we were on our way.

During the drive along an impressive new tarmac road, we saw many palms: stands of *Borassus aethiopicum*, occasional *Phoenix reclinata*, *Elaeis guineensis*, one lonely *Corypha umbraculifera* and naturally the ubiquitous *Cocos nucifera*. The hour long journey was very pleasant as we crossed ridges and valleys with little swampy pools and near the coast, were wonderful sea views.

We were very excited to reach Ngezi as this kind of forest in lowland East Africa is rare (see H. J. Beentje, Botanical Assessment of Ngezi Forest, 1990 p. 6). “It is a small Reserve, only 14.4 square kilometres, of which just over one third is covered by moist forest. The rest of the area comprises coastal evergreen thicket, dry coastal forest, giant heath vegetation, secondary bush and swamp forest. The status of Forest Reserve has been in force since the early 1920s, when planned extraction of timber started. This had continued, often to the serious detriment of the forest environment, on and off since that time until recently—though some replanting has been done since the 1940s. The climate is the same as the rest of Pemba, 21 degrees Celsius being the coolest and 34 degrees Celsius the warmest temperatures. There are the usual Masika and Vuli rains experienced by the rest of the Tanzanian coast, but the climate is equable with regular rainfall. The soil of the main part of the forest is alluvial sand. There is some wildlife in the forest: the Pemba flying fox (*Pteropus voeltzkowi*) as well as the red



1. A view in Chake Chake. Photo by F. Liebst.

colobus monkey (*Colobus basius kirkii*, which was originally transported across from Jozani forest in Zanzibar. There is the Pemba vervet or green monkey (*Cercopithecus aethiops nesiotus*) and the shy Pemba blue duiker (*Cephalophus monticola pembae*).” We saw some *Colobus*, but high in the forest canopy.

Arriving at Ngezi is like arriving in another world, the contrast from coastal vegetation and sand to a lush, thick forest with dense tree canopy and one muddy rutted track is almost a shock to the system. The immediate sensation is of relief from the sun’s heat and a conversation stopping silence. An overwhelming sight of luxuriant growth meets the eye. From the huge and magnificent *Asplenium nidus* resting precariously on branches to the creepers covering the tree trunks. We would have loved to have included some of them in our specimen bags! There is much to see, including the introduced *Maesopsis eminii* which is such a pest both in Ngezi and on the mainland in the Amani Forests of the Usambaras.

Soon we saw our first *Chrysalidocarpus pem-*

banus complete with scarlet infructescence, but at 10 m height and being rank amateurs with no crampons, lassoes or any kind of equipment for gathering fruits from great heights, we were reduced to scavenging on the ground for seeds. We were almost through the forest near the west coast, when at last we saw some stands of mature *C. pembanus*, many of which were fruiting. Unfortunately, the thickets in which they stood had been savagely hacked about. Whole trees of *C. pembanus* had been felled—probably for building purposes. With great enthusiasm and renewed energy we gathered sackfuls of seeds from around the bases of the palms.

The drive through the forest had revealed many interesting trees and plants, including *Elaeis*, *Phoenix*, the massive *Raphia farinifera* (another introduced species) plus a spiny palm which none of us recognized and which had not been mentioned in any botanical survey we had read. As it had a flanelum covered in spines (Figs. 2,3) we thought it must be a *Calamus* species, but which? We were very puzzled so we stopped for a closer



2. *Calamus ornatus* in the Negezi Forest Reserve, Pemba.

look and took a photograph. We later sent this with a letter to Kew for identification and received a very polite reply from John Dransfield pointing out that our picture was not very clear, although interesting. Could we, he asked, gather some specific material to assist him in making a positive identification? What a perfect reason for another trip to Pemba.

The next trip took place on 11th December, 1993. This time we were more organized—we took a rope with us, an ornithologist and friend and two bottles of champagne. How could we fail? In high spirits and with much optimism we took off from Dar es Salaam in a single engined aircraft (piloted by the same generous friend) and, after first landing in Zanzibar, arrived in Pemba an hour later. The transport and fuel had been arranged in advance and one and three quarter hours later we were at Ngezi Forest again. Now five pairs of eyes were searching for our mystery palm.

Despite this, we initially failed to find it. Suddenly we had reached the other side of the forest, and we were beginning to think it had been imag-

ination after all. Disappointed, we retraced our steps and were half way back when suddenly black prickles were sighted! We all scrambled out of the vehicle and unloaded the camera, the rope, the champagne, the binoculars, and the secateurs. The required specimens were collected very carefully, not only with the desire to avoid the wickedly sharp thorns, but also to obtain exactly what had been requested. We were even luck enough to find an infructescence, which we skilfully lassoed with the help of a rock on the end of our rope!

This time it was clear to us that this was a rattan—we thought probably *Calamus deeratus*. In places the flagella reached high up to the top of the canopy, over 100 ft above our heads. There were about twenty clumps of this clustering palm, concentrated in an area of about half to three quarters of an acre, but how on earth did it find its way here? Local people passing by, fascinated with our activities, told us that it was the only place in the forest where these palms occur. They said it had come from the mainland and had been planted by a man over his wife's grave many years



3. A close-up of *Calamus ornatus* showing part of the stem with spiny sheath, a petiole (right) and a flagellum (left).

ago. At this point we uncorked the champagne and congratulated ourselves on a good day's work.

Returning home with our booty we empathized with those palm botanists who do this sort of thing

all the time. We found out that it is not easy to transport specimens which have inch long viciously sharp spines and a flagellum like razor wire. Getting the specimens packed in suitably sized parcels

was another challenge. Somebody had to be persuaded to take the parcel to the Post Office, because it was not possible to reduce the packages to letter box dimensions. Neither are large pieces of prickly palm welcome additions to a suitcase. A student son was eventually persuaded that by arranging delivery of the parcels to Kew he would be helping mankind and the environment. So, after lots of packaging material was obtained the specimens were carefully packed, addressed, and included in the young man's luggage and all despatched to London while we waited anxiously for news.

In due course the identification arrived—we had confounded the experts and found *Calamus ornatus*. This is one of the many species mentioned in John Dransfield's book (The Rattans of Sarawak 1992 pp. 163–166), where it is described thus.

'Robust clustering rattan climbing to great heights, to 50 m or more; stem without sheaths to 40 mm diam., with rather prominent nodes and frequently slightly angular in cross section, with sheaths to 70 mm diam., internodes to 30 cm long. Sheaths dark green, armed with large triangular, flattened, yellowish-based black spines 4 × 1 cm, and scattered dull brown scales; knee conspicuous; ocrea short, quickly tattering. Flagellum massive, to 10 m or more long, dark green, armed with short black, yellowish-based spines. Leaf subcirrate, very robust, to 4 m long including the petiole to 1 m (usually less; leaflets 20–30 on each side of the rachis, usually pale green, regularly arranged, the proximal to 50 × 5 cm increasing to 80 × 8 cm in mid leaf, decreasing to minute at the tip, c.4 × 0.5 cm, forming a subcirrus, the leaflets drying pale green, not blackish, prickly on the upper surface of the veins near the tip and along the margins. Inflorescences to 8 m long including the long terminal flagellum, bearing 4–6 partial inflorescences to 80 cm with robust reflexed rachillae in female, and more finely branched in the male. Ripe fruit ellipsoid to 30 × 20 mm, tipped with short beak and covered in 15 vertical rows of matt brown to black scales with paler bases. Seed to 20 × 8 mm, rather angular and grooved with one flattened lateral face; sarcostesta sour, endosperm homogeneous. Seedling leaf bifid, shiny green.

