PRINCIPES

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PRINCIPES

JOURNAL OF THE PALM SOCIETY

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Contents for January

Cover Picture

The interior of a grove of *Howea forsteriana*, North Beach at north end of Lord Howe Island. Photo by H. E. Moore, Jr.

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The Palm Seed Industry of Lord Howe Island

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The elegant and decorative kentia palm (*Howea*) is well known to palm fanciers and is a favorite of indoor decorators throughout the world. Many hotel foyers, office blocks, apartments, and houses are graced by young kentias and the truly fortunate have adult plants growing. All these palms are grown from seed harvested on a tiny and beautiful speck of land in the Tasman Sea—Lord Howe Island.

Seeds were first exported to Belgium in the 1880's and quickly became the major industry on Lord Howe. European markets were lost during World War I and the demise of the industry was hastened in 1918 when rats invaded and rapidly spread across the island. The rats found palm seed a major food source and harvests dropped catastrophically. The advent of flying boats in the 1920's improved transport, increasing the number of visitors and making tourism the major industry. An airstrip built in 1976 further improved transport so that today, seeding is very much in second place.

The palm seed industry has not been critically examined since the Royal Commissions of Inquiry in 1911 and 1912 (Langwell 1911, Bevan 1912), and even harvesting methods are unchanged in 80 years (Maiden 1898, Moore 1966). In 1927, Cook summarized earlier studies and presented comparative growth data on the *Howea* species. Articles and letters in PRINCIPES by Moore (1966), Martens (1972a, b), and Pickard (1972) describe the island, highlighting some of the problems. The excellent photos by Clark (1935) illustrate why all visitors regard Lord Howe as "the paradise of the Tasman."

In 1970 the Lord Howe Island Board (which is responsible to the New South Wales Government for administration of the island) commissioned a Biological Survey of Lord Howe Island. A report was published in 1974 (Recher and Clark 1974a) and a summary is available in Recher and Clark (1974b). I was requested to describe and map the vegetation for the Biological Survey (Pickard 1974, 1978). Subsequently I have revisited the island several times to examine specific features of the vegetation and to report on the palm industry. This study involved setting up long-term experiments to monitor seed yield, and examining available data on seed yield and economics. This paper presents an analysis of available yield data, an outline of the trials set up, and a summary of the economic analysis.

Palm Species Involved

There are four palms in three genera (Fig. 1) native to Lord Howe, all endemic. They are easy to identify in the

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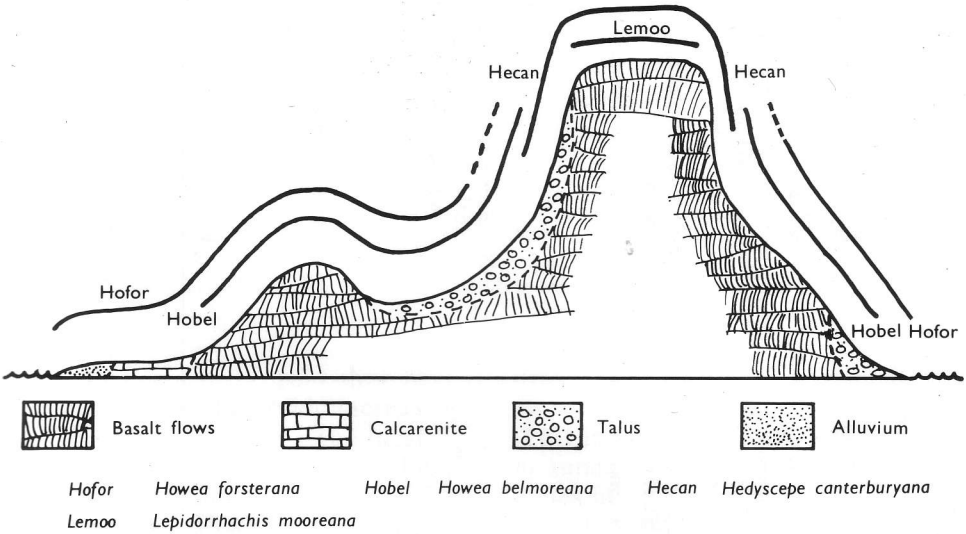
1. Palms of Lord Howe Island. A, *Hedyscepe canterburyana;* B, *Lepidorrhachis mooreana;* C, *Howea forsterana;* D, *Howea belmoreana.* Photographs by H. E. Moore, Jr.



2. Composite section of Lord Howe Island showing distribution of palms in relation to substrate and altitude (note that aspect is ignored).

field as they differ in gross morphology (Table 1) and they occupy separate but overlapping habitats (Fig. 2). Synonyms are listed because of the varied nomenclatural history of the palms. The species are listed in Table 1 in order of abundance and economic importance on the island. Each species is an important component of the vegetation—the *Howea* spp. and *Hedyscepe* dominate palm forest associations and *Lepidorrhachis* is a major species in Gnarled Mossy Forest (Pickard 1974, 1978).

Harvests in Previous Years

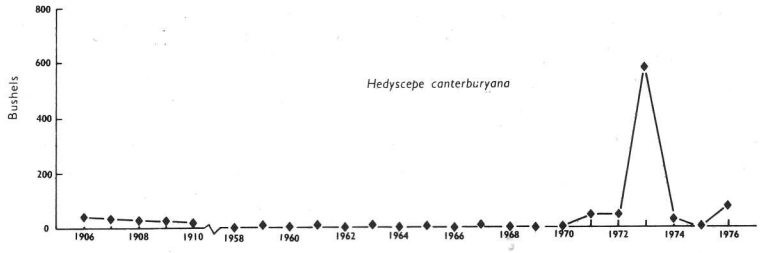
All the harvest data I have been able to find are shown on Figures 2, 3, 4, and 5. I have not analyzed the data statistically because they are uncontrolled and too many unknown variables are involved to satisfy statistical assumptions. The discussion is restricted to a consideration of the trends that show little relationship to obvious environmental factors, e.g. rainfall. In particular the tenfold increase in seed harvest of *Hedyscepe canterburyana* in 1973 (Fig. 3) could be thought to imply enormous environmental changes. If this were the case then the other palms should show a corresponding (but not necessarily as spectacular) increase. They do not, and the reverse is the case. The harvest of all three other palms drops—*Lepidorrhachis* by 65%, *Howea forsterana* by 50%, and *Howea belmoreana* by 47%. This can best be explained by the vagaries in the economic and human environments. Thus, the increase in harvest of *Hedyscepe* in 1973 merely indicates that more or bigger orders were placed for seed.

However, the picture with the two *Howea* species is not as clear. (Figs. 4, 5). The moderate peaks in 1972 clearly correspond to the tremendous peak in gross and net return (Fig. 6). Cause and effect are intermixed: as the islanders knew that a higher price

Table 1. Summary of nomenclature and distinguishing features of Lord Howe Island palms

	Howea forsterana	*Howea belmoreana*	*Hedyscepe canterburyana*	*Lepidorrhachis mooreana*
Common Name(s)	Thatch Palm, Kentia, Forsterana	Curly Palm, Belmoreana	Big Mountain Palm, Canterburyana	Small Mountain Palm, Moorei
Synonyms*	*Kentia forsterana* *Howea forsteriana* *Kentia forsteriana* *Denea forsteriana* *Howeia forsteriana*	*Kentia belmoreana* *Howeia belmoreana*	*Kentia canterburyana*	*Clinostigma mooreanum*
Leaf bases	Not sheathing stem	Not sheathing stem	Glaucous, tightly closed,	Not glaucous, not tightly closed, sheathing stem with scurfy brown hairs
Fibrous material at rhachis bases	Yes	Yes	No	No
Adult leaf shape	Arching horizontally	Strongly ascending, arching only near ends	Ascending	Slightly ascending
Pinnae	Droop gently down	Acute V upwards	Acute V upwards	V upwards
Height	to 20 m	to 10 m	to 10 m	to 3 m

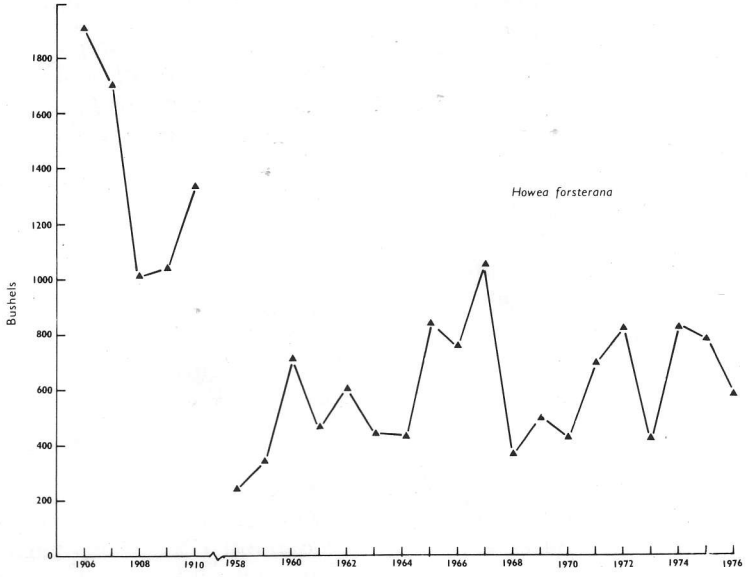
* Reference: Jacobs & Pickard (ms.), Cook (1927), Moore (1966).



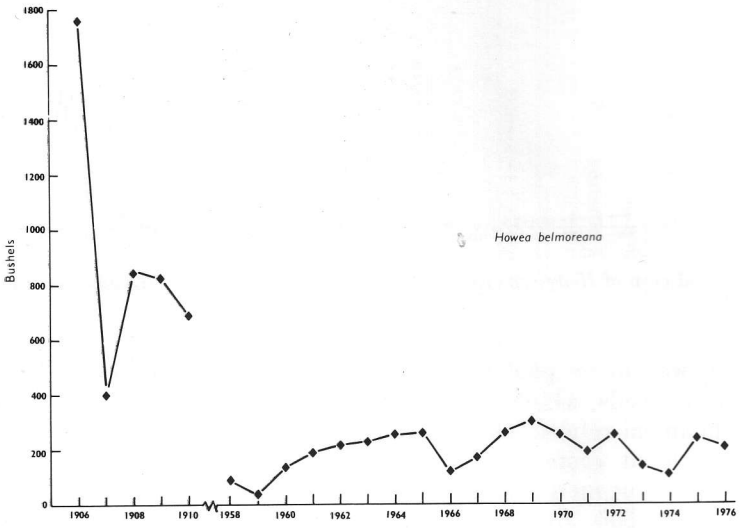
3. Annual crop of *Hedyscepe canterburyana* (data from Anonymous 1954 and Bevan 1912).

per bushel was to be paid they harvested more seeds which increased the total financial return. The biggest harvest in recent years was in 1967 when over 36 cubic meters (1000 bushels) were sold. This also appears related to economic conditions: more orders were received. Obviously the economic environment is more variable than the biological.

The depressed harvest of *H. forsterana* (Fig. 4) in 1968 is more difficult to interpret. The Annual Report states that this depression was caused by a drought in that year. The rainfall data show that while the rainfall was low (1421 mm), many other years had lower rainfall without corresponding declines in seed harvest yield, e.g. 1972 recorded 1309 mm yet doubled the harvest! The seeds of *H. forsterana* take four years to develop from the bud. Thus any stress during critical periods within this time could affect the yield up to four years in advance. This effect may be indicated as the cause of the decrease in 1968. A severe drought at some time in 1965



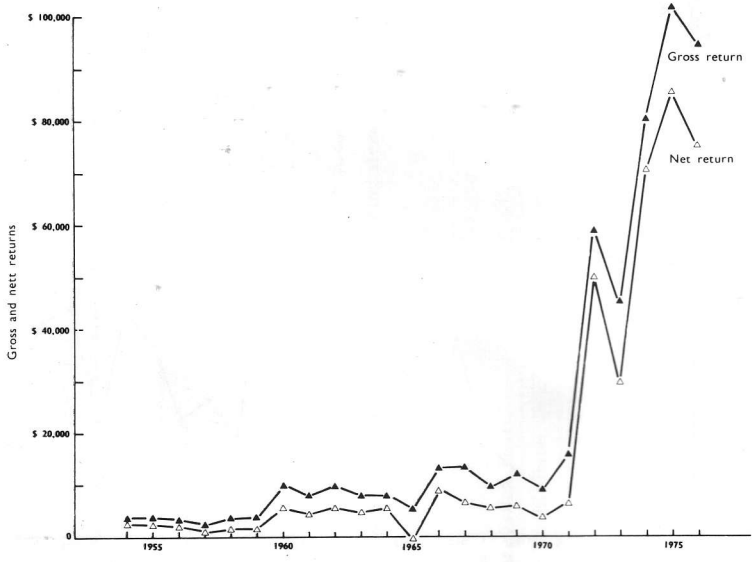
4. Annual crop of *Howea forsterana* (data as in Fig. 3).



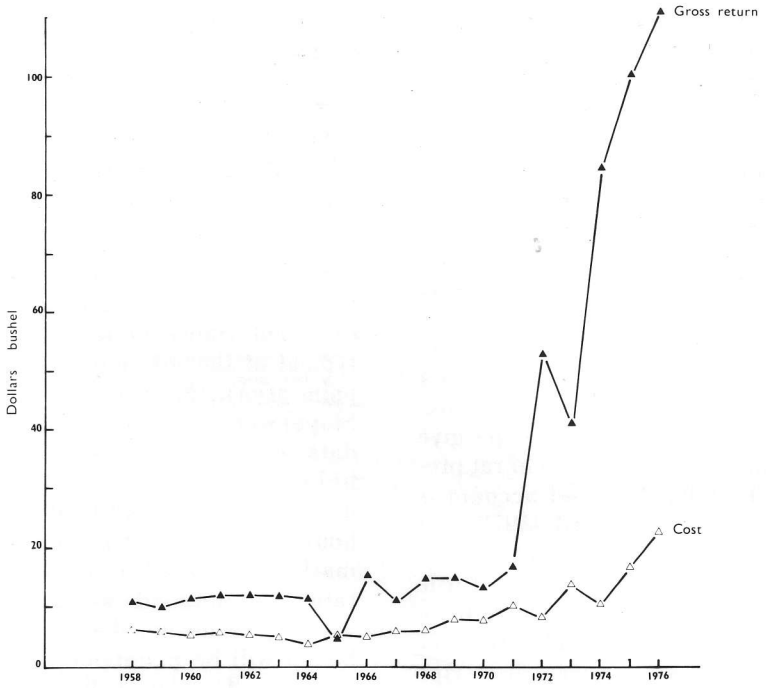
5. Annual crop of *Howea belmoreana* (data as in Fig. 3).

could well have damaged or killed buds and reduced the 1968 crop.

