PRINCIPES

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PRINCIPES

JOURNAL OF THE PALM SOCIETY

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Contents for July

Cover Picture

A group of *Pigafetta filaris* at Pajahi Bay, Halmahera, Indonesia, photographed 27 May 1940 by Edward Beckwith.

PRINCIPES

JOURNAL OF THE PALM SOCIETY

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The Coconut in Florida

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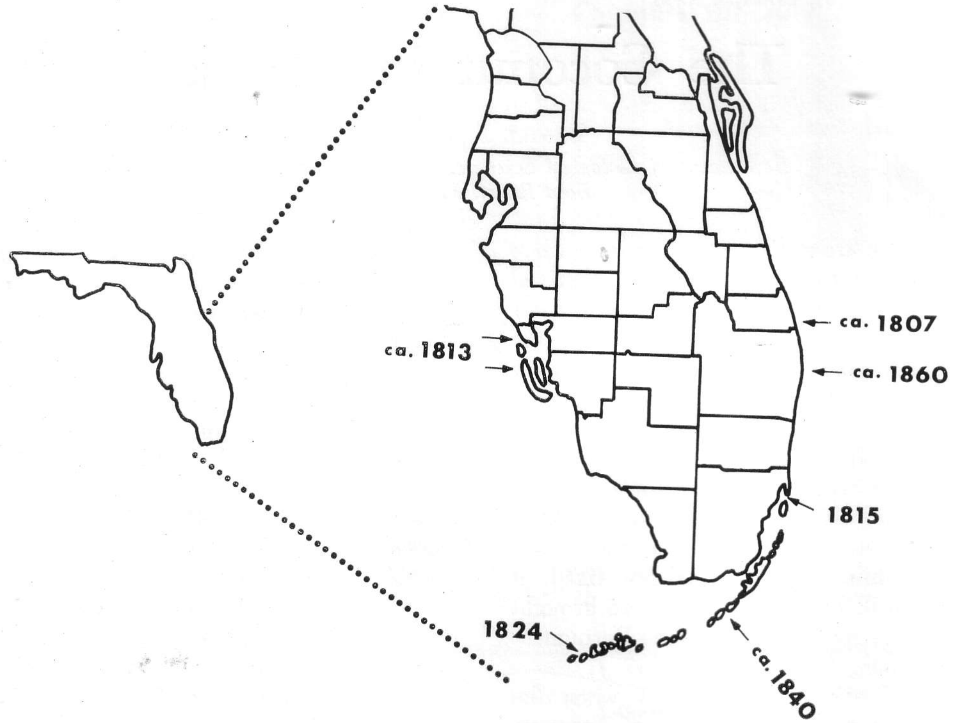
There are no records of exactly when the coconut (*Cocos nucifera* L.) arrived in the New World, but Oviedo (1526) recorded these Asian palms on the Pacific Coast of Mexico by 1516. They were on the Cocos Island west of Panama when it was discovered in the 1530s. In the Caribbean their history is more recent. Small (1929) thought that the palms were brought to the West Indies from Panama about the 1550s, and while the dates are not fixed, it seems likely that the trees were brought to the Americas by the Portuguese (Bruman, 1944; Harries, 1977).

Similarly, no one knows when the first coconuts came to Florida. Accounts by Solis de Meras (1567), Fontaneda (1575) and others in the 1500s, and by Jonathan Dickinson (1699) record only our native palms and saw palmettos. One translation of a letter written in 1568 by Brother Francisco de Villareal said that the Indians at Tequesta (modern Miami) ate "coconuts and palm grapes" (McNicoll, 1941). The plants in the letter are probably "hicaco"; these are not palms but the coco plum (*Chrysobalanus icaco* L.), which had been mentioned among the Ais Indians earlier (Solis de Meras, 1567; Barcia, 1723).

What may be the first mention of the coconut in Florida was made by Bernard Romans (1775). His statement is ambiguous: "The coco-nuts found on the shore [of Florida] likewise convince us, that Cuba sends much of her outcast this way" (Romans, 1775: 199). Whether they were only stranded nuts from Cuba or actual trees is not known. If they were trees, they must not have been common, because neither he nor other visitors in the following 30 years cited them as aids to navigation in the way they did the cabbage palm.

Forbes (1821) did not record the coconut on his visit in 1803. He thought that they might be planted here with economic profit (p. 152), but did not mention actual growing plants. It would be logical to assume that the many Spanish (Cuban) "ranchos" and plantations where gardening, turtling, and fishing had been carried on since the 1700s in Florida (Barcia, 1723; Romans, 1775) would have brought the plants. If they did, it has not been recorded, and the plants seem to have been introduced after the turn of the century.

The first account of the palms seems to be that by Vignoles (1823). On a surveying trip down the eastern coast of the peninsula in 1822, this visitor found an abandoned grove of coconuts about four miles north of Jupiter Inlet. This was formerly part of an old plantation started in 1807 by James Hutchinson (Nance, 1962: 303). Vignoles thought that it might have even been occupied before that time by a Padre Torres, although no details are given. The size or age of the palms was not recorded, but they were large enough to be used by pilots to gain their bearings (Vignoles, 1823: 47–48) and giving fruits which suggests "about fifteen years coming to perfection. . ." (Williams, 1837: 113) for an age. This would place the trees in the time period



1. Locations and early introduction dates of the coconut (*Cocos nucifera*) in southern Florida. The earliest recorded plants were grown on Jupiter Island ca. 1807 (Vignoles, 1823). Plants were on North Captiva Island and Boca Grande by ca. 1813 (Williams, 1837), and were started in Miami in 1815 (Williams, 1937). Coconuts were planted in Key West in 1824 (Williams, 1837). Trees on Indian Key may have been planted ca. 1840, and on Lake Worth ca. 1860.

of Hutchinson's settlement attempt. Coconuts at the Jupiter Island site are the oldest recorded in the historical documents.

By the year 1828 there were at least five distinct sites with coconut groves in Florida. The northern site on the southeastern coast was the same that Vignoles had seen on Jupiter Island and the trees remained (Williams, 1837: 43). There were also several palms in the vicinity of Miami where ". . . the shores is high and precipitous. . ." (Williams, 1837: 143). The palms had been planted there near 1815 according to Williams. This was probably the modern town of Coconut Grove since it was south of the Miami River and north of Coconut Point. Apparently this is the first record also of "Cocoanut Point."