'Geographically occurring throughout the lowlands of Sarawak. Widespread in Borneo, Java,

Sumatra, Peninsular Malaysia, S. Thailand, and Sulawesi. It produces good quality cane for furniture manufacture; however, it does not command the highest prices because the cane is rather uneven in cross-section.'

We are not sure either when or why this palm has been planted in Ngezi, but it is likely to have been for experimental and economic reasons, as is true for many other species that have been introduced into tropical forests.

During a recent trip to Zanzibar when the authors conducted a search of the Herbarium material stored in two dusty cupboards in the National Museum they came across a palm specimen labelled '*Areca catechu*', Ngezi Forest, Feb. 18th 1929, P. J. Greenway. There is no record of this palm having been found in Ngezi in any of the Botanical surveys produced recently. Also, the accompanying material was definitely *Chrysalidocarpus pembanus*. What a pity we did not gather some material of *C. ornatus* for inclusion in the Herbarium records and a specimen of *C. pembanus*. Perhaps this could be a reason for another field trip to Ngezi. We would, of course, not forget to take the champagne.

Acknowledgments

To Nicola Colangelo of Coastal Steel Limited, Dar es Salaam Tanzania who made these trips possible and personally flew us on both occasions to Pemba. He not only organized transport and fuel on the ground to get us to Ngezi, but joined in wholeheartedly with the seed search and gathering operations, even at one point trying to shin up the *C. pembanus*. We are very grateful to him both for his generosity and his company.

LITERATURE CITED

- BEENTJE, H. J. 1990. Botanical assessment of Ngezi Forest, Pemba. Consultancy report for the Zanzibar Forestry Development Project, FINNIDA.
- DRANSFIELD, J. 1992. The Rattans of Sarawak, p. 233. Forest Department Sarawak and Royal Botanic Gardens, Kew.
- JOHNSON, D. V. 1991. The Mpapindi Palm (*Chrysalidocarpus pembanus*) of Pemba Island, Tanzania. *Principes* 35(2): 83–85.
- WILLIAMS, R. O. 1949. Some useful and ornamental plants in Zanzibar and Pemba. Zanzibar.

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A New Species of *Gronophyllum* from the Bismarck Archipelago

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Some time ago, John Dransfield forwarded to me a specimen of an unusual *Gronophyllum* that had come to the herbarium at Kew. It had been collected in 1975 by a team of British botanists on Manus Island, in the Bismarck Archipelago of Papua New Guinea. I have just now had a good look at the specimen, and as John suspected, it is a new species. Moreover, it exhibits an interesting combination of characteristics, and I believe would be worthy of cultivation. A name and description for the new species follow.

Gronophyllum manusii Essig sp. nov.

G. chaunostachydi similis sed foliis brevioribus, 1.5–2 m longis, pinnis effusis, nondum erectis, usque ad 65 cm longis, linearibus, apicibus praemorsis, inflorescentia minore, 12–14 rachillas gerendi, floribus masculis minoribus, 4.5 mm longis, 6 staminibus gerendibus, floribus femineis minoribus, petalis apicibus valvatis, sed vix sepalis longioribus, fructibus elongatis, valde curvatis, rubris differt. Typus: Papua New Guinea, Manus Province, Lorengau Subprovince, Manus Island, Mt. Dremsel summit ridge, alt. 740 m, *Sands et al.* 2880 (holotypus USF; isotypus K).

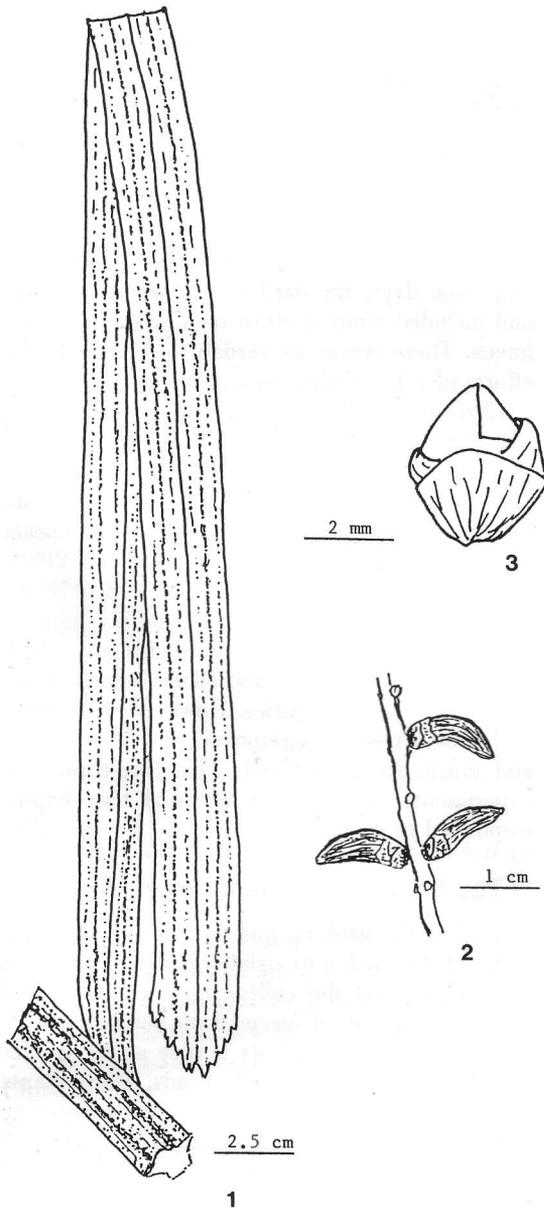
A solitary, slender palm to 20 (–40?) m in height; stem 10–15 cm diam. Leaves ca. 9 in a crown, spreading, 1.5–2 m long, sheath ca. 1 m long, petiole ca. 10 cm long, axis finely white and brown tomentose; pinnae ca. 40 per side, spreading, evenly spaced, linear, widest near the praemorse tips, to 60 cm long and 2.2 cm wide, lacking ramenta below. Inflorescence broomlike, with peduncle 18–19 cm long, 9 mm wide and 3.5 mm thick, splitting into 3 parts that immediately divide into 12–14 rachillae, these to 45 cm long and bearing up to 200 closely spaced decussate triads; all axes glabrous. Staminate flowers 5–6 mm long, sepals broadly lanceolate, 1–1.5 mm long, petals long-triangular, 5–6 mm long, loosely closed around the 6 stamens, anthers about equal-

ling the petals; pistillate flowers conic-ovoid, ca. 2.2 mm high, sepals broad, imbricate, petals ca. 1.5 times as long as the sepals, the valvate tips tightly closed in bud. Fruit 12–14 mm long, 4.5 mm wide, strongly curved, coral red when ripe; pericarp thin with exocarp tanniferous, mesocarp of a single series of large fibrovascular bundles, and the endocarp consisting of a prominent locular epidermis; seed with endosperm homogeneous.

Distribution. Known only from the summit of Mt. Dremsel on Manus Island, the westernmost island of the Bismarck Archipelago in Papua New Guinea.