The effect of economic conditions on harvest of *H. forsterana* seed can be seen most clearly in 1965 when, despite a large harvest, the Board lost money! Yet 1972 and each year after 1974 had a smaller harvest but returned in excess of $A50,000 (except for 1973: ca. $A30,000).



6. Annual gross and net returns from all species in $A.



7. Annual gross returns and costs per bushel of all species in $A.

Economics of the Crop

Data from Annual Reports of the Lord Howe Island Board illustrate the economics of the crop (Figs. 6, 7). The major features are the net loss in 1965 and the changes in marketing in 1972 leading to vastly increased returns (Fig. 6). The ratio of costs to gross return has varied considerably but since 1972 has been generally lower than in the previous 18 years. When the effects of variations in crop quantities are removed by considering costs and returns per bushel the picture becomes even clearer (Fig. 7).

The loss year 1965 is seen as an isolated year in a period when returns varied slightly but costs were gradually increasing. Since 1971 the industry has become very healthy: costs per bushel have increased 124% and gross return per bushel has increased 560%. As a general observation I will point out that in the present depressed world economic climate the industry is booming.

One major cost inexplicably omitted from the Annual Reports is the cost of rat poisoning. At a public meeting on the island in March 1977 it was stated that the present annual cost of rat control is ca. $A18,000.

Rats

All available data on the seed crop, reports by island residents, and my own observations indicate that rats are a major problem. They are probably the main biological factor limiting seed production at present. The history of black rats (*Rattus rattus*) on the island is documented by Hindwood (1940).

Briefly, rats landed in cargo dumped from a beached ship in 1918. They spread rapidly to all parts of the island and despite attempts to control them by hunting, predation by introduced owls, and by poisoning, their numbers are beyond human control. For example, seed production from *Lepidorrhachis* is negligible unless the inflorescences are enclosed in wire mesh which exclude rats (Moore 1966).

Unfortunately I have been unable to locate a complete set of crop data showing the effect of rat predation. However, data from Little Slope give some indication of the effect of rat predation. The following brief account is condensed from Pickard (1978 and ms.) where references are given.

The crop of *H. forsterana* on Little Slope declined from 342 bushels in 1921 to 50 bushels in 1922. In 1977 none of the 50 marked trees bore ripe seeds and some trees were seen with unripe seeds (i.e., 1978 crop) partially eaten by rats. Such severe predation was seen nowhere on the lowlands although it is the major cause of low yields of *Lepidorrhachis* on the mountains. The meager data allow little analysis but drought cannot be excluded as a cause of the decline in 1922.

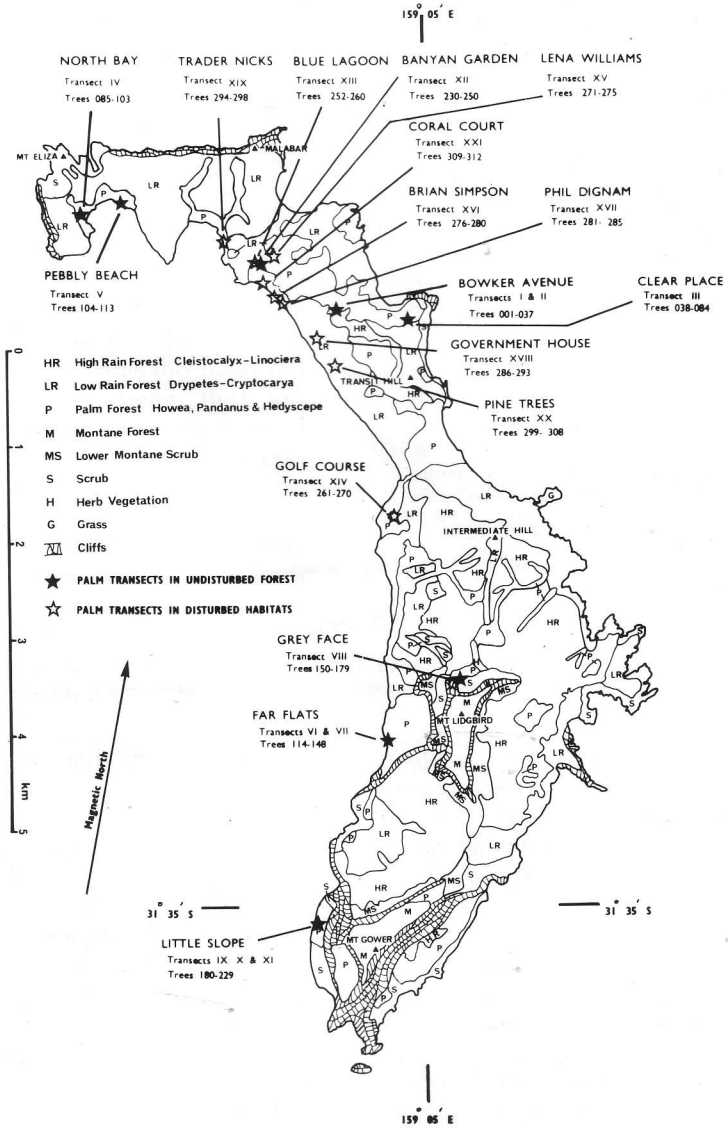
Three observations indicate that rat densities here are considerably higher than elsewhere on the island. Firstly, the eating of unripe seed. Secondly, the present structure of the palm forest on Little Slope is partially due to seed predation by rats (Pickard 1978 and ms.). Seed predation by rats since 1921 and browsing by feral goats (*Capra hircus*) from 1914 to 1955 have prevented seedling establishment, consequently there is now a marked lack of young palms. Thirdly, numerous owl faecal pellets are composed almost entirely of rat fur and bone. Masked owls (*Tyto novaehollandiae*) released between 1922 and 1930 to control rats were a failure as they apparently find birds easier prey. On Little Slope the rat density must be so high as to make rats an attractive proposition.

Palm Seed Yield Trials

The program was directed to *Howea forsterana* as this is the major seed species. Three hundred and twelve trees were chosen in 20 transects (Fig. 8). Eight transects were selected as typical of the major easily accessible palm areas, three transects (on Little Slope) were chosen to supply base-line data for possible future research (see below), and nine transects were marked on leasehold land adjacent to houses or cleared land. Each year the marked trees will be harvested separately and the seeds weighed. The tree marking is designed to last and it is hoped will be maintained for at least 20 years. The data will be accumulated and analyzed when sufficient are available to detect long-term trends. This sampling pattern is also designed to investigate the relationships between seed yield and the following factors: tree size, tree density, substrate, altitude, disturbance, slope, aspects, microclimate, and rat density.

Analysis of 1977 and 1978 Samplings

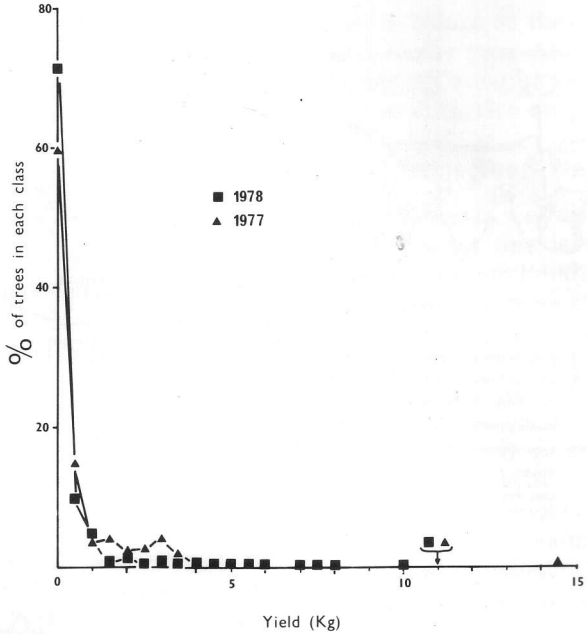
In 1977, 52 of the 312 trees had been harvested before they were sampled (due to misunderstandings with the island seeders), 157 had no seed although seed stalks were present, and 39 had less than 0.5 kg seed. Thus 16% of the possible data are missing and 63% is effectively zero so detailed analyses are not possible. The frequency distribution of seed yield classes is skewed. In 1978, all trees were examined before normal harvesting commenced and the picture is similar (Fig. 9). The only trees consistent-



8. Vegetation map of Lord Howe Island showing location of palm transects.

ly giving even mediocre yields (more than about 1 kg of seed) are at Grey Face and adjacent to houses and lodges.

Possible explanations for these higher yields are: a) consistently higher soil water regimes from mist and cloud or watering of gardens; b) fewer rats around houses and lodges because of poisoning; c) more open stands around houses and lodges because of thinning and gardens; and d) lower temperatures at Grey Face may favor higher seed yields.



9. Frequency distribution of seed yield from 312 sampled trees in 1977 (note that 52 trees were harvested before sampling and the percentages are based on 260 trees) and 1978.

Of these, hypotheses (a) to (c) are reasonable on general biological grounds, (d) less so. Hypothesis (a) would not lead to a practicable course of action. Hypotheses (b) and (c) can be tested experimentally and could lead to practical action. Any experimental thinning would be very destructive as a large number of palms would be felled to satisfy standard statistical conditions of replication, etc. I am unconvinced that thinning is ecologically acceptable while rats are uncontrolled and I did not proceed with a thinning experiment as it would be mere vandalism.

Conclusions

Palms are sold for decoration and the industry is subject to the whims of fashion. At present demand for seeds is high and the industry is extremely healthy. The Board has before it various recommendations concerning future avenues of research and management. Rats are the major environmental limitation and research is urgently required. One seeder summed up the effect of rats by saying that good harvests now are only surplus seeds remaining after rat satiation. I can only agree with him. The rats on Little Slope are essentially a captive sample—high cliffs, the sea, and long distances to other food sources effectively stop rats moving off the slope. Thus it is an ideal site for testing effectiveness of various control techniques.

Analysis of the 312 sampled trees and the total crop data will allow separation of the biological components of variation in the potential crop. Most of the variation in the actual crop appears due to economic and social rather than biological factors.

The future of the industry is difficult

to predict. Already there are indications that the traditional harvest of seeds from wild trees is phasing out. Seedlings are being harvested from the forest floor in larger numbers. Ecologically there is little difference between the two operations—both are predation! Two new approaches have been recommended to the Lord Howe Island Board: plantations for seed supply and export of seeds germinated on the island in nurseries. Initially the seeds would come from the bush but later from the plantations. Both approaches require reorientation of thinking from the older exploitative ethic to a more conservative long-term investment ethic. For too long the palm industry has supplied money with no reinvestment—the time is ripe for a commitment to research and future plantations.

Acknowledgments

Field work was supported by the Lord Howe Island Board, the Royal Botanic Gardens, Sydney, and the Australian Museum. I received friendship and help from all island residents on my visits.

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Palm Collecting in Papua New Guinea. I. The Northeast

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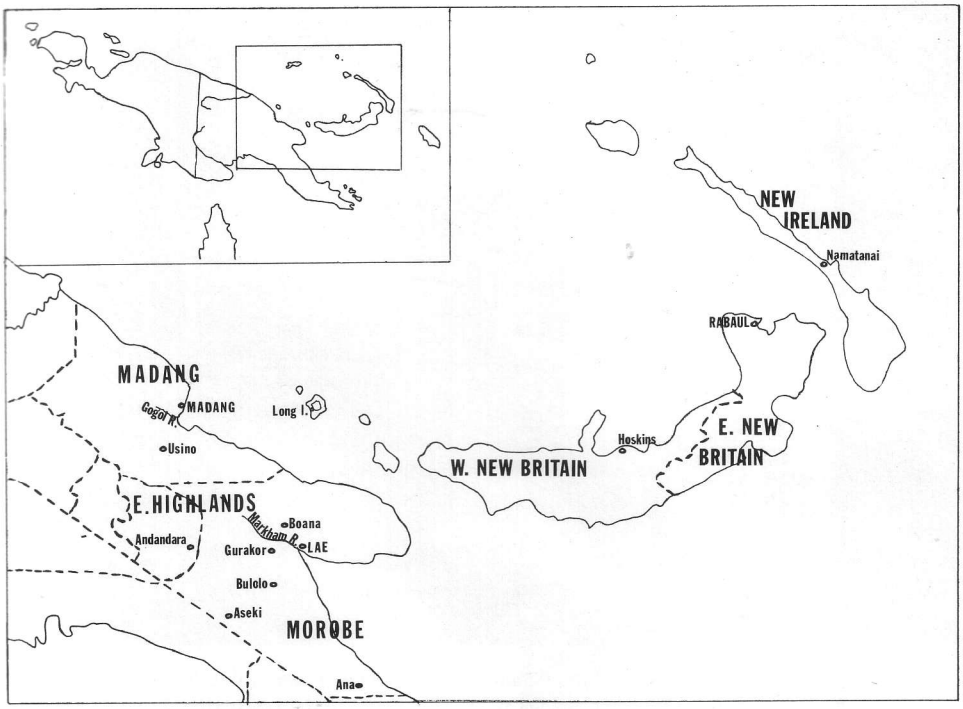
New Guinea should perhaps be called the "continent island," to paraphrase a description often made of its neighbor, Australia, because in diversity of biological and human resources it can rival several of the continents. The island is about 1500 miles long, but only 500 miles wide at the widest point. A massive system of mountain ranges runs the length of the island, with individual peaks soaring to over 16,000 feet elevation and capped with glaciers and snowfields. The northwestern tip of the island is almost on the Equator, while the southeastern tip is only about 10 degrees south of the Equator. Though most of the lowland areas are covered with tropical rain forest or swamp, there are large areas of dry savanna along the south coast. This diverse topography and climate support a rich fauna and flora derived from several sources. Plants and animals have migrated from Asia via the Indonesian islands and from Australia and Pacific islands to the east and south. Only the placental mammals are conspicuously lacking from the island. Palms are represented by 30 genera and about 270 species. In more recent times, wave after wave of humans have followed the same routes to New Guinea, resulting in a polyglot of over 300 distinct languages. One encounters negroid Melanesians, long-haired Polynesians, oriental Malays and Micronesians as one moves from one part of the island to another. In the towns, Europeans, Chinese, and many other nationalities mingle with the natives.