Williams found the palm in Key West (p. 38), and recorded that "many of these trees planted in 1824, are now in full bearing. . ." (p. 113). The Calde family, who had previously lived on Indian Key, were found by Williams on Toampe Island (modern North Captiva Island). They had a village of 20 palmetto huts and ". . . several cocoanut trees in bearing. . ." (p. 33) along with a number of other crops and fruit trees. About five miles north at Boca Grande there was a ". . . stout, healthy, old, white-headed Spaniard. . ." (p. 25) who fished and farmed for a living. He maintained 18 to 20 palmetto huts, and kept two schooners running to Havana with fish and turtles. Among the plants he cultivated were several coconuts.

There were coconuts on Indian Key in the 1850s (Small, 1929) and it is locally believed that these were planted by Henry Perrine who was killed there in 1840 by Indians. Oral tradition has maintained that the first settler on Lake Worth, a former gardener to the King of Saxony named August Lang, brought the first trees to that part of the coast in the 1860s.

Certainly the most famous of the coconut imports to Florida happened in 1878 when the wreck of the Spanish ship "Providencia" spread the trees along the coast near Lake Worth (Pierce, 1970). In the next few decades the trees made impressive palm forests. John K. Small, who travelled through much of southern Florida in the first three decades of the 1900s, reported that these trees were more impressive near Lake Worth than anywhere else in the state (Small, 1929). The profusion of these tropical palms led to a town being named "Palm City" in the late 1800s, which was shortly thereafter changed to "Palm Beach" (Pierce, 1970; Morris, 1974). This in turn gave rise to "West Palm Beach" and in 1909 to Palm Beach County.

Fascination with the coconut in the early days was stimulated not only by the ornamental and edible qualities of the palms, but a desire to turn them into profit. During 1877 there were groves of coconuts growing mixed with other fiber-bearing plants on Boca Chica and Sugar Loaf Keys (Small, 1929). Between 1882 and 1883 two men, Messrs. Field and Osborn, from New Jersey launched a coconut-planting campaign that put trees along the beaches from Key Biscayne to Boca Raton, a distance of forty miles. Some 316,000 nuts were imported from Trinidad, only to have the rabbits eat most of them (Small, 1929; Pierce, 1970). A few palms remained, and although they did not bring the profit their planters expected, they did increase the value of the land when it later sold. In the Great Freeze of 1894–1895 trees were killed in Jupiter (Small, 1929) and those farther south were damaged.

Another attempt at mass planting was made by Commodore W. J. Matheson in 1910. At this time the trees were planted in association with Australian pines (*Casuarina equisetifolia*) as windbreaks (Small, 1929). In the next decade about the only profit made directly from coconuts was to sell them to tourists. By 1921, this was an established business, although always on small scale.

The beginning of what appears to be the end of Florida's tall coconuts started in the West Indies about 1890. At the time no one knew what caused a disease that came to be called lethal yellowing. In 1955 this palm disease was noted in Key West, Florida. Slowly the blight moved up the Florida Keys, and few even knew what was happening. It was October of 1971 when Dade County began to count its losses—50 infected trees. The following October there were 2,000 dead palms, and a year later 20,000 were gone (McCoy, 1974). October of 1974 saw the elimination of 100,000 coconuts in Dade County alone, and by that year the problem had spread to two other counties.

State agricultural officials quarantined Dade, Broward, and Palm Beach Counties in 1974. In the spring of that year the first infected trees were found in the southern parts of Palm Beach County, but by August there were dying trees as far north as Palm Beach. As elsewhere, the disease seemed to follow the Intracoastal Canal north and then spread inland. The summer of 1975 heralded the first wave of dying trees through the inland regions and in southern Collier County. Trees are still dying.

Years of examination produced a dichotomy of opinion among plant pathologists. Some maintained that the disease was caused by a new type of plant pathogen first reported in the 1960s and located in coconuts in the early 1970s. The suspected pathogen, a mycoplasmalike organism (MLO), has not been convincingly implicated for others.

There is a usually effective method of combating mycoplasmas, with antibiotics like oxytetracycline. At best, treatment with drugs delays death of the tall varieties of palms. It has been estimated that, in a good program of inoculation, 90% of the trees are saved each year. Eventually, the trees will be lost because, by definition, lethal yellowing is ". . . an alway lethal . . . disease of coconut palms . . ." (McCoy, 1974).

The prevailing philosophy is to treat the tall varieties of coconuts and underplant with resistant strains. One cultivar of coconut thoroughly tested in Jamaica and found to be highly resistant is being used in Florida to underplant. This is the 'Malayan Dwarf' or 'Golden Malay.' According to the Florida Institute of Food & Agricultural Sciences about 98% of these plants survive, and there are some 250,000 of these palms now in Florida (Donselman, personal communication).

Popenoe (1977) discussed the effects of this disease on other palms in southern Florida. Not only is the coconut affected, but to date there are 23 different species of palms where the MLO has been associated with their death. An additional 8 or 12 species are suspected by Popenoe to be infected, but a disease organism has not been implicated. Whatever the cause, these other species are dying along with the tall coconuts in Florida.

Acknowledgments

I would like to thank the following people for offering suggestions on various parts of this manuscript: Henry Donselman (Agricultural Research Center, Ft. Lauderdale), DeArmand Hull (Cooperative Extension Service, West Palm Beach), John Popenoe (Fairchild Tropical Garden, Miami), and Richard Roberts (Department of Natural Resources, Hobe Sound).

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PALM QUESTIONS AND ANSWERS

Q. The leaves on my palms are being affected by something that appears to be a disease. There are brown spots appearing on several areas on each leaf. What is wrong and how can I control it?

