PRINCIPES

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PRINCIPES

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Contents for October

Cover Picture

Ravenea musicalis, mature fruiting trees in deep water. Photo by Henk Beentje. See p. 197.

PRINCIPES

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Principes, 37(4), 1993, p. 183

Editorial

One of the hallmarks of the palms is their extraordinary diversity. Indeed, the family is now recognised as displaying a wider range of structural variability than any of the other 53 families of monocotyledons, the major division of flowering plants to which the palms belong. Surprisingly new information in this issue actually adds to that amazing diversity of form. Henk Beentje has discovered a remarkable new species of *Ravenea* in Madagascar that starts its life as a true submerged aquatic. Although nipah (*Nypa fruticans*) could be regarded as an aquatic, as a juvenile it is submerged and exposed with the tides, whereas the new Madagascar palm has seedlings that remain submerged until a trunk begins to form. This is the first submerged aquatic palm to be recorded.

Three other new palms from the Vanuatu Archipelago are described by John Dowe as a precursor to his planned book on the palms of Vanuatu. John is now director of the Botanic Gardens in Townsville that includes the late Robert Tucker's special project, The Palmetum. Many IPS members will remember the 1988 Biennial Meeting and the dedication of The Palmetum.

Andrew Henderson and Flor Chavez discuss the climbing palm genus *Desmoncus* and its use. They record the utilisation of *Desmoncus* as raw material for a cottage industry making furniture. The genus may have some potential as an alternative to the Old World rattans that are the usual source of raw material for the cane furniture industry.

Our last major article is a detailed analysis of a threat to coconuts in the Pacific—Cadang-Cadang disease. Karl Maramorosch has spent years in researching the disease and has important observations and recommendations.

As another year draws to a close, we would like to take the opportunity to thank all our members for support over the last year. As editors we would like to produce a journal that reflects the very wide range of interest and research in the palm family. In order to maintain a diversity of articles we invite all members to submit articles for possible publication in Principes.

NATALIE UHL
JOHN DRANSFIELD

Notice to Chapters

PACSOA (Palm and Cycad Society of Australia) will provide a set of back issues of their journal *Palms and Cycads* to any Chapter requesting them. (See review by Jim Cain in April 1993 *Principes* 37(3): 176).

Principes, 37(4), 1993, pp. 184–186

Desmoncus as a Useful Palm in the Western Amazon Basin

ANDREW HENDERSON AND FLOR CHÁVEZ
New York Botanical Garden, Bronx, NY 10458

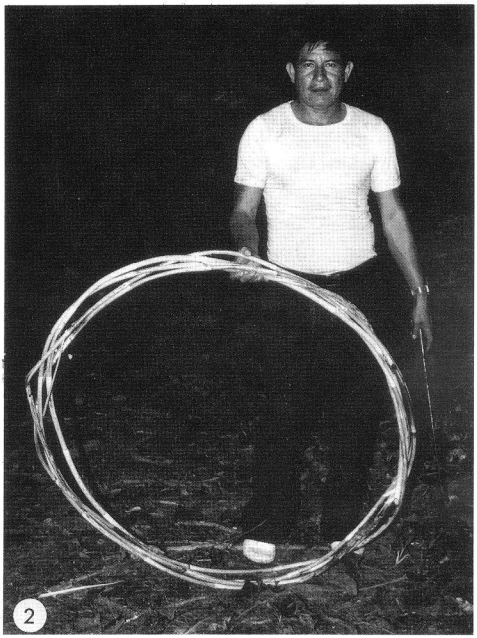
Unlike the rattans of the Old World, the New World has few climbing palms. Most species of *Desmoncus* are climbers, and also one species of *Chamaedorea*. Many names have been proposed in *Desmoncus* but only about 7 species exist, most of them occurring in the Amazon region. However, the total range of the genus is from southern Mexico through Central America and northern South America as far south as Paraguay. The genus also occurs in Trinidad and just reaches the Lesser Antilles.

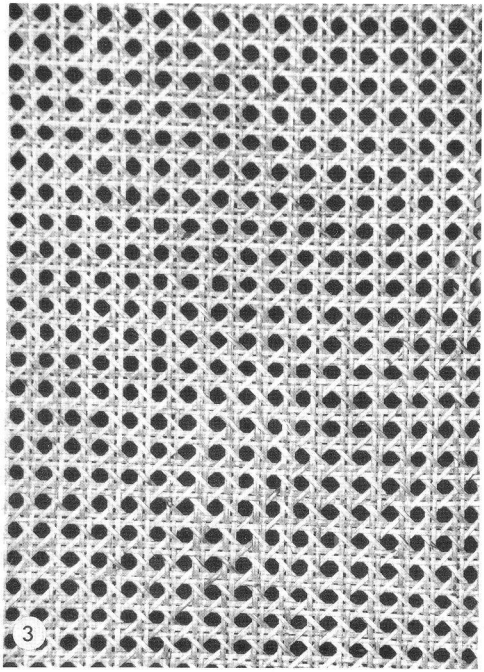
Desmoncus is poorly known but very interesting, both morphologically and ecologically. Different species can be either spiny or non-spiny and have climbing or non-climbing stems with distichously or spirally arranged leaves. The rachis can be developed or not developed into a cirrus, and the pinnae can have filiform or acute apices. The spicate or branched inflorescences can be either solitary or multiple at each node. Ecologically the genus is interesting because of its unusual reproductive behavior. Unlike other New World palms, several nodes will flower and fruit simultaneously. The species prefer light gaps and other open areas in the forest, but habitat can range from forest to river margins, disturbed areas or savannas, to flooded areas near the sea.

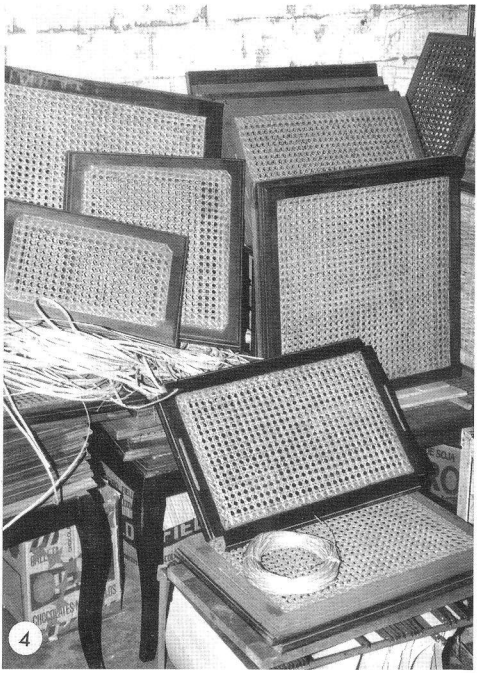
Most interesting is the climbing habit itself, and adaptations associated with this habit are responsible for the ethnobotanical importance of the genus. Although the stems of *Desmoncus* are flexible, they have great tensile strength. The genus is apparently widely used for weaving material, but there are few reports in the literature (Balick and Beck 1990). The most detailed account is by Schultes (1940), who reported on basket making with *Desmoncus* by Chinantec Indians in Mexico. Schultes also reviewed the scant literature. Since then there have been a few additional reports (e.g., Gentry 1986). Gentry (1988) reported on the usefulness of *D. cirrhifera* in the Chocó region of Colombia, where the stems are used to make nets and shrimp traps. Gentry and Blaney (1990) briefly mentioned a cottage industry using *Desmoncus* stems in Iquitos, Peru. Here we report further on this small industry.

Near Iquitos at least two species are used. We first encountered one of these, still undescribed, in western Brazil, on the upper Rio Juruá in Acre. It is a massive palm (Fig. 1), reaching over 20 m into the canopy. One of its most distinctive features is the fibrous and spiny ocrea. Another interesting feature is the apparently solitary stem. It is locally common in the western Amazon region in Ecuador, Peru, and western Brazil, but is most often seen as free-standing juveniles in the forest understory. Adult plants reach 20 m or more into the canopy and are difficult to see and even more difficult to collect.

A second, and more common species, *Desmoncus polyacanthos*, also occurs near Iquitos. Here both species are called "vara casha." Stems are collected by country people, on demand from the manufacturer in the city. The plant is cut at ground level and the sheathing leaf bases are stripped away. The stem is then rolled up (Fig. 2) and taken to the city. Stems are used either







1. *Desmoncus* in the western Amazon basin in Brazil. 2. The stem stripped of its leaf bases and coiled up. 3. Detail of woven stems. 4. Piano stool seats made from woven stems.

in private houses, where cottage industries manufacture furniture or baskets, or in small factories or workshops where artisans make furniture.

Processing is a skillful task, that needs to be completed by two days after collection. First the stems are cut into 6 m long sections. Then the stem is cut lengthways in half and the soft central pith is removed. Then the halves are further cut into two or four strips, depending on the thickness of the stem. The strips are refined by drawing them over a sharp blade. The final strips are about 2 mm thick. For 1 kg of prepared strips, 10 kg of raw stems are needed. The strips are extremely strong and impossible to break by pulling; however, they are relatively easily broken by bending.

The most common use in Iquitos for the *Desmoncus* strips is for weaving (Fig. 3), using a wooden frame, into chair backs and seats, headboards of beds, cabinet doors, and especially piano stools (Fig. 4). These items are sold locally, but demand is generally low. There is, however, a demand from tourists for these attractive woven articles.

We believe these palms and their uses are worthy of consideration as a sustainable resource of the kind used in extractive reserves in the western Amazon basin.

Acknowledgments

We thank Hernan Gonzales Polar and Karen Morote Diaz of Fibro-Maderas, Empresa de Promoción Artesanal, Iquitos, for their help. The Guevara Fasabi family, also of Iquitos, provided much information. The manuscript was improved by Dr. Alwyn Gentry. Fieldwork in Brazil and Peru was supported by the World Wildlife Fund—U.S.

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Principes, 37(4), 1993, pp. 187–196

The Threat of Cadang-Cadang Disease

KARL MARAMOROSCH

Department of Entomology, Cook College, New Jersey Agricultural Experiment Station, Rutgers—The State University, New Brunswick, NJ 08903

ABSTRACT

In 1975 the viroid cause of cadang-cadang disease of coconut and other palms became established in the Philippines and Guam. The suspected occurrence of this disease on other Pacific inlands requires confirmation. Replanting with the early maturing Mawa cultivar, widely advocated in the Philippines, merely provides a temporary but inadequate remedy because this cultivar is susceptible to viroid infection. The spread of the disease could be controlled by proper extension work, requiring the thorough decontamination of tools used by plantation workers. Concentrated sodium carbonate solution can degrade RNA viroids, remaining stable and retaining its RNA-destroying activity under tropical conditions. An extensive testing program for resistance to cadang-cadang is imperative. Such a long-term program will require proper funding, commitment, trained personnel and quarantined importation of coconut cultivars from all parts of the world.

Cadang-cadang disease of palms, the most devastating viroid disease known, is always fatal. In the Philippines, where the disease has killed more than 30 million coconut palms, currently 1,000,000 palms succumb every year. The Philippines are the world's largest producer of coconuts and half of the country's export income is derived from copra, the dried coconut meat from which coconut oil is extracted. This oil provides the main source of fat in the diet of the local population. Elsewhere coconut oil is used in soaps, margarines, synthetic rubber, cosmetics and moisturizing compounds. Coconut palms also provide lumber, while leaves are used for thatching, brooms, baskets and hats. The husk fiber is transformed into mats and carpets, and ropes are made from the yarn. On many Pacific atolls the only potable liquid is provided by the coconut water (coconut "milk") and the palms provide the only shade and building material.

Cadang-cadang disease occurs and spreads currently on Luzon and a number of other Philippine islands, as well as on Guam. The disease has been suspected on a few other Pacific islands recently.

Historical Background

Cadang-cadang means "dying-dying," or slowly dying in Bicolano, the language spoken in southeastern Luzon. The first well-documented outbreak of the disease was noticed on San Miguel Island off Luzon in 1928. By 1933 nearly 25% of the coconut palms had died there and the plantation owners approached Prof. Gerardo Ocfemia, a U.S. trained plant pathologist and head of the Plant Pathology Department at the College of Agriculture in Los Banos, to help control the disease. Since no fungi or bacteria were found associated with dying palms, Ocfemia (1937) concluded that the disease was infectious and most likely caused by a virus. Shortly thereafter the disease reached the mainland of Luzon Island. Before the Japanese invasion in 1941, nearly half of the original 250,000 coconut palms on San Miguel had died and the disease appeared in several provinces in the Bicol area of Luzon, as well as on some nearby islands. During World War II no further research was carried out, but after the war the Philippine Government obtained active help from the United States, through the International Cooperation Administration (ICA). By that time cadang-cadang was devastating plantations in the provinces of Albay,

Sorsogon, Camarines Sur, and Camarines Norte, as well as on the islands of Samar, Masbate, and Catanduanes. On San Miguel 90% of the palms were dead and the remaining ones died soon afterwards. Elsewhere on Luzon the disease incidence ranged from 10% to 60%. ICA assigned Dr. Donald De Leon, an entomologist who had earned his Ph.D. at Cornell University in 1933 and specialized in insect transmission of viruses and taxonomy, to study the disease in the Philippines (De Leon and Bigornia 1953). In 1953 the ICA abruptly cancelled the technical assistance program for cadang-cadang and permanently abandoned it under the pressure of U.S. soybean and corn oil producers' lobby. The Philippine Government turned for help to the United Nations' Food and Agriculture Organization (FAO). During the following four decades, experts were sent by FAO to the Philippines to study the devastating disease and to determine its cause, manner of spread, and possible means of control. Indian, U.S., Australian, German, and Italian experts were assisted by Philippine scientists from the Bureau of Plant Industry.

By 1960 the disease reached Bondoc Peninsula in Quezon Province, only a short distance from the solid stand of coconut palms of Laguna Province (Maramorosch 1961). Less than 100 palms of the original quarter million on San Miguel were still standing and slowly dying. Strip surveys indicated that more than a million trees became infected every year (Maramorosch 1964).

Until 1967 plant pathologists did not know of the existence of autonomously replicating low-molecular-weight RNA species that could infect and damage plants. In 1967 Diener and Raymer (1967) found that potato spindle tuber disease is caused by a free RNA. The following year Diener (1968) demonstrated that this RNA is sensitive to ribonuclease. In 1971 Diener coined the name "viroid" as a generic term for pathogenic nucleic acids of low molecular weight. Viroids were subsequently found as causative agents of other plant diseases (Romaine and Horst 1974; Van Dorst and Peters 1974; Diener 1979, 1987). In 1975, Randles provided evidence for the association of two RNA species with cadang-cadang disease. The establishment of the viroid etiology was followed by intensive studies on the epidemiology of the disease and rate of spread as well as on certain measures to control cadang-cadang. Surprisingly, by 1992 the disease has not yet entered the main coconut growing areas in Laguna province. Its spread in some areas appears to be very slow, yet in parts of Camarines Sur, where the incidence in 1956 was only 3%, some areas are now heavily affected and up to 70% of the palms are dying.

Symptomatology

The cadang-cadang disease cannot be diagnosed authoritatively by symptomatology, but in an endemic area symptoms can assist in the detection of affected palms.