Surprisingly little attention has been paid to the palms since botanical exploration of New Guinea began in earnest about a century ago. Odoardo Beccari collected palms in the western part of the island in the 1870's and wrote extensively on their taxonomy. Later, sporadic collections of palms were made by general collectors, and written up by various authors, principally Beccari, and later Burret (see Essig 1977). Leonard Brass was outstanding among these general collectors, making many excellent palm collections from the 1920's through the 1950's. More recently, many good collections have been made by botanists from the Division of Botany in Lae, and from the CSIRO in Australia. Professor H. E. Moore, Jr. was the first palm specialist to visit New Guinea since Beccari. Though his visit was brief and confined to the Morobe District, his collections and notes were extensive and he was able to describe two new species from among his collections, *Ptychococcus lepidotus* (Moore 1965) and *Cyrtostachys glauca* (Moore 1966b). His palm collecting adventures were written up in PRINCIPES (Moore 1966a).

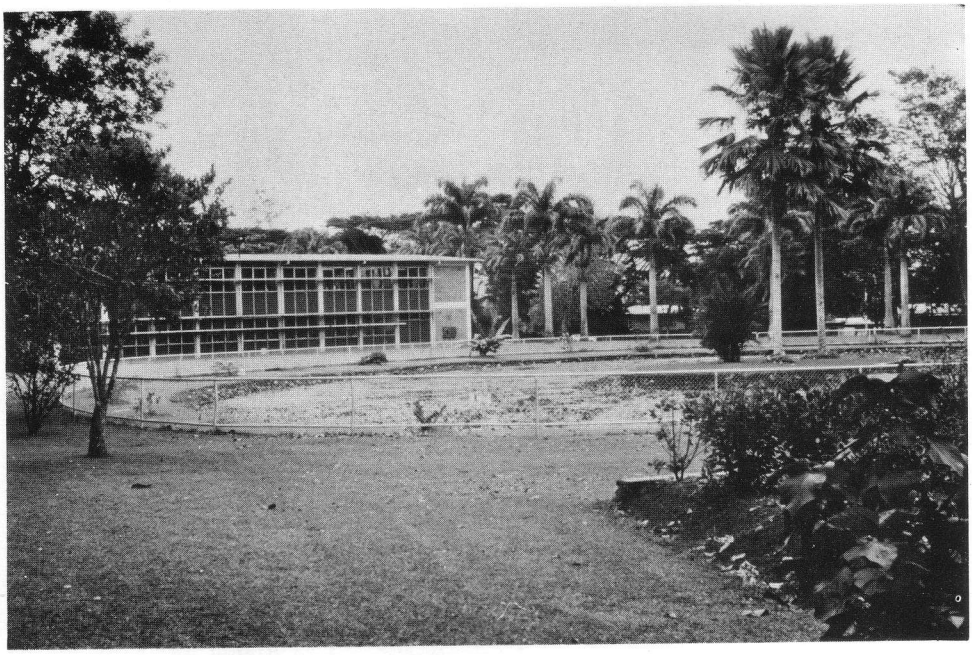


1. New Guinea and adjacent islands, with region visited enlarged.

The present authors have been involved in a systematic effort to collect the various palms of New Guinea and understand their taxonomy. Our efforts have been confined so far to the eastern part of New Guinea, which is now the independent nation of Papua New Guinea. The western half of the island, known as West Irian, is now part of Indonesia, and not an easy place to visit. Political problems and poor travel conditions have vitually ended botanical exploration of West Irian since the Dutch left two decades ago. So we have had to content ourselves with eastern New Guinea in our efforts to understand the palms of the island (Fig. 1).

The senior author's first trip to New Guinea was aimed at understanding the genus *Ptychosperma*, but much information was also gathered on the other palms there. A revision of the genus *Ptychosperma* (Essig 1978) and a preliminary analysis of the New Guinea palm flora (Essig 1977) have now been published. Both authors went to New Guinea in April of 1978 in order to fill in some of the gaps remaining in our knowledge of the New Guinea palms, and in particular to be concerned with the genera *Orania*, *Gulubia*, *Nengella*, and some of the other arecoid palms. Sets of our specimens have been deposited at the herbarium in Lae, Papua New Guinea, at the Bailey Hortorium at Cornell University, and at the University of South Florida. Seeds of many of the collections have been distributed through The Palm Society.

The following is a geographic account of our experiences, combining the results of the two trips.



2. The herbarium building at the National Botanic Garden, Lae, with waterlily pond in the foreground, unidentified *Livistona* sp. with red fruit to the right.

The Morobe Province

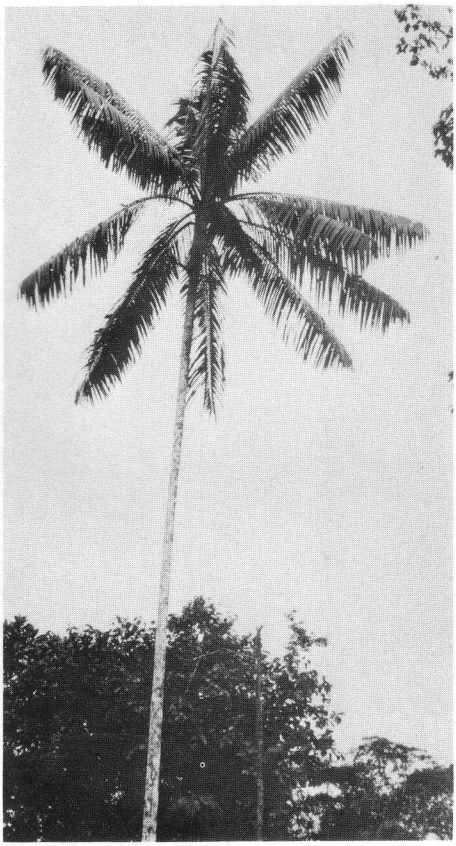
The town of Lae, modern capital of the Morobe Province, is the botanical gateway to Papua New Guinea. The National Botanic Gardens and Herbarium (Fig. 2), operated by the Office of Forests, are located here, offering research facilities and logistical support for visitors. John Womersley, the founding father of this botanical institution, recently retired as chief of the Division of Botany, and now Michael Galore serves as the first native director. Both of these men provided generous assistance to our projects.

Lae sits at the mouth of the Markham River, which flows through a broad, grassy valley, flanked on both sides by high mountains. From Lae, roads lead in several directions, providing access to a large part of the country. We made a number of trips into the forested area around Lae in which a representative sample of New Guinea palms can be seen. We were struck first by the abundance of the very elegant palm, *Gulubia costata* (Fig. 3). The tall, slender trunk, prominent green crownshaft, and stiff leaves with graceful, pendulous pinnae give the palm a distinctive appearance among the New Guinea palms. As we discovered, it is also one of the most common palms throughout lowland New Guinea. Also common in the area were two species of *Orania*, *O. lauterbachiana* and *O. macropetala*. These large palms have stiff, erect leaves, no crownshaft, and large, globose, orangish fruit, that are sometimes two- or three-lobed. The two species are distinguished on floral characters, but the biological and ecological distinctions between them are not yet clear.

In the swamps, the sago palm, *Metroxylon sagu*, is abundant. This is a large, suckering palm, each stem of which produces one large terminal inflorescence after years of storing up food reserve. This food reserve is exploited by the swamp-dwelling peoples of New Guinea, who rely upon it as a staple in their diet. The trunks are felled before flowering, the soft pith is scraped out, and the starch removed from it is used as a dough for simple breadlike items (see Barrau 1960).

Another very elegant palm, which is much rarer around Lae than the others mentioned, is *Actinorhytis calapparia*. It differs from *Gulubia costata* in having strongly arched leaves with ascending pinnae, and much larger fruit. Among the smaller palms, *Hydriastele microspadix* is the most common. This is a close relative of *Gulubia*, but is a cluster palm, with oddly grouped, spreading, truncate pinnae. The masses of whitish flowers are followed by small globose red fruits. Another small palm is *Paralinospadix hollrungii*, which we found in two forms in the same population (Fig. 4). Some had pinnately dissected leaves, while others were entire. The flowers and fruit are borne on slender spikes. Other palms that are fairly common in the area are *Licuala lauterbachiana*, a small fan palm, *Arenga microcarpa*, a coarse cluster palm, and *Caryota rumphiana*, a tall, solitary fishtail palm. Rattans were prominent in the forest, particularly *Korthalsia zippelii* and *Calamus hollrungii*. The *Korthalsia* has distinctive, diamond-shaped pinnae, while the *Calamus* has particularly large leaves with broad pinnae and a terminal spiny whip.

One puzzling aspect of the flora of the Lae area is the apparent lack of ptychospermate palms. No *Ptychosperma*, *Ptychococcus*, or *Brassiophoenix* has been found in the area, though these genera are common in other parts of New Guinea.



3. *Gulubia costata*, one of the most common palms in New Guinea.

From Lae, one can drive up into the mountains to the old gold mining town of Bulolo, which is now the center of a booming forestry industry. On a trip in 1971 (Essig and Paul Katik), we headed up the Bulolo Road looking primarily for a small *Ptychosperma* that had been collected up there. We stopped along the road near the village of Gurakor, and scrambled up a steep forested slope looking for what Paul thought was the *Ptychosperma*. The small palm with reddish, wedge-shaped pinnae that we found turned out to be

4. Two forms of *Paralinospadix hollrungii* found together near Lae.

a *Nengella* (see Fig. 5), of which the specific name is not yet certain. It is an elegant dwarf, often suckering, that has proven quite adaptable to cultivation in Florida. The small panicles of bright pink flowers are followed by elongated red fruits.

On another trip to Bulolo in 1972 (Essig and forest botanist Heinar Streimann), we found the *Ptychosperma*, growing under majestic stands of a native *Araucaria*. The species has been determined to be a form of *Ptychosperma caryotoides* (Fig. 6), a widespread species in the mountains of eastern New Guinea. It is a dwarf, single-stemmed palm, with wedge-shaped pinnae, yellowish flowers, and red fruit. It is in the same section of the genus as *Ptychosperma elegans*. The only other palms we found were a species of *Calyptrocalyx*, a close relative of *Paralinospadix*, and an *Areca* bearing a small spikelike cluster of green fruit.

On our most recent trip to Bulolo in 1978 (Essig and Young), we hoped to see these palms again and perhaps some others, for we had heard that there was a new road from Bulolo, leading into the hinterland to the west. We were accompanied by Karl Karenga, a recent botany graduate of the University of Papua New Guinea. Because of a mix-up in our transportation arrangements, we had no car for the start of the trip, so we took a PMV up to Bulolo. PMV stands for Public Motor Vehicle, the equivalent of our bus, which can come in many forms in Papua New Guinea. Ours happened to be a pickup truck with wooden benches and a canvas canopy over the back. It wasn't the most comfortable ride we had ever had. We waited two days in Bulolo without our promised transpor-

5. *Nengella* sp. growing at the Botanic Garden. This is the species common in the lowlands of northeastern New Guinea.

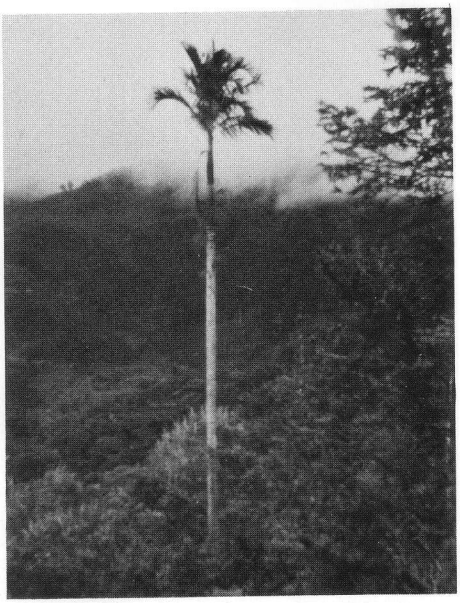
6. *Ptychosperma caryotoides* growing in the shade of giant *Araucaria* near Bulolo.

tation, but finally managed to borrow a truck and driver from the Forestry College. We looked for the *Ptychosperma* again, but found that most of the native *Araucaria* stands have been cut and replanted with a variety of species. We found only one scrawny individual of the *Ptychosperma* in a gully, but the *Calyptrocalyx* was still relatively common.

The new road, which led to the outpost of Aseki, was more interesting. Though there was much disturbance along the road, we did begin seeing some palms as we got away from the forestry area. *Ptychococcus lepidotus* (Fig. 7) was fairly common along the road, often growing close to villages. This palm is highly esteemed by the local people for various structural purposes, and is tended by them, if not actually cultivated. The outer "wood" of the palm is extremely hard, but flexible, and used for bows, arrowheads, etc. Further up the road, between 5000 and 6000 feet in elevation, *Gronophyllum chaunostachys* (Fig. 8) was quite frequent. This is perhaps the grandest of the high elevation palms, often standing well above the low vegetation of the montane forests. At the highest elevations of the pass, on exposed, windy ridges, a species of *Heterospathe* (affin. *H. obriense*?) was found (Fig. 9). This was at about 6000 feet, possibly the highest elevation for any arborescent palm in New Guinea (some rattans, however, occur much higher).