A. South Florida's high humidity is ideal for the palm leafspot which is common on many species of palms and is caused by a fungus called *Stigmina palmivora* (Sacc.). In Florida the fungus has been officially reported on the following palm hosts:

Arecastrum romanzoffianum (Chamisso) Beccari
Butia capitata (Martius) Beccari var. *capitata*
Caryota mitis Loureiro
Phoenix canariensis Chabaud
Phoenix dactylifera Linnaeus
Phoenix loureirii Kunth.
Phoenix reclinata Jacquin
Phoenix roebelenii O'Brien
Phoenix rupicola Anderson
Roystonea regia O. F. Cook
Sabal palmetto (Walter) Loddiges
Thrinax microcarpa Sargent
Veitchia merrillii (Beccari) H. E. Moore

This disease is usually found on plants grown under glass or lath shade where insufficient light is provided. Any time that a palm is slowed down in growth due to poor cultural conditions, the plant does appear more susceptible to fungus and bacterial diseases.

The palm leafspot first appears as a minute, circular, tan spot which is transparent when held to the light. As this lesion develops it becomes circular to elongate, light to medium brown, depressed, with a dark brown to black spot in the center surrounded by a somewhat diffuse yellow halo. The yellow halo serves as a field characteristic to help identify the disease. Several of these lesions may coalesce to form irregular shaped spots on the rachis of the palm frond. Severity of the disease may be reduced by removing the infected leaves and spraying the foliage at regular intervals with a fungicide.

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Principes, 22(3), 1978, pp. 88–93

Palms in Northeastern Australia I. Species from Iron Range, far Northeastern Queensland

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Little has been published on Australian palm species generally and there has been only one report on species from northeastern Australia in PRINCIPES (Moore, 1965). This account was based on visits to Darwin, Brisbane, and areas of southern Cape York Peninsula, so species confined to far northeastern Australia were not included. Results of a recent excursion (November, 1976) to Iron Range (Fig. 1), an area of lowland closed (= rain) forest and sclerophyll forest, on northeastern Cape York Peninsula are presented here.

Australia has a depauperate palm flora, supporting only 17 native genera of the 212 genera assigned to the Palmae by Moore (1973). Most of the genera occurring in Australia are found in Queensland and here many (13 genera) are represented in the moist closed forests of the tropical east coast. Four genera are endemic to Australia—*Archontophoenix, Laccospadix, Normanbya,* and *Carpentaria.* The last mentioned occurs only in the Northern Territory and the other three genera are confined to eastern Australia.

Iron Range supports a diverse palm flora by Australian standards. Nine genera are represented, apparently because of the favorable combination of a moist, tropical environment and the strong Southeast Asia/New Guinea influence on the flora of northeastern Australia. Iron Range is a sparsely settled area well known to many American servicemen who were based there during World War II, when the area was a key base in the Battle of the Coral Sea. It has a moist, tropical climate with an average annual rainfall of 2086 mm (based on 20 years records) and an average annual temperature of 80°F+. Two major types of vegetation occur in the lowland area—closed (= rain) forest, and sclerophyll forest (including some highly acidic 'heath' lands). The closed forests (semideciduous mesophyll vine forest, after Webb, 1959) occur in

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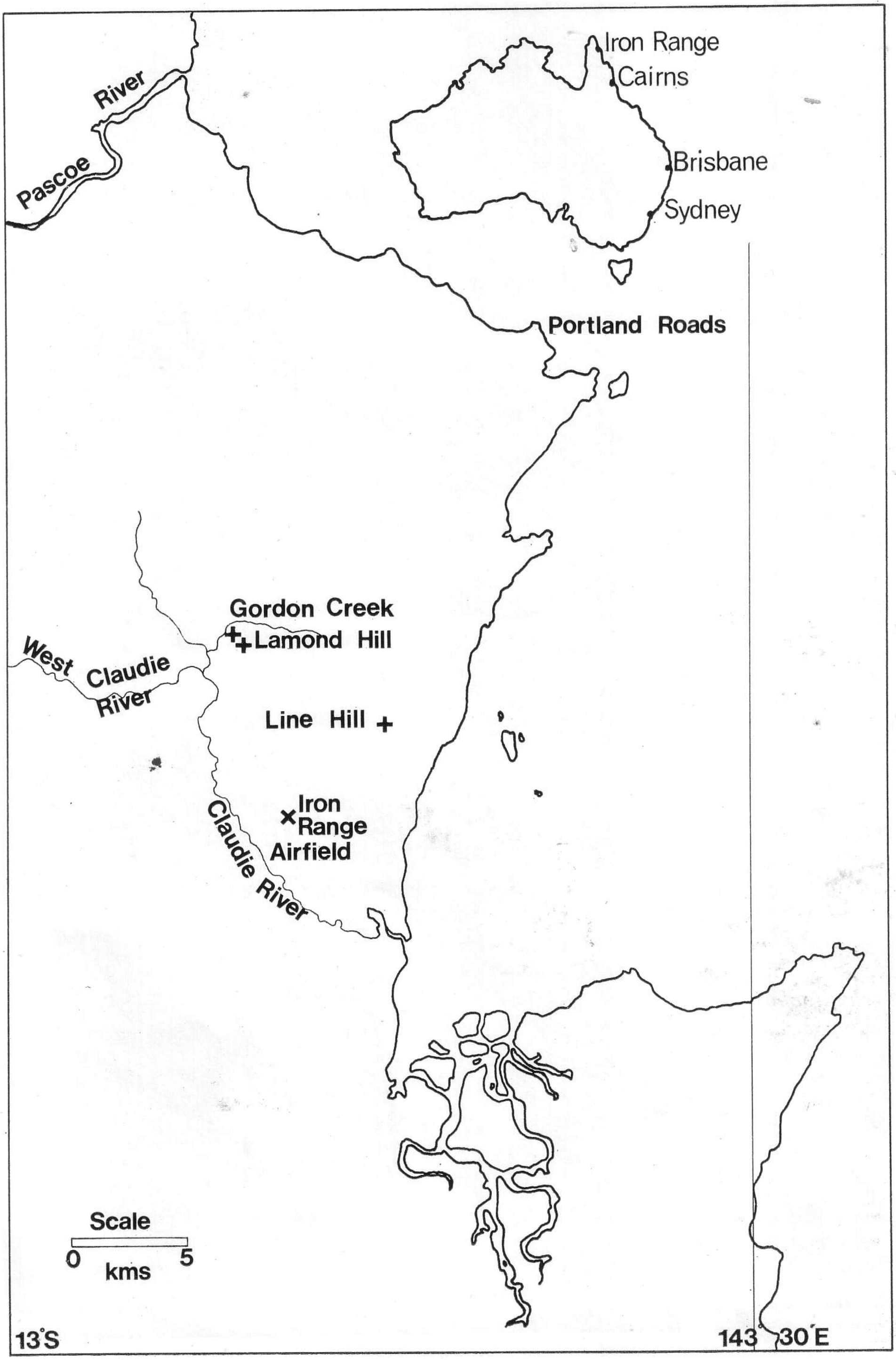
1. Localities mentioned in the text and Iron Range area in detail.