Specimens Examined. PAPUA NEW GUINEA. Manus Province: Lorengau Subprovince Mt. Dremsel summit ridge, ca. 6 km inland from Pelekawa on the south coast, alt. 740 m, 29 November 1975, *Sands, Pattison & Wood* 2880 (holotype USF!, isotype K); Mt. Dremsel, alt. 630 m, 26 March 1981, *Kerenga & others* LAE 77518 (LAE, USF!).

The species exhibits an unusual combination of characters. It is a relatively large, single-stemmed palm, with its pinnae linear and evenly spaced, and its seeds with homogeneous endosperm. In these respects it is like *G. chaunostachys* (Burret) H. E. Moore, *G. mayrii* (Burret) H. E. Moore, and other species formerly included in *Kentia* Blume (non Adanson) (cf. Essig and Young 1985). Despite the reported height of the palm, however, the leaves and inflorescence of the new species are relatively small. The pinnae, moreover, are widest in the upper part, have praemorse tips rather than the briefly notched tips characteristic of the other large species (Fig. 1), and appear to be spreading rather than semi-erect. These vegetative features suggest affinity with the species formerly included in the genus *Nengella*. The inflorescence bears a scant 14 rachillae, compared to 40–50 in *G. chaunostachys*, and the peduncle is rather elongate. Species of *Nengella* typically have only 1–4 rachillae. In addition, the elongate,



1. The elongate pinnae of *Gronophyllum manusii* are broadest at the tip and praemorse. 2. The fruits of the new species are bright red and strongly curved. 3. The petals of the pistillate flowers, in particular the valvate upper portion, are not as long as in other species of *Gronophyllum*, but still cover the stigma, indicating that the plants are protandrous.

bright red fruit, although unusual in their strong curvature resemble those of a number of former *Nengella* species (Fig. 2). The structure of the fruit wall, with its simple tier of large fibrovascular bundles, appears to be similar to that of *G. pleurocarpum* (Burret) Essig & Young, and *G. gracile* (Burret) Essig & Young, both formerly in *Nengella*. *Gronophyllum manusii*, therefore, appears to be intermediate between the two formerly separate genera.

The petals of the pistillate flowers (Fig. 3) are less than $\frac{1}{2}$ again as long as the sepals, not twice as long or more as traditionally described for the genus (cf. Uhl and Dransfield 1987). This could lead to confusion with *Gulubia*, in which petals are scarcely longer than the sepals. The critical difference between the two genera, however, has to do with the order in which staminate and pistillate flowers attain anthesis. In *Gulubia*, the petals of the pistillate flowers do not cover the gynoecium in bud and the stigmas are exposed and receptive as soon as the large covering bracts fall from the inflorescence. Staminate flowers shed pollen 24 hours later (technically this is called protogyny). In *Gronophyllum*, the petals have valvate tips that tightly enclose the gynoecium in bud. Staminate flowers shed pollen first, and the pistillate flowers open later (protandry). The two genera are kept separate on this basis, despite similarities in the vegetative aspects of some species in the two genera. However, the whole complex of *Gronophyllum*, *Gulubia*, *Siphokentia* and *Hydriastele* is in need of critical reassessment.

LITERATURE CITED

- ESSIG, F. B. AND B. E. YOUNG. 1985. A reconsideration of *Gronophyllum* and *Nengella* (Arecoideae). *Principes* 29(3): 129-137.
- UHL, N. W. AND J. DRANSFIELD. 1987. *Genera Palmarum: a classification of palms based on the work of H. E. Moore, Jr. L. H. Bailey Hortorium and the International Palm Society*, Allen Press, Lawrence, KS.

ERRATUM

In the 1985 paper (cited above), Fig. 3b should read *Gronophyllum leonardii*, rather than *G. papuanum*. The latter name was used in an early version of the manuscript but changed in the final version. It is of no botanical standing.

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The FCCJ Palm Garden

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Every chapter of the IPS needs a major purpose for its membership to add focus to chapter activities. For our chapter, the focus is the palm garden at Florida Community College Jacksonville (FCCJ). The garden was born from the collective desire to grow palms north of the tropics.

It is arguable what came first, the garden or the chapter. Perhaps the desire formed the garden and the garden begat the chapter. Certainly, the latent interest in the local membership was the energy for the chapter and the garden was the catalyst for the process. What is true for thermodynamics is true for palm societies I suppose.

In these very uncertain ecological times, the garden can be a time capsule for palms. Certainly, this is no substitute for responsible management and a garden can never be the answer for the biodiversity of a rain forest. However, a garden can be a repository against extinction for palms and cycads under high risk.

Surely it is better to preserve *Neodypsis decaryii* on its mountainside home or *Jubaeopsis caffra* in its Pondoland habitat or *Encephalartos cerineus* in its lonely Kraal. Unfortunately scarce resources, burgeoning populations, and political instability prevent developing nations from effectively managing their resources and the botanical resources are the casualties of these scenarios.

The Beginning

Our garden was born with these lofty goals in mind. It was dedicated March 15, 1988. Two years of preliminary work including fund raising committees, landscape planning, and garden development predated the dedication.

The garden flourished over the next 1½ years under the patient and consummate leadership of Dr. Kyle Brown and the institutional support of Dr. Joan Hill and Earl Farris. This progress was punctuated by the efforts of James Menge and Earl Farris who obtained and planted a 70 year old 40' tall *Phoenix sylvestris* and stately *Phoenix dactylifera*. After only a year

and some days, the garden had over 25 species and included many mature seed-producing specimens. These served as verdant testimony to the efforts of a few dedicated palmophiles.

Christmas 1989, the progress of the garden was abruptly halted as the forces of the Arctic looked south. With this came another of the one too many Siberian Expresses which visited Florida during the 1980's. This plunged northern Florida into four days of blowing snow and sub 20° F temperatures. As the respondent I can only say the garden was defoliated and severely injured. With the freeze came a record drought which exacerbated the damage and allowed many plants to succumb to bud injuries. However in response to this, dead trees were removed, new trees planted and infirm trees nurtured. This freeze put the experimental garden to a test and the chapter responded to its first test.

The Present and Plans for the Future

Four mild winters and wet summers have restored the garden to viability. Diligent efforts of the chapter and the college have enhanced the garden. A number of species have been added and the total number of plants is now at 54 species of palms and six species of cycads. Many plants are in seed. As I write, a comprehensive inventory and future planning for the garden is underway.

The FCCJ garden staff and our membership will not be content with just a collection of plants but seeks to establish small groves of critically endangered palms and cycads to serve as seed and restocking sources. Initially, these will include the formation of groves of *Phoenix theophrasti* and *Brahea edulis*. Future annexes for the garden are being discussed by the membership, which could serve as repositories for critically endangered species and as a source for future restocking. These annexes will increase the size of the garden to 25 acres.

A large fine arts complex is under construction with many plantings of palms programmed for

Table 1. List of palms in the garden.