We did not continue down the road

7. *Ptychococcus lepidotus* growing near Aseki.



8. *Gronophyllum chaunostachys* in the mountains near Aseki.

to Aseki, as we had run out of time, but a trip had been made to that remote outpost in 1972 (Essig, Streimann, and P. Stevens). It is in the heart of Kukukuku country, inhabited by stone-age tribesmen (Fig. 10), who, until recently, had been the most feared cannibals in eastern New Guinea. The only signs of western civilization in the area were a few steel knives, axes and pots, and around the patrol post some western clothing. We had a fascinating tour of the local "burial" grounds which were located on ledges in the limestone cliffs above the valley. The bodies of several generations of Kukukukus were propped up on rickety wooden pedestals, and were in various states of disrepair. The bodies had each been smoked over a fire before being moved to the cliff, thus preserving the skin. Returning from the burial cliff, we met a young man who was eager to sell his bow and arrow set, and thus we obtained a prized souvenir of New Guinea. The bow was made of *Ptychococcus lepidotus* wood, as were several of the arrowheads.

Palms were similar to those found in the Bulolo area, but we did find also a *Nengella* that was smaller than, but otherwise very similar to, the lowland

9. *Heterospathe* sp. near Aseki.

10. Kukukuku villagers near Aseki.

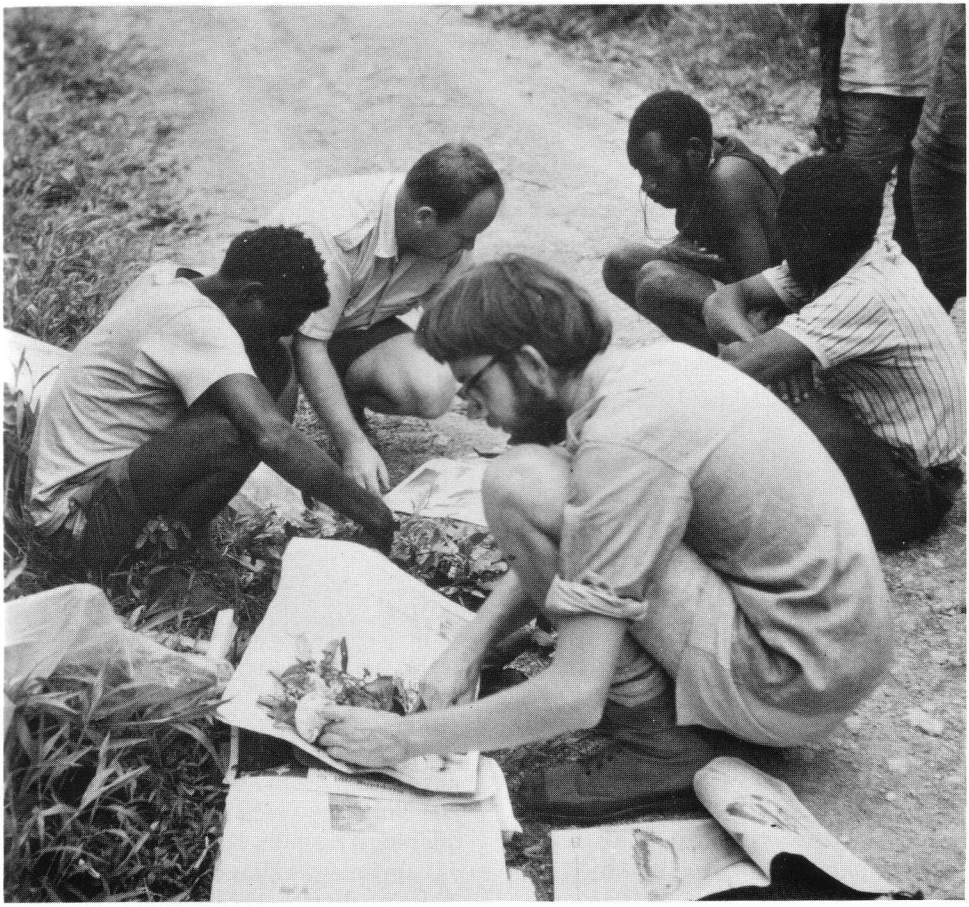
forms, and an odd *Orania*, with narrow, widely spaced pinnae.

In 1972, we (Essig and Streimann) had a very enjoyable visit with the people of Ana village, along the Mo River, in the southernmost part of the Morobe Province. Much of the enjoyment of the trip must be attributed to Streimann (Fig. 11). His twelve years in New Guinea had given him a fluent command of Pidgin English, and he struck an especially good rapport with the happy villagers of Ana. Jokes and stories from both sides were unending during our stay there, and at least half of the village would gather around the hut where we stayed whenever we brought in a load of plants for pressing. Heinar even went through an elaborate explanation, in Pidgin, of the principles and procedures of plant taxonomy which seemed to quite satisfy the villagers.

In the forests above the village, our most interesting finds were *Brassiophoenix schumannii*, growing in abundance and fruiting, *Ptychosperma caryotoides*, in a more robust form than we had seen at Bulolo, plus a *Nengella*, a *Heterospathe*, an *Areca*, several *Calyptrocalyx*, several *Calamus*, and a *Gulubia*, none of which have been finally identified yet. The *Gulubia* had arched leaves, unlike the straight leaves and drooping pinnae of *Gulubia costata*. Another important find was in the brackish mangrove swamps close to where our plane had landed near Morobe Patrol Post. This was a species of *Ptychosperma*, later identified as *P. mambare*, which is a clumping palm with black fruit, similar to *Ptychosperma schefferi*, but differing in several minor features as well as the unusual habitat.

The Highlands

The highlands of New Guinea occupy a vast area in the middle of the island. Explorers in the mid 1930's were surprised to find dense populations and a diversity of cultures flourishing where only barren mountains were thought to exist. The Eastern Highlands are easily accessible from Lae. In fact, most major highland areas are connected by an extensive road system built by the astute and industrious highlanders who were quick to grasp the essentials of capitalism and the western way of life. The cool climate of the area has fostered farming for cash crops, and the highlanders are moving aggressively into the twentieth century. Since they are but one or two generations removed from their aboriginal roots, however, much of their culture is still intact. Traditional dress can still be seen along back roads, and the elaborate ceremonial costumes are brought out in force for various special occasions. The highland "sing-sings" are famous worldwide for their spectacular displays of costumes, dancing, singing, and other activities.



11. Heinar Streimann, Peter Stevens, and assistants pressing plants near Aseki.

From Lae, the highlands highway runs up the Markham Valley, through many miles of grassy, palmless savanna before turning westward to zigzag up the side of a narrow canyon to Kassam Pass. Essig and Streimann made one trip to the Eastern Highlands in January 1972. We encountered little forest on the whole trip. The highlands have been so intensively farmed that much of the area has been taken over by grass (Fig. 12). Near the village of Pantura, at the edge of a swamp, we found a species of *Heterospathe* similar to the one found around Bulolo and Aseki.

We finally came to a small forest preserve near the village of Andandara. Even here though, at an elevation of over 5000 feet, there were few palms. *Heterospathe humilis*, a dwarf, clumping palm, was common. We found forms with simple and pinnately dissected leaves growing together in the same population. There was also an occasional *Orania*, similar to the species found around Aseki, and a small, caespitose *Paralinospadix*.

12. The grassy terrain of the Eastern Highlands.

Aside from these palms, there was, of course, *Areca macrocalyx*, the highlands betel nut (Fig. 13), which is cultivated near every village. This is one of the species of *Areca* in which the fruit are borne very close to the central axis, forming a dense clublike structure. The lowlands betel nut, *Areca catechu*, has a more open infructescence, with several main axes bearing fruit. *Areca macrocalyx* is also found throughout the Solomon Islands.

New Britain and New Ireland

To the east of New Guinea are several large islands and a number of smaller ones belonging to the Bismarck Archipelago. Together they constitute one of the botanically least known regions in the world. Many of the smaller islands have never been visited by botanical collectors. The largest island, New Britain, has received considerable botanical attention in the past twenty years, but there are large areas that have not been explored. The palm flora of these islands is obviously related to that of New Guinea, but there are many endemic species and several genera not found on the big island. Conversely, many genera found on New Guinea never made the jump to New Britain or the other islands. Most intriguing are a number of specimens, collected at various times, that appear to belong to the genus *Drymophloeus*, but also show some affinity with *Ptychosperma*. Some of these were collected by anthropologists in remote regions that have not been revisited. These are certainly new species, but their taxonomy remains to be worked out.

A brief visit to New Britain and New Ireland was made by Essig in 1972, with assistance from forestry officials on the islands, and the usual good co-

13. *Areca macrocalyx* infructescence, a widely used betel nut in the highlands and elsewhere.

14. *Areca* cf. *A. guppyana* growing on New Britain.

operation of the local residents. Flying into Rabaul, provincial capital of East New Britain there was a spectacular view of the volcanoes that surround the city. We spent a few days at the east end of New Britain, visiting several forestry areas. There was little time for collecting but we did collect a *Licuala* that resembled *L. lauterbachii* from mainland New Guinea, a large *Calyptrocalyx*, with bright red, egg-sized fruits, and two species of *Areca*. One of the latter was a form of *Areca macrocalyx*, mentioned earlier in connection with the highlands. The other appears to be a form of *Areca guppyana* (Fig. 14) which is common here and in the Solomon Islands, and which is also sometimes used as a betel nut. This species is very attractive. It is a small, stilt-rooted palm, differing from the other betel nuts in having bright red fruits. The fruit are spread out evenly along long rachillae, which are also different from the other species. Seen but not collected in that area were a small *Hydriastele*, a small *Calyptrocalyx*, and a *Ptychococcus*.

Essig then flew from Rabaul to Namatanai, in the center of New Ireland, hoping to find *Ptychosperma gracile* here. This is the type species for the genus *Ptychosperma*, collected by Labillardière in 1792, and rarely seen since that time. One other specimen had been collected in the 1960's by botanists from Lae. With the help of forestry officials again, several localities along the north coast were visited. *Ptychosperma gracile* proved to be abundant, but unfortunately, not in ripe fruit. The species is similar to *P. elegans*, but slenderer, and not as robust. The inflorescence also is not as large and the axes smooth and green, compared with the rough grayish axes of *P. elegans*. We collected the stilt-

15. *Cyrtostachys peekeliana* surviving in a cleared field on New Ireland.

rooted *Areca* (cf. *A. guppyana*) again, also *Hydriastele kasesa*, which is more diminutive than the mainland species, and a *Licuala* similar to the one on New Britain. Perhaps most spectacular on this island was *Cyrtostachys peekeliana* (Figs. 15, 16), named for a missionary who lived here during the first half of this century. This species must be one of the most robust in the genus. It has a large, solitary stem and a massive crown and inflorescence. It lacks the bright red crownshaft of *C. lakka* as do all of the New Guinea species. The fruit of this and all other species seen in New Guinea are small, black, bullet-shaped, and partially sunken in pits on the rachillae.

After a few days Essig flew back to New Britain, this time to Hoskins in the center of the north coast of the island. There again we found *Hydriastele kasesa* and another, taller form of the *Areca* (cf. *A. guppyana*). It seemed like a different species at the time, perhaps matching *Areca novohibernica*, but we have since seen a number of intergrading herbarium specimens that have given us some doubt. The two species will probably be combined. We also found a species of *Ptychococcus* that seems very similar to *P. elatus* from mainland New Guinea, and, most importantly, a *Drymophloeus*. The latter species has broad wedge-shaped pinnae resembling more the species of Indonesia than those of the nearer Solomon Islands. The Solomon Island species, formerly considered a separate genus, *Rehderophoenix*, have elongate pinnae, like those of *Ptychosperma elegans*.

While in the Hoskins area we also visited an oil palm plantation where young oil palms were replacing acres of natural vegetation. Apparently these palms were largely replacing coconuts in the economy of the area.

The Madang Province

Our several trips into the Madang Province in 1978 were relatively unproductive as far as palms were concerned. The accessible areas are generally heavily populated, the forests are disturbed, and palms are scarce. The exception among our experiences was a trip to the Gogol River in 1971 (Essig and Paul Katik). A forestry preserve there has maintained a large area of intact forest. We found specimens of a large *Ptychococcus*, which is probably *P. elatus*, but the taxonomy of this genus is still somewhat uncertain. The branches of the enormous inflorescence were glabrous and very pale green. Fruit were the size of chicken eggs. Also striking in the area were several species of *Licuala*: the

16. The massive inflorescence of *Cyrtostachys peekeliana*.

moderate sized *L. lauterbachii*, and two dwarf species, *L. beccariana* and *L. parviflora*. Along the coast north of the Gogol River we were excited to find populations of a clumping *Ptychosperma* growing in low areas that appear to be seasonally flooded. This orange-fruited species proved to be *P. lauterbachiana*.

Another trip in 1971 (Essig and Yakas Lelean) was to a volcanic island, known as Long Island, in the Bismarck Sea between Madang and New Britain. We joined two American biologists, Eldon Ball and Joe Glucksman, on a coastal steamer out of Madang. Long Island is volcanic and had recently (i.e. 20 years ago) exploded, forming a large, freshwater lake in the center, and destroying most of the native vegetation in the process. Eldon and Joe were studying colonization and succession in the lake. We thought it might also be interesting to see what palms had colonized the island. As expected there were few palms, but *Caryota rumphiana*, *Arenga microcarpa* and, surprisingly, *Ptychosperma gracile* were established and quite common. Another

palm was reported to us as growing high up on a ridge at one side of the island. It sounded like possibly a *Gulubia*, but no one has ever collected it.

One highlight of the trip was watching our native guides build a makeshift canoe for use on the lake. The floats were made out of a very light wood, into which stakes of the very dense *Caryota* wood were driven to provide the supports for the crossbeams. Chalk up one more use for the palms!