2. *Nypa fruticans* at Iron Range N. Queensland. A, stand of *Nypa fruticans* on banks of estuary, Claudie River, Iron Range, NE. Queensland showing sandy situation in which palms occur and their total domination of this section of the river bank; B, base of *Nypa fruticans* showing submerged trunk and position of inflorescence; C, inflorescence of *Nypa fruticans*; D, mature fruits of *Nypa fruticans*.

3. Stand of *Nypa fruticans* on banks of estuary of Claudie River, Iron Range, NE. Queensland showing dominance of the area by this species, extremely dark conditions, sandy habitat, and long ascending pinnate leaves from the submerged trunk.


Iron Range
Cairns
Brisbane
Sydney
Pascoe River
Portland Roads
Gordon Creek
Lamond Hill
West Claudie River
Line Hill
Iron Range Airfield
Claudie River
Scale
0
5
kms
13°S
143°30′E


A
B
C
D

narrow strips along the Claudie River and its tributaries, in patches along the coast, and on low hills and ranges near the coast. The remainder of the area supports rather sparse, open sclerophyll forest. Large sections of both major vegetation types have been cleared for cattle grazing.

Close to forty species of native palms are known from Queensland. At least 11 species (approximately 27%) are known from Iron Range. More species probably occur in the area, particularly in the closed forests of higher altitudes in the ranges, which lie west and south of the area examined for this brief report. *Nypa fruticans* is undoubtedly the most interesting species encountered (see Figs. 2, 3). In Australia it occurs in dense stands in tidal flats along the estuaries of some streams from the Herbert River, near Cairns in the south to the tip of Cape York Peninsula. *Nypa fruticans* does not flower seasonally. Residents of Iron Range report the presence of flowers and fruit throughout the year. We collected approximately 40 mature fruit. Of these, eight young plants are thriving in large pots in a rich black soil/sand mix which is watered frequently with fresh water only. *Nypa fruticans* is obviously highly tolerant of saline conditions but salt may not be essential for its survival, possibly like *Cocos nucifera* which grows well in either saline or nonsaline conditions. *Nypa fruticans* is known surrounding freshwater lakes in New Guinea (A. Irvine, pers. comm.). The lower survival rate of the seeds collected is probably due to attack by insects or their larvae rather than a poor germination rate, because all seeds that either failed to germinate or died soon after germination, bore signs of insect attack when examined. No data are available on germination time for the seeds.

Palms encountered at Iron Range

Table 1. Systematic list of palms encountered at Iron Range, northeastern Queensland, Australia, with notes on their occurrence.

Coryphoid palms

- *Livistona benthamii* F. M. Bailey: one stand only observed in swampy open forests.
- *Livistona muelleri* F. M. Bailey: common; throughout open forest.
- *Licuala ramsayi* (Mueller) Domin: two stands observed in closed forest.

Lepidocaryoid palms

- *Calamus* spp.: common in understory of most closed forest areas. "Four species definitely known from Iron Range—*C. australis* Martius, *C. caryotoides* Martius, 2 *C.* spp., possibly New Guinea species" (A. Irvine, in litt.).

Nypoid palm

- *Nypa fruticans* Wurmb: common along swampy estuary banks in dense stands.

Caryotoid palm

- *Caryota rumphiana* Martius: common; confined to riverine closed forests.

Arecoid palms

- *Archontophoenix alexandrae* H. Wendland and Drude: common; found in creeks and in riverine closed forests.
- *Ptychosperma elegans* Blume and *Ptychosperma macarthurii* (H. Wendland) Nicholson: both species common throughout closed forests.
- *Hydriastele wendlandiana* (F. Mueller) H. Wendland and Drude: common throughout closed forests.
- *Gulubia costata* (Beccari) Beccari: one stand observed in very moist riverine closed forest.

are listed in Table 1. Most of the species are confined to the closed forests as expected and some (e.g., *Caryota rumphiana, Gulubia costata*) are confined to very moist areas along the creeks. *Livistona* species are common in the sclerophyll forests, often near or in seasonally dry swamps and occasionally just inside the closed forests. All genera known from Iron Range (except *Archontophoenix*) are represented in New Guinea and/or Southeast Asia. This is not surprising because the strong New Guinea influence in both the flora and fauna of Cape York Peninsula is well documented (e.g., Walker, 1972). In recent geological times (during the Pleistocene) New Guinea and Australia have been linked through the Torres Strait several times by land bridges, and the Torres Strait separating them is barren. The late tertiary history of these connections has been summarized by Tate (1951).

Acknowledgments

Mr. & Mrs. J. Hennig of Iron Range provided us with information on the location of palm species in their area. Mr. A. Irvine, Division of Forest Research, C.S.I.R.O. has constructively criticised the manuscript.

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NEWS OF THE SOCIETY

April 1, 1978 saw a large group of members from the South Florida area meet at the home of Paul Drummond to visit again his delightful garden and to learn something as well.

After eating our picnic lunches, we followed Paul through his plantings to watch him pick male inflorescences of various chamaedoreas and demonstrate how the pollen is shed in clouds when the flowers are shaken. He then took the male blooms and shook them over blooms on female plants. Many questions were asked and helpful answers given. We all learned something, and even though not all of us could readily distinguish the male from the female flowers, despite using a hand lens, the type of growth of a bloom spike often discloses which sex it is. No doubt many more members will try their hand at producing their own seeds as a result of the lessons learned.