On young leaves the earliest symptoms are tiny, circular, translucent spots on the veins. On mature leaves the number and size of the spots increases so as to impart a characteristic chlorotic pattern of the spots (Fig. 1). On the lower surface of mature coconut leaves appear irregular "water-soaked spots." Mature coconut leaves display yellow streaks as a result of enlargement and fusion of adjacent spots. The veins and veinlets become cleared in a very characteristic, although not very pronounced, way. The basal portion of the petiole of a healthy tree differs strongly from those of a diseased one, because the stipules of diseased trees remain attached to the base of the petiole, giving it a winged appearance. Nuts are produced only during the early stages of the disease, but they are smaller, rounded at the base or misshaped and scarified with brown streaks (Fig. 2). Nut bearing of diseased trees can stop within 18 months, but occasionally the period is extended to 4–5 years. A

comparison of healthy and diseased inflorescences shows an abundance of female florets (buttons) on the healthy and fewer on the diseased, that is reduced in size and retains a characteristic upward position of its branches (Fig. 3).

The fronds of diseased palms gradually assume an erect position in the crown (Fig. 4), dry up, die, and drop off. This results in a gradual reduction in the total number of fronds until a small, yellowish-green or yellow tuft is left at the apex of the trunk. Finally, the bud dies, falls off, and leaves the crownless trunk standing. A plantation in this stage looks like a field of telephone poles (Fig. 5).

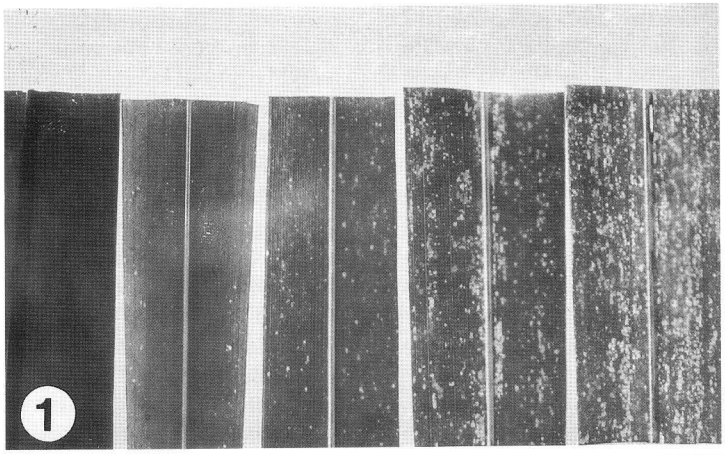
Coconut palms seldom become diseased before flowering. In rare cases the disease strikes before flowering sets in. The progress of the disease is slow, with a five to ten year interval between the appearance of first symptoms and the death of younger trees. In older palms this period may extend to 15–18 years.

The proper recognition of typical symptoms of the disease helps in field diagnosis but it requires long practice and experience and cannot prove accurately cadang-cadang etiology. In an epidemic area, symptomatology is still adequate for recognizing the disease. However, the symptoms may differ slightly, depending on the coconut variety and other factors. While the progression of symptoms is constant in the Philippines, observations in Guam, where the disease is called tinangaja, revealed slightly different nut symptoms there (Weston 1918, Maramorosch 1961, Boccardo et al. 1981, Boccardo 1985). The outbreak of cadang-cadang on Guam preceded the appearance of the disease on San Miguel Island by more than 20 years (Weston 1918). No recovery has ever been observed and the disease is always fatal. Therefore cadang-cadang presents one of the most serious threats to coconut palms not only in the Philippines but also to some Pacific islands, and, if not controlled, to all of southeast Asia.

Epidemiology

The mode of spread of cadang-cadang has not been well elucidated. An aerial vector has been suspected, but none ever found or incriminated. Viroids that cause potato spindle tuber, chrysanthemum stunt, hop stunt, citrus exocortis, and other viroid diseases are mechanically transmissible and do not require vectors to infect susceptible plants (Diener 1979). Man is the actual vector in those diseases. Experimentally, the cadang-cadang viroids have been transmitted to coconut and other palms mechanically (Randles 1985). There is no doubt that mechanical transmission could be responsible for the spread of the disease under natural conditions. The fact that young palms that have not yet commenced bearing nuts are very seldom infected might support this assumption. On the other hand, pollen transmission or long incubation periods would also fit this observation. However, pollen transmission could in no way explain the very rare infection of palms before flowers are formed. Pollen transmission could hardly be responsible for the very slow, perhaps not more than 500 meters, spread of the disease in certain areas, while in others cadang-cadang seemed to have been able to jump from island to island.

The mechanical transmission hypothesis seems supported by observations made by me on Luzon Island (Maramorosch 1987*a*, *b*, 1992). A consistent correlation was found between the destruction of coconut palms owned by Bicolanos and the lack of infection on plantations owned by Tagalogs. This correlation, at first, appeared to be absurd. However, if we accept that viroids are primarily or exclusively transmitted mechanically by man, the observed correlation can easily be explained. Most likely the cadang-cadang viroids are being carried from infected to healthy palms by tools, called bolos, the machetes used by plantation workers. Steps are first cut at the base of a palm to facilitate climbing.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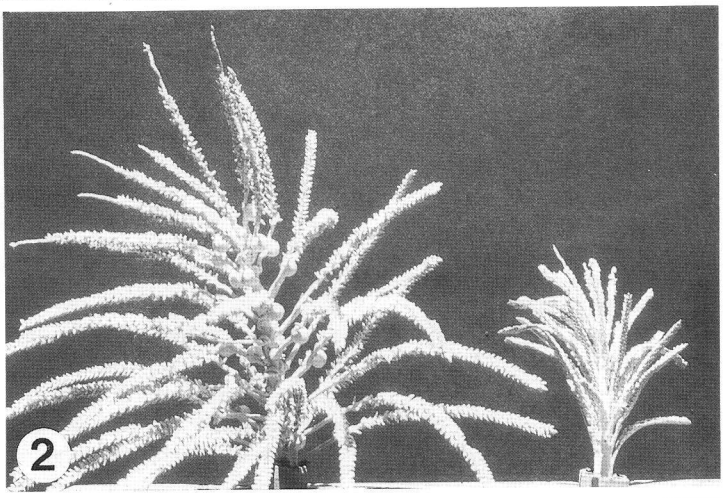
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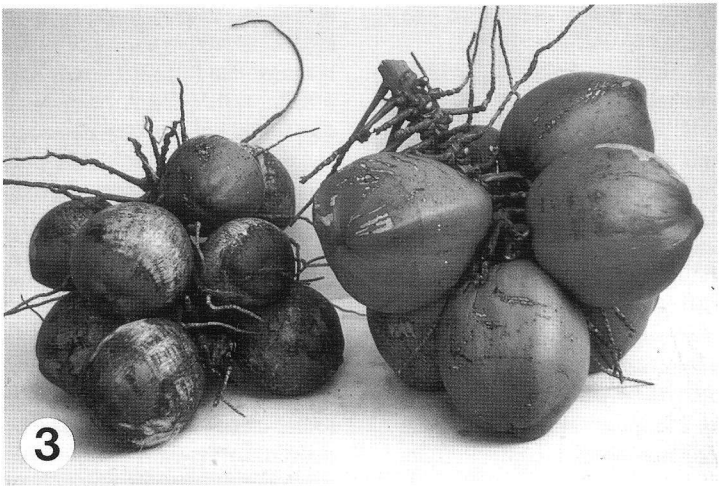
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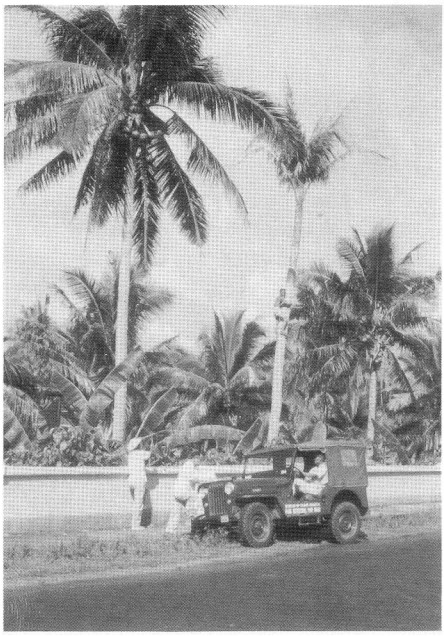
Afterwards, the same knives are used in the crowns to dislodge the nuts. In addition, flower sap is often being collected for "tuba," the sugary sap that ferments and provides a cheap alcoholic beverage in the Philippines. For tuba collection, crowns of several palms are usually linked with bamboo planks so workers can move from palm to palm high up in the crowns, without descending each time. This practice easily explains why clumps of diseased palms often occur at considerable distance from other diseased palms. If a worker uses his bolo on an infected palm, the cadang-cadang viroid can be transmitted to the next palm when steps are cut into the base, when nuts are being collected, or when the inflorescences are being tapped for tuba. Bicolano plantation owners prefer to hire Bicolano workers, while Tagalog owners prefer mainly Tagalogs for work in their plantations. Workers employed decades ago on San Miguel island were Bicolanos from Tabaco, the first locality where subsequently the disease appeared on Luzon Island. The link with Bicolano language seems to make sense on Luzon, but it does not pertain to Guam. There the disease was actually noticed earlier than in the Philippines (Weston 1918) and it spread all over the island in later years (Boccardo 1985).

It is generally accepted that all viroid diseases are of recent, twentieth-century origin (Diener 1979). Despite the fact that all viroids of plants can be transmitted mechanically, attempts to find other means of transmission are often being made. Attempts to find an insect vector of cadang-cadang viroids have been continued until now, even though this seems a complete waste of time and funds. If an insect were responsible, the localization of the disease in a very small pocket area in Quezon Province, at the locality of Mulaney, could not be explained. This small pocket is surrounded by healthy plantations. Neither can the hypothesis of pollen transmission be sustained—the disease would have moved out of Mulaney town since 1958 if the causative viroids were pollen-borne, wind-borne, or carried by insects. The mechanical transmission by contaminated machetes of plantation workers remains the most plausible explanation for cadang-cadang.



4. Left: healthy coconut palm. Right: diseased palm with erect fronds and leaflets reduced in size.

Cadang-cadang viroids have a narrow host range, limited to the palm family. No

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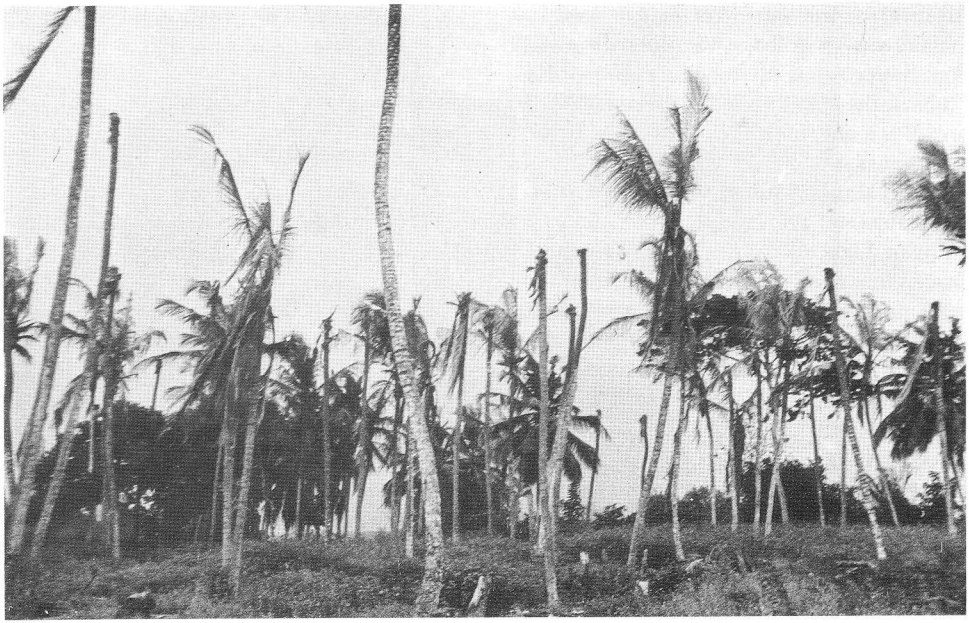
1. Portions of diseased leaflets in transmitted light, with progressive appearance of spots. 2. Left: healthy female inflorescence with an abundance of buttons. Right: inflorescence from diseased palm, lacking buttons and reduced in size. 3. Left: scarified small nuts from cadang-cadang diseased coconut palm. Right: healthy nuts.



5. Coconut plantation on Luzon island, totally destroyed by cadang-cadang disease.

herbaceous hosts are known to be susceptible. In addition to coconut, *Cocos nucifera*, several other members of the palm family, growing in the Bicol provinces, were found to exhibit symptoms similar to cadang-cadang (Maramorosch 1961). The African oil palm, *Elaeis quineensis* Jacq., the Anahau (*Areca catechu* Linn.), the Bunga de China (*Adonidia merrilli* Becc.), and the pugahan fish tail palm (*Caryota cumingii* Lodd.) have all been found to display the yellow mottle symptoms, olivaceous spots, decline in fruit production followed by sterility, brittle leaves, stunting, and a general slow decline and death, characteristic of cadang-cadang.

It is reasonable to assume that cadang-cadang disease is of fairly recent origin in coconut palms. Its ability to spread from plantation to plantation and from one island to another, demonstrated clearly in its progress during the past decades, makes cadang-cadang a dangerous potential threat to all the islands of the Philippine Republic and to other coconut growing areas of southeast Asia. In the Philippine Republic, with its population increasing very fast, the loss of so many million coconut palms is catastrophic.

Etiology

Randles (1975) discovered two viroid-like ribonucleic acid species, associated with cadang-cadang affected coconut palms. This finding determined the viroid etiology of cadang-cadang. Consequently, viroid association of tinangaja-affected palms on Guam was also demonstrated (Boccardo et al. 1981, Boccardo 1985).

When coconut seedlings were inoculated with crude nucleic acid extracts by high power injection and by razor slashing (Randles et al. 1979), typical cadang-cadang symptoms appeared in the mechanically inoculated seedlings. Nucleic acid probes (Randles and Hatta 1979) were used in hybridization assays, permitting the analysis of the kinetics and comparison of percentage homology. This method defi-

nitely identified the presence of cadang-cadang viroids in the African oil palm and the buri palm, as well as the Manila palm grown in the Philippines. It also confirmed that tinangaja, the coconut palm disease of Guam, was cadang-cadang because homologous ccRNA was detected there as well (Boccardo et al. 1981). The viroid nature of cadang-cadang disease was further confirmed by using highly purified RNA and demonstrating that it was infectious and reproduced the disease in mechanically inoculated palm seedlings. Nucleic acid hybridization probes are now being used in the Philippines to detect infected coconut palms long before they show symptoms of the disease—perhaps two years before visual symptoms appear. This allows removal of trees before they could become a potential source of infection to neighboring palms.

Control

Sound and successful strategies to control cadang-cadang should make use not only of the available manpower in the Philippines but also of facilities of international organizations. Simple, reliable and cost efficient measures of control will require long-term and costly efforts.

Replanting has been suggested as early as the 1950s, because the disease spreads comparatively slowly and kills slowly, so that copra production can be maintained in affected areas by new plantings. The use of early maturing varieties, such as Mawa, permitted coconut production to continue on Luzon Island despite considerable losses. Unfortunately, Mawa palms are not resistent to cadang-cadang infection and they die just as do later maturing palms.