<i>Acoelorrhaphe wrightii</i>	<i>Phoenix canariensis</i>
<i>Acrocomia media</i>	<i>Phoenix dactylifera</i>
<i>Acrocomia totai</i>	<i>Phoenix paludosa</i>
<i>Allagoptera arenaria</i>	<i>Phoenix roebelenii</i>
<i>Arenga australasica</i>	<i>Phoenix reclinata</i>
<i>Arenga engleri</i>	<i>Phoenix sylvestris</i>
<i>Arenga tremula</i>	<i>Phoenix theophrasti</i>
<i>Butia capitata</i>	<i>Rhapidophyllum hystrix</i>
<i>Butia</i> × <i>Syagrus</i>	<i>Rhapis excelsa</i>
<i>Butia</i> × <i>Jubaea</i>	<i>Rhapis humilis</i>
<i>Brahea armata</i>	<i>Rhapis subtilis</i>
<i>Brahea brandegeei</i>	<i>Sabal causiarum</i>
<i>Brahea edulis</i>	<i>Sabal domingensis</i>
<i>Chamaedorea microspadix</i>	<i>Sabal etonia</i>
<i>Chamaedorea radicalis</i>	<i>Sabal guatemalensis</i>
<i>Chamaerops humilis</i>	<i>Sabal mauritiiiformis</i>
<i>Cycas revolutii</i>	<i>Sabal mexicana</i>
<i>Cycas taiwaniani</i>	<i>Sabal palmetto</i>
<i>Dioon edule</i>	<i>Sabal yapa</i>
<i>Dion mejiae</i>	<i>Serenoa repens</i>
<i>Dion spinulosum</i> <i>Livistona australis</i>	<i>Syagrus romanzoffiana</i>
<i>Livistona carinensis</i>	<i>Syagrus</i> sp.
<i>Livistona chinensis</i>	<i>Trachycarpus fortunei</i>
<i>Livistona decipiens</i>	<i>Trachycarpus takil</i>
<i>Livistona mariae</i>	<i>Trithrinax acanthocoma</i>
<i>Livistona merrillii</i>	<i>Trithrinax brasiliensis</i>
<i>Livistona muelleri</i>	<i>Washingtonia filifera</i>
<i>Livistona saribus</i>	<i>Washingtonia robusta</i>
<i>Nannorrhops ritchiana</i>	

1995. This will be connected to the garden by board-walk through a wetland hammock (to be named Poet's Walk). This project was inspired by the late author and historian Mary Graff who generously contributed initial funding for the project to demonstrate her love and respect for nature. The wetland hammock will be augmented by plantings of rain forest palms such as *Ceroxylon* sp. *Chamaedorea* sp. *Rhopalostylis sapida*, *R. baueri*, *R. cheesemanii*, *Linospadix monostachys*, *Lepidorrhachis mooreana*, and *Laccospadix australasica*. Overhead fine mist systems will

be used to enhance the nutrient recycling between falling detritus and ground.

With these features, the garden will provide a three dimensional experience of the rain forest that will serve as an educational laboratory for the student who will not only be able to read about the rain forest but take a short walk (via Poet's Walk).

Lastly, the garden will serve as a source of inspiration for generations after our passing and stimulate future palm and cycad enthusiasts.

CLASSIFIED

PALM SEED FOR SALE. *Rhopalostylis sapida* US\$50\1000; *Rhopalostylis baueri* US\$80\1000; *Chambeyronia macrocarpa* US\$300\1000. Also other New Caledonian species available from time to time, e.g., *Basselinia*, *Burretiokentia*, *Actinokentia*, *Moratia*, *Veillonina*, etc. Contact: BRYAN LAUGHLAND, 20 Vic Butler St., Mt. Roskill, Auckland, New Zealand. Phone: 64-9-6243709. Fax: 64-9-6257704.

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Observations on the Seasonal Consistency in Germination Timing for *Scheelea zonensis*

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Seeds of palms are often reported to be difficult to store, presumably due to the lack of mechanisms for enforced dormancy (*sensu* Harper 1977; DeLeon 1958, Corner 1966, Dickie et al. 1993). However, many display innate dormancy (*sensu* Harper 1977; e.g., Braun 1968, Jordan 1970, Koebernik 1971, Basu and Mukherjee 1972, Broschat and Donselman 1988); delays to germination of over 6 months are not uncommon for seeds of palms (e.g., Braun 1968, Jordan 1970, Koebernik 1971).

Long delays to germination in palms has meant that little is known of the variation in germination timing for palms. Braun (1968)³ stated that dramatic variation is commonplace for species of palm, but published data to support this generalization are few. We herein present relevant observations on the germination of seeds from *Scheelea zonensis* Bailey in seasonal moist forest of Panamá (Leigh et al. 1982).

S. zonensis fruits were collected in August, 1991 from along Old Gamboa Road near Summit Gardens, Panamá. Fruits with intact exocarps were found directly beneath adult palms, indicating that they had not been manipulated by fruit or seed eating animals prior to collection. All exocarp and mesocarp was removed from each of 400 seeds;

seeds were from 9 plants and the numbers collected from beneath each were: 22, 32, 33, 35, 40, 45, 50, 50, 63. These seeds were placed on the surface of the soil and were surrounded and covered by a hardware-cloth cage, to protect them from rodents, on Orchid Island in the Panama Canal. During September 1992 experiments were terminated on Orchid Island. 108 (27%) of the 400 seeds had germinated during the previous 5 months (April–August).

In order to follow subsequent germination of seeds remaining in the cage, a random sample of 184 of the ungerminated seeds were removed to nearby Barro Colorado Island (B.C.I.), Panamá in September 1992. These seeds were placed in seed-trays, on top of 3-cm soil, on the bottom shelves in a greenhouse. Over the course of the next year, seeds in the greenhouse experienced similar conditions of light to those they would have experienced had they been left in the understory on Orchid Island. However, trays were watered regularly during the dry season; therefore soil water was more evenly available than if the seeds had been left in the field. Seeds were inspected monthly for germination.

No further germination occurred until 8 months later, when in April 1993, 10 seeds germinated. An additional 2 seeds germinated during July of 1993. Again no further germination occurred until 1994, when 2 seeds germinated in April, 3 in May, 3 in June and 1 in July. A summary of the time to germination for these seeds is that most germinated after 10 months. However, small percentages of seeds germinated only after 2 or 3 years on the surface of soil.

It is striking that all seeds germinated at approximately the same time of year (the early wet season). In a community-wide study of germination strategies on B.C.I., Garwood (1983) found a sin-

³ "A most peculiar phenomenon and one typical for the palm family is the delayed germination of the seed at certain intervals. Early-germinating seeds, usually few in numbers, are followed at intervals by more groups of germinating seeds. Frequently, but depending on the species, the second batch represents the majority of seedlings. Delayed germination continues, but in reduced numbers. Often the last seedlings appear when the first seedlings have developed into strong young plants. There is an obvious benefit to the plant in delayed germination, especially in the natural habitat. Losses caused by climatic influences or herbivorous animals thus may be replaced by late-germinating seeds."

gle peak in germination at the beginning of the wet season. Of 157 woody dicot species studied, 18% remained dormant for between 4 and 8 months between dispersal in one wet season and germination during the following. Therefore seasonal dormancy to prevent germination during the unfavorable dry season appears to be a common trait. Seasonal consistency over >1 yr for a single cohort of seeds was not reported by Garwood (1983), but seasonal germination after more than one year has been observed for the understory palm *Astrocaryum mexicanum* (N. Garwood and N. Smythe, pers. comm.). Similarly, seeds of the canopy tree *Vantanea occidentalis* (Humiriaceae) germinated in synchrony with those of *S. zonensis* after one, two, and three years in the greenhouse (Garwood and Dalling, unpubl. data).