On April 29, 1978 a group of members of the Miami-Ft. Lauderdale area drove to Naples on Florida's West Coast to visit members' gardens there. Fred Shick has a lovely garden with many large specimens, all planted since the hurricane of 1961 flooded his property with three feet of salt water. His soil is none too good, but for some years he has been getting truckloads of shredded tree trimmings available when power lines and streets are cleared. He runs this coarsely shredded material through his own grinder and puts the resultant mulch about one foot deep on all planted areas except grass. He says it decomposes in a year, leaving a crumbly black layer that has cut down on his weeds, on

(*Continued on page 109*)

Principes, 22(3), 1978, pp. 94–98

Effects of the Winter of 1976-77 on Certain Palm Species in Dallas, Texas

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I am sure that no one east of the Rockies will soon forget the winter of 1976–77. Many long-standing records for low temperatures and prolonged cold were broken. About the only good thing we can say about it is that it gave us an excellent opportunity to observe how much cold and freezing temperatures certain palms can take.

Table 1 gives the date and temperature of every day when the temperature was 32° F or below in Dallas, Texas. Rainfall is also given for each month. The thermometer used is a Taylor Minimum-Maximum type and is accurate. During the 30 years from 1940 through 1969, Dallas has averaged 35 days per year in which the low temperature was 32° F or below. The winter of 1976–77 recorded 65 such days. The lowest temperature was 9° F. Another indication of the severity of the winter was that the temperature fell into the "teens" or below on 11 nights, with four consecutive nights of temperature between 12° F and 16° F.

Pictures taken in June 1977 show representative palms that survived the winter of 1976–77. Where leaves had been killed, they were trimmed away as new growth emerged. Notes on individual species follow. It is hoped that these data will shed additional light on cold hardiness of selected species.

Sabal minor is native, therefore no damage was expected, and this was true of adult plants and those younger ones that had gone through at least one previous winter. Some selected seedlings did perish whereas others survived. Those surviving mostly did not have a north exposure, although a few did survive in the coldest areas.

Sabal texana experienced some damage; the older the plant, the less the damage. One large plant, with 4½ feet of trunk, showed some leaflet tip burn, but most of the leaf surface remained green. One peculiar thing occurred, however: the exposed leaf surfaces had very narrow elongated areas that apparently died and fell out giving a minor buckshot appearance. These areas constituted less than 5% of the leaf surface. The bud area showed very minor browning, which subsequently grew out. All exposed leaves, including the central unexpanded one, of plants in the range of three to seven years of age were killed, but new leaves have grown out. As might be expected, plants with some protection, like a fence, were less burned. Numerous seedling were present before winter but only a few survived. Natural selection may have been a factor here.

Sabal palmetto plants varied in age from two to six years. Generally speaking, individuals experienced less leaf burn than *Sabal texana* of comparable age. A few two-year-old plants perished, but the remainder have recovered. *Sabal palmetto* appears to be slower growing than *Sabal texana* in our climate, possibly due to lower humidity and dryer soil conditions.

Sabal etonia exhibits the same hardi-

1. Palms in Dallas, Texas, from left to right, are *Trachycarpus fortunei* (two individuals), *Washingtonia filifera* 11 years old, and *Sabal texana* 15 years old. Photographed in June 1977.

3. *Sabal texana* approximately 15 years old with inflorescences in June 1977.

ness as *Sabal minor*. There was no damage to the three six-year-old plants.

Sabal causiarum is borderline in Dallas. Each winter it freezes to the ground but always comes out. The winter of 1976–77 was no exception. All four five-year-old plants grew out.

Trachycarpus fortunei experienced no burn on five of six plants ranging in size from 10 feet of trunk to 10 inches of trunk. Very slight tip burn to some leaflets occurred on the sixth plant. Some petioles were broken by the weight of ice and snow, but these still retained green leaves. Some seedling plants experienced moderate leaf burn.

Trachycarpus wagneranus was represented by two rather weak plants at the beginning of the winter and both died.

Chamaerops humilis has not shown itself to be as hardy here as *Trachycarpus fortunei*. One plant with eight inches of trunk has had heart rot for several winters. Each previous spring

2. *Sabal minor* approximately 15 years from seed in bloom, June 1977. A trunk of *Trachycarpus fortunei* appears at right.

4. *Butia capitata of* unknown age in June 1977.

Table 1. Temperature and rainfall in Dallas, Texas, winter of 1976–77

Date	Low Temp (F)	Date	Low Temp (F)	Date	Low Temp (F)	Date	Low Temp (F)
11/5/76	27°	12/9	32°	1/7	27°	2/4	28°
11/8	28°	12/11	30°	**1/9	12°	2/5	30°
11/12	31°	12/12	30°	1/10	9°	2/6	24°
11/13	*28°	12/16	30°	1/11	20°	2/9	30°
11/14	29°	12/17	29°	1/15	21°	2/13	32°
11/15	32°	12/20	32°	1/16	16°	2/16	28°
11/18	29°	12/21	21°	1/17	12°	2/17	31°
11/22	24°	12/22	28°	1/18	15°	2/20	30°
11/28	21°	12/23	24°	1/19	16°	2/27	26°
11/29	13°	12/24	26°	1/20	22°	2/28	31°
11/30	21°	12/26	25°	1/21	25°	3/6	27°
12/1	26°	12/31	11°	1/25	24°	3/7	32°
12/2	25°	1/1/77	18°	1/28	30°	3/20	30°
12/3	28°	**1/2	26°	1/29	15°	3/22	30°
12/4	29°	1/3	28°	***1/30	29°		
12/7	22°	1/5	28°	1/31	10°		
12/8	25°	1/6	30°	2/1	20°		

* 4½″ snow.
** Freezing rain and sleet.
*** 4″ snow.

Rainfall in inches:

Oct. 1976—4.56	Jan. 1977—2.38
Nov. 1976—0.48	Feb. 1977—2.40
Dec. 1976—2.67	Mar. 1977—8.63

the main trunk grew out. In the spring of 1977, the main trunk recovered and the four suckers were green and growing well. All leaves, including the unexpanded one, were killed on two younger plants six years of age but only one recovered. The younger plants grown from seed in open ground here had done better in previous winters than the larger plant with eight inches of trunk, which was purchased several years ago in Houston.