Usually eradication is recommended as a standard procedure to prevent the spread of a plant disease. Eradication has failed to control cadang-cadang, probably because of the long period between the actual contraction of the cadang-cadang viroids and the appearance of symptoms that would permit the identification and removal of diseased trees.

At present, eradication can be carried out much earlier. It was hoped that this early eradication would prevent further spread of the devastating disease. However, it has not been proven that the infected and as yet symptomless trees were unable to contaminate the tools of plantation workers. In fact, eradication has not been able to prevent further spread of cadang-cadang and disease continues to appear in places where all infected trees were cut and removed.

There is another possibility to control cadang-cadang. Viroids form mild strains that barely affect plants but protect them from infection by a virulent strain (Fernow 1967, Niblett et al. 1978). If a mild strain of the cadang-cadang viroid could be found in nature or developed artificially, such strain could be introduced into healthy seedlings to protect the palms from the killer form. Long-term tests will be required to implement this approach.

The decontamination of bolos used by coconut workers could provide a simple control measure, by dipping the knives into a solution of concentrated sodium carbonate solution (Na_2CO_3). This solution would degrade the contaminating RNA viroids and retain its stability and its RNA-degrading ability in the tropical environment. Although this suggestion has been made repeatedly (Maramorosch 1987*b*, 1992), it has yet to be implemented.

Hopefully, cadang-cadang will be curtailed eventually by a combination of control measures—selection of tolerant or resistant cultivars, introduction of mild strains for cross-protection, and decontamination of tools.

Discussion and Conclusions

Cadang-cadang, like all other viroid diseases, originated in the twentieth century. Where did it come from? A possible source

of the viroid could have been an ornamental plant introduced to Guam, and later to San Miguel Island around the turn of the century. Perhaps Spanish boats, sailing from Acapulco to Guam, carried such a plant on board? Cadang-cadang was already well established on Guam when Prof. Weston described the disease in 1917, and it appeared on San Miguel Island a decade later, but since the incubation period and slow progress of the disease are now well established, the first contacts of coconut palms with the infectious viroids must have preceded the observed destruction by several years. No plant quarantine existed then and even today quarantine is comparatively lax in tropical countries.

Cadang-cadang is unquestionably an extremely serious palm disease that has caused huge devastation and great economic losses. If we look at the problem as a "local," Philippine disease, the present economic and political instability in that country makes any suggested solutions highly problematic. The rapid and constant population growth in the islands is hardly conducive to long-term breeding for disease resistance, the best practical solution. Preventing the spread by decontamination of machetes has been suggested but not implicated. Replanting gives temporary relief only. The disease, endemic in certain parts of the Philippines and Guam, apparently has been noted on a few remote Pacific islands recently. Besides, cadang-cadang is not limited to coconut palms. In the Philippines other palms have been diagnosed—first only by symptomatology and later by viroid analysis—to be infected by cadang-cadang viroids. Therefore the problem is not, and must not be, considered as of local importance only.

Large trials have been initiated in Albay Province to find whether natural selection for resistance would reveal a resistant coconut population among native palms. This attempt has been based on the assumption that cadang-cadang disease may have existed in Bicol long before it was reported by Ocfemia from San Miguel Island in 1930 and thus natural selection may have started quite early. I consider the assumption as incorrect and the tests as ill-conceived for the following reasons. Ocfemia, a native of Guinobatan, used to spend his yearly vacations and holidays in that locality in Bicol. A very well trained plant pathologist and a keen observer, he never saw a cadang-cadang diseased palm in or around Guinobatan, as he told me when he visited Rockefeller University in the late 1950s. If the disease had existed in Albay earlier, resulting in the survival of resistant palms, the subsequent severe outbreaks could hardly be explained.

Attempts to import a large number of coconut varieties from other parts of the world were initiated by me and were also attempted by the late F. O. Holmes 30 years ago in the hope that a resistant variety would be found. Shipments were made possible by a joint effort of several people and financial support obtained from the Franklin Baker Company. When sacks with seed nuts arrived by air in Manila, they were "accidentally" destroyed or "forgotten" while in the customs area of the airport. At present only local varieties are being tested. The Mawa variety, owned by a former close friend of President Marcos, the "coconut king" Eduardo Cojuangco, was hailed as the best solution to the cadang-cadang problem. It grows faster than the tall varieties but is susceptible to the disease. Instead of depending on such temporary remedies, an effort should be made to plant both local and imported varieties in isolation, on San Miguel Island, where the disease has never ceased to exist and where seedlings could be mechanically inoculated. Even if such tests were performed and a resistant variety found, the results would benefit the Philippines in 20–50 years at the earliest. Who could, and would be willing, to finance such a long-term effort?

There seems to be no question that cadang-cadang, similarly to all other viroid

diseases, is of recent, twentieth-century origin. Human activities have contributed to the origin of viroids in cultivated plants but they might have existed earlier in a latent state in as yet unknown natural hosts in which they cause no symptoms. Through human activities, such as grafting, handling or cutting, viroids have been transmitted to susceptible cultivated plants. We can expect that new viroids will continue to appear unexpectedly, just as did those known today which all appeared in the twentieth century (Diener 1987).

The discovery of viroids has opened new vistas in plant pathology as well as in medicine and molecular biology, becoming the first RNA pathogens whose molecular structure became completely known. Even though the natural mode of transmission and possible natural reservoirs of cadang-cadang and other viroids are still an enigma, they are among the most thoroughly understood host-pathogen systems.

In terms of dollars lost in copra production, the cadang-cadang disease represents the most important viroid disease known today and one of the most devastating diseases of plants anywhere. Efforts to curtail the disease have not yet been successful and cadang-cadang continues to post a serious threat to the economy of the Philippine islands and to other tropical areas of the world.

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BOOKSTORE

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Principes, 37(4), 1993, pp. 197–202

A New Aquatic Palm from Madagascar

HENK J. BEENTJE
Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE, U.K.

On my way to an isolated area of forest during fieldwork in Madagascar in 1992 I drove across a bridge and saw a group of palms growing along the river with their feet in the water (Fig. 1). On the way back that evening, I stopped the car to take a closer look, and spotted quite a number of clumps, with their roots in the riverbed. My excitement grew; I thought I had discovered the first Malagasy stand of *Nypa*, the Indo-Pacific mangrove palm. I started walking upstream to see if I could find any fertile material, and it was not long before I saw a palm full of fruit—and I actually gasped in amazement, because it was a *Ravenea*, my very "own" genus, and a new species to boot! (Figs. 2,3). That was immediately clear because the tree showed a combination of characters unknown in the genus. I found a few seedlings sprouting under the water, on a rock pavement, and in my mind I dubbed the species "rheophytica." Then I found some fruit, opened it to look at the seed, and found that it had already sprouted inside the fruit, a strategy employed by many types of mangrove trees (Figs. 4,5,6).

By now the light was fading fast and so I drove back to the nearest town for the night. Early the next morning I was back at the site of the new palm, accompanied by a Malagasy assistant. We walked along the river bank and saw about 400 trees with trunks, as well as large numbers of young plants. The population was in full fruit, but the male trees showed only dead inflorescences. All the trees grew in the fast-flowing stream, not one being found on dry land. The river here was 1–2½ m deep (3–8 feet). All trees were bent over the water, probably anchored to the banks. I climbed a female tree to collect the leaves and the fruit, but while I was working my way up the steeply inclined trunk the orange fruits started dropping in great numbers—plopping into the river with a very melodious sound, each seed with its own note, depending on size and the length of the drop. As I grasped the inflorescence with the few remaining fruits a wonderful name for the new species hit me—*Ravenea musicalis*.

The male inflorescences were old and dead, but it was still possible to see they were multiple, as in several other *Ravenea* species. I asked a local man when these trees had flowered, and he replied "December." Since it was March, this seemed quite likely, and I resolved to come back at the end of the year.

When I did so, in December 1992, the situation was virtually the same, with the exception being that the fruit was in a slightly younger stage, and only just turning yellowish. I checked a few hundred trees, but not a flower in sight. Again, I asked a local man when these trees flowered, but our languages did not quite match—his French was even worse than my Malagasy—and it took some time before he understood. Ah, flowers on the "Torendriky"? Well, it had been a strange year. "August?" I asked hopefully; "Eny [yes]" was the answer, but when I went through the months with him he said "eny" to December as well. . . .

"I'll have to come back again" should be the palm chaser's motto. Still, the material at hand is enough to distinguish the species from all others, and it is one of my

1. My first view of *Ravenea musicalis*—a small stand in deep water. 2. Young and mature trees. Note the large amount of floating fruit. The large-leaved aroid is *Typhonodorum lindleyanum*.

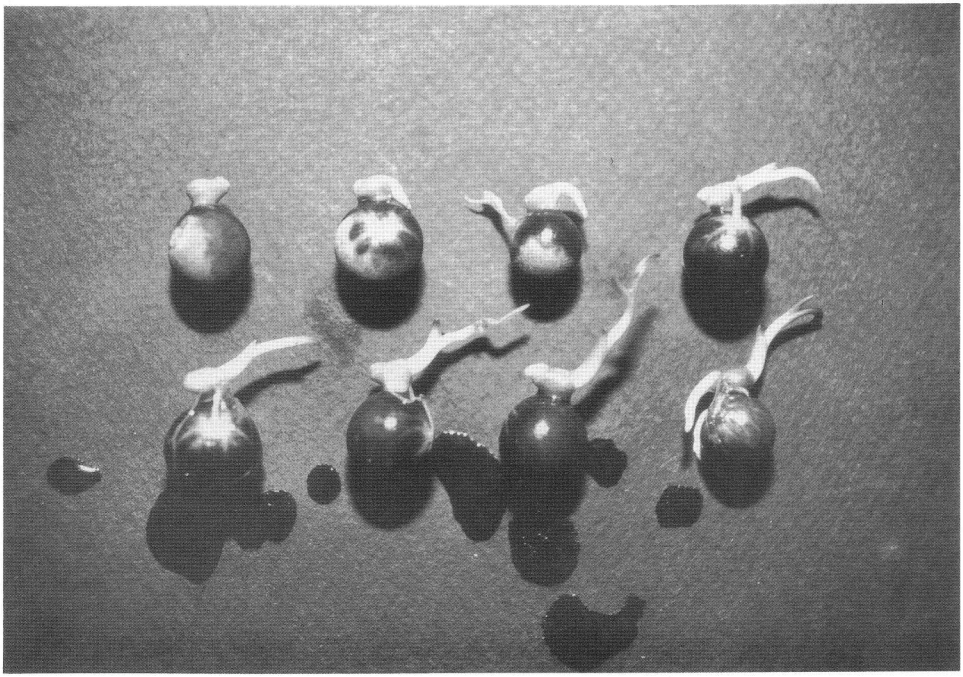
favorite Malagasy palms. Large amounts of mature seed have been distributed from the Royal Botanic Gardens, Kew, and are growing vigorously in places as far apart as Hawaii and London. In its home range, the palm seems to be restricted to a very small area. Despite a search of the area, I only saw it in that single river. Even considering the large numbers there, and the fact that it is not used by local people, it must be considered "vulnerable." Any serious upstream pollution or drying up of the river could wipe out the entire population.

3. Close-up of crown with fruiting branches.

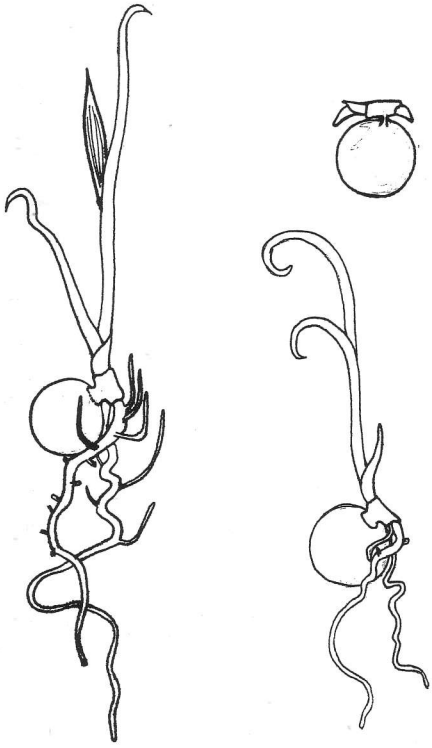
Ravenea musicalis *Beentje*, **sp. nov.**

R. rivulari affinis sed ligno molli, inflorescentiis maribus semel ramosis, inflorescentiarum feminearum rachillis paucioribus, fructu semineque majore recedit; a congeneribus diversa habitu atque habitatione, germinatione singulari distinctissima. TYPUS: Madagascar, pagus Belavenona, flumen Andriambe, *Beentje & Andriampaniry* 4611 (holotypus K; isotypi BH, MO, P, TAN).

Solitary, unarmed dioecious palm to 10 m tall, of which 0.5–2.5 m below the water; trunk ventricose, DBH 30–40 cm, base (at water level) to 50 cm across, near the crown ca. 11 cm across, internodes here 0.5 cm, nodal scars 0.5 cm; bark pale brown, soft, with internodes 1–2 cm; wood soft, cream-colored, fibrous, without hard fibers. Leaves 14–16, spiral, porrect to spreading, arching, held on edge in distal half, with stiff or arching leaflets; sheath 36–41 × 13–20 cm, adaxially orange, abaxially proximally orange, distally green, with thin gray tomentum; fibers few; petiole 15–19 × 3.5–5 × 1.5 proximally, glabrous, keeled; rachis 132–178 cm, in mid-leaf 1–1.5 cm across; with little abaxial tomentum; leaflets in one plane, regular (interval in mid-leaf 2–2.5 cm), stiff, 59–63 on each side of the rachis, the proximal 36–47 × 0.5–1.5 cm, median 42–53 × 1.6–2.4 cm, distal 10–30 × 0.4–1.3 cm; ramenta none or few, large, basal on midrib and outer main veins; main veins 4. Staminate inflorescence multiple in 5's, the individual inflorescences to 115 cm, branched to 1 order, pendulous in later stage; peduncle 36–38 cm, proximally 1 cm across, distally 0.6–0.7 cm across; bracts 29–30 cm, 38 cm, 64 cm (in 2), 84 cm (in 5), 80 cm (in 10); rachis 54 cm, with many dense rachillae; rachillae 7–24 cm, 1–1.5 mm across; flowers spaced; flowers unknown. Pistillate inflorescence solitary, spreading, 105–125 cm, branched to 1 order, the axes green; peduncle 48–52 cm, proximally 3–5 × 2–2.5 cm, distally 2–3 × 1.3–2 cm; prophyll 10 × 4 cm; peduncular bracts 20–24 cm (inserted at 0–2.5 cm), 49–52 cm (inserted at 3–3.5 cm), 82–83 cm (inserted at 4–9 cm), 100–103 cm (inserted 10–24 cm); rachis 39–55 cm, with 58–68 branches; rachillae 9–42 cm, the proximal spreading, the distal porrect, the base



4. Germination: the four upper stages are found within closed fruit, the four lower stages are found under water.



proximally flat, 0.6–1.5 × 1 cm, in fruit 3–3.5 mm across; pedicels 0.5 mm; calyx connate for 1 mm, 1.5 mm wide, free lobes 1.7–2.6 × 1.6–2 mm, ovate, acute; petals in fruit only present as fiber remnants, ca. 2.5 mm long. Fruit orange, 17–23 × 14–19 mm, one-seeded; stigmatic remains subapical to lateral. Seed brown, 10–14 mm across, hard, seedcoat black, 0.2 mm thick; endosperm solid, homogeneous. Seedling with 3–4 scale leaves: the first small, the second, third and fourth to 9 cm long and with curving tips; eophyll pinnate.