Competition between seedlings may be the factor that selects for emergence during the early wet season among pioneer species (Garwood 1983). Non-pioneer and understory species may be selected to germinate during the wet season in order to grow sufficiently to survive the up-coming dry season and/or due to the availability of resources during that time (Garwood 1979, 1983 and references within). Wet season germination, but spread over several years within a seed-cohort, could increase plant fitness in species where the size of seed crops varies dramatically year to year, or under fluctuating pressure from herbivores that feed on reproductive structures (flowers, seeds, etc.). These conditions may apply to *S. zonensis*. DeSteven et al. (1987) reported that on average 19% of individuals of reproductive size failed to ripen fruit in any given year of their census. Of 12 reproductive individuals censused over 4 fruiting seasons, only 4 produced fruit in all 4 seasons (see Wright 1990). *S. zonensis* seeds are heavily attacked by larvae of a bruchid beetle once they reach the ground (Wright 1990) and a variety of vertebrates feed on and scatter-ward these seeds (Smythe 1970, Giacalone-Madden et al. 1990). The combination of unpredictable reproduction and fluctuating seed-predation intensities suggests that there is a high degree of variation in viable seed output across years for individual adult palms.

The extent to which variability in the timing of germination for *S. zonensis* is genetically and environmentally determined is unknown. Differences in the time to germination may be the result of a genetic polymorphism since adults producing seeds which do not all germinate at the same time under identical immediate conditions are likely to

be favored by selection (Bradshaw 1965, Cohen 1966, Westoby 1981). However, delays to germination may be environmentally determined (Bradshaw 1965, Silvertown 1984, Schlichting 1986). Phenotypic plasticity may allow seeds of identical genotype to express alternative phenotypes (e.g., variation in germination delays); individual seeds found in unique circumstances may express unique phenotypes (e.g., different lengths of time to germination). The relative importance of these mechanisms on their own, or in concert, in producing variation in delays to germination deserve attention. Elucidating these mechanisms is necessary to understand the potential constraints on and adaptive significance of variation in germination timing for *S. zonensis* in particular and for palms in general.

There exists a gradient in rainfall and seasonality across the isthmus of Panamá (Croat 1978). Due to the occurrence of *S. zonensis* throughout the former Canal Zone (Croat 1978), this palm may serve as an appropriate species for evaluating the significance of variation in germination timing across sites of varying environmental conditions. We predict that seeds of individuals from less seasonal locations will show less seasonal tendency in germination timing.

Acknowledgments

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LITERATURE CITED

- BASU, S. K. AND D. P. MUKHERJEE. 1972. Studies on the germination of palm seeds. *Principes* 16: 136-137.
- BRADSHAW, A. D. 1965. Evolutionary significance of phenotypic plasticity in plants. *Adv. Genet.* 13: 115-155.
- BRAUN, A. 1968. Cultivated palms of Venezuela. *Principes* 12: 39-103.
- BROSCHAT, T. K. AND H. DONSELMAN. 1988. Palm seed storage and germination studies. *Principes* 32: 3-12.
- COHEN, D. 1966. Optimizing reproduction in a randomly varying environment. *J. Theor. Biol.* 12: 119-129.
- CORNER, E. J. H. 1966. The natural history of palms. Weidenfeld and Nicholson, London.
- CROAT, T. 1978. The flora of Barro Colorado Island. Stanford University Press, Stanford, California, USA.
- DELEON, N. 1958. Viability of palm seed. *Principes* 2: 96-98.

- DESTEVEN, D., D. M. WINDSOR, F. E. PUTZ, AND B. DE LEON. 1987. Vegetative and reproductive phenologies of a palm assemblage in Panama. *Biotropica* 19: 342-356.
- DICKIE, J. B., M. J. BALICK AND I. M. LININGTON. 1993. Studies on the practicality of ex-situ preservation of palm seeds. *Principes* 37: 94-98.
- GARWOOD, N. C. 1979. Seed germination in a seasonal tropical forest in Panama. Ph.D. Dissertation. University of Chicago, Chicago, Illinois, USA.
- GARWOOD, N. C. 1983. Seed germination in a seasonal tropical forest in Panama: a community study. *Ecol. Monog.* 53: 159-181.
- GIACALONE-MADDEN, J., W. E. GLANZ, AND E. G. LEIGH, JR. 1990. Adición: fluctuaciones poblacionales a largo plazo de *Sciurus granatensis* en relación con la disponibilidad de frutos. In: E. G. Leigh, Jr., A. S. Rand, and D. M. Windsor (eds.). *Ecología de un bosque tropical: ciclos estacionales y cambios a largo plazo*. Smithsonian Tropical Research Institute, Balboa, Rep. de Panamá, pp. 331-335.
- HARPER, J. L. 1977. *Population biology of plants*. Academic Press, London.
- JORDAN, C. B. 1970. A study of germination and use in twelve palms of northeastern Peru. *Principes* 14:26-32.
- KOEBERNIK, J. 1971. Germination of palm seed. *Principes* 15: 134-137.
- LEIGH, E. G., JR., A. S. RAND, AND D. M. WINDSOR, (EDS.). 1982. The ecology of a tropical rain forest: seasonal rhythms and long-term changes. Smithsonian Institution Press, Washington, D.C., USA
- SCHLICHTING, C. D. 1986. The evolution of phenotypic plasticity in plants. *Ann. Rev. Ecol. Syst.* 17: 667-693.
- SILVERTOWN. 1984. Phenotypic variation in seed germination behavior: the ontogeny and evolution of somatic polymorphism in seeds. *Am. Nat.* 124: 1-16.
- SMYTHE, N. 1970. Ecology and behavior of the agouti (*Dasyprocta punctata*) and related species on Barro Colorado Island, Panama. Ph.D. Dissertation. University of Maryland, College Park, Maryland, USA.
- WESTOBY, M. 1981. How diversified seed germination behavior is selected. *Am. Nat.* 118: 882-885.
- WRIGHT, S. J. 1990. Cumulative satiation of a seed predator over the fruiting season of its host. *Oikos* 58: 272-276.

Principes, 39(2), 1995, pp. 106-111

CHAPTER NEWS AND EVENTS

Prepared by Jim Cain except as noted

See also pp. 88 and 94

South Africa Palm Society News

The 1995 Annual Congress is going to be held from April 29 through May 1, 1995 at Trichardtsdal in Eastern Transvaal. The venue has been arranged by Ernest and Sandra Helm, long time benefactors of the South African Palm Society. The venue will be near the *Borassus aethiopicum* grove and, of course, Carpe Diem Nursery. Additional details can be obtained from the South African Palm Society (see Roster for contact details).

In addition, the social scene saw newsletter posting on Saturday, January 21 at Brits, a meeting in Durban, and a day of palm planting at the Hectorspruit Palmetum.

The December 1994 issue of *The Palm Enthusiast* contains an excellent article by Bernard Fischer on *Ceroxylon* in Bolivia.

News from New South Wales, Australia

On January 17, the Sydney Branch of P.A.C.S.O.A. met at the Maiden Theatre, Royal Botanic Gardens, Sydney. Peter Kristensen showed slides from recent trips to the Solomon Islands, Costa Rica, Mexico, and the United States.