A trip to Usino in 1978 (Essig, Young, and Karl Karenga) was disappointing, because most of the large palms within walking distance apparently had been cut down for house construction. A species of *Orania*, however, was fairly common. The trunks were probably too soft for use in construction. This proved to be *O. macropetala*, which we had previously seen in swamps around Lae, but which here was growing on the side of a mountain. We collected also a small *Licuala* and a *Paralinospadix*, but saw little else.

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PALM RESEARCH

V. THOMAS ALEXANDER, Agricultural Experiment Station, P.O. Box 160, Paramaribo, Surinam, South America is conducting research on various aspects of palms including the control of hartrot or fatal wilt of palms, mainly on coconut and African oil palm in Surinam.

JUDAS TADEU DE MEDEIROS COSTA, Universidade Federal de Pernambuco, Av. Bernardo Vieira de Melo, 986, Recife, Pernambuco, Brazil, is studying the genus *Bactris* in Brazil and phenological observations of the palm species from Pernambuco, Brazil.

G. R. NIMBALKAR, Department of Botany, University of Poona, Poona 7 India, is studying the developmental aspects of stomata and trichomes in various palms, pinnate as well as palmate, available in India.

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Dispersal of a Desert Palm by Opportunistic Frugivores

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Abstract

Fruit of *Washingtonia filifera* matures in winter, and seed is dispersed by both birds and mammals that are not predominantly fruit eaters. Differences in the animals' habits affect the distances and sites to which seeds are transported, their aggregation, and their germinability.

Although the seasonality of fruiting in middle latitudes drastically limits the possibilities for animals to specialize as frugivores, many plants in these regions depend on fruit-eating vertebrates for their dispersal. Specialized frugivores may provide higher quality seed dispersal (McKey 1975), being able to handle larger seeds (Snow 1962), taking seeds more reliably (Howe 1977), and treating them more uniformly (Walsberg 1975). However, omnivores may transport seeds consistently greater distances, generate a more heterogeneous seed shadow (McDiarmid, Ricklefs, and Foster 1977), or provide a larger population of dispersers or capacity for more seeds. These hypotheses will be considered here in relation to observations on the dispersal of *Washingtonia filifera*. This winter-fruiting palm of the Sonoran desert is extremely restricted in habitat (Vogl and McHargue 1966; Smith 1958) and typically occurs in small, isolated groves, though there are a few subpopulations exceeding 1000 trees (among ca. 29,000 total for the species, Henderson 1965). Observations were made at groves in the southern Anza-Borrego region (California, T15S, R7E, sections 13, 14 and 23), in the winters of 1974–75, 1975–76, 1977–78, and 1978–79. Other groves throughout the species' range to the north and east were visited in February and November 1975.

Fruiting

The fruits mature in November. There was not a brief period of complete fruit drop in the Anza-Borrego groves, but the extent of autogenous fruit drop was not critically tested. Conspicuous remnants of the crops were often present on the trees through the summer. Undispersed fruit can be found on old infructescences among the dead, reflexed, unabscised leaves that form the "skirt" of *Washingtonia*. Richard J. Vogl (pers. comm.) notes that trees in the Indio Hills, 105 km NE, do drop the fruit in November.

The fruits are a substantial resource, but the quantity produced varies greatly between years. A heavy crop for an individual tree probably approaches 10^4 fruits. Of 326 adult trees, only 11% fruited in 1975, while 57–59% fruited in the other years. The fruiting of individual trees is even

more variable as indicated by the records for separate groves (Table 1). Thus the difference between the best and poorest years ranged from 10% to 54% (for groves of more than 10 trees, excluding 1975), although this difference for the local population was only 2%. Elsewhere in the range, in February 1975, neither fruits nor seeds were apparent in four groves in Joshua Tree National Monument, at Biskra or Whispering Palms in the Indio Hills, at Palm, Andreas or Fern Canyons in the Palm Springs vicinity, or Borrego Palm Canyon. However, all of these except the Andreas and Borrego groups showed 8–50% of the trees fruiting in the next season (November 1975).

Individual fruits value about 0.509 kcal (3.55 kcal/g dry weight, n = 3). No nutritional analysis of the fruits was done, but they are nonoily and sweet when fresh, with a sap between the flesh and seed. The fruit is spherical with an intact volume of 0.23 ml and a fresh weight of about 166 mg excluding the seed (n = 50). The seed is loose, not bound to the fruit flesh; its volume is 0.08 ml and weight 101 mg (n = 50).

Table 1. Census of groves in Anza-Borrego region for fruiting

Number of trees >4 m tall	Percentage fruiting			
	1974	1975	1977	1978
3	100	0	100	100
4	100	25	100	75
5	100	0	100	100
6	33	0	50	67
13	31	0	85	54
26	0	0	4	19
34	24	0	59	59
41	37	0	64	17
97	72	0	53	67
97	77	35	67	75

Dispersal

The western and mountain bluebirds (*Sialia mexicana* and *S. currucoides*) are the most consistent winter residents of the palm groves. These birds shift from aerial insectivory to frugivory as the winter progresses; sallying from hillside perches is common in November, but by late December the birds do little else than feed on fruits and sit in the palms. Cedar waxwings (*Bombycilla cedrorum*) were present and feeding on palm fruit only in 1977–78, then outnumbering the bluebirds.

Sialia had obvious difficulty swallowing the fruits; they dropped 23% of those they detached (n = 609). The seeds swallowed were not passed but individually regurgitated. These seeds were uniformly clean, unscarred, and covered with a clear fluid.

The phainopepla (*Phainopepla nitens*) is present every winter in the washes, feeding on fruits of *Phoradendron californicum*, for which it is highly specialized (Walsberg 1975). I have never seen it in the palms, and it may be incapable of handling the fruits internally. The house finch (*Carpodacus mexicanus*) cannot swallow *Washingtonia* fruit, but occasionally feeds on the fruit by pecking off small pieces.

Fruit on the ground was available to mammals and formed a large part of the winter diet of the coyote (*Canis latrans*) and the fox (*Urocyon cinereoargenteus*). The only signs of damage to any of the approximately 15,000 mammal-dispersed seeds examined were rare surface scratches. The appearance of some mammal-dispersed seeds suggested they were regurgitated, not defecated as was usually the case. In addition to naked seeds, mammals deposit many seeds still partially or wholly enclosed in the fruit coat.

Mammals do not deposit the seeds

Table 2. Sizes of seed cohorts deposited by mammals

Number of seeds per cohort	Percentage of cohorts	
	inside groves (n = 119)	outside groves (n = 129)
1–10	4	32
11–50	58	44
51 or more	38	24

singly but in compact cohorts. However, the number of seeds in a cohort deposited at one time by one mammal (dispersal-cohort) does not define the number present at a single spot on the landscape at the end of the season. One to several dispersal-cohorts may comprise a spot-cohort. There was a tendency for the mammals to defecate on or close to existing scat: minimally 32% of the seeds and 27% of the scat were so grouped in 1974 around one large grove. The distribution of numbers of seeds per spot-cohort is presented in Table 2. Outside the groves there was a significantly greater proportion of very small cohorts ($p \ll .01$); the cause of this difference is obscure.

Germination was observed for seeds collected in February 1975 and maintained on damp sand at 20°C. The lots of seeds regurgitated by birds reached 82% germination, not significantly different from the lots deposited naked by mammals, which reached 87%. But significantly fewer germinated among those deposited enclosed partially or wholly in fruit (60%, $p < .05$). No control was possible for the time seeds spent in the mammal GI tract, though this may be a factor (Rick and Bowman 1961).

Discussion

Birds and mammals differ in every aspect of the dispersal of seeds: the reliability of their presence, the quantity of seeds taken, the distance and location at which seeds are deposited, the aggregation of seeds, the digestive treatment of fruits and seeds affecting germinability, and susceptibility to later predation. Neither class of dispersal agent emerges as uniformly superior to the other. The plants' selection between the two, or balancing of them, may be suggested by the fruit-drop behavior. Although further study is necessary, the apparent paucity of autogenous fruit drop in the Anza-Borrego groves means that most fruits available to mammals are those dropped by birds, still a substantial fraction (23% for *Sialia* spp.). Complete fruit drop by trees in the northeastern part of the range would present virtually all fruits to the mammals.

The birds' energetic requirements can be met easily in a situation that also provides shelter from weather and predators, protection that is rare outside the groves. They concentrate on *Washingtonia*, becoming quite sedentary, with the result that they normally provide dispersal of only a few meters, though most of the seeds land within a macrosite of proven quality. This specialization is accompanied by highly reliable treatment of the seeds. The bluebirds and waxwings are seasonal migrants, however, and may occasionally provide medium- or long-range dispersal. The migratory habit also means that their numbers may be very great or small in different years, and are probably influenced by factors very remote from the groves, including agriculture and horticulture.

The number of canids may not change rapidly in response to local fruiting, but their individual consumption capacity for total fruit volume is high, and they are capable of gently dispersing many seeds an order of

magnitude larger than *Washingtonia*, e.g. *Prunus ilicifolia*.

The canids are desert residents but never confine themselves to the groves. Year-round omnivores, they continue their daily foraging for animal prey as shown by their scat, and thus habitually move seeds out of the parent groves (perhaps returning a large proportion). The canids are thus probably the prime agents of colonization of new or depopulated (by flood or fire) sites, and of gene flow between existing groves. The mammals do produce a more heterogeneous seed shadow than the birds, depositing cohorts of various sizes in nonfruiting groves, and in unoccupied washes and spring areas. Few seeds are left in inappropriate habitat: at one large grove in 1974, canids deposited 72% of the seeds in the grove, 22% in washes within 0.5 km but outside the grove, and 6% on a similar sample area of the adjacent open desert.

Survival of the embryonic plants is significantly affected by the dispersal agents. Mammal-dispersed seeds vary as to the amount of fruit coat removed, which affects their germination. However, seeds in scat may also have de facto protection from post-dispersal predation by rodents: bird-dispersed seeds scattered in one grove in 1978 showed 36% (n = 400) predation by rodents biting out the embryos. Finnally, survival and growth of seedlings in spot-cohorts of various sizes have not been studied in *Washingtonia*, but severe competition could be expected with the pattern of seed aggregation left by canids.

Acknowledgments

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Notice

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The Current Importance of the Palm Herbarium at Berlin-Dahlem

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The herbarium of the Botanical Museum at Berlin-Dahlem (abbreviated as B in citation of specimens) was an active center for palm taxonomy from the mid-1920s to the 1950s. The principal palm specialist at that institution, Professor Dr. Max Burret, received a continual flow of material, much of it representing undescribed species from tropical regions of both the Old and New Worlds. His type collections are important to contemporary students of the palms who may be attempting revisions or monographic work.

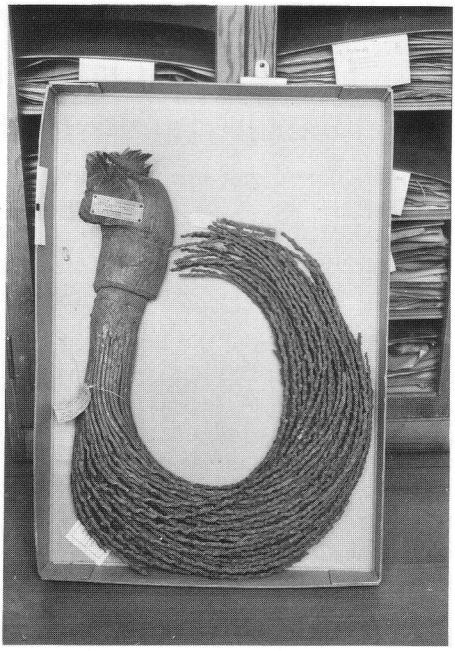
During the Second World War, a bomb attack in March of 1943 destroyed a great portion of the herbarium at Berlin, and millions of herbarium sheets were burned in the resulting fire. From 1943 to 1945, close to 70% of the buildings in this vast museum complex were destroyed (Sleumer 1949). A number of palm specimens were among those herbarium sheets that were lost.

For a taxonomic revision of any palm genus, it is necessary to assemble herbarium material from as many locations as possible. This includes both field collections made by the monographer and as many previously existing collections (including types) as possible. Along with the literature, these collections are the base upon which such botanical work is founded. Palm specimens, however, are not easily sent on loan, owing to their bulky nature and awkward dimensions. Woody material often weighs more than is allowable for international shipment, or is too costly to send. Thus the specialist is sometimes obliged to visit those collections that may be important to his or her work.

Because of the bomb attack and the resulting disorder in the Botanical Museum at Berlin-Dahlem, many botanists are under the impression that today the herbarium would be of little value for their studies. This is true for some botanical families, but for others a substantial amount of material was saved, in part by sending the material out on loan to other institutions or storing it in rural areas. Hiepko (1978), in an attempt to inform his colleagues of the current utility of the herbarium, published an impressive list of the collections and facilities that exist today. Still, many believe the palm collections, including the types of Burret, to be of little or uncertain value because of their supposed incompleteness.

During the preparation of a revision of the *Jessenia-Oenocarpus* (Palmae) complex, I had an opportunity to visit this herbarium while on a three-and-a-half week trip to Europe in the summer of 1979. The visit to Berlin was most productive, and many specimens crucial to the understanding of this group of palms were carefully studied. I therefore submit the following notes on the palm specimens and the way they are curated at Berlin-Dahlem.

1. Side view of a "palm closet" in which the large hanging sheets are stored.



2. The type specimen of *Jessenia weberbaueri* Burret. The fruiting panicle has been halved and is stored in a shallow box.

The palm collection occupies the corner of a large room in which many other collections are contained. The palms are stored in four ways:

1. On banks of shelves containing cardboard trays with fruit collections. There are 79 trays in total, each of extra-thick cardboard, 59 cm long by 40 cm wide by 8 cm high, and holding a number of small plastic boxes containing separate fruit collections. The *entire* fruit collection was saved, and thus one should search this collection carefully for any fragments of types that may still exist.