Distribution. Madagascar, only known from one site.

Specimens Examined. Belavenona, R. Andriambe, March 1992 (fr.), *Beentje & Andriampaniry 4611* (type); idem (old stam.), *Beentje & Andriampaniry*

←

5. Germination: from within the closed fruit (upper right) to the first emerging leaf (left).

6. Submerged seedlings, with young emergent plants, in fast-flowing water 7. Seedlings in cultivation at Kew.

4612; idem, Dec. 1992 (y. fr.), *Beentje 4756*.

Ravenea musicalis grows in 0.5–2.5 m deep, flowing water and always leans over towards deeper water. The seeds sprout within the closed fruit; the fruits float and rot and then the seeds sink. The palm also grows as a rheophyte on submerged rock pavements, but is then sterile and only grows to a height of 1 m. The local name is "Torendriky" ("submerged trunk"); there are no uses known to local people.

Note. The species is distinct from all other *Ravenea* species by the absence of hard fibers in the outer wood; by its habit and habitat; and by the seed sprouting within the unopened fruit. Its nearest relative is probably *R. rivularis*, from which it differs by the staminate inflorescence, branched to one order only, by the pistillate inflorescence, with much fewer rachillae, and by the much larger fruit and seed.

In cultivation in Antananarivo and at Kew a few curious characteristics became apparent. The second and third scale leaves curve through 180–270° at the apex at an early stage in development, which is perhaps a feature to aid establishment in fast-flowing water, since they may catch on protuberances on the riverbed. A similar strategy might be employed by the secondary rootlets, which sprout in large numbers and grow towards the light, rather than in the direction in which the main roots grow (i.e., downwards). Remarkably, the first true leaves are floppy, and the leaflets soft and pendulous (Fig. 7).

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New Species of Vanuatu Palms

JOHN L. DOWE
The Palmetum, P.O. Box 1268, Townsville, Queensland 4810, Australia

ABSTRACT

Three new species, *Licuala cabalionii*, *Calamus vanuatuensis* and *Cyphosperma voutmelense*, are described from Vanuatu as a precursor to a revision of the palm flora.

Vanuatu (formerly the New Hebrides) is an archipelago of about 80 small to moderate-sized volcanic and coral-based islands orientated linearly north-west to south-east between 13°S and 22°S and 165°E and 170°E in the southwest Pacific Ocean. The closest neighboring land mass (16,192 sq km) is la Grande Terre of New Caledonia, which is about 500 km to the southwest. The scattered southern islands of the Solomon Islands, of which San Cristobal is the largest at 4,200 sq km, are about 600 km to the north while the Fiji Islands lie some 1,200 km to the east. Espiritu Santo, at 4,100 sq km, is the largest island in Vanuatu.

Geologically much of Vanuatu is of recent (Eocene and younger) age when compared with nearby terrains; both New Caledonia and Fiji retain evidence of continental (Cretaceous) formation dating from the break-up of the continent of Gondwana. There are six active volcanoes and many semi-active areas within the Vanuatu archipelago. Island-building is presently taking place because of uplift wrought by the convergence of tectonic plates.

The flora of Vanuatu, in essence an extension of the floras of Malesia and New Guinea, is not as well known as those of some nearby island groups (e.g., Fiji and New Caledonia), as many of the remote and outlying islands (most of which harbor complex forests) have yet to be thoroughly botanized. P. S. Green (1979), while writing on the findings of the 1971 Royal Society Expedition to Vanuatu, noted an unexpectedly large number of plant species which were recorded for the first time in Vanuatu, particularly species from the Solomon Islands, New Caledonia, and Fiji. Of those regional affinities which have been ascertained, that with the Fiji Islands (even though they are considerably farther away than either New Caledonia or the southern Solomon Islands) is the most obvious (Schmid 1966).

The affinity of the palm flora displays the same trends as does the flora in general (i.e., in a broad sense an extension of the Malesian and New Guinea floras and in a regional perspective having a close relationship with that of the Fiji Islands) (Schmid 1966, Chew Wee-Lek 1984, Dowe 1991), although in the northern islands, such as the Torres and Banks Groups, a shared distribution and/or close relationship with palm species from the southern Solomon Islands exists (the Santa Cruz Group of the Solomon Islands is geologically similar to the northern islands of Vanuatu). An appraisal of the relationship between the Vanuatu and Fijian palm floras (Dowe 1991) recognizes that, despite there being only one shared species (i.e., *Cocos nucifera*), the number of shared genera is relatively high, being in the order of seven of a total of fifteen. This is significant when it is considered that many palm genera which occur in the southwest Pacific are monotypic or have only a few species and that Fiji is a considerable distance away. Compare this to the number of palm genera shared with Vanuatu's clos-

1. Juvenile plant of *Licuala cabalionii* with the obvious symmetrical segmentation of the leaf.

est neighbor, New Caledonia; only two genera (*Cocos* and *Cyphosperma*) of a combined total of 25 genera occur in both areas. Whether Vanuatu was or is in a favored position to receive propagules from Fiji (i.e., abutting prevailing ocean currents, in the paths of migrational birds, etc.) has yet to be investigated, although the uniformity of the strand vegetation of the region is evidence of ocean currents being a major influence on the distribution of plants in the southwestern Pacific (Gunn and Dennis 1976, Merrill 1981). Of the eight genera which are not shared, four are monotypic, three of which are endemic to Fiji.

A list of the recognized Vanuatu palm species, including the three new species described here, is as follows: ** denotes suspected or known to be introduced/naturalized taxa: † denotes endemic taxa: ‡ denotes indigenous taxa which also occur elsewhere.

Licuala cabalionii Dowe†
L. grandis H. Wendl. ex Linden‡
Pritchardia pacifica Seem. & H. Wendl.**
Metroxylon warburgii (Heim) Becc.‡
M. salomonense (Warb.) Becc.**
Calamus vanuatuensis Dowe†
Caryota albertii F. Muell. ex H. Wendl. & Drude**
Veitchia arecina Becc.†
V. macdanielsii H. E. Moore†
V. metiti Becc.†
V. montgomeryana H. E. Moore†
V. spiralis H. Wendl.†
V. winin H. E. Moore†
Gulubia cylindrocarpa Becc.‡
Pelagodoxa henryana Becc.**
Clinostigma harlandii Becc.†
Carpoxylon macrospermum H. Wendl. & Drude†
Physokentia tete (Becc.) Becc.†
Cyphosperma voutmelense Dowe†
Cocos nucifera L.‡

New Species

Licuala cabalionii Dowe, sp. nov. *L. grandi* H. Wendl. ex Linden proxissima a qua lamina foliorum segmentata, caulibus tenuioribus altioribusque, fructibus maturis aurantiacis non carmesinis, et endocarpio parce costato differt. TYPUS: Vanuatu. Malekula: *Dowe 048*, 5 Sept. 1991 (holotypus BRI). Figures 1–3.

Stem solitary, erect to slightly reclining, to 5 m tall, to 8 cm diam., portion below leaves retaining decaying leaf-bases, proximal portion smooth, light brown/gray. Leaves to 12 in a loose crown; petiole very long and thin, to 3 m long to 1 cm wide in distal portion, irregular marginal spines only at the base; leaf-blade segmented; segments to 12, symmetrically arranged, central segment twice or more times broader than lateral segments which become progressively narrower toward the leaf margins, all segments slightly pendulous. Inflorescence interfoliar, pendulous, to 1.8 m long, five once-branched branches; bracts subtending primary and secondary branches tubular, remaining green during fruit development and maturity. Flowers pedicellate, single, spirally arranged, sepals fused to one-third their length, apex rounded, to 12 mm long, petals fused basally, apex valvate, pointed to 4 mm long. Fruit yellow/orange when ripe, globose, to 10 mm diam.; endocarp brittle with few longitudinal ridges. Seed to 6 mm diam., testa intruding into endosperm below the raphe. Eophyll plicate, leaf dividing early.

Distribution. Vanuatu, on the islands of Vanua Lava (in littoral forest at sea-level on volcanic soils) and Malekula (in rainforest to 250 m above sea level on volcanic soils). Endemic.

Specimens Examined. VANUATU. SOUTH MALEKULA: "Amethyst Camp," 250 m in rainforest on volcanic soil, 5 Sept. 1991, *Dowe 048* (holotype BRI).

Typification. Although this taxon had been recognized by the author to be distinct in 1988, no suitable sample for typification was available until that collected on 5 September 1991 (*Dowe 048*, BRI). This collection consists of two leaves (one with petiole) and a complete infructescence with immature fruit. Mature fruit has been seen by the author in the field but no sample of it has been preserved.

2. *Licuala cabalionii* in rainforest at altitude of about 200 m at Amethyst Camp, southern Malekula.

Derivation of Name. Licuala cabalionii is named for Pierre Cabalion (born 1947), French ethnopharmacologist whose work in Vanuatu has been an important contribution to the Flora of Vanuatu Project.

Licuala comprises about 110 species distributed from northeast India, through southern China, Philippines and southeast

3. Prolific production of seedlings below the "parent" plants is characteristic of *Licuala cabalionii*.

Asia to New Guinea, northern Australia, Solomon Islands and Vanuatu. The genus has developed its greatest diversity in Malay Peninsula and Borneo (about 50 species) and New Guinea (about 36 species). *Licuala* was not recognized as occurring in Vanuatu until 1970, when *L. grandis* was collected from southern Espiritu Santo (Whitmore 1973). Erroneously this species had been documented in numerous publications as originating from New Britain, an island to the east of New Guinea, an error most probably originating from its initial description from a horticultural source.

Licuala cabalionii is distinguished from the closest occurring species, *L. grandis* H. Wendl. ex Linden (distributed throughout much of Vanuatu as well as the Santa Cruz Group and San Cristobal Island of the Solomon Islands) by its divided leaf-blade, less spiny petiole, shorter floral pedicel and sparingly as opposed to multi-ribbed endocarp. *L. lauterbachii* Dammer & K. Schum. (Solomon Islands and New Guinea) differs in having a short and erect inflorescence, red fruit, and irregularly divided leaf-blade.

The known populations of *L. cabalionii* do not occur close to populations of *L. grandis* although they occupy similar habitats. The former occurs in very dense colonies (almost monospecific) in primary rainforest; the forest floor in the vicinity is thickly cover with seedlings and small plants. *L. grandis* is much less gregarious, with very few seedlings being observed and individuals being relatively widely spaced. *L. grandis* is more commonly found in disturbed or secondary forest. No traditional uses or vernacular names have been recorded for *L. cabalionii*.

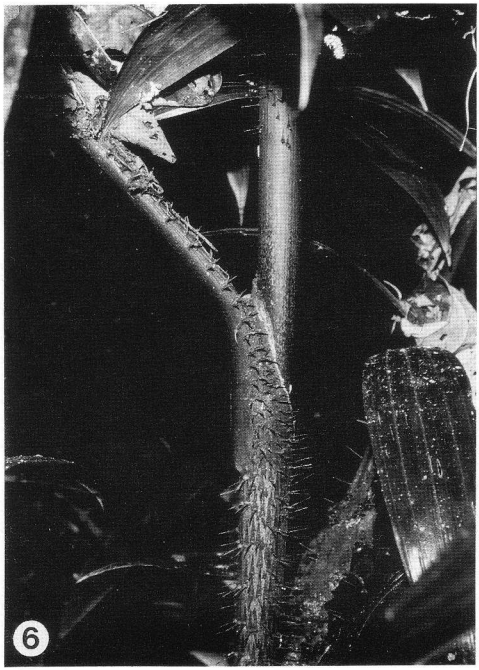
Licuala cabalionii has appeared as the manuscript names "*Licuala* sp. Vanua Lava" (Dowe 1989a) and "*Licuala* sp." (Dowe 1989b).

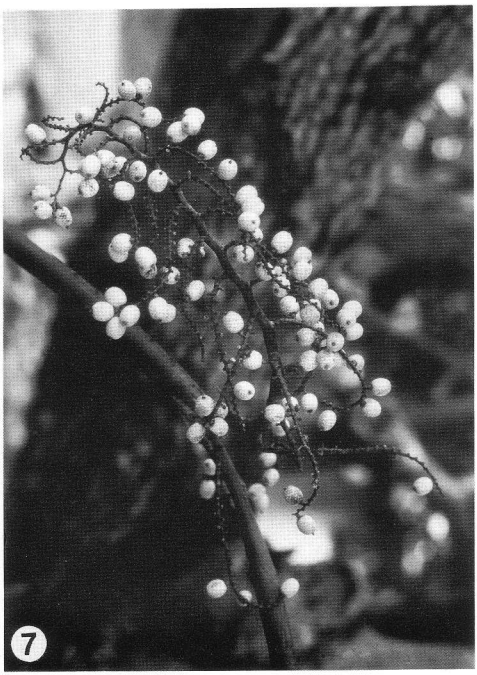
Calamus vanuatuensis Dowe, sp. nov. *C. vitiensi* Warb. ex Becc. et *C.*

4. *Calamus vanuatuensis* is a cirrate climber, seen here in the low altitude forest of central Espiritu Santo. 5. Leaflets of *Calamus vanuatuensis* are characteristically broad and chartaceous in appearance.

hollrungii Becc. affinis; a *C. vitiense* spinis in pectine non nisi in juvenalibus, ligula in pagina abaxiali petioli fructibus maturis cremeis majoribusque distinguitur; a *C. hollrungii* foliolisque non spinescentibus, et fructibus multo majoribus distinguitur. TYPUS: Vanuatu. Erromango: *Chew Wee-Lek* (*RSNH*) *118* (*1 & 2*), 3 August 1971 (holotypus PVV; isotypus K). Figures 4–7.

High climbing solitary-stemmed rattan. Stem without sheath bright green, glossy, 10–50 mm diam., narrowing above the nodes. Sheaths dull green to coppery/brown, densely spiny particularly toward the knee and petiole; spines green to yellowish green, light brown to almost black, to 4 cm long, irregularly spaced, robust and infrequently in combs in juvenile plants; knee prominent, spineless, but spines densely aggregated near its margins. Leaf cirrate, to 4 m long; cirrus thick, to 2 m long, bi- to five-clawed on all surfaces; petiole 7–30 cm long, with spines on margins and adaxial surface; ligule prominent on adaxial surface of petiole base; rachis spineless in median portion, but with clawed spines developing on abaxial surface of distal portion; leaflets regularly arranged, well spaced, coriaceous, dark green on both surfaces, 45 × 12 cm, four- to seven-veined, apex acute, spineless, terminal pair in non-cirrate juvenile leaf united basally. Inflorescence to 2 m long, non-flagellate, pendulous, with about six branches; staminate inflorescence smaller than pistillate inflorescence; bracts persistent, green, basal portion narrow, apical portion funnel-shaped, truncate, with marginal spines, rachillae to 12 cm long, curved, alternate and distichous, about 24 per branch. Flow-





6. The petiole and upper leaf-sheath of *Calamus vanuatuensis*. Note the spineless knee which is characteristic of the species. 7. Infructescence of *Calamus vanuatuensis*.

ers pedicellate; staminate flowers closely spaced, subtended by prominent funnel-shaped, truncate bracts; pistillate flowers 8–12 per each side of rachillae, to 15 mm long, staminodes prominent. Fruit sub-globose to 20 mm long, stigmatic remains prominent, white or cream suffused at maturity, scales arranged in seven rows. Seed pebbled, basally depressed, raphe prominent. Eophyll bifid.