Serenoa repens showed no damage and is in the same hardiness category here as *Sabal minor* and *S. etonia.* The three plants involved are five years old from seed collected by Dent Smith.

Jubaea chilensis is very hardy here, according to my observations. One plant, six years old, showed no damage. The other plant, four years old, showed no damage and started growing in the spring, but did succumb to a center bud rot. The younger plant had never been as vigorous as the older one.

Trithrinax campestris is another hardy species here. Several plants, ranging from three to four years of age, showed very slight tip burn in some but no damage in others.

Trithrinax acanthocoma, represented by only one plant, failed to survive the winter.

Rhapidophyllum hystrix is a very

hardy species, but very slow growing. Two plants, four years old, showed no damage. One seedling plant a year old was weak in the fall and did not survive the winter. Two adult specimens in White Rock Lake Park showed no damage.

Butia capitata suffered moderate leaf burn, even in the bud area. This plant has two feet of trunk and grew out well.

Butia sp. was represented by two plants, one a year old, the other two years old. Only the latter survived.

Butia paraguayensis was represented by eight plants two years old and two plants one year old. Two of the two-year-old plants were badly burned but grew out. The others died.

Nannorrhops ritchiana, of which I had two plants five years old, two four years old, and one three years old, survived with moderate to severe burn and grew out.

Acoelorrhaphe wrightii with four inches of trunk started to grow out and two new suckers appeared at the base of the trunk in the spring of 1977.

Erythea armata went into the winter with two plants. One with two inches of trunk suffered severe burn but grew out well. The other plant, six years old, died.

Erythea edulis, with two plants three years old, had all parts above ground killed but grew out well.

Livistona chinensis has previously lost all parts above ground each winter but foliage grew back. One of two plants died in the winter of 1976–77, the other grew out.

Livistona australis also loses all its foliage each winter. I have one plant, two years of age, that burned similarly this winter. It is now growing out.

Washingtonia filifera suffered the worst winter burn I have seen on this species. Two trees, with trunks of 10½ feet and 8½ feet, had leaves burned including the unexpanded blades. Both grew out. One other plant, four years of age, suffered similar damage and also grew out. Numerous seedlings perished. All leaves of the many specimens in Fair Park were also killed but new ones grew out nicely.

Phoenix dactylifera has suffered severe damage with loss of all leaves in the crown each winter. I had two plants six years old and another with one foot of trunk. Only the last grew out.

Phoenix canariensis was also represented by two plants, one six years old and the other with eight inches of trunk bought last spring. Both died.

Rhapis humilis in the form of four three-year-old plants was located in protected areas. Only one survived, and it is weak.

Various species in containers above ground. I plant most palm seeds in open ground. However, I had various species, some normally very hardy, in pots as an experiment to see how they would survive the winter. All perished. I am convinced that the latent warmth of the soil is responsible for seedling survival, since the root zone is not subject to freezing in our climate.

Postscript

When edited manuscript was sent for checking, we had just finished a second winter almost as bad as the 1976–77 one. I write "almost" because I find less browning of leaves on most of the palms. This winter we had much more snow and ice. In fact, we set a record of about 18 inches over a period of six different snows. As of 25 March 1978, we have had 63 days at or below 32° F. We also had 11 days with the low in the "teens" and our minimum this winter was 10° F.

I know that absolute minimum temperatures are not the whole story on palm survival. Cold, dessicating wind is a big factor, and in 1976–77 we had this. In the winter of 1977–78 there was little wind but excessive cloudiness, which kept our temperatures down. The winter of 1977–78 was concentrated in January and February. In fact, until 9 January 1978 we were experiencing a very "normal" winter. From then until 22 February it was solid winter and the average temperature was actually lower than that of 1976–77.

The big question is why the palms show less damage in 1977–78 than in 1976–77. Perhaps my explanation of the effects on *Washingtonia filifera* best explain the difference between the two winters.

In 1976–77, leaves on all plants were completely burned. In fact, the center bud leaf just above the point where it emerges from the trunk (on the two larger plants) was so badly damaged that when it finally grew out, the first leaves on each did not completely unfold but grew out at an angle of about 30° from perpendicular. The small plant four years old showed no green in the bud area but later grew out.

In 1977–78, the two larger trees still were green in the bud area and the fans are now unfolding normally. In fact, some of the outer leaves still showed considerable green areas up to 17–19 February, when we got eight inches of snow and a low of 11° F on the 18th and 10° F on the 19th. The smaller plant, now five years old, already has a green fan growing out.

Notice

The Palm Beach Chapter will hold a plant sale on Saturday, October 7, 1978, beginning at 10 a. m. at the Mounts Agricultural Center, 531 N. Military Trail, West Palm Beach.

CULINARY NOTES

The following recipe may be of interest to Palm Society members who have fruiting plants of *Arenga pinnata* available to them. It comes from Mrs. Ligaya Capin, a student at the College of Home Economics, Central Mindanao University, Musuan, Bukidnon 8213, Philippine Islands, via Mr. Kermit H. Adams and Professor Norma R. Montemayor, who has given permission to publish it.

KA-ONG PRESERVES

Ingredients: 1 cup of sugar and ½ cup of water per cup (about 23 pieces) of young *ka-ong* nuts (*Arenga pinnata*).

Put *ka-ong* nuts in a large kettle with enough water to cover the nuts, boil for 20 minutes, then rinse with cold water. Repeat this procedure three times, then pound the nuts individually to get out the edible portion (the white gummy part inside the shell). Soak this edible portion in rice washing overnight and rinse thorouphly with tap water. If rice washing is not available, substitute a mixture of 1 tablespoon vinegar (4.5% acidity) to a cup of water or a mixture of 1 tablespoon flour to a cup of water.

Make a syrup of ½ cup sugar and ½ cup water per cup of *ka-ong* nuts, bring to a boil, add the *ka-ong*, and boil for approximately ten minutes—the *ka-ong* should not become mushy. Then soak the *ka-ong* in the syrup overnight.