2. In larger cardboard trays, 36 in number, measuring 83 cm long by 57 cm wide by 8 cm high. These boxes contain much of the bulky material, including inflorescences, bracts, sheaths, and petioles.

3. In conventional cases with a total of 72 shelves that contain herbarium sheets larger than those normally used in this country, measuring 55 cm long by 37 cm wide. These sheets are stored in heavy cardboard folders and include fruit collections that have been placed in envelopes and affixed to the sheets.

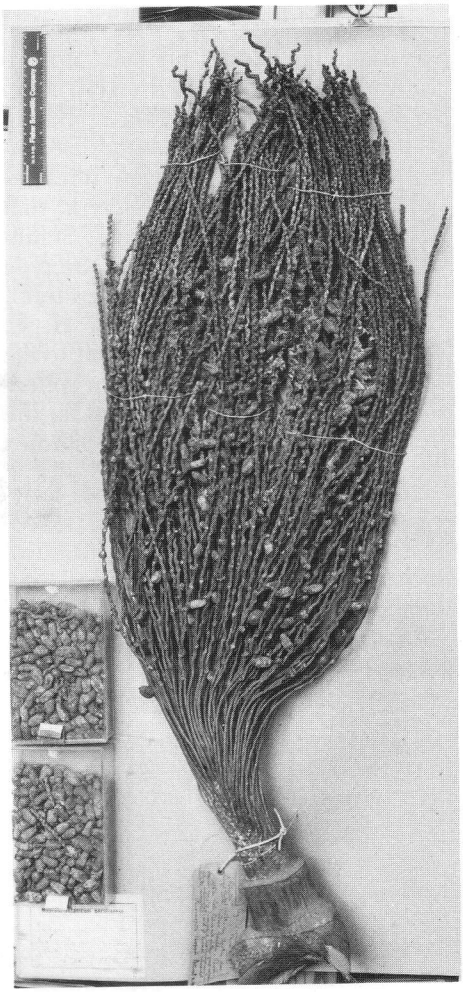
4. On hanging sheets, 90 cm long by 66 cm wide, stored in custom-made "palm closets." These sheets are made of extra-thick cardboard, and

3. A box of individual fruit collections. This particular example contains specimens of *Raphia*.

are suspended by a wire hook inserted into a metal flap ca. 1.8 cm wide that is riveted into the upper edge of the sheet. The material is sewn or taped onto the sheets, and includes plastic boxes that contain additional fruit or fragment collections. There are three large, rectangular, more or less airtight "palm closets" with two sets of sliding doors for each of the two sides of a closet. A pair of pipes suspended in the manner of a coat rack in each closet allows for the storage of approximately 700 hanging sheets.

The fact that some of Burret's type material is extant is of great importance to palm taxonomists. For example, in the *Jessenia-Oenocarpus* complex, I was able to locate type collections (at least portions) of all eight of the species described by Burret. While in every group a 100% representation could not be expected, the chances are that at least fruits might be available, and perhaps also leaf, stem, inflorescence, or other diagnostic material.

In view of the documented existence of a large portion of the palm collection



4. The type specimen of *Oenocarpus hoppii* Burret—a complete fruiting panicle affixed to a hanging sheet. Note the two plastic boxes containing additional fruit in the lower left corner.

at Berlin, it is suggested that those workers in other palm groups that were treated by Burret (see Potztal, 1958) seriously consider the value of this herbarium in their own studies. In addition, an attempt should be made to ascertain the completeness of the types and other important historical material that is available and to publish a checklist of them.

Acknowledgments

I would like to offer my most sincere gratitude to Prof. Dr. E. Potztal, Prof. Dr. P. Hiepko, and Prof. Dr. F. Butzin of the Botanical Museum at Berlin-Dahlem for their cooperation, interest, and hospitality during my stay at that institution. In addition, Miss B. Schilling assisted in photographing the type specimens, for which I am grateful. Thanks are also due to Prof. H. E. Moore, Jr., who first pointed out to me the unknown status of the palm collections at Berlin and offered input for the preparation of this note. The studies in European herbaria were undertaken as a result of the awards from the George H. M. Lawrence Memorial Fund and from the Atkins Garden Fund of Harvard University.

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Production and germination data are presented in the first two papers, while in the third it is shown that it takes about 182 weeks from germination and planting for *Eugeissona tristis* to develop ten leaves.

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H. E. MOORE, JR.

NATURAL HISTORY NOTES

How Pelagodoxa Got to the Solomon Islands

Pelagodoxa henryana is native to the Marquesas Islands. Its discovery on San Cristobal in the Solomon Islands some years ago raised questions as to its origin, questions that have interested Mr. Geoffrey Dennis, who now lives on the island of Santa Ana off San Cristobal. The following paragraphs, taken respectively from letters of Mr. Dennis written to the editor in 1976 and to DeArmand Hull in 1979, provide some background and an apparent answer.

To Moore (1976): "On last week's voyage, I also took the opportunity to investigate the still unexplained presence of the rare and beautiful Marquesan palm *Pelagodoxa henryana* on San Cristobal. At the village of Maregu, about two-thirds of the way westward along the south coast, I saw a planted specimen of *Pelagodoxa*, a few feet tall. The owner explained that he had grown it from seed taken from a palm at Makira Harbour, and that the original palm had been found growing on the beachside there following a freak midyear cyclone (which affected the entire Solomons, I recall) in 1952. On my arrival at the village of Tetere, which lies at the head of deeply indented and sinuous Makira Harbour the following day, I was taken to see a planted mature palm bearing numerous fruit, and a smaller immature specimen. The larger palm had been grown from a seed taken from the original palm, which formerly grew on a low headland, near the beach, on the opposite side of the harbour. According to my informant, a man in his mid-40's or more, the original palm was already mature when he was a small boy and grew on land where the first Catholic missionaries in the Solomons (French Marists) had established themselves in the last century and subsequently vacated. Although John Corner has postulated that seed may have drifted from the Marquesas (which it certainly could do relatively quickly in view of prevailing wind and ocean currents) it is most unlikely that it would ultimately reach a destination on the opposite side of San Cristobal in a relatively land-locked harbour, and my theory is that some homesick French or Polynesian missionary from the Marquesas brought and planted the seed many years ago. Apart from these three palms, I saw only one other at Rumahui village further along the coast, planted from seed obtained from the present mature palm at Makira Harbour, and the palm is otherwise unknown either on San Cristobal or anywhere else in the Solomons. I planted three or four in our botanic garden here [Honiara] and in my own

1. *Pelagodoxa henryana* growing in a garden in Honiara, Guadalcanal, Solomon Islands. Photograph G. Dennis.

garden in mid-1960's and the largest still has only a foot or two of trunk, so it is a slow grower."

To Hull (1979): "Amaraiah Marauhuiasi, the native schoolteacher who sent me the fruits and belonging to the area, has written as follows in a section of his letter to me: 'The story about how the palm tree came to be there was like this. It was in the olden days a very big ship came into the harbour. The men from Tetere village came to the big ship in canoes. One of the things they threw to the men was the fruit of that palm tree. The fruit went into my grandfather's canoe. He took it and planted it. It was the one on the other side of the harbour. The first one, and from there the palm tree spread to other places in the harbour.' Amaraiah is a man in his 50's, so the sailing ship (a big ship by old time standards) must have visited Makira Harbour, where Tetere is located at its head, probably 100 or so years ago, as his grandfather was reputed to be a young man at the time and, in fact, one of only several men who were game enough to paddle out to the sailing ship, the others having fled in fear of the visitors . . . . I visited the Honiara Botanic Gardens only yesterday to the look at the *Pelagodoxa* I planted there about 1967, and it now has a 7–8-foot trunk and should start fruiting within a year or two . . . . One in my garden here planted at the same time has only about 2½–3 feet of trunk, but is already an outstanding palm with its large entire leaves."

Postscript (to Moore in 1979): ". . . the Anglican Archbishop of Melanesia recently told me that during his touring of the San Cristobal diocesan area, which includes the Makira Harbor location of *Pelagodoxa*, he has called once or twice on an islet in the harbor where there is quite a considerable grove of the palm . . . and has collected a few fruits for his own garden. . . . local villagers are planting the palm as an ornamental not only in the vicinity of Makira Harbor, but in village areas many miles distant along the south coast of San Cristobal, so the palm has a bright future in the Solomon Islands."

LETTERS

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Dear Editor,

I read the enquiry by Paul C. Savage regarding *Licuala ramsayi* (*Principes* 22: 142, 1978) with some interest, as it has been my experience over seven years that this species in its southern population does not produce abundant fruit.

Of many thousands of individuals inspected between Cooktown and Cardwell, only several dozen were seen with fruit. The main locations of this species are north of the Daintree River, between Cairns and Innisfail on the coastal plain and ranges and on the foothills of the Great Dividing Range, between Tully and Mission Beach and on the coastal plain between Kennedy and Cardwell. In these areas, the palm often forms dense groves dominating to the point of being pure stands with only a light canopy of emergent trees. Elsewhere it is scattered along creeks and forms small dense communities on hill slopes. These palms may be suffering from a reduction in pollinating agent; however, I do not know if that may be insect or wind.

The case of the northern Cape York Peninsula population may be of interest. *Licuala ramsayi* occurs widely along the northeastern Peninsula and extends to the northwestern coast and Torres Strait Islands and New Guinea. The New Guinea plants are unknown

to me and may differ in minor details. The northern Peninsula plants are different from the southern in a few conspicuous ways. Firstly, their petioles are virtually unarmed, the petiole bases lack the large quantity of fiber that surrounds the younger leaves, the leaves themselves are more conspicuously lobed at the segment apices, and the trunks are more slender with much wider internodes. The northern *L. ramsayi* are also different in that they are prolific fruit producers; nearly every inflorescence results in hundreds of small, ovoid, bright orange fruit. All through the day, small native bees and butterflies can be seen visiting the flowers and wind may be an important pollinating agent as well. Small moths visit the flowers in the early hours of the night and flying foxes occasionally feed on the flowers. Whether the latter are seeking nectar or actually eat the flowers I have not discovered.

Southern *L. ramsayi*, when grown in gardens, usually set fruit; even plants in deep shade (the preferred environment) and wild plants in exposed situations may be fruitful. This may indicate that easy access is necessary for some pollinating agents, and in the case of cultivated trees their pollinators are probably incidental feeders on other cultivated plants. Whatever the reason, it seems that the southern plants have been in this apparent predicament for a long time and that the occasional tree that does set fruit (usually several thousand per tree) is sufficient to maintain the population. At times a small number of trees all bearing fruit can be found growing together. It does seem strange that the large groves of tall *L. ramsayi* are usually devoid of fruiting trees, but in most places there is no conspicuous lack of juveniles.

Sincerely,
ROBERT TUCKER

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July 19, 1979

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Principes, Journal of the Palm Society
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Ithaca, New York 14853

Dear Hal:

I have just finished reading your article *Endangerment at the Specific and Generic Levels in Palms* (*Principes* 23: 47–64) and thought you would be glad to known about some of our efforts to protect *Calyptronoma rivalis*. As you known, the survival of this species is a project very close to me (I even have a battle scar on my forehead to prove it).

Sponsored by the Botanic Garden of the University of Puerto Rico, I have visited the San Sebastián population several times. This population is located along Quebrada Collazo, a small and narrow stream, and occupies an area 500 meters long and about 5 meters wide. The substrate of degraded limestone has a pH of about 8 and is permanently moist. I have counted 44 mature individuals that range from 25 to 45 feet tall. Small plants and seedlings are abundant; in some areas the seedlings look like a grass carpet.

Observations in the field and in the conservatory seem to indicate that the germination rate is excellent, close to 100% if the seeds are collected from the tree when cherry-red. Seed germinates both in shade or full sunlight, but small plants are found only in the shade. It may be possible, however, that at some point in time, an opening in the canopy is necessary for the small plants to continue developing into adult plants.

Mature seed has been collected several times during the last three years. Several thousands have been sent to The Palm Society Seed Bank as part of our exchange program with the Society. In addition, seed has been germinated in our conservatory and at the propagating facilities of the Public Parks and Recreation Administration of the Commonwealth of Puerto Rico.

The Ornamental Division of the Public Parks and Recreation Administration, under the direction of Miss Hilda Diaz-Soltero, is propagating *Calyptronoma rivalis* and plans to introduce it into parks and recreational facilities with habitats similar to that found in San Sebastián.

The Botanic Garden has about 200, 2-year-old, 12-inch plants; however I do not know what will be done with them. Last year I suggested that part of them be sold to palm enthusiasts throughout the world, but the proposal was tabled by then Garden Director Mr. Arturo Roque. I do not know what the new director, Entomologist Dr. Silverio Medina-Gaud plans to do with them, especially now that I am leaving the Garden.

Finally, you will be glad to know that, in response to a letter of mine to the mayor of San Sebastián, the Department of Natural Resources of the Commonwealth of Puerto Rico has declared *Calyptronoma rivalis* as a rare plant protected by law. This is the only plant I know that is protected in that way here in Puerto Rico. A copy of the resolution protecting *Calyptronoma rivalis* is included. Let's hope this resolution is really enforced.

Cordially yours,
JOSÉ L. VIVALDI
Associate Taxonomist

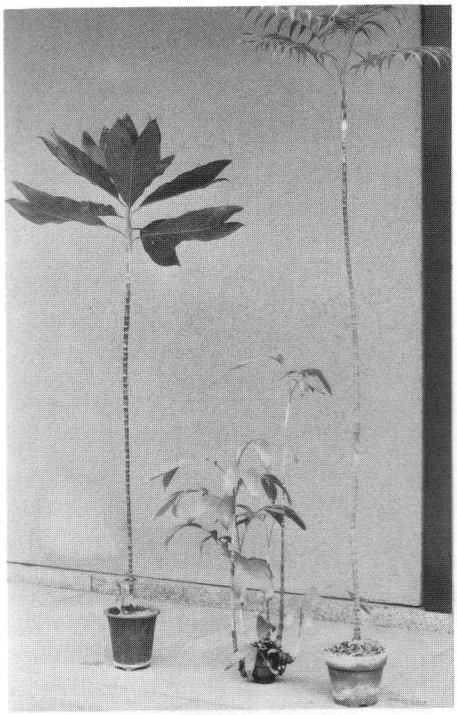
NOTES ON CULTURE

Bonsai Palms

I have been living with palms since 1933. The beginning of my study of palms was unplanned and started unexpectedly when I planted a *Livistona chinensis* var. *subglobosa* in a small pot. This palm is one of the total of five to seven native to Japan. I reside in a part of Japan where the temperature falls to −10°C during the winter. It is impossible to grow a *Livistona* outside under these conditions. By potting this palm and keeping it indoors during the wintertime, the plant does remarkably well. This palm is now 46 years old and is still very hardy.