Distribution. Vanuatu, occurring on most islands between Erromango and Vanua Lava in moist forests from sea-level to an altitude of over 1,000 m on a variety of soil types but most commonly in forest on basalt at 200–300 m. Endemic.

Specimens Examined. VANUATU. ERROMANGO: Nouankao River, agathis forest at 150 m, *Chew Week-Lek* (*RSNH*) *118* (*1 & 2*), 3 August 1971 (holotype PVV; isotype K); Southeast, in kauri forest 200–300 m, *Schmid 3272*, 12 May 1970 (NOU); River 5 km southwest of Ipota, *Cabalion 3028*, 16 November 1985 (PVV). EFATE: Loukpat, near Tagabe, dense forest about 200 m, *Green* (*RSNH*) *1076* (*1–4*), 11 July 1971 (PVV); South, Rentabao River in secondary forest on red-brown soils at sea-level, *Schmid 3271* (*2 sheets*) 29 April 1970 (NOU); Mt. Bernier at 470 m, *Seoule 38*, 12 August 1981 (PVV). PENTECOST: valley to the south of Melsisi, *Cabalion 1153*, 3 October 1980 (NOU). BANKS GROUP: *Vienne s.n.*, 1972 (NOU). MOTA LAVA: 300 m, *Bourret 216*, May 1978 (NOU).

Typification. The earliest known collection of this taxon is that by D. Levat, 1883, conserved at Montpellier University (MPU), France. The next recorded collections were those made in the 1970's by botanists from ORSTOM, based in Noumea, New Caledonia and collectors involved in the 1971 Royal Society and Percy

Sladen Expedition, New Hebrides. It is from this expedition that the type specimen has been chosen: *Chew Wee-Lek 118*, 3 August 1971, consisting of two parts; (1) a basal leaf section (including petiole), a packet of pistillate flowers and a section of infructescence with fruit and (2) a mid leaf section and a section of infructescence with fruit; this is the most complete and representative collection seen by the author; it is preserved at PVV with a duplicate at K. The only collection to contain staminate flowers is *Schmid 3271*, 29 April 1970, preserved at NOU.

Derivation of Name. Calamus vanuatuensis is named for Vanuatu, the type locality.

Discussion. This species has a relatively widespread occurrence and is variable. Samples collected from higher altitudes and from the northern parts of its range display a smaller overall size. It appears most closely related to *C. vitiensis* Warb. ex Becc., an endemic Fijian species and *C. hollrungii* Becc. from northeast Queensland, New Guinea and the Solomons. *C. vitiensis* has basally aggregated and obliquely arranged spines, a shorter and more robust pistillate inflorescence, smaller fruits which are whitish at maturity, and lacks the often prominent ligule on the adaxial surface at the base of the petiole. *C. hollrungii* has leaflets aggregated into groups (2–5) and which have marginal and rib spines and a leafsheath with a spinous knee.

Distinguishing Features of Three Calamus Species

C. vanuatuensis	*C. vitiensis*	*C. hollrungii*
leaflets evenly arranged	leaflets evenly arranged	leaflets unevenly arranged
leaflets unarmed	leaflets unarmed	leaflets armed
sheath spines not in combs	sheath spines in combs	sheath spines not in combs
knee unarmed	knee unarmed	knee armed
inflorescence long	inflorescence short	inflorescence long
fruit 2 cm long	fruit 1.5 cm long	fruit 1 cm long
fruit cream	fruit white	fruit white

Calamus L. is the largest genus in the Palmae with about 380 species distributed in tropical Africa (one species), eastern and southern India through Burma, southern China, Philippines, south-east Asia, Malesia, New Guinea, Solomons, northern and eastern Australia, Fiji and Vanuatu. The greatest concentration of species occurs in Malesia. The few species occurring in the Solomons, Fiji, Vanuatu and eastern Australia represent outliers; apart from the three species noted above, other outlying species in Australasia/western Pacific appear not to be closely related.

Calamus vanuatuensis has appeared as manuscript names as follows:

Calamus sp. 'Efate' (Guillaumin 1948)
Calamus (Schmid 1965)
Calamus (Moore 1966)
Calamus (Schmid 1973a)
Calamus sp. 'Erromango Sud-Est' (Schmid 1973b)
Calamus sp. 'Vaté-Sud' (Schmid 1973b)
Calamus sp. (Schmid 1974a)
Calamus sp. (Schmid 1974b)
Calamus sp. (Hodel 1982)
C. sp. aff. *vitiensis* (Dowe 1989a)
Calamus sp. (Cabalion 1989)
Calamus sp. (Dowe 1991)

Cyphosperma voutmelense Dowe, sp. nov. *C. balansae* (Brongn.) H. Wendl. ex Salomon proximissa a qua statura aliquantum minore, inflorescentia dimidio breviore squamis persistentibus obtecta, bracteis subtendentibus ramos inflorescentiae humilibus rotundatisque, et fructibus multo minoribus distinguitur. TYPUS: Vanuatu. Espiritu Santo: *Morat 6488*, August 1979 (holotypus NOU; isotypus BH).

Stems solitary, to 6 m tall, markedly cylindrical, leaf-scars closely spaced. Leaf

to 1.5 m long; leaf-base smooth, not forming a crownshaft; petiole narrowing abruptly, deeply channelled adaxially, rounded abaxially; leaflets widely spaced on rachis, to 5 cm apart, falcate, acuminate, to 45 × 3 cm, mid-rib prominent; two pronounced lateral ribs, equidistant from mid-rib and leaf margin; mid-rib with brown scales below, only at the base. Inflorescences interfoliar, arching to pendulous, to 92 cm long; prophyll to 30 cm long, open abaxially and not fully encircling peduncle at attachment; peduncular bract, attached 2–2.5 cm above prophyllar attachment, to 55 cm long, becoming fibrous with age; rameal bract to 4 cm long, pointed, attached 12 cm above peduncular attachment; all bracts persistent; peduncle to 35 cm long, to 10 mm wide, adaxially flat, abaxially rounded, covered with persistent brown scales; rachillae, about 13 per inflorescence, to 25 cm long, angled, covered with persistent brown scales, rachillae becoming closer spaced toward inflorescence apex; inflorescence branches subtended by low rounded bracts. Flowers spirally arranged, triads in the basal one-quarter to one-third, paired or solitary staminate flowers distally; staminate flowers symmetrical, larger than pistillate flowers, sepals imbricate to 1 mm long, petals valvate to 3 mm long, stamens 6; pistillate flowers to 2 mm high and wide, sepals imbricate with smooth margins; bracteoles large. Fruit sub-globose 10 × 8 mm, red at maturity, stigmatic remains subapical; endocarp ridged and furrowed. Seed 6 × 4 cm, in shape similar to endocarp.

Distribution. Vanuatu, on Espiritu Santo where it is known from a small population on the Cumberland Peninsula on a ridge below Voutmélé Peak (1,535 m) in moist forest on volcanic soils at 900–1,100 m. Endemic.

Specimens Examined. VANUATU. ESPIRITU SANTO: Cumberland Peninsula, ridge below Voutmélé Peak in forest on volcanic soils at 1,000 m, *Morat 6488* (5 sheets), 3 August 1979 (holotype NOU; isotype BH).

Typification. The only collection of this taxon is *Morat 6488*, 3 August 1979, preserved at NOU and BH. The sample at NOU consists of five sheets of which three comprise a complete leaf, the remaining two are complete inflorescences both with staminate and pistillate flowers. Fruit and a section of inflorescence are preserved at BH.

Derivation of Name. Cyphosperma voutmelense is named for Voutmélé (also spelt Vutmélé and Vutimélé), a peak above the ridge from where the type specimen was collected.

Discussion. Cyphosperma voutmelense is most closely related to *C. balansae* from New Caledonia, from which it differs by its much smaller inflorescence, brown, scaly inflorescence branches, rounded and not prominent inflorescence branch bracts and smaller fruit. The two Fijian species are more distinct: *C. tanga* H. E. Moore has undivided or only apically divided leaves and a sparsely branched inflorescence while *C. trichospadix* (Burret) H. E. Moore has a distinct crownshaft, an infrafoliar inflorescence, and large fruit to 2 cm long.

Cyphosperma voutmelense has appeared in manuscripts under the following titles:

Cyphosperma sp. 'New Hebrides' (Moore & Uhl 1984)
Cyphosperma sp. 'Vanuatu' (Dowe 1989b)
Cyphosperma cf. *balansae* (Cabalion 1989)
Cyphosperma sp. (Dowe 1991)

Key to Species of Cyphosperma

1. Crownshaft developed; inflorescence infrafoliar
   Vanua Lava, Taveuni, Fiji . . . *C. trichospadix*
1. Crownshaft undeveloped; inflorescence interfoliar
   2. Peduncle greater than 1 m long
      3. Leaf undivided except irregularly toward the apex fruit oblong/ellipsoidal to 1.3 cm long ..... Vitu Levu, Fiji . . . *C. tanga*
      3. Leaf divided regularly throughout fruit globose to 1.2 cm diameter ..... New Caledonia . . . *C. balansae*
   2. Peduncle less than 1 m long ..... Espiritu Santo, Vanuatu . . . *C. voutmelense*

Acknowledgments

I must thank Dr. Pierre Cabalion of ORSTOM, Paris, for his encouragement, discussion and sustained interest in the Vanuatu Flora; Mr. Chanel Sam of ORSTOM, Port Vila, Vanuatu, for access to the Tagabe Herbarium (PVV) and other general assistance; Dr. Tanguy Jaffre of ORSTOM, Noumea, New Caledonia, for access to the Noumea Herbarium (NOU); Mr. John Crook of the Department of Forestry, Port Vila, Vanuatu; Dr. Les Pedley of the Queensland Herbarium, Brisbane, for assisting with the Latin diagnoses; Dr. Gordon Guymer of the Queensland Herbarium for general assistance and access to Herbarium (RBI); Dr. John Dransfield of Royal Botanic Gardens, Kew, for critically reviewing the manuscript; members of the Palm and Cycad Societies of Australia for granting me use of the word processing equipment and funding for correspondence and stationary needs; and the Yves Rocher Foundation, Paris, France, for funding the field trip of September 1991.

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Principes, 37(4), 1993, pp. 212–215

Local Distribution and Ecology of "Palha Preta"—A Pioneer and Invasive Palm in Jari, Lower Amazon

M. J. PIRES-O'BRIEN

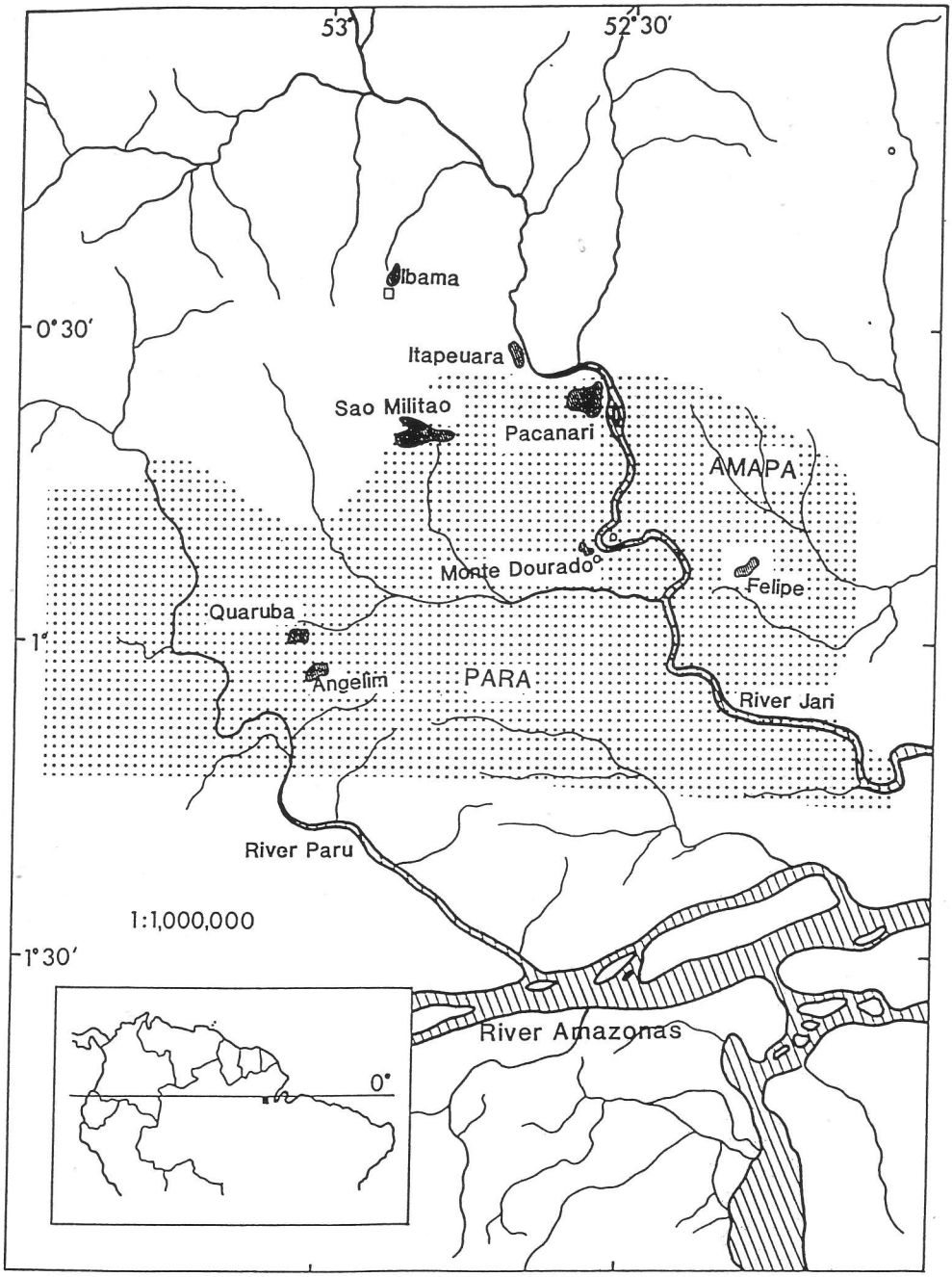
Museu Paraense Emílio Goeldi, Dept. of Ecology, C.P. 399, 66040 Belém, PA, Brazil

The region of the Jari River, situated between the Brazilian states of Pará and Amapá, is dominated by some 110,000 hectares of forestry plantations of *Gmelina*, *Pinus* and *Eucalyptus* managed by "Companhia Florestal Monte Dourado," formerly Jari Project. This Company started in 1969 in a very large land holding (estimated in 1.6 million hectares) in the mid-low Parú-Jari river basins. Outside the northern boundary of the Company's lands is the Jari Ecological Station, a large native forest reserve with lodgings, administered by "Instituto Brasileiro do Meio Ambiente" (IBAMA = Brazilian Institute of the Environment). A total of eight forest communities from the area of Jari was subject of botanical surveys and an extensive phenology study from 1985 to 1990 by the author and collaborators (Fig. 1). Of these, seven were native forests set aside as gene banks by "Companhia Florestal Monte Dourado," and the one remaining was a forest community located at IBAMA's Jari Ecological Station. The "palha-preta" palm described in this paper is one of the commonest plants of the native forests of the Jari river basin, also occurring in disturbed areas such as forestry plantations.