The group met again on February 26, to hear Loran Whitelock speak on "The Cycads of America." Loran's private collection rivals any in the world.

Paul and Elizabeth Anderson hosted a Sydney Branch island fest on April 1. This featured a "hangi," where the food is cooked underground, as is done in several Pacific nations. In Fiji, it's called a "lovo."

The January 1995 issue of the chapter's magazine, *Principes Minor*, has an excellent short-list of known species of the current genera *Dypsis* and *Neodypsis*. As pointed out by author, Peter Kristensen, these genera are being taxonomically combined (by Drs. John Dransfield and Henk Beentje) with genera *Phloga*, *Neophloga*, *Vonitira* and *Chrysalidocarpus* into a single genus, *Dypsis*. Both *Dypsis* and *Neodypsis* are endemic to Madagascar. The May 1995 issue of *Principes Minor* will make a similar pass at the other four genera to be "lumped."

Officers for the Sydney Branch of P.A.C.S.O.A. are now:

President:	Edmund Wee
Vice President:	Peter Byrne
Vice President:	Peter Kristensen
Treasurer:	Peter Carroll

Secretary:	Paul William Anderson
Auctioneers:	Nick Heath Werner Raff Hans Olminkhoff
Publicity	Lynette Stewart
Librarian	Hans Olminkhoff
Committee	John Reid Hans Olminkhoff Bill Homer
Catering	Peter Byrne
Editor:	Peter Kristensen
Edit. Assist.	Ian Edwards Craig Thompson Peter Carroll

News from South Australia

The Palm & Cycad Society of South Australia (P.A.C.S.O.S.A.) met on December 3 at the Waite Arboretum to plant the palms and cycads donated by the Society. Dr. Jennifer Gardener, curator of the arboretum, was also in attendance. Approximately 25 palms and 7 cycads were planted on the very hot, dry day. Palms planted included *Neodypsis*, *Livistona*, *Rhapis*, *Guihaia*, *Ravenea*, *Rhopalostylis*, *Trithrinax* and *Phoenix roebelenii*. Cycads were *Cycas revoluta*, *Macrozamia miquelii*, *Dioon spinulosum* and *Zamia furfuracea*. The plantings were followed by the society's breakup BBQ.

The group also met on February 26 at the home of Heinz-Dieter Froehlingsdorf. Tours of Heinz' garden and potting up of the Society's plants were featured.

Future meetings include a working bee at the Waite Arboretum on April 23, visit to the Adelaide Botanical Gardens on June 4, a field trip (venue to be announced) on August 27, and Annual Breakup Show on November 26, 1995. Details will follow as available.

News from Southern Queensland, Australia

The South Queensland Group, P.A.C.S.O.A., met on December 21, 1994 at the Bread House. Allan Wilson spoke of the incredible hardness of cycads and their ability to regenerate even after severe disfiguration. After the break, Rolf Kyburz talked to the group about his recent trip to Cuba. Amidst his other adventures, Rolf managed to see and photograph many palms and native flora.

The SQG met again on January 16 at the Bread House. Kerry Rathie showed a selection of slides

on Queensland and Northern Territory cycads, as well as a variety of other plants in a wide range of habitats.

A meeting was held on February 12 at Stan Walkley's nursery in Burpengary to prepare plants for the Annual Show. In addition, a garden outing was held at the home of Nick Powell in Jindalee on February 18. Tea/coffee and light refreshments were served.

The 1995 Annual Show and Sale was held at the Mt. Coot-tha Botanic Gardens in Brisbane on March 4 and 5. Mr. Loran Whitelock of California was the featured speaker at the Saturday dinner with a presentation on "aspects of cycads." The show featured displays of Madagascar palms, and also groupings from other parts of the world. A cycad display was also featured. Volunteers spent most of Friday, March 3, setting up and preparing the displays for the public.

A regular meeting was also held at the Bread House on March 20.

Sunshine Coast (Australia) News

The Palm & Cycad Society, Sunshine Coast Group of Queensland, Australia met on February 6 at the Nambour Band Hall. A video on Cycad Reproduction, produced by Knut Norstog, was shown. This was a "hands-on" display of how to fertilize cycads. As an additional bonus, Peter Heibloem gave a talk on his recent trips into Mexico, Uganda and Zaire. The raffle prize was a *Chamaedorea radicalis* about 2 meters (6.5 feet) tall, in seed.

News from Gold Coast—Tweed (Australia)

The Gold Coast—Tweed Palm & Cycad society of P.A.C.S.O.A. held their Annual General Meeting on February 12 at the Haseler home at Mt. Tamborine, following a "byo" lunch.

The January 1995 newsletter of the Gold Coast—Tweed group featured a very nice article on the Cycad collection in the Durban (South Africa) Botanic Gardens. Several other interesting cycad writeups were also given.

News from North Queensland

The North Queensland Palm Society met on February 13 at Tumbetin Lodge, The Palmetum. Following society business, a talk was given by John Dowe on "New Palm Species." A revision of the genus *Archontophoenix* was published in

September 1994 and four new species were named by John Dowe and Don Hodel. Members were brought up to date on the new names, heard how they were named and the process involved. Seedlings of *Nenga macrocarpa* were available at the February meeting.

News from Western Australia

The Palm & Cycad Society of Western Australia met on January 16 at the Leederville Town Hall. Representatives from JAYLON discussed their line of products, which includes various shade cloths, plastic protectors, and planting containers. Ken Adcock also gave a brief talk on a cycad he has hand pollinated and which appears to be starting to produce seed.

This IPS affiliate society also met on February 20. Bill Baynor and Neil Jones spoke on Australian cycads. Members brought specimens of various Australian cycads to the meeting.

The Gascoyne Park reticulation watering system was damaged by the Shire's irrigation contractor. With the hot weather, some palms suffered from the lack of water.

An outing to Ken Adcock's place was held on Sunday, February 26, to kick off 1995 weekend activities.

The Editor of the Western Australia society newsletter for 1995 is Belinda Riley, with supplemental contributions by Ken Adcock, Adam Peterson, and Barry Shelton.

Pacific Northwest Chapter News

The Pacific Northwest Palm & Exotic Plant Society (PNWP&EPS) met on November 28, 1994, with 48 members in attendance. Rudi Pinkowski was elected as President, succeeding Mel Frank who had served the previous two years. Michael Svardh and Edie Baer were named Vice Presidents to represent Washington and Oregon, respectively. Other officers (Michael Ferguson, Frank Hunaus, and Nick Parker) were returned to office. The local society had just celebrated its 10th anniversary and a special moment was set aside at the meeting to honor Richard Woo, the founder and first president of the PNWP&EPS. Richard also serves as a Director of the International Palm Society.

The meeting finished with a slide show, featuring lots of palms and fabulous European locations, by the new president on his trip to Europe last summer.

The Northwest Flower and Garden Show was

held at the Washington State Convention Center in Seattle on February 22-26, 1995. Van Dusen Gardens sponsored one-day bus trip packages from Vancouver again this year.

Due to increased attendance, most future 1995 meetings will be held in the larger floral hall of the Van Dusen Gardens, Vancouver. On March 27, the group met to see Gerald Pury's slide show featuring exotic gardens of the Swiss Lake Country.