After soaking, drain the syrup from the *ka-ong*, add the second ½ cup of sugar per cup of *ka-ong* to the syrup, bringing this to a boil, then return the *ka-ong* and simmer until the syrup is thick.

Pack in sterilized jars immediately, seeing to it that the *ka-ong* is completely covered with syrup, and seal at once.

Principes, 22(3), 1978, pp. 99–106

Observations on Diameters of Vessels in Stems of Palms

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Abstract

Diameters of the wide vessels of metaxylem were measured in axial bundles in the central part of the stem of 166 species of palms. Relative to the diameter of the stem and the diameter of the petiolar vessels, the vessels in the stem tend to be widest in the lianoid species, narrowest in the rhizomatous species, and intermediate in the erect-stemmed species. Among the erect-stemmed palms within the various taxonomic groups, the most slender species have the narrowest vessels. Diameter of vessels is not generally related to form of perforation plates except that the small, slender species with erect stems tend to have the narrowest vessels and the most primitive perforation plates within their respective major groups.

Introduction

Vessels are the principal conduits of water in palms.[2] The physical dimensions of vessels are significant regarding the physiological characteristics of water conduction (Zimmermann, 1978). This paper presents observations on the diameters of the wide[3] vessels of metaxylem in the stems of palms (Fig. 1). The data originally composed part of a larger study on the form of vessel elements in palms (Klotz, 1977). Tomlinson (1961, unpublished data) and Mahabalé (1959) have also produced data on diameters of vessels in stems of palms, but they did not sample as many species or examine the data in the same way as does the present study.

Materials and Methods

Diameters of vessels were measured in stems of 166 species of palms representing all but one of the major taxonomic groups (Moore, 1973).[4] A piece from one stem constituted the sample in most of the species. The measurements were obtained from transverse sections made with razor blades or a sliding microtome. The sample was taken within the central one-third of the diameter of the stem except in a few species in which only the peripheral two-thirds of the stem were available for study. These specimens were sampled as near to the interior of the stem as possible, for the diameter of the vessels decreases toward the periphery of the stem (P. B. Tomlinson, unpublished data). The position of the sample along the length of the stem was usually not known, but the middle of the length

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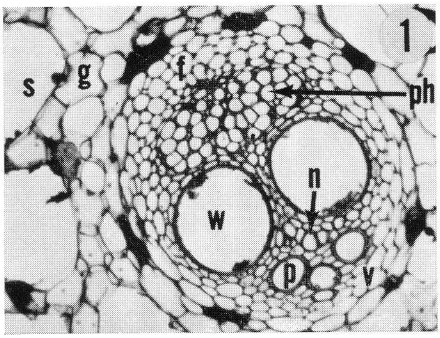
[1] Present addess: Harvard Forest, Petersham, Massachusetts 01366. Partial support for this and a previous study (*Principes* 22: 64–69) came from Hatch Project #407 at Cornell University. The author is grateful to Drs. M. V. Parthasarathy, H. E. Moore, Jr., N. W. Uhl, and M. H. Zimmermann for reviewing the manuscript.

[2] One species (*Ammandra decasperma*) possibly has only tracheids in its rhizomatous stem but is nevertheless included in the present tabulations.

[3] In the vascular bundles of palm stems, one or more vessels of the metaxylem are markedly wider than the other tracheary elements (Fig. 1). The former are here termed "wide" and the latter, "narrow."

[4] A list of the species examined is available with author citations and collection data (Klotz, 1977). Stems of the borassoid major group were not available at the time of the study.



1. Vascular bundle from central part of stem of *Mauritiella pacifica.* Two wide vessels in metaxylem. Debris adhering to their walls possibly remnants of their protoplasts. × 52. Explanation of details: *f*, fibers; *g*, ground parenchyma; *n*, narrow tracheary elements of metaxylem; *p*, tracheary element of protoxylem; *ph*, phloem; *s*, intercellular space; *v*, parenchyma of vascular bundle; *w*, wide vessel of metaxylem.

was selected where possible.[5] The range of the diameters of the vessels in each species was based on 10 or more wide vessels from the sample of the stem. The choice of the vessels to be included in these ranges was necessarily somewhat subjective. Only vascular bundles of comparable form and size were considered—i.e., the large axial bundles

[5] The diameter of vessels can vary along the length of the stem, but no consistent pattern of variation has been observed (L. H. Klotz, unpublished data; P. B. Tomlinson, unpublished data). However, in the larger palms examined, the vessels tend to be wider toward the middle of the stem than toward the basal or apical ends.

(Zimmermann and Tomlinson, 1974). The measurements include the thickness of the cell wall and were made to the nearest 0.01 mm across the maximum diameter of the wide vessels, which usually are approximately circular in transverse section. The ranges of the samples varied from 0.02 to 0.16 mm. The mean of the ranges was 0.06 mm, with a standard deviation of 0.03 mm. The midpoints of the ranges constitute the data in this paper and are intended to indicate collectively the general trends of diameters of vessels in palms rather than to represent valid estimates of the characteristic diameters of vessels for individual species.[6, 7]

Results and Discussion

Diameters of the wide vessels of metaxylem in stems of palms show relationships with the habit of the species. Scatter diagrams of diameter of vessels plotted against diameter of stems show that most of the lianas have wider vessels relative to the diameter of the stem than are found in the other habit categories

[6] The midpoint differed from the mean on the average of 0.005 mm in samples of wide vessels from various organs where a mean of 10 or more measurements was obtained (Klotz, 1977).

[7] Klotz (1977) examined different collections of two of the same species investigated by Mahabalé (1959) and 10 of those investigated by Tomlinson (1961, unpublished data). The data of Klotz (1977) agree to the nearest 0.1 mm with those of the other authors.