In 1933, exotic palms were practically nonexistent. The Koishikawa Botanical Garden of the University of Tokyo and Takatsuki Botanical Garden of the University of Kyoto were the only two locations where a very few palms could be seen. Over a period of several years, I succeeded in collecting over 60 different palms. It was a very difficult task to obtain this number because transportation was limited to ocean liners. When air transportation became available after the end of the Second World War, I managed to collect over 500 species and was able to do germination experiments on these. At the present time, my greenhouse has an area of 600 square meters. A temperature of over 20°C can be maintained throughout the year.

The problem encountered in growing palms in greenhouses is that they grow very rapidly. By potting the palms, it becomes possible to grow the plants in the greenhouse for a long time. It is interesting to note that the characteristics of the palms become different when they are grown in pots. For instance, a *Cocos nucifera* is only one meter tall after 20 years. A *Lodo-*



1. Three species of *Chamaedorea* grown as bonsai palms.

icea maldivica grown in a pot for 16 years is only four meters tall. *Corypha umbraculifera* and *C. elata* can also be grown in the same manner. The *Corypha* is very sensitive to these conditions and after 16 years has grown only 30 centimeters. Potted *Howea forsterana* and *H. belmoreana* have been widely accepted as interior decorative plants because they require very little sunshine. The *Chamaedorea elegans* is the most popular plant for decorative purposes, because the light from a neon lamp is sufficient for it to flower and fruit. This palm is most suitable for potting because it adjusts to these conditions very easily and does not require a long maturing period.

On the occasion of Dr. H. E. Moore's visit in 1966 to my residence in Hiroshima, I had a potted *Chamaedorea erumpens* H. E. Moore in the greenhouse. Dr. Moore on observing this pot inquired, "What is the name of this palm?" This episode not only reveals that a potted palm looks quite different from its normal appearance but also gives further proof that the conditions on the plant are very hard.

2. A coconut 20 years old is only one meter tall.

Although in the strict sense of the word bonsai means a pot that is flat and shallow like a tray, I believe the small pots that I have used can be con-

sidered as bonsai pots. This is because the roots of palms grow straight down and deep and would not survive in flat shallow pots.

In Japanese universities there are no lectures on palms and no one who can be said to be knowledgeable in this field. My only source of guidance is Dr. H. E. Moore whom I consider a great professor and teacher. I had an opportunity to visit Dr. Moore at Cornell in 1966 and was privileged to have his visit in the fall of that year. This was after the Pacific Science Congress when Dr. Hodge also visited my home some 800 kilometers from Tokyo. Dr. and Mrs. Hodge had visited me several years before this. In the past years, Dr. and Mrs. Darian came to see my greenhouse, but did not take time out to see Hiroshima City, Osaka, or Tokyo. The came and went directly to the air terminal without a bit of sightseeing. This was the first time I had such guests.

It is indeed meaningful that goodwill and friendship can be spread by palms. Palm enthusiasts are all my friends and I welcome everyone to visit me.

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Japan

3. *Lodoicea maldivica* at far left rear is only four meters and scarcely exceeds the cycads.

The Palm Collection of the Botanic Garden at the Vrije Universiteit of Amsterdam

In 1967, plant material to supply the Faculty of Biology at the Free University of Amsterdam was cultivated in a small garden along the Amstel River in which there was only one small, unheated glasshouse unsuitable for the cultivation of palms. A new botanic garden at van de Boerchorststraat 8 behind the academic hospital has since provided a rather large glasshouse with space enough to start a palm collection.

Many seeds of palms were received through seedlists from botanic gardens all over the world and most of them germinated rather well. After a few years of intensive sowing of all kinds of seeds needed for a good teaching and research collection, there was no place left to grow the bigger palm species. Thus only small and slow-growing species are still added to the collection when they become available, for a small collection will suffice to show palms to students.

The indoor cultivation of pot plants is very popular in the Netherlands. There are many palms suitable for room decoration, for example *Phoenix roebelenii*, *Microcoelum weddellianum*, *Howea forsterana*, *H. belmoreana*, *Chamaedorea elegans*, and others. Many *Phoenix canariensis* and *Washingtonia filifera* and a few *Chamaerops*

humilis were imported from countries along the Mediterranean. Although large plants are rare and can only be seen in botanic gardens, palms are rather common here.

At the moment, we possess in the botanic gardens, large specimens of *Phoenix dactylifera*, *Jubaea chilensis*, *Howea forsterana*, *Trachycarpus fortunei*, a fruiting plant of *Microcoelum weddellianum* and one of *Chamaedorea elegans*. Some of these are treated as Orangery plants and are placed outside during the summer from mid-May until mid-October. Then they are stored in a cool glasshouse until the following years. There is only one palm, *Trachycarpus fortunei*, that may be left outside during the winter when it is not too cold. Last year a small one about 1.25 m high was planted and is still growing well. This winter we had temperatures of about minus 15°C (5°F) and the plant was not protected but nevertheless survived. The following is a list of palms cultivated at the botanic garden.

Allagoptera arenaria (*A. pumila*), *Archontophoenix cunninghamiana*, *Arecastrum romanzoffianum*, *Brahea armata* (*Erythea armata*), *B. edulis* (*E. edulis*), *Butia eriospatha*, *Caryota mitis*, *C. urens*, *Chamaedorea cataractarum*, *C. elegans*, *E. ernesti-augusti*, *C. graminifolia*, *C. radicalis*, *C. tepejilote*, *Chamaerops humilis*, *C. humilis* var. *lusitanica*, *Chrysalidocarpus lutescens*, *Cocos nucifera* and *C. nucifera* 'Nana,' *Cyrtostachys lakka*, *C. renda*, *Elaeis guineensis*, *Howea belmoreana*, *H. forsterana*, *Hyophorbe verschaffeltii*, *Jubaea chilensis*, *Latania loddigesii*, *Livistona chinensis*, *Microcoelum weddellianum*, *Phoenix canariensis*, *P. dactylifera*, *P. roebelenii*, *Rhapis excelsa*, *Sabal minor*, *Salacca edulis*, *Trachycarpus fortunei*, *Verschaffeltia splendida*, *Washingtonia filifera*, and *W. robusta*.

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CULINARY NOTES

Palm Fruit Products From Southeast Asia

Southeast Asian cuisines are rich in the utilization of products derived from palm fruits. Most of those products are unknown outside their areas of consumption because they are used fresh and are not preserved. In recent years, however, some of the items have reached the shelves of specialty food markets in the United States. This change has been the result of the migration of people from Southeast Asia who have created demand for such products, and because of efforts by several Southeast Asian countries to develop new export items to exploit local palm resources more fully.

In June 1979 I conducted a survey of the two largest Oriental food markets in Houston specifically to look for preserved palm products. The items found in the survey are described below.

Coconut milk. This is an emulsion of coconut meat and water. It has a milky color, is about the consistency of dairy cream, and has an excellent fresh coconut flavor. Coconut milk is used to make coconut soda, and is an ingredient in sweetmeats and in sauces for seafood, meat curries, and vegetables. The name of this product creates confusion in English because "coconut milk" may refer to the clear refreshing fluid in the fresh fruit. That fluid is more accurately called "coco-

nut water" and in other languages like Spanish it is. In this paper, "coconut milk" refers to the emulsion. Causing further confusion is the use of the term "coconut cream" for coconut milk. The general distinction that should be made is that coconut cream is a concentrated form of coconut milk, which has often been cooked. The consumer must read the label to be sure of the exact nature of the product sold under a particular brand name.

Coconut cream. This product is a thin, brownish liquid, the color apparently resulting from cooking, which has a high oil content (up to 80 percent). Coconut cream is made from coconut milk and since it is concentrated, has a more pronounced flavor. It is used in the preparation of various confectionary items.

Coconut spread. Similar in appearance and flavor to coconut cream, coconut spread also contains eggs and sugar. It has the consistency of butter and is excellent on bread.

Coco jelly. This coconut product looks like melted caramel and has a rich coconut flavor. It is made from coconut milk and sugar, and is eaten as jelly on bread or toast. It also makes a tasty ice cream topping.

Nata de coco. The name of this product in Spanish literally means "coconut cream," but it is quite different from the product of that name in English. Nata de coco is made from coconut water, sugar, acetic acid, and a bacterial culture from pineapple. A period of two to three weeks is required to culture the white, gelatinous substance, which is removed, washed, sliced, and cooked in syrup. The product has a bland taste, with only a slight hint of coconut flavor. It is eaten as a dessert, mixed in fruit salad, and in other sweet dishes.

Coconut sport or macapuno. In certain coconut palm varieties, some of the ripe fruits contain no water, but instead are completely filled with a gelatinous curd which is quite palatable. Coconut sport is white, chewy, and has a milder flavor than fresh coconut meat. When preserved, it is cut into thin strips and cooked in syrup. The designation "sport" derives from the biological reference to a spontaneous variation or mutation. Fruits from which coconut sport is derived are infertile. In the Philippines, *macapuno* refers to such palms and to the product.

Palm nut or kaong. These are immature seeds of the sugar palm (*Arenga pinnata*). The fruits are harvested, the seed coats removed, and the soft endosperm cooked in syrup. Palm nuts have a pale white color, a gelatinous texture, and a bland taste. They are eaten as a sweetmeat, used to flavor a refreshing cold drink, or mixed into fruit salad. Compared to the coconut products, palm nuts most closely resemble nata de coco. Palm nuts are known as *kaong* in the Tagalog language of the Philippines.

The palm products discussed here are exported by the Philippines, Thailand, and Singapore. In nearly every case several brands of each product were found for sale. Palm enthusiasts who are also adventurous cooks might wish to experiment with these delicacies.

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PALM PORTRAIT

Tectiphiala ferox

Tectiphiala ferox, a new genus from Mauritius in the *Oncosperma* alliance, was described recently by Dr. Moore (*Gentes Herbarum* 11: 284–290, 1978). On our second visit to Mauritius, which comprised one leg of an exten-

1. *Tectiphiala ferox* at Crown Land Declerc with Phyllis Sneed and T. A. M. Gardner for scale.

2. The crownshaft and inflorescences with developing fruit of *Tectiphiala ferox*.

sive trip we had undertaken, my wife Phyllis and I were privileged to see *Tectiphiala* and to attempt to collect its seeds. Not many of the palms exist (about 28 as reported by Dr. Moore) and apparently they have survived because they occur in scrub forest on land unsuited for the growing of sugar cane that has replaced the indigenous flora of most lowland areas of the island. We had not seen this palm before and assume that it doesn't exist elsewhere.

We are much indebted to Mr. T. A. M. Gardner of the Forestry Department (and a member of The Palm Society) not only for his good hospitality but also for his helpfulness in guiding us to the site of the palm in a reserve.

3. Long blackish spines over a cover of short brown hairs adorn the leaf sheaths and unexpanded inflorescences of *Tectiphiala ferox*. Photo by H. E. Moore, Jr.

Although Mauritius is not a big island, it is doubtful that one in quest of the palm could find it without knowledgeable direction.

Tectiphiala is a very attractive small palm with unusual features that enhance its allure to us as a potential ornamental. In Figure 1, Mr. Gardner and Phyllis provide scale for one of three specimens located not far from each other in low bush in a reasonably accessible area in the reserve. The crownshaft and inflorescences with developing fruits are shown in Figure 2. The crownshaft has considerable beauty, being of unusual color and texture. I would call the color cinnamon-brown or, perhaps, rust. It is adorned with long, blackish, yet soft spines in the lower part over a covering of short brown hairs that feels almost velvety to the touch (Fig. 3). Unfortunately, it is unlikely that the few popcornlike, dark-colored fruits we were able to collect had viable seed. The mature fruit, according to Dr. Moore, is blue-

black, larger than those pictured, and rarely obtainable.

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PALM BRIEFS

On Champion Palms of Texas

Recently, Johnson (1979) reported the sizes of several champion palms from the 1978 National Register of Big Trees (American Forests 84: 18–47, April 1978). An error originating within this National Register was repeated by Johnson (1979).

The error involves the location of the champion *Sabal mexicana* which was reported to be growing at "Cameron City, Texas." No such community exists (Texas Almanac, A.H. Belo Corp., Dallas); the error probably originated as a misprint of "Cameron County." In Texas, *Sabal mexicana* is restricted to river bottom and resaca (abandoned river channels) woodlands of the Rio Grande in extreme southern Texas where it is limited to Cameron and Hidalgo counties (almost totally in the former county).

The National Champion *S. mexicana* occurs in the best remnant of *Sabal* woodland remaining in this area. This palm stand—long known as Rabb's Grove—is located approximately ten kilometers southeast of Brownsville. The nearest settlement is an unincorporated area known as Southmost. Essentially all of the surrounding country has been cleared for agricultural utilization. Formerly owned by a series of private individuals, this area has recently (1972) been purchased and protected by the National Audubon Society. The Sabal Palm Grove encompasses a total of 172 acres but only about 34 acres still support native stands of *S. mexicana* (Keating, 1975; see also Jan. 1978 *Audubon* 80(1): 128–137,198).