Taxonomy and Ecology

The Jari species described here was identified as *Attalea spectabilis* Martius by Andrew Henderson. However, there are many problems with the taxonomy of neotropical palms. At present *Attalea-Orbignya* forms a difficult complex still unresolved taxonomically. The Jari collection was originally identified as *Orbignya sagotii* Trail ex Im Thurm, a Guyana species, not known to occur in the Amazon. According to Rodrigues (1903), the specimens identified as *O. sagotii* have been confused with *Attalea spectabilis* Mart. and *Attalea monosperma* Barb. Rodr. He distinguishes the two last species by pointing out that the leaves from "*A. monosperma*" are long-lasting and can be used to cover houses while those of *A. spectabilis* deteriorate quickly (Rodrigues 1903). Wessels Boer (1965) recommended reducing certain species now in *Orbignya* and in other related genera to *Attalea*, proposing the new combination *Attalea sagotii* (Trail ex Im Thurm) W. Boer (Boer 1965). Andrew Henderson (personal communication) endorses the return of certain *Orbignya* species to *Attalea* and plans to reduce the name *Orbignya sagotii* Trail ex Im Thurm to a synonym of *Attalea spectabilis* Martius (Andrew Henderson, personal communication).

In Jari the "palha-preta" palm reaches 11 m. It is very frequent in the understory of most lowland forests of the Parú-Jari basin (Fig. 2). The leaves are up to 6 m long, pinnate (palmate in the young plant); sometimes the pinnae remain united at the apex. Inflorescence is light yellow, and the floral rachis is 65 cm long, of one sex only, the plants being dioecious or monoecious but also reproducing through underground runners. Mature fruits are 5 × 3 cm,



1. Map of the Parú-Jari River basins in the Lower Amazon region, showing the area of occurrence of *Orbignya sagotii* Trail ex Im Thurm.

2. *Orbignya sagotii* in one of the Jari forests studied.

ovate, reddish-brown, and the rachis bears some 140 mature fruits. Each fruit has one single seed within the thick and hard mesocarp. Found in association of *Ananas ananosoides*, the species occurs most frequently in poor sandy soils. The only known economic importance of this palm is that the leaves are used to cover local dwellings.

The architecture of "palha-preta" can be described as an inverted cone made of the convergence of its very large leaves, which act as a trap for the debris which fall from the upper canopy (Fig. 2). It is very difficult to observe flowering of this species because the inflorescence is normally completely concealed under the trapped debris. Such behavior could be an indication of cantharophily, but more observation is needed to establish the pollination mechanism. For a period of three years (1987–90), my field crew and I paid monthly visits to the eight forest sites of Jari (Fig. 1) to collect phenological data on trees. During that period I systematically searched for individuals in flower and fruit to make fertile collections. By inspecting a large number of neighbors of a flowering individual, I found that only a few individuals flowered synchronously (September), while most remained in the vegetative stage. Vegetative reproduction through underground runners was observed by the author.

The "palha-preta" palm is a very strong pioneer which invades newly disturbed habitats and any open area available. In the forestry plantations of Jari, this palm species is one of the most noxious weeds, especially in areas recently harvested and cleared for the next crop. Because of its size and shape, it takes up the space as well as the light needed for young forest seedlings to establish. Information from the plantation engineers is that all attempts to kill this palm with herbicides, including concentrated doses of Monsanto's herbicide "Roundup," have failed.

Distribution

The complex *Attalea-Orbygnya* has a large number of species, some of which

are found in the Amazon rainforest. The most widespread species of this complex, *O. phalerata* Mart., known as "babassú," occurs mainly in Maranhão and in eastern to southeastern Pará and Amapá, and is considered an ecological marker of the Amazon transition forest. *A. spectabilis* occurs mainly in the east Amazon. Its synonym, *O. sagotii* Trail ex Im Thurm, was described from a collection from British Guyana (Im Thurm 1984). The "palha-preta" variety seems to be more abundant in the eastern-northeastern Atlantic Coast phytogeographic region of the Amazon sensu Pires and Prance (1985), occupying mainly dry open forests on alluvial sandy soils.

Although the "palha-preta" palm is abundant in the region of Jari, observation of the major forest types found in the region showed that it does not occur with equal frequency in the eight forests. It is more frequent in the dry forests with lower canopy than in mesophytic forests with higher canopy, and it is absent in the dense high forest of Ibama's Jari Ecological Station. The forests where "palha-preta" are more abundant turned out in the first of four clusters in which the eight forests of Jari were classified by Pires (1991). This suggests that the "palha-preta" palm follows closely the soil-relief-geomorphology gradient found in the region of Jari, and could be used as an ecological marker for Tertiary terrains of that region.

Specimens Examined

G. S. Jenman-520, s/d, 1879, Corentine River, British Guyana (Fl.), K; E. F. Thurm-27, s/d/, Corentine River, British Guyana. Holotype (Fl. + Fr.), K; Sagot-631, s/d/, 1856. Karouany, in wet woodlands, K; M. J. Pires & N. T. Silva-1765 (Fl. + Fr.), NY, JARI, MG.

Acknowledgments

I thank the New York Botanical Garden and Andrew Henderson for the botanical determination of collection M. J. Pires & N. T. Silva-1765 from Jari.

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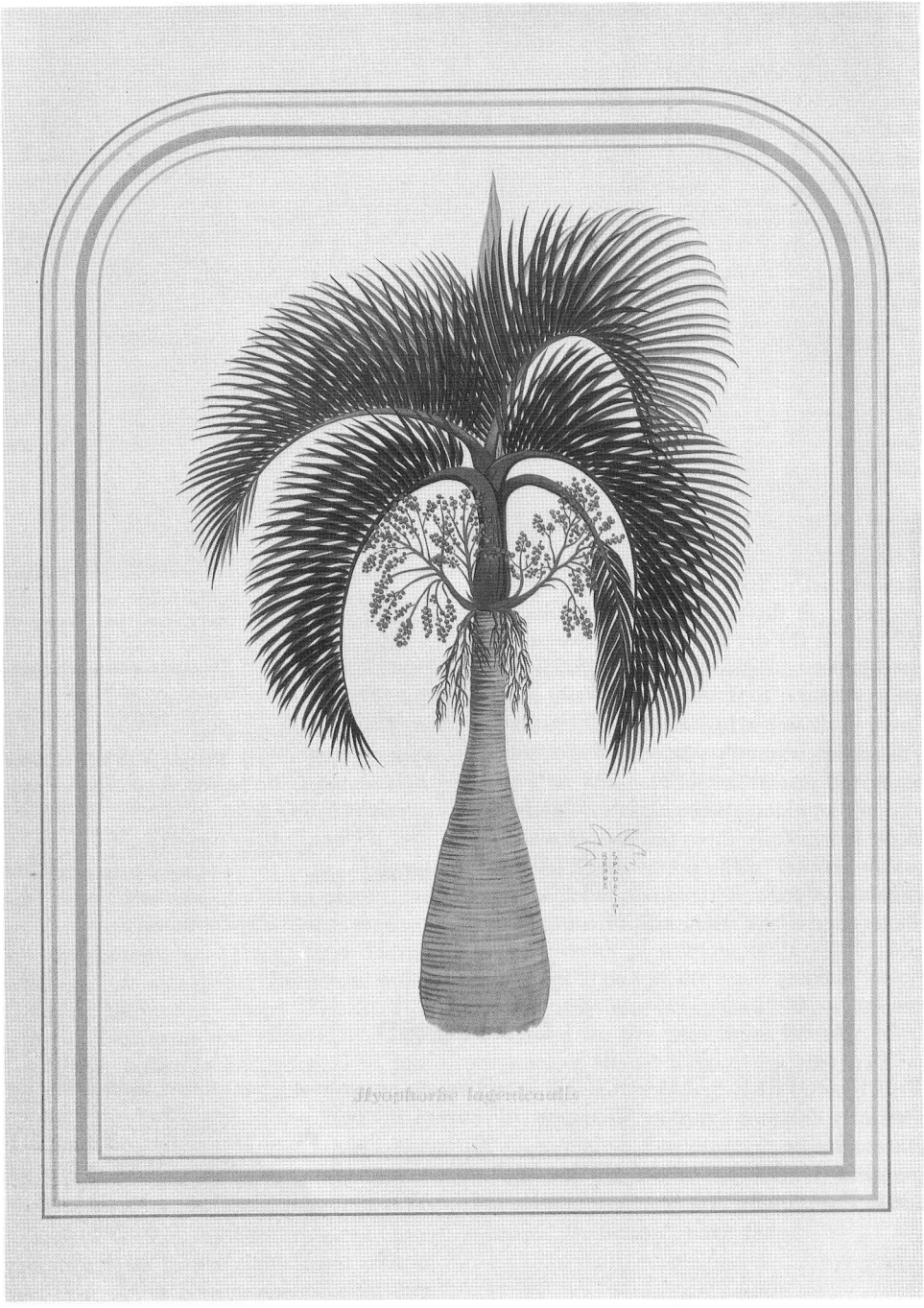

1. The bottle palm, *Hyophorbe lagenicalus*, painted by Beppe Spadacini. Permission to reproduce this plate given by the artist for this purpose only and not for other commercial purposes. See review on page 217.

Principes, 37(4), 1993, p. 217

PALM LITERATURE

PALMS OF THE WORLD. Series 1. By Beppe Spadacini. A folio of 15 offset reproductions of color paintings in a case; 18⅝ by 24⅞ inches (47.3 by 63.2 cm). Studio Tucano, Lungo Lario Trieste 54, 22100 Como, Italy. 1991. $900.00.

This lavishly-produced collection consists of individual plates each enclosed in a protective folder. An introductory folder carries the folio title and a photograph of the artist, and contains two folio sheets on which are printed an explanatory essay on palm trees and a botanical note on palms and their uses, both by Giorgio Sacchi, in Italian and English. The naturally colored palm portraits in this beautiful collection are each reproduced with a handsome multicolored border and the scientific name inscribed below the palm. The folder for each painting has on its cover a sepia silhouette of the enclosed palm painting, the scientific name, and information about its origin and general botanical characteristics, also in Italian and English. The repository for these plates is a stiff, very attractive, white case with in-folding sides bearing a color reproduction of the double coconut palm on its cover. The case is trimmed in soft tan leather and has a leather tie.

The species presented in this first series broadly represent the world's palms. They are: *Brahea brandegeei*, *Butia capitata*, *Caryota mitis*, *Caryota no*, *Coccothrinax crinita*, *Erythea edulis* (=*Brahea edulis*), *Howea forsteriana*, *Hyophorbe lagenicaulis* (Fig. 1), *Latania lontaroides*, *Licuala lauterbachii*, *Lodoicea maldivica*, *Phoenix roebelenii*, *Phoenix rupicola*, *Rhapis humilis*, and *Sabal palmetto*.

Mr. Spadacini kindly responded to some questions I posed concerning the genesis of his interest in doing paintings of palms. He states that he became attracted to palms as subjects through his travels in the tropics where he was impressed by their variety of beautiful growth forms and utility. The paintings were done from live palms. The artist has drawn sixty designs of palms; fifteen were selected for this first series. Subsequent series will complete the publication of all sixty. It was Mr. Spadacini's intention in this collection to create the impression of antiquity in the paintings using modern off-set reproduction.

Art and science have been very successfully united in these color paintings and their splendid presentation achieves the utmost in artistic taste and beauty, without any sacrifice of accuracy.

DENNIS JOHNSON
605 Ray Drive
Silver Spring, MD 20910

Principes, 37(4), 1993, pp. 217–219

BETROCK'S GUIDE TO LANDSCAPE PALMS. By Alan W. Meerow. 154 pp. ISBN 0-9629761-1-3. Betrock Information Systems, Inc., Cooper City, FL (mailing address: 1601 N. Palm Ave., Suite 303, Pembroke Pines, FL 33026). Price (including applicable taxes and shipping in U.S.A.) $34.70.

"In recent years, more books have appeared about palms than ever before. What has not been available is a concise guide to the most common palms utilized in subtropical and tropical landscapes, providing as much cultural information as is known for each and significant identifying characteristics, in a format accessible to the average home gardener or landscape professional," the publisher states in the preface to this new book about selection and care of landscape palms. It is evident that *Betrock's Guide to Landscape Palms* clearly meets that objective.

The publication begins with a short introduction explaining how to use the book

along with explanatory notes about the terms and data fields used in the main section, the encyclopedia of landscape palm species. The encyclopedia composes about two-thirds of the book and covers in detail more than 100 of the most common landscape palms of the tropics and subtropics. The format is simple and easy to follow. One species, well illustrated with a color photo or two of the plant in the landscape, is presented per page. Each treatment, provided in a concise, short-phrase form, begins with general data such as growth rate, hardiness, origin, height, and basic taxonomic and nomenclatural information. Following these are sections on the species' landscape characteristics and morphology or identifying characteristics. Cultural requirements, uses, propagation, and pest and disease management are covered in the former section while the latter section includes information on the habit and a descriptive account of the trunk, leaves, inflorescence, flowers, and fruits. Completing the treatment of each species is a paragraph or two containing interesting information and comments that do not fit into the previous sections but are still important and useful in selecting and growing these palms in the landscape successfully.

The last third of the book is devoted to horticultural aspects of palms in general, including culture and nutrition, transplanting, cold protection, pest and disease management, a descriptive account of the palm family, and several keys to identify landscape palms based on vegetative characters. As in the encyclopedia, this section is well illustrated with color photos. At the end there are numerous and useful lists grouping palms by their cultural requirements (sun, shade, etc.) and habit (solitary, clustered, spiny, etc.), an index to common names and synonyms, a glossary, and a short bibliography.

There is little to find fault with in this book. Perhaps my biggest complaint is that it covers only 102 species, leaving out or only briefly mentioning some common and/or useful ones (for example *Arenga engleri*, *Brahea brandegeei*, Hawaiian *Pritchardia* spp., and some *Sabal* and *Syagrus* spp. among others) and barely scratching the surface of what could be grown. However, deciding which species to include is always the biggest obstacle and most limiting factor in a work of this nature. I hope the author is planning a supplement or second volume in the near future.

I checked out several of the treatments of each species in the encyclopedia section and they provided accurate and useful information presented in an easily accessible format. I also checked out a few of the keys in the last section of the book. Generally, they seemed to work, although the obvious major limitation here is that you can only key out species covered in this book, again pointing out that deciding which species to include must have been one of the most difficult tasks faced by the author. Also, I do feel that indented keys are easier to work with than unindented ones.

A minor irritant, though not detracting from the book's usefulness in the least, is the common names. Some appear to be dubious; and were they selected or contrived solely for use in this book? Are there really palms commonly known as the zombie palm, sunshine palm, spiny fiber palm, spiny licuala (most licualas are spiny), hospita palm, seashore palm, macaw palm, etc.? Perhaps I am being overly sensitive and it is only my natural aversion to common names, but I cringe when I hear the likes of "radicalis palm" for *Chamaedorea radicalis*. If there are such legitimate common names then I stand corrected, but at the least, originality is lacking. If there are no good common names, let it be; it is perfectly acceptable to know a plant only by its botanical name.