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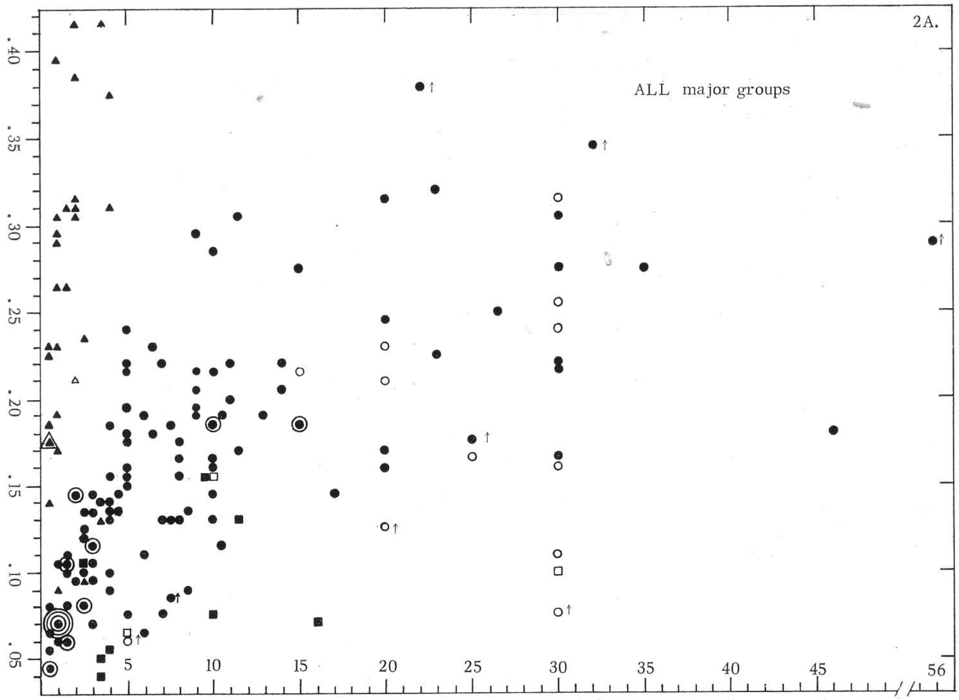
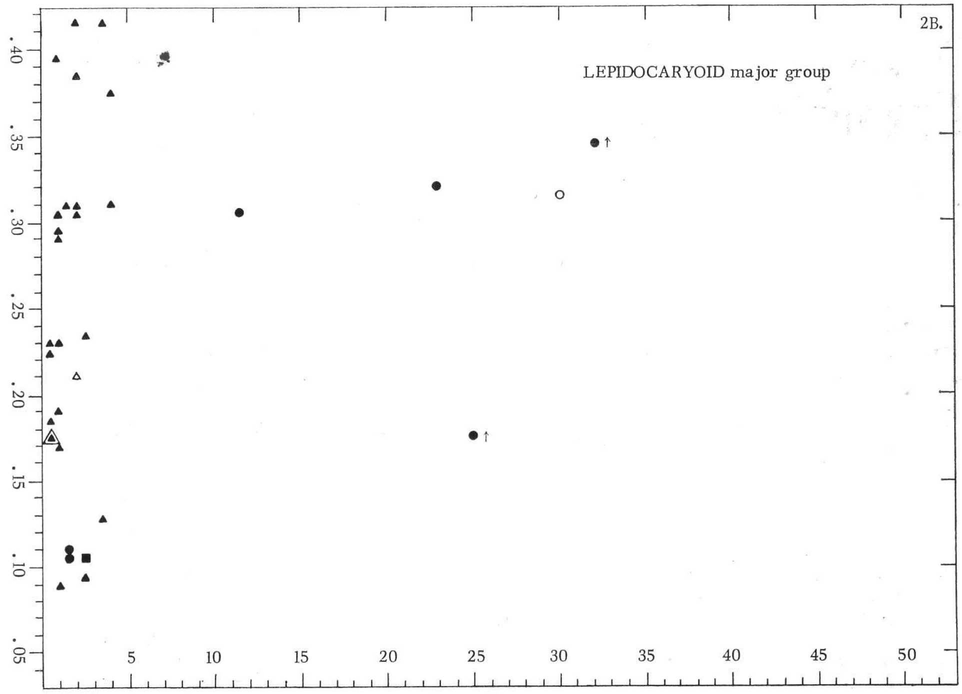
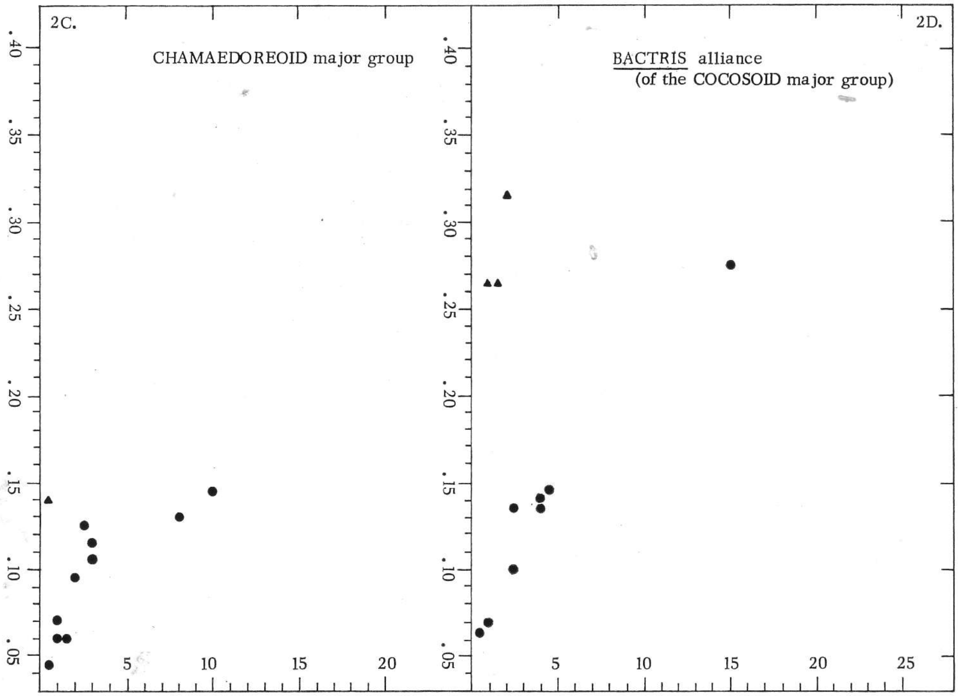