Discussion of a recent nomenclatural change is appropriate at this point. Johnson (1979) stated that the listed *S. mexicana* "probably refers to the Texas palmetto, *Sabal texana*." His supposition is correct. The most recent nomenclatural list of palms (Glassman, 1972) reduces *S. texana* (Cook) Beccari to a synonym of *S. mexicana* Martius. Most workers north of the Rio Grande have, probably partially through political chauvinism, referred to the South Texas populations as *S. texana* (e.g., see Correll and Johnston, 1970: 341). Note, however, that the Registry of Champion Big Trees in Texas (Texas Forest Service, May 1979) now lists this champion as the Mexican palmetto, *Sabal mexicana*. This nomenclatural change no doubt reflects reality as the now isolated populations of the delta of the Rio Grande would have been in contact with populations in Tamaulipas, Mexico, during the most recent pluvial period of the Pleistocene. Of course, these Rio Grande populations may differ subspecifically from southern Tamaulipas populations.

One other champion palm classification could be created for a Texas palm. However, there is a complicated nomenclatural problem associated with the population. The dwarf palmetto, *Sabal minor*, is normally acaulescent or only slightly caulescent. Populations of a palmetto with well-developed trunks are known in a restricted area of the San Bernard River bottomlands in Brazoria County. The tallest known specimen is reported to be 5.4 meters or 17.8 feet (*fide* R. A. Vines in Bomhard, 1943). Vines (in Bomhard, 1943) reported these caulescent forms to be "very limited in distribution. Eighteen plants within a half-mile radius. Old settlers say this small iso-

lated group of palms has been growing wild in the bottomlands as long as they can remember."

While some authorities (Correll and Johnston, 1970:340) consider these trees to be merely caulescent individuals of *S. minor*, others (including Bomhard, *op. cit.*) refer to these populations as *Sabal louisiana* (Darby) Bomhard. The most recent Registry of Champion Big Trees in Texas (Texas Forest Service, May 1979) refers to these trees as *S. minor* var. *louisiana*. Still others have placed these forms under *Sabal palmetto* (Walt.) Lodd ex J. A. & J. H. Schult. The trees from Texas are mere dwarves to Florida specimens; the champion *S. palmetto* is over 27 meters (90 feet) tall (1978 National Registry of Big Trees).

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NEWS OF THE SOCIETY

News from California

From Frank Ketchum the following account has been received: "Beautiful and hilly north Whittier was the site of the September 9, 1979 South California Chapter meeting. The extremely hot weather did not discourage approximately 75 members and guests from coming out to see Dick Palmer's excellent palm collection.

"Lunch was served at tables that had been set up on Dick's long driveway and in the shade of a row of *Caryota urens*. Lois Rossten, Chairman, called the meeting to order. A moment of silence was observed in memory of Mark Foster who had passed away suddenly. He had served as our Treasurer since 1977. Ross Wagner will assume the responsibilities of Treasurer. Several new members were introduced, including special guest Don Hodel and his wife Anne visiting from Hawaii. Don is a long-time society member, formerly of our South California chapter.

"Jim Specht of San Diego has been doing some research and would be interested in hearing from California members about their cold-hardy palms.

"A highlight of the day was a guided tour by Dick of his large garden with many full-grown palms which were a delight to see. Then many different kinds of palms were auctioned by Allen Bredeson and Doug Hughes who did a commendable job."

News from Texas

The Houston (Texas) Area Chapter held its first meeting of 1979 on January 11 at Eric and Deanna Erdmann's home. Jim Cain opened the meeting to a discussion about a program that would distribute seedlings of unusual palms to members at each bimonthly meeting. One year later the seedlings will be brought back and compared for growth and cultivation practices. An information sheet will accompany each seedling. The program was agreed upon and the first seedlings distributed. They were gallon cans of

Coccothrinax species with six to eight representative leaves.

The possibility of starting a chapter library was discussed, for which *Palms of the World, Supplement to Palms of the World,* back issues of *Principes* and *Tropica* were suggested. The photo album of palms of Houston has been started with members encouraged to bring slides for printing. Erwin Ruhland showed slides of Palms of Florida, featuring Cypress Gardens, Fairchild Tropical Garden, and the Parrot Jungle in Miami.

The next Houston meeting was March 8 and started with an announcement and discussion about the Palm Show and Sale to be held on September 15 and 16. Then there were brief comments about the severe cold damage caused by the very cold winter. *Arecastrum romanzoffianum, Livistona chinensis, L. australis, Rhapis excelsa* seemed to be the hardest hit. *Washingtonia robusta* suffered severe damage. Mature *Chamaerops humilis* and *Trachycarpus fortunei* suffered no apparent damage but younger plants were killed. *Washingtonia filifera, Sabal texana,* and *S. palmetto* apparently suffered little, nor did *Butia capitata.* Following these reports slides of Huntington Gardens and palms of Southern California were shown.

The next meeting on May 10 was held at the home of Bonny and Edwin Ruhland. The previously distributed seedlings were discussed with comments on progress and problems. The September Show and Sale will be at the Houston Arboretum. A Houston-Harris County Fair will be held Thanksgiving weekend in November and the possibility of setting up a booth was decided upon. A discussion of winter cold damage was again held and everyone had been pleasantly surprised that many palms thought dead are still very much alive, especially *Livistona chinensis* and *Chamaerops humilis.* Jim Cain is gathering information for an article for *Principes.* The possibility of adding more winter-hardy palms to the Houston Arboretum was considered as a chapter project. Members who miss a meeting may buy seedlings from the missed meeting for 50¢. Any leftover plants will be sold at the September Show, as well as any suitable plants that become available through purchase.

A meeting held August 31 and another on September 6 were devoted almost entirely to plans for the Show and Sale. A list of plants needed for the display was read. A palm frond comparison display was decided on and everyone was reminded to collect seeds for giveaways. Erwin Ruhland donated several thousand seedlings to be sold at a nominal fee. Seedlings distributed were *Caryota mitis.*

News from Florida

The South Florida Area members held a Palm Show and Sale at Fairchild Tropical Garden on November 3 and 4, 1979. Collecting of the plants began at 7 A.M. Wednesday, October 31, and by opening time Saturday at 10 A.M. everyone was astounded at the quantity and quality of the palms that had come in. There must have been at least 5000—no one had the time to count them. Probably 60–70 species or more were represented—small, medium and large, common and rare, something for indoors or out, something for everyone. The only thing missing were palms on the lethal yellowing list as the Garden does not permit these to be sold from its premises. Species of *Veitchia, Pinanga, Aiphanes, Rhapis, Licuala, Copernicia, Heterospathe, Chamaedorea, Carpentaria, Ptychosperma, Livistona,* both green Malay and Maypan coconuts,

Phoenix, *Arecastrum*, *Caryota*, *Brassiophoenix*, *Zombia*, *Coccothrinax*, *Gastrococos*, *Thrinax*, *Rhyticocos*, *Pigafetta*, *Acoelorraphe*, *Roystonea*, *Areca*, *Neodypsis*, *Euterpe*, *Elaeis*, *Drymophleous* were there and rarer ones too—*Neoveitchia*, *Calamus*, *Balaka*, *Chambeyronia*, *Burretiokentia*, *Verschaffeltia*, *Welfia*, *Deckenia*, *Phoenicophorium*, and many more. Surely there has never been a larger collection and selection of potted palms at any one time anywhere in the world. We wish all of you could have been there.

DeHull was Chairman and everyone agreed that he had done an absolutely fantastic job. Palms seemed to materialize out of thin air, though actually much work and many phone calls were responsible. Most of the plants were there because of De's efforts. A large number of the sale plants were brought in by members. Some were donated. A great many of the larger ones were obtained on consignment from nurseries, including the coconuts.

Beautiful Fairchild Garden provided a perfect background for the event and the help of their dedicated staff, especially that of Dave Mitchell, was invaluable. Their publicity, handled by Ann Prospero, was excellent. They also provided tours of their palm collection during the two days the event was open.

Allen Fernandez set up the beautifully designed show area in the Corbin Building. A collection of outstanding specimen palms was exhibited to show the plants to best advantage. It emphasized the amazing diversity of palm fronds and forms. Ten-foot-tall specimens of *Licuala grandis*, borrowed from the Miami Beach Parks Department, were the outstanding feature. Big pots of *Howeia*, *Chrysalidocarpus* and *Chamaedorea seifrizii* provided the background for the unusual pinangas, the two large *Cyrtostachys*, the dozen or so smaller *Licuala grandis*, the *Verschaffeltia*, *Calamus*, *Phoenicophorium*, *Astrocaryum*, *Ceratolobus*, and the others too numerous to mention.

Without the help of the many members who donated countless hours to setting up, arranging, selling (and yes, counting money and sales tags, then paying bills), and helping wherever needed, it could not have been done. Let us not overlook Lennie Goldstein's contribution. He made all our signs in a most professional way. The whole event was a milestone and overwhelmed all of us; we stood back and looked at it in amazement. Many who came to see or buy joined The Palm Society and we hope that many others came away awakened to the wonderful world of palms.

TEDDIE BUHLER

WHAT'S IN A NAME?

Adelodypsis (a déll oh díp sis) and *Adelonenga* (a déll oh nén ga) combine the Greek *adelos* (uncertain, obscure) with the names of the better known genera *Dypsis* (explained in *Principes* 14: 116, 1970) and *Nenga* (explained in *Principes* 3: 144, 1959).

Adonidia (ád on íd ee a) was not explained by Beccari, who gave the name to what is now known as *Veitchia merrillii*, but it must have come either from the name of Adonis, the handsome youth of classical mythology, or perhaps, because of its red fruit, from the genus *Adonis*, so called because the blood of Adonis supposedly stained its flowers.

Aristeyera (á riss tíe err a) was formed by combining parts of the names of two botanists, Leandro Aristeguieta (1920–) and Julian A. Stey-

ermark (1909–), both of whom have worked in Venezuela and written much about its plants.

Bacularia (bák yew láre ee a), a name of a genus with slender stems, is derived from the Latin word *baculum* (stick, rod, staff).

Beethovenia (báy toe vée nee a), a synonym of *Ceroxylon*, was named by Engel after the famous composer, Ludwig van Beethoven (1770–1827).

Blancoa (blan kó a) was named after Francisco Manuel Blanco (1778–1845), a Spanish clergyman, explorer, botanist, and author of the *Flora de Filipinas* (1837).

Dahlgrenia (dahl grén ee a) commemorates Bror Eric Dahlgren (1877–1961), for many years a curator of botany at the Field Museum of Natural History in Chicago, student of *Copernicia*, and author of *Index of American Palms* (1936).

Dypsidium (dip síd ee um) combines *Dypsis* with the Latinized Greek diminutive *-ium*, thus "little *Dypsis*."

Eupritchardia (yéw pri chár dee a) is a substitute name for *Pritchardia* but is no longer used. The prefix *eu-* (Greek for true, original) was added when it was thought that the name *Pritchardia*, now conserved, might have to be abandoned.

Gastrococos (gás tro kó kos), the "pot-bellied *Cocos*," is a cocosoid palm with a stem that is much swollen, as indicated by the name, which combines *gastro-*, from the Greek for belly (*gaster*), with the generic name *Cocos*. See *Principes* 11: 116, 1967, for a photograph.

Gigliolia (jéel ee óh lee a) was dedicated by Beccari to his friend and colleague, Dr. Enrico H. Giglioli (1845–1909), Professor of Zoology at Florence and author of the scientific part of a work on the round-the-world voyage of the Italian corvette Magenta in 1865–1868.

Guilielma (gwíll ee éll ma or gíll ee éll ma), the Latin equivalent of Wilhelmine, was dedicated by Martius to Karoline Fredericke Wilhelmine von Baden (1776–1841), once Queen of Bavaria.

Haplodypsis (háp lo díp sis), from the Greek *haploos* or *haplos* (single, simple) and *Dypsis*, was apparently used by Baillon because the one species had a spicate inflorescence.

Haplophloga (háp lo fló ga) was also derived from *haplos* in combination with the generic name *Phloga* (see *Principes* 13: 22, 1969).

Hyospathe (hígh oh spáy thee), according to Martius, derives its name from the Greek equivalent of the Indian name *tajassu-ubi*, which is to say "pig leaf" or "pork palm." The Greek roots are *hyo-* from *hys* (hog) and *spathe* (a broad blade, stalk of a palm leaf, sheath enclosing an inflorescence).

Johannesteijsmannia (yo háh ness tice mán ee a) and the illegitimate *Teyssmania* or *Teysmannia* (tice mán ee a), which it replaces, are taken from the name of Johannes Elias Teijsmann (1808–1882), a Dutch gardener and botanist at the famous Buitenzorg Botanical Garden in Java (now Bogor, Indonesia).

Kunthia (kóon thee a), a synonym for *Morenia*, honors Karl Sigismund Kunth (1788–1850), a German botanist who described many of the plants collected by Humboldt and Bonpland in Mexico and South America.

Leopoldinia (lée oh pol dée nee a) is derived from the name of Maria Leopoldina Josephina Carolina of Habsburg (1797–1826), Archduchess of Austria and Empress of Brazil, whose father sponsored an expedition to Brazil during which Martius collected many of the palms he later described in *Historia naturalis palmarum* (1823–1853).

H. E. Moore, Jr.

THE PALM SOCIETY BOOKSTORE

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Notice

Due to a typographical error on the dues notice, the regular dues, which should have been $15.00, were entered as $12.50. The Board of Directors has decided not to correct this error. Therefore, the regular dues remain at $12.50 for 1980.

STATEMENT OF OWNERSHIP MANAGEMENT, AND CIRCULATION OF PRINCIPES, JOURNAL OF THE PALM SOCIETY, REQUIRED BY ACT OF 23 OCTOBER 1962: SECTION 4369, TITLE 39, UNITED STATES CODE, FILED 11 SEPTEMBER 1967.

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2. Mail subscriptions	1416	1447
C. Total paid circulation	1416	1447
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1. Samples, complimentary	9	9
2. Copies distributed to news agents	None	None
E. Total distribution	1425	1456
F. Office use, left-over	316	344
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I certify that the above statements made by me are correct and complete. Signed, Mrs. Theodore C. Buhler, Executive Secretary.