There are only a few mistakes or oversights in the book. Of course I am sensitive to *Chamaedorea*, and the plant photographed as *C. metallica* on page 24

appears to be *C. ernesti-augusti*. One would be unable to key out the pinnate-leaved form of *C. metallica* since it is not included in the key.

But these are all really minor objections and should not stop anyone from obtaining a copy of *Betrock's Guide to Landscape Palms*. In fact, the book is the most thorough yet concise, well-written and illustrated, informative, up-to-date, and useful guide available to the selection and care of palms in the landscape, and the author should be commended for this superb and long-needed work. Hard bound in a glossy color cover, it is attractively packaged and presented. I highly recommend it; every palm researcher, hobbyist, grower, landscaper, and landscape designer and architect should have a copy in their library. I am sure it will be one of their most useful and consulted references.

DONALD R. HODEL

Principes, 37(4), 1993, pp. 219–227

CHAPTER NEWS AND EVENTS*

News from South Florida Chapter

The South Florida Chapter met on June 16th at Fairchild Tropical Gardens. Dr. Alan Meerow addressed the group on "Field Production of Palms." Hurricane Andrew left south Dade County without a canopy cover. The only way to get immediate relief is through replanting of larger palms and trees. These will need to come from field-grown stock. Dr. Meerow's program provided insight into several important aspects of growing and supplying the proper material for re-palming Dade County.

The chapter meeting on August 18th featured a program on "Unusual Palm Problems in the Landscape" by Dave McLean. Dave teaches a palm course at Broward Community College and has a wealth of experience in caring for palms.

The South Florida Chapter also participated in the West Coast Field Trip on October 2–3, described under Central Florida Chapter News. Additional regular meetings for 1993 are planned the third Wednesday of the even-numbered months. That is, on October 20th and December 15th. Regular meetings are held at Fairchild Tropical Garden and begin at 7:30 p.m.

South Florida Chapter workdays at the Metro Zoo continue on a regular basis. Contact Lennie Goldstein for additional information on this community support program.

The Fall Show and Palm Sale is scheduled for November 6–7 at Fairchild. The theme this year is Palms of the Pacific Islands. Don't miss it!

News from the West Palm Beach (Florida) Chapter

The West Palm Beach Chapter met on August 4th. Paul Craft spoke about the germination of palm and cycad seeds. The September 1st meeting featured Dr. Alan Meerow speaking about his recent trip to Brazil and the palms of Brazil. A workday was held at the Norton Sculpture Garden on August 14th and a Society picnic followed this on September 11th, giving members a chance to tour the garden with its large collection of palms and recent transplants from the Vaughn estate.

The West Palm Beach Fall Palm and Cycad Sale was held on October 2–3 at Morikami Park. Hours are 9 a.m. to 5 p.m. on Saturday and 9 a.m. to 4 p.m. on Sunday. Books, T-shirts and fertilizer were available in addition to plants.

News from the Broward County Chapter

The Broward County Palm and Cycad Society met on July 22nd at the Cooperative Extension Service Office, College Avenue, in Davie, Florida. The meeting was devoted to an auction of palms and cycads, with many rare species from all over the world available. Plants at the auction included many species of *Pinanga*, *Cyrtostachys*, *Neodypsis*, and numerous others. Chapter meetings are regularly scheduled for the 4th Thursday of every other month. Thus the next meeting for 1993 is planned for September 23rd.

A garden tour was held on August 7th at the home of Kenny Johnson, just west of I-95 in Margate. Kenny has over 170 species of palms in the ground. Each is clearly marked with genus, species and often origin.

News from Florida First Coast Chapter

The Florida First Coast Palm Society and the Central Florida Palm Society held a joint meeting on August 14. The meeting included a tour of two gardens, a buffet lunch and plant sale. The meeting began at the FCCJ South Campus Palm Garden in Jacksonville where many mature specimens of palms hardy to North Florida are grown and cared for by the First Coast Chapter. From there the meeting shifted to Dr. Kyle Brown's house in Glen St. Mary. Following the buffet lunch and palm sale, Kyle conducted a tour of his garden. During the tour Kyle pointed out numerous plants he collected or germinated as part of his thesis work.

News from Central Florida

On August 14th, the chapter toured two palm collections in the Jacksonville area. For details see First Coast Palm Society news.

In addition to regular meetings, the CFPS featured a two-day fall palm tour in the Fort Myers–Cape Coral area on October 2–3, 1993. David and Geri Prall planned a busy schedule that included an evening talk by Dave Besst on Indoor Landscaping. Members of the other Florida chapters were invited to participate. The events kicked off Saturday morning at 9:20 at the Edison House, Fort Myers, under the large banyan tree by the office. After a tour of the Edison Estate (group fee $7), there was a lunch break. This was followed by a tour of the Bochette Estate, 2413 McGregor Boulevard, a beautifully landscaped older Ft. Myers home only a block from the Edison home. This event was followed by a tour of the Garden of Palms Park on Edwards Drive at Lee Street, downtown Ft. Myers, a small garden across from the river marina with a nice collection of palms including a giant *Corypha*. Attendees were also able to see the rows of Royal Palms (*Roystonea* sp.) lining McGregor Boulevard. The evening featured a talk and slide presentation. Lodging was at the Quality Inn and Del Prado Motel. Sunday began with a tour of the private collection of David and Geri Prall at 328 SE 33rd Terrace, Cape Coral. Over 200 species of palms and cycads were featured. There was a palm sale after the tour. T-shirts were also available.

ED HALL/JIM CAIN

News from Louisiana and the Gulf Coast

The Louisiana Chapter held their Spring meeting on Sunday, May 23rd, hosted by Mal and Mich Mele in Covington, Louisiana. The Mele estate is known as "The Property" and is comprised of 17 manicured acres, complete with commercial-style greenhouses, a large free-standing entertainment building, fountains and a large irregularly-shaped lagoon (home of "Thea," the resident alligator). In addition to palms, Mal is an aficionado of cycads

and bromeliads, and there were many species to be inspected. Gary Fleming and Isidore Grisoli brought an album of palm pictures which they had recently taken in Singapore. Several new palm books were also discussed by the members present. The meeting concluded with a palm auction.

The Louisiana Chapter held their Summer meeting and luncheon on Sunday, August 15. The meeting was hosted by members Charles "Shep" Field and Shelton Pollet, 5330 Bancroft Avenue (at Filmore) in New Orleans. President John Voss gave a slide presentation on "The Flora of Campbell Island."

In October of 1993, the Chapter will host the IPS Board of Directors meetings to be held at the Royal Sonesta Hotel in New Orleans. Festivities kick-off Thursday, October 7th, with an open house at the home of Danny Braud from 12 noon to 6 p.m. in New Orleans. Friday morning the group will tour the Batavia area of the Jean Lafitte National Historical Park, followed by lunch at the Royal Sonesta Hotel. Board of Directors and Committee meetings will take place on Friday afternoon and Saturday at the hotel. On Sunday, October 10th, a number of the IPS Directors will travel from New Orleans to Mobile, to tour the estate of Maxwell and Gloria Stewart, in conjunction with the Fall meeting of the Gulf Coast Chapter of the IPS. Lunch will be served. It is important that any IPS members wishing to attend any portions of the Board of Directors meeting or the associated events advise either Jim Cain, (IPS), Lynn McKamey (IPS), Wilbur LeGardeur (Louisiana Chapter) or Maxwell Stewart (Gulf Coast Chapter).

News from the Pacific Northwest Chapter

It was a busy spring and summer for the Pacific Northwest Palm and Exotic Plant Society (PNWP&EPS). In addition to two garden parties at the homes of the Felicellas and the Richardsons, the group had a very well attended and successful plant sale at Van Dusen Gardens on May 18th, with over $800 collected. On August 7th, the Pinkowskis hosted the Annual Barbecue at their North Vancouver home. Plants were offered for sale, including several rare palms. A technical committee was also formed primarily to devise new ways to keep their plants alive over winter. A general meeting was also held on August 23rd at Van Dusen Gardens.

The Aug. '93 edition of The Hardy Palm International contained a very interesting article on the kiwi fruit industry on Vancouver Island.

A special palm tour of the Portland, Oregon, area was organized for the Labour Day weekend, September 4–6, 1993. Two nights were spent on the trip. In addition, the group provided a booth at the Pacific National Exhibition in Vancouver on August 20 through September 6, 1993.

An additional meeting and general elections are scheduled for November 29th at Van Dusen Gardens in Vancouver.

ED HALL/JIM CAIN

Hawaii Island Palm Society Chapter Activities

The Hawaii Island Palm Society (HIPS) Chapter met on July 30th for a slide show on "Palm and Cycad Collecting in New Caledonia and Australia" by nurseryman and HIPS member, Jeff Marcus. The show spanned a wide variety of habitats—from arid areas of Australia to the rain, mud, and mountains of New Caledonia. Also on the agenda were discussions of the palm planting project for the Panaewa Zoo and of HIPS participation in the IPS Seed Bank.

New President for New Zealand Group

The Palm & Cycad Society of New Zealand held their annual General Meeting and election of officers in June, 1993. The

newly elected President is Kevin Johnson, the Vice President/Treasurer Allan Booth, and the Secretary Gary Knox. Correspondence should be addressed to Palm and Cycad Society of New Zealand, P.O. Box 3871, Auckland, New Zealand.

Texas Chapter News

On July 24th, the Texas Chapter met in Galveston at the home of Alfred Loeblich and Wendy Ann Alwyn. During the business meeting, the group agreed to purchase an additional $300 of books for the chapter's lending library. Alfred gave a slide presentation of his recent trip to Huntington Garden in San Marino, California. An interesting non-palm highlight was the informal tasting of unusual home-grown bananas gathered from Alfred's outdoor plants. There were at least 5–6 varieties in various stages of fruiting, with several providing ripe fruit for the occasion. They were sweet and tasty and nicely topped off the East Indian Buffet dinner served by the hosts.

The August meeting was rescheduled to August 14th, at the home of Bill Bittle in Rockport (near Corpus Christi), in an attempt to get a wider representation of attendees from South Texas to the meetings. Members from Rockport, Corpus Christi and San Benito attended their first Texas Chapter meeting along with 8 from the Houston area and two from Beeville. Bill has a nice property on Key Allegre with many juvenile palms. Following lunch, the group toured the nearby property of Mrs. Pauline "Honey" DeCosta, widow of a long-standing IPS member. Honey's garden was a beautiful one, with massive *Sabal blackburniana*, a large stand of *Rhapis excelsa*, and assorted other palms. Following refreshments at the DeCosta home, members and guests were invited to tour the O'Connor Rockport estate by Mr. Dennis O'Connor. Plantings included: numerous very large *Sabal mexicana* (= *s. texana*), some with up to 40–50 feet of trunk; a very tall (30–40 feet) *Syagrus romanzoffiana* × *S. capitata* (= *Arecastrum* × *Butia* cross); a nearby standard Queen Palm (*Syagrus romanzoffiana*) of a similar trunk size for comparative purposes; a juvenile *Jubaea spectabilis* with 1–2 feet of trunk; very nice clumps of *Acoeloraphe wrightii*; a clump of *Arenga engleri* with leaves about 12 feet tall; and beautiful old specimen plants of *Washingtonia robusta*, *Chamaerops humilis*, and *Rhapis excelsa*. Members spent some time trying to identify a very attractive and massive *Sabal* species, which might well be *S. causarium*.

Additional meetings planned for 1993 include: September 4th at Grant Stephenson's, October 2nd (with Members-Only Palm Sale) hosted by Horace and Cynthia Hobbs, and November 13th at the home of Bill and Kelley Burhans, all in Houston.

News from Southern California Chapter

The Southern California Chapter of the IPS met at noon on September 18th at the U.C.L.A. botanical garden. The meeting featured a tour of the garden by John Hall, including a short talk on future garden plans (including the possibility of incorporating more palms in future plantings). The guest speaker was Guy Wrinkle, who presented a slide show entitled "The Natural History of Peru" based on his visit to Peru in March of this year. This was followed by the always popular palm raffle and auction.

News from Northern California

The Northern California Chapter of the IPS started the year with a Sunday Brunch in early February at the Garden Court of the Palace Hotel in San Francisco. The

Palace is the oldest of the large hotels in San Francisco. It survived the 1906 earthquake and fire, and the Garden Court is a magnificent Victorian Dining Room with many large parlor palms. It is truly the grandest dining room in San Francisco and a perfect place for the Palm Society to gather and socialize. Members came from as far away as Mendocino County and Sacramento to join the Bay Area members for a grand Champagne Brunch. While we were dining, the rain was coming down in buckets! California finally broke a 6-year drought cycle! The rain continued right into June. May was the wettest and coolest in 25 years.

Our Spring meeting, in early May, was held in Stockton at one of our newer member's garden. This was our first meeting held outside of the Bay Area in four years. Our Summer meeting was held on July 18th at Dale and Cindy Moteska's Neon Palm Nursery (the only palm nursery in Northern California) in Santa Rosa (60 miles north of San Francisco).

The group has two public gardens on the drawing boards: one in Walnut Creek (the Heather Farms Gardens) and the other in San Jose (the Guadeloupe Gardens). Individuals within the chapter are working with the public agencies to help design, supply palms, and contribute labor. We still maintain our Palmetum at the Lakeside Garden in Oakland. This effort consumes most of our public labor and finances. The Oakland Garden is over 12 years old now, and although it suffered during the freeze of 1989, it looks great now—there just are not any subtropical palms left. That is what we wanted to find out: just what will survive in the Coastal Bay Area. We just didn't think we would be tested so soon. The freeze that hit the entire west coast was the worst in recorded history, which goes back to the 1820's or so. It was 11 degrees Fahrenheit in Marin County.

DAN SEKELLA

Sunshine Coast [Australia] News (PACSOA)

The Sunshine Coast Palm & Cycad Society met on Monday, June 7th, 1993 at 7:20 p.m. at the Nambour Band Hall on Daniel Street. A presentation of extensive slides of Townsville Palmetum with narrative was followed by a slide presentation of Cycads of the "Ewanrigg Botanical Gardens—Zimbabwe" by Peter Heibloem. This is reputedly the botanical garden with the greatest number of cycads worldwide—a fantastic collection. Raffle prize was a large *Cycas taiwaniana.*

The August 2nd meeting featured Steve Moran's talk on "Successes and Failures in growing Cycads." Leo Gamble also gave a short talk on the final naming of the Red-Neck Palm, now *Neodypsis leptocheilos.*

The Society participated in the Nambour Plant Expo for three days beginning June 25th, with a premium position for display held by the group. Landscaping of the stand by Anne Weller was very artistic. Palms and cycads were very tastefully displayed.

The Sunshine Coast Palm Society also held a social evening at Eat's Restaurant in Eumundi on July 10th. Excellent food at moderate prices.

South Queensland Group (SQG) [Australia] News (PACSOA)

The next PACSOA Annual Palm and Cycad Sale will be held on March 4–6, 1994, at the Mt. Coot-tha Botanical Gardens in Brisbane. Dr. John Dransfield from Kew Gardens (England) and co-author of *Genera Palmarum*, will speak on "Palms of Madagascar" at a dinner open to all members. Tony Irvine will also speak. This will be the tenth anniversary of the event and will feature other special events. Make your plans to attend.

The SQG held an outing on June 20th,

to Mike Kvauka's "Palm Fascinations," Howard Street, Nambour. This was followed by a visit to Leo Gamble's "The Palm Place" nursery on Wappa Falls Road.