A spring sale is scheduled for April. Additional general meetings are scheduled for May 29, July 24, September 18, and November 27, 1995. All are to be held at Van Dusen Gardens, Vancouver and all will start at 7:30 p.m. A summer barbecue will be held in August (further details to follow later).

The PNWP&EPS will also have a booth at the Pacific National Exhibit in Vancouver from August 19 through September 4, 1995.

News of the South Florida Chapter

Good weather, large crowds and spectacular plants converged November 5 and 6 to create another successful year for what is probably the largest palm sale anywhere. When the curtain came down on the 1994 Show and Sale of the South Florida Chapter at Fairchild Tropical Garden, member growers had sent a record number of plants into the world of palm enthusiasts.

While a recitation of dry statistics cannot convey the overall aesthetic of the event, it does provide clear proof of the increasing popularity of palms and the diversification of their use in the South Florida landscape. The "modern" era of the chapter Show and Sale began in 1979, when a relative handful of growers—arrayed around FTG's Montgomery Garden House—achieved just under \$30,000 in sales to a public which was still intimidated by the potential breadth of Lethal Yellowing Disease. In 1994, revenues reached almost \$97,700, continuing a pattern in which nearly every sale since 1979 has established a new record. Figures for 1993 and 1992 were \$85,396 and \$71,149, respectively. 4,847 palms were sold in 1994, up from 4,334 in 1993. As recently as 1989, a thousand fewer plants were sold, and yet that number itself was a record for its time. The average price per plant in 1994 was \$20.25, an increase of 35¢ over the prior-year mean.

But perhaps the most remarkable figure is 550,

for it represents the number of palm species/varieties offered by growers. (In comparison, a survey conducted by Teddie Buhler in 1981 found but 150 species.) The number is not only truly astounding in itself but is also perhaps symbolic of the role played by the South Florida Chapter in developing and broadening interest in the Palmae. In many cases, our members have not simply responded to demand, but have created interest by electing to grow and sell species which they deem desirable. A case in point: In 1980, *Bismarckia nobilis* was a palm seldom seen outside of collectors' gardens. But that year two or three growers offered seedlings at the sale, and public interest in the species was suddenly ignited. As result, *Bismarckia* has had a noticeable impact on private and public landscape planning throughout south Florida.

The 1994 educational display was also well-conceived and well-received. The Montgomery Garden House featured a diverse group of interesting exhibits: specimen plants, finished art, art in progress, photographs, printed materials, and palm products. A group of volunteers from Dade County Master Gardeners bagged and distributed a large quantity of free palm seeds.

Specimen plants on display were judged for the best representative in five categories: (1) Overall Show, (2) Southern South America, (3) Educational Exhibit, (4) Florida Native and (5) Containerized. The first-place ribbon for Best of Show was awarded to Jeff Searle for his striking *Dypsis madagascariensis*.

For the third consecutive year, the Chapter and the Garden jointly offered reproductions of a work by Lee Adams, a talented Floridian who created a beautiful series of palm drawings for the Garden before his untimely death over 30 years ago. The Caribbean Basin series now includes 20" × 24" posters of *Coccothrinax argentata*, *Zombia antillarum*, and *Copernicia macroglossa* (See Covers and pp. 42–46 of January 1995 *Principes*). Each sells for \$20.

The seventeenth edition of the South Florida Show and Sale will be held next November 4 and 5. The theme for 1995 is Palms of India, Sri Lanka, and the Nicobar Islands.

LENNIE GOLDSTEIN

News from the Palm Beach (Florida) Chapter

The Palm Beach Palm & Cycad Society held a general meeting on January 4 at Mounts

Botanical Gardens. Dr. Timothy Broschat gave an excellent lecture on the nutrition and mineral deficiencies in palms at last summer's Palm Seminar. A plant auction followed.

The group met again on February 1, 1995. Chuck Hubbuch, curator of palms and cycads at Fairchild Tropical Gardens, spoke on palms of Central America—particularly those of Panama, Guatemala, and Honduras. Chuck has recently travelled extensively in those areas. A plant auction again followed the meeting.

On March 1, 1995, Larry Walker from Nurseryman's SureGrow spoke to the group about fertilizers. He was followed by a plant auction, and all members received a free plant for attending.

At the April 5 meeting, Scott Zona addressed the group on "the genus *Sabal*." Scott has recently published an update on the genus. He's also doing research on *Roystonea*.

Workdays were held at the Norton Sculpture Gardens on January 21 and February 18, to care for the over 300 species of palms planted there.

The Spring Sale was held on April 8 and 9, 1995, at Morikami Park in Delray, Florida.

A field trip is planned for May 20–21 to visit Selby Botanical Gardens, the gardens of Libby Besse, Michael Perry, and others. This is a preview of some of the sites to be seen by the IPS Board of Directors at their planned meeting in Sarasota in October, 1995.

The Palm Beach Palm and Cycad Society, in conjunction with Fairchild Tropical Garden and other IPS groups, is putting on two days of talks from some of the leading palm researchers in the world. Thirteen speakers have been confirmed including palm experts from Australia, Malaysia, England, Denmark, Colombia, and all over America. The main focus of this symposium will be the conservation and preservation of palms. There will be talks on this as well as on new studies on various palm genera.

News from Broward County, Florida

On January 26, the Broward County Palm & Cycad Society (BCP&CS) met at the Broward County Cooperative Extension Service Office in Davie. The meeting featured Mr. Raymond Jungles, a landscape architect who worked extensively with Roberto Burle Marx. His presentation included slides of Mr. Marx gardens and gardens of his own design that emphasize the

use of palms and cycads in the subtropics. Mr. Jungles has worked in the South Florida area for 13 years. His designs have been implemented at the Fairchild Tropical Garden entrance (*Wodyetia*), around the auditorium (*Bismarckia*), for the restoration of the "Vine Pergola," and at the Corbin Building.

The Broward County Chapter held their Spring Sale at Flamingo Gardens in Davie in May 1995.

News from the Florida First Coast Chapter

The City of Jacksonville recently saw the planting of numerous large mature edible date palms, *Phoenix dactylifera*. IPS Director and local member Kyle Brown worked with the landscape consultant and encouraged her to use the date palms. The area looks great!

News from Central Florida Chapter

The Central Florida Palm Society has new officers as of January 1995. Stacy Peacock is now President, Mike Dahme is 1st Vice President, Chris Tully is 2nd Vice President, and Nancy and Ed Hall continue as Secretary and Treasurer, respectively.

The Chapter met on February 12 to tour several private gardens. First stop was at the home of Cathy and George Joseph. They have numerous palms in a highly tropical landscape enhanced visually and audibly by dozens of exotic avians. This was followed by a brunch at the Holiday Inn, Indiatlantic. After lunch, the group continued on to the homes of Alan Ingalls and Bob Walker. Of particular interest were perhaps the fattest coconut ever and Bob's caiman, "Elvis." Elvis has the run of the place and track shoes were advised. The last stop was the home of Bud Wideman in Cocoa Beach. This garden features a beautiful cluster of *Hyphaene* trunks (with hundreds of infertile fruit in all sizes) dominating the front lawn.

On May 6, the Chapter will meet at the home and gardens of Hersh and Jackie Womble. Their palm and cycad collection includes both mature and juvenile specimens—over 60 strong.