The South Queensland Group met at Bread House, opposite Brisbane Grammar in Brisbane on May 17th. Tom Turner showed a collection of *Cycas wadei* from Cullion and donated a sample for the raffle. A further collection of slides from the Townsville Palmetum with commentary prepared by John Dowe was presented. In addition, Cheryl Basic presented slides on her trip to the 1992 IPS Biennial in Miami and her trip to Costa Rica. Included were slides showing the damage to Fairchild Tropical Garden. Will Kraa suggested that the Society make a donation to Fairchild to help with the restoration. The meeting voted a donation of A$500.

The SQG met again on July 19th and also provided a display at the 1993 R.N.A. exhibit from August 5–14.

North Queensland Palm Society [Australia] News (PACSOA)

The North Queensland Palm Society (NQPS) met on June 7th at the Kirwin State High School. John Dowe presented a new species of *Archontophoenix*, which he and Don Hodel are preparing for publication, showing slides and discussing their revision of the genus (listing 4 new species with expanded descriptions of the genus itself and *A. cunninghamiana* and *A. alexandrae*. Palm of the Month was *Drymophloeus*, presented by John Hayne. The major raffle prize was a 1.5 meter tall *Drymophloeus beguinii*, donated by the Townsville City Council, Parks Service, Botanic Gardens.

The Friends of the Palmetum invited NQPS members to a dinner at the Tumbetin Lodge on July 31st. The guest speaker was Tony Irvine of the CSIRO Rainforest Ecology Unit, whose topic was "The *Wodyetia* Experience." Tony is best known as the "discoverer and namer" of *Wodyetia*, as well as for his work with north Queensland palms in general and rainforest ecology in both Australia and South America.

The group also met on August 2nd, with Jo Valentine presenting "From the Sea to the Edge"—a photographic journey through Queensland's wet tropics from the seashore to its western edge. Jo is the Wet Tropics Public Contact and National Parks and Wildlife Service Ranger for the Department of Environment and Heritage. Palms of the month were *Arenga* and *Phoenix*, presented by Ron Aitkin. The major raffle prize was a 1.8 meter tall plant of *Arenga porphyrocarpa*, donated by the Townsville City Council.

A boat excursion field trip was held on August 8th through the Hinchinbrook Passage to view the *Nypa* palm colonies (from the water) and then on to Hinchinbrook Island for a short walk to visit all of the palm species indigenous to the island. The boat departed Dungeness at 9 a.m., returning in the very early afternoon. This was a most interesting and unusual excursion.

Palm and Cycads Society of Mackay [Australia]

The Palm and Cycad Society of Mackay (PACSOM) of PACSOA met on July 25th at the home of Percy and Val Simonsen in Sarina for a garden tour and barbecue lunch. Plans were also discussed for a possible exhibit at the Garden Expo on August 14–15. The August 22nd meeting was held at the King's place in Eimeo.

A working bee at the Farleigh Plot palm collection was held on July 10th. This was mainly a maintenance work day, designed to keep the weeds under control. The Farleigh Plot may possibly be included in the itinerary of the conducted mill tours of the Racecourse sugar mill.

Sydney Branch (PACSOA) News

The Sydney Branch of PACSOA met on Tuesday, July 20th at the Maiden The-

atre of the Sydney Royal Botanic Gardens. Ian Edwards and Peter Kristensen presented a slide show of the renowned Wilson Garden in southern Costa Rica. The usual palm auction was held. Future meetings are scheduled for the third Tuesday of each odd month at the same location, starting at 7 p.m.

A spring outing was held to the Joseph Banks Native Plants Reserve in Kareela.

Gold Coast Tweed (PACSOA) News

The Gold Coast Tweed Branch of PACSOA met on August 9th at the Miami High School. At the prior meeting, members and guests viewed the first portion of the John Dowe slide collection of the Townsville Palmetum (as well as a nice collection of gingers, many with spectacular blooms). The second portion of this collection was viewed at the August meeting. It was even larger and more varied than the first.

The group held a field day on Sunday, July 11th, first visiting the Channon Markets in northern New South Wales. This was followed by a trip to Protester Falls along Terraina Creek for lunch.

News from the Northern Territory (PACSOA) News

The year of 1993 has seen the addition of at least three dozen new palm (and a few cycad) plantings to the Fred's Pass Palm Garden. Species added include *Polyandrococos caudescens*, *Livistona* sp., *Arenga caudata*, *A.* sp. [Trane], *A.* sp. [Phuket], *Hyphaene compressa*, *Neodypsis* sp., *Veitchia joannis*, *Neoveitchia storckii* and *Cycas angulata*.

News from South Australia (PACSOA)

The Palm & Cycad Society of South Australia (PACSOSA) held their general meeting for 1993 on April 18, 1993, on the lawns of the Southern Parkland near the Adelaide Japanese Garden. At the meeting plans were discussed for increased palm plantings at the Waite Arboretum and establishing a cycad garden there. Several members have donated plants to this cause and a planting day is forthcoming. PACSOSA plans to produce a small booklet on Palms & Cycads for South Australia and Victoria for distribution to members and local nurseries. The Palm & Cycad Sale was also discussed, with a pre-sale meeting to be held by members to establish sale requirements. PACSOSA is also planning a visit to Queensland to coincide with the PACSOA Annual Palm & Cycad Sale in Brisbane.

Prior to the Annual Meeting, the group toured the area around the Adelaide Oval. Many of these old specimen palms can possibly be attributed to Dr. Shomburgk, the Director of the Adelaide Botanical Gardens between 1865 and 1891. Mature plants examined included *Washingtonia robusta*, *Butia capitata*, *Jubaea chilensis*, *Livistona australis*, *L. chinensis*, *Syagrus romanzoffianum*, *Phoenix dactylifera*, *P.* sp., *Trachycarpus fortuneii*, *Brahea armata*, *B. edulis*, an unidentified *Sabal* species and a lone *Howea forsteriana*. Many of the plants were in full fruit.

Palm and Cycad Society of Western Australia Activities

The Society met on June 21st at the Leederville Town Hall. Gary Thornton from Dynamic Lifter gave a talk on the full range of their products and how to use them. The Annual General Meeting was held on July 19th, with election of new officers. The new President is Neil Jones, the new Secretary is Karen Knight and the new Treasurer is Christine Crump. Ken Adcock remains the Newsletter Editor. John Banasiewicz gave a five-minute talk on one of his more favored *Chamaedoreas*. A lavish supper was put on for the group by Linda, Falicity, Judy and Karen.

Some bad news was received concerning the Gascoyne Park Palm Garden project. It seems that kleptomaniacs dug up 6–7 cocos and about 12 bangalow palms. These were well established palms and their absence is saddening. Work days were held on June 26th, July 24th and August 22nd. At the July workday, a good-sized *Howea* was relocated to the park from Barry Winter's house. Several other palms were planted, including a *Bismarckia* from Linda Therkelson's impressive collection.

The August 16th meeting featured a talk on Cycads by the new President, Neil Jones.

Journals and Newsletters of the Individual

In the last issue of *Principes*, the PACSOA publication *Palms and Cycads* was discussed. A further note—the April–June 1993 issue included excellent separate articles on *Archontophoenix*, *Rhapis*, *Lepidozamia*, *Wodyetia*, *Linospadix* and *Lavoixia*. The first of these is a detailed guide to the various *Archontophoenix* species and varieties by John Dowe. In addition, quite a few good photographs are included. My favorite was an excellent shot by Lynette Stewart of a *Linospadix monostachya* (the "walking stick" palm) in habitat. It brought back good memories.

Newsletters of individual PACSOA-affiliated Societies are covered below. All of these are available through PACSOA.

Principes Minor, the Sydney Branch (formerly the Palm and Cycad Society of New South Wales) newsletter, is usually a 14–20 page (A5 size = 5.83″ [14.8 cm] × 8.27″ [20 cm]) newsletter devoted to both palm articles of interest and the happenings of the local chapter. Occasionally newsletters are reduced to a 1–6 page (A4 paper size) summary of previous meetings and events and notice of future meetings. Australian residents add A$12 per year to the PACSOA membership fee and non-Australian residents add A$22 per year for subscription to *Principes Minor*, generally published five times per year. As an example to show type of coverage, the May 1993 issue (No. 62) of *Principes Minor* featured an international repertoire of articles. Included were: a review of Shri Dhar's garden in Calcutta, India; a list of variegated *Rhapis* varieties with descriptions of each; a palm travelogue of members' New Caledonia trip; "*Macrozamia secunda*"; a review of Don Hodel's new *Chamaedorea* Palm book published by the IPS; and separate articles on different trips to Costa Rica, one concerning the escorted IPS trip and the other a self tour focusing on Monteverde.

Journal of The Palm Society of the Northern Territory is a 14–20 page (A5 size) newsletter printed quarterly, devoted to palm and cycad articles and the happenings of the local chapter. Australian residents add A$5 per year to the PACSOA membership fee and non-Australian residents add A$15 per year for subscription. In addition to local news items, it sometimes features articles of a more general nature. For example, the June issue provided excellent photographs and additional information on *Neodypsis lastelliana* and *N. leptocheilos*. Also included was a writeup on Fairchild Tropical Garden.

Each of the four individual *Newsletters* of the *South Queensland Group* (S.Q.G.), the *Sunshine Coast Group*, the *North Queensland Palm Society* and the *Palm & Cycad Society of Mackay* is a 1–6 page monthly or bimonthly summary of previous meetings and events and notice of future meetings, with occasional other information as appropriate. Most are printed on full-sized paper (A4) paper. Australian residents add A$5 per year to the PACSOA membership fee and non-Australian residents add A$10 per year for subscription. In addition to local Society news, brief articles on palm and cycad culture are often contained, along with local seed bank information, etc.

Each of the individual *Newsletters* of the *Gold Coast Tweed (Queensland) Palm Society* and the *Rockhampton Palm & Cycad Society* are also available from PACSOA. They generally provide a summary of previous meetings and events and notice of future meetings. (I have not seen the Rockhampton newsletter, but presume same type of information is included.) Australian and non-Australian residents add A$5 per year to the PACSOA membership fee for subscription to each of these newsletters.

The *Newsletter of the Palm & Cycad Society of South Australia* is also available from PACSOA. It is a 8–12 page (A5 size) newsletter, devoted to palm and cycad articles and the happenings of the local chapter. Australian residents add A$12 per year to PACSOA membership fee and non-Australian residents add A$20 per year for subscription to this newsletter. The South Australian *Newsletter* occasionally has articles of wide and general interest, in addition to local chapter news and notices. One of these, "*Rhapis* in South Australia" was reprinted in the April–June 1993 issue of PACSOA's *Palms & Cycads* journal.

Although not published by PACSOA, one other Australian palm journal definitely merits mention. *Mooreana*, published by the Townsville City Council (Townsville, Queensland) is available through PACSOA and Friends of the Palmetum. *Mooreana* is sized similarly to *Palms & Cycads*, is of good quality print, with numerous black and white photographs. Australian residents add A$20 per year to the PACSOA membership fee and non-Australian residents add A$25 per year for subscription. *Mooreana* articles often cover a wide spectrum of topics of interest to the general palm enthusiast. The April 1993 issue featured several articles on the endangered Northern Territory palm, *Ptychosperma bleeseri* as well as a very thorough article on "Palm Diseases of Australia Associated with Fungi and Oomycetes."

* All items by Jim Cain unless otherwise indicated.

BOOKSTORE (*Continued from page 202*)

PALMS FOR THE HOME AND GARDEN (L. Stewart, 1981, 72 pp., some color) 19.95

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

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

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 MINIATURE PALMS OF JAPAN (Y. Okita and L. Hollenberg, 1981, 40 pp., 40 color photos) 9.95

* New arrival

The palm books listed above may be ordered at the prices indicated plus $2.50 extra per book to cover packaging and postage. (California residents please add 7.25% sales tax.) Foreign checks must be in U.S. dollars and payable on a USA bank. In some countries it is possible to send International Money Orders through the Post Office. No VISA cards. Please include your International Palm Society membership number. Send check payable to The International Palm Society to Pauleen Sullivan, 3616 Mound Avenue, Ventura, CA 93003, U.S.A. ALL SALES FINAL.

Principes, 37(4), 1993, pp. 228–229

A New Pest of the African Oil Palm in the Neotropics: Periphoba hircia (Lepidoptera Saturniidae Hemileucinae)

GUY COUTURIER[1] AND FRANCIS KAHN[2]

[1]*Museum National d'Histoire Naturelle, Entomologie Antenne ORSTOM, 45, rue Buffon, 75005 Paris, France*
[2]*ORSTOM, CP 09747, 70001-970 Brasilia (DF), Brazil*

Five species of Saturniidae Hemileucinae cause defoliation of the African oil palm, *Elaeis guineensis* Jacquin, in the Neotropics (Genty et al. 1978). According to Lemaire (pers. comm.) these include: *Automeris liberia* (Cramer, 1780), *A. cinctistiga* (R. Felder & Rogenhofer, 1875), *A. bilinea* (Walker, 1855), *A.* sp. and *Pseudodirphia gregatus* (Bouvier, 1924).

Damage caused by these caterpillars can become important. One individual destroys 400 to 1,000 cm^2 of leaf, i.e., 2 to 4 pinnae; the critical threshold is 50 to 100 caterpillars per palm (Genty et al. 1978). Caterpillars of Hemileucinae have been considered polyphagous by Janzen (1984).

On October 1991 we found caterpillars of *Periphoba hircia* eating leaves of *Elaeis guineensis* in an 8 year old, 500 ha plantation located in Peruvian Amazonia, Department of Loreto, Province of Maynas, in the lower Manití River valley, near Papero village, 3°24′S, 72°45′W. Elevation is 125 m above sea level. The surrounding vegetation is tropical rain forest. Average annual rainfall is 2.3 m with a peak in February and the driest period in August.

The biology of *Periphoba hircia* was studied by Gardiner (1967). Up to 200 eggs are laid by a female (Fig. 1) in captivity. Incubation period is 53 days at 20–25° C. Caterpillars are gregarious and processionary. Pupation period varies from 40 to 50 days in Peruvian Amazonia.

In the Manití River valley we also found caterpillars of *Automeris liberia* causing damage to the palms.

Periphoba hircia is a new "pest of medium consequence which could become dangerous" as concluded by Genty et al. (1978) for the other five Saturniidae previously reported on *Elaeis guineensis* in the Neotropics.

Acknowledgments

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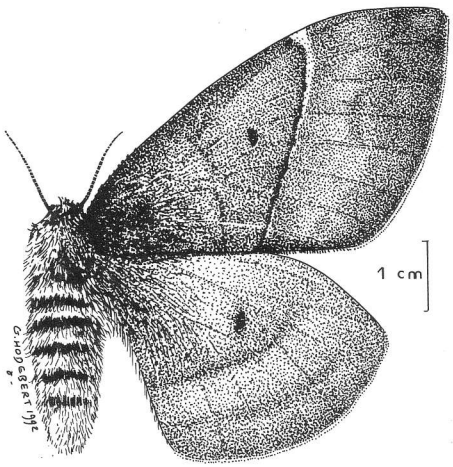

1. Female of *Periphoba hircia*.

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Mayon volcano on Luzon Island, The Philippines, with cadang-cadang diseased coconut on the right. Photo by Karl Maramorosch. See p. 187.