News from the Hawaii Island Chapter

Hawaii Island Palm Society members and friends met on January 13 to hear Peter Mayotte present

a slide show "Palm Travelogue of Cuba." The show featured the National Botanical Gardens of Cuba, in Havana, and the Botanical Garden of Cienfuegos, in Solidaridad, as well as sites in the region of Pinar del Rio and Flora de Vinales. Soft drinks and snacks were served.

New officers were also elected at the January meeting. The New President is Jeff Marcus, Vice President is Karen Piercy, Secretary is Helen Carlson, and Treasurer is Grace Kissell.

On March 12, the Chapter visited Frank Streeter's nursery, Kapoho Palms. Frank and his wife Chris and their new baby boy were out from Massachusetts for the occasion. Kapoho Palms has 7 acres, with large field plantings of landscape palms, and with hundreds of rare and interesting things from all over the world in containers. A 3-gallon *Syagrus sancona* was given as a door prize.

On the following Saturday, March 18, the Chapter sponsored a members plant sale at Mo'oheau Bandstand across from the Farmers' Market. Members netted 85% of proceeds, with the other fifteen percent going to the local chapter, to cover expenses and to raise funds for the group.

News from Louisiana and the Gulf Coast Chapters

On January 21, Maxwell Stewart and several other members of the Gulf Coast Chapter drove to New Orleans for a little get-together and palm 'research.' After being met by Louisiana chapter Treasurer Jack Chisholm, the small group toured the garden of Wilbur and Marguerite LeGardeur. This was followed by a visit to the garden of local President, Danny Braud, to see all of his magnificent palms and tropical exotics. The group visited City Park before beginning their trip back to Mobile.

The Louisiana Chapter of the IPS met on March 12 at the Audubon Institute. At the conclusion of the meeting, members were invited to tour the Audubon Zoo free of charge.

The Spring Meeting of the Louisiana Chapter is tentatively set for May 28 at the estate of Mal and Mich Mele in Covington, Louisiana. This idyllic setting is ideal for celebrating the rites of spring.

A social day out and "water extravaganza" is planned for June 25 in Covington, with Eddie Assmann providing the facilities. Contact the Louisiana chapter for details on this event and for the proposed August meeting.

BOOKSTORE UPDATE

April 1995



- 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
- BRAZILIAN PALMS.** Notes on their uses and Vernacular names (C. Pinheiro and M. Balick, 1987, 63 pp.)..... \$9.25
- CHAMAEDOREA PALMS** (D. Hodel, 1992, 350 pp., 127 pp. of superb color) **EXCELLENT!**..... ~~\$59.95~~ **LIMITED TIME**..... \$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
- CYCADS OF THE WORLD** (D. Jones (1993) 312 pp., 250 color photos)..... \$45.00
- 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
- ECUADORIAN PALMS FOR AGROFORESTRY** (H. B. Pedersen and H. Balslev, 1990, 105 pp.)..... \$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 NEOTROPICA INTRODUCTION AND THE IRIARTEINAE** (A. Henderson, 1990, 100 pp.)..... \$23.00
- FLORA OF TROPICAL EAST AFRICA, PALMAE** (J. Dransfield, 1986, 52 pp.)..... \$23.00
- FLORES DES MASCARIGNES** (La Reunion, Maurice Rodrigues, 1984, 31 pp.)..... \$8.00
- FLORIDA PALMS.** Handbook of (B. McGeachy, 1955, 62 pp.)..... \$3.95
- FLORIDA TREES AND PALMS** (S. A. Rose, A. A. Will, Jr., T. B. Mack, 1984, 30 palm species, 120 pp.)..... \$6.00
- GENERA PALMARUM** (N. W. Uhl and J. Dransfield, 1987, 610 pp.)..... \$79.00
- HARVEST OF THE PALM** (J. J. Fox, 1977, 244 pp.)..... \$30.00
- INDEX TO PRINCIPES** (Vols. 1 - 20, 1956-1976, H. E. Moore, Jr., 68 pp.)..... \$4.00
- 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
- 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
- PALEM INDONESIA** (in Indonesian) (Sastraprdja, Moge, Sangat, Afriastini, 1978, 52 illustrations, 120 pp. For English translation add \$3.00)..... \$5.50
- PALMAS DEL DEPARTAMENTO DE ANTIOQUIA** (Palms of Colombia, in Spanish; G. Galeano and R. Bernal, 1987, 207 pp.)..... \$18.95
- PALMS** (M. Gibbons, 1993, 80 pp. Identifying 120 species in color, description, habits & cultivation)..... \$10.95
- PALMS AND CYCADS AROUND THE WORLD** (J. Krempin, 1990, 267 pp., 267 pp. color) REVISED EDITION..... \$50.00
- 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 IN COLOUR** (David Jones, 1985, 93 pp.)..... \$14.95
- 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)..... \$34.95
- 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
- SECRET OF THE ORIENT DWARF RHAPIS EXCELSA** (L. McKamey, 1983, 51 pp.)..... \$5.95
- SOWING OF PALM SEEDS IN THE TROPIC AND GERMINATION RESULTS** (A. Braun, 1994, 53 pp.)..... \$10.00
- 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 STRUCTURAL BIOLOGY OF PALMS** (P. B. Tomlinson, 1990, 477 pp.)..... \$120.00
- TROPICA** (A. Graf, 7000 color photos, 1138 pp.)..... \$165.00
- TROPICAL RAINFOREST** (A. Newman, 1990, 241 pp., World survey of endangered habitats, all color)..... \$45.00
- VENEZUELAN CLOUD FOREST** (A. Braun), 1994, 54 pp., 16 pp. color, English & Spanish..... \$11.00

PALM PAPERS (Postage Included)

- A NEW PRITCHARDIA FROM KAUAI, HAWAII** (Reprint from Principes, R. W. Read, 1988, 4pp.)..... \$2.00
- HARDEST PALMS OR FURTHER INFORMATION ON HARDY PALMS** (J. Popenoe, 1973, 4 pp.)..... each \$2.00
- NOTES ON PRITCHARDIA IN HAWAII** (D. Hodel, 1980, 16 pp.)..... \$2.50
- RARE PALMS IN ARGENTINA** (Reprint from Principes, E. J. Pingitore, 1982, 9 pp., 5 beautiful drawings)..... \$2.75
- PALMS FOR SOUTHERN CALIFORNIA** (Trish Reynoso, 1990, 11 pp.)..... \$3.00
- PALMS FOR TEXAS LANDSCAPES** (R. Dewers & T. Keeter, 1972, 3 pp.)..... \$1.25
- PINANGA ISSUE OF PACSOA** (#16, 1987, 17 pp.)..... \$2.50
- RHAPIS PALMS - CULTIVATED SPECIES AND VARIETIES CULTURE AND CARE OF THE LADIES** (Lynn McKamey, 1989, 10pp.)..... \$2.00

The palm books listed above may be ordered at the prices indicated plus \$2.50 extra per book to cover packaging and book-rate postage. (California residents please add 7.25% sales tax.) Foreign checks must be in U.S. dollars and payable on a USA bank. No credit cards. If insured add 10% extra. Please include your International Palm Society membership number. ALL SALES FINAL. Send check payable to:

The International Palm Society
Paulen Sullivan
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Ventura, CA 93003 U.S.A.

Back Cover

Closeup of the Stone Gate Palm (*Trachycarpus princeps*) in northwest Yunnan, China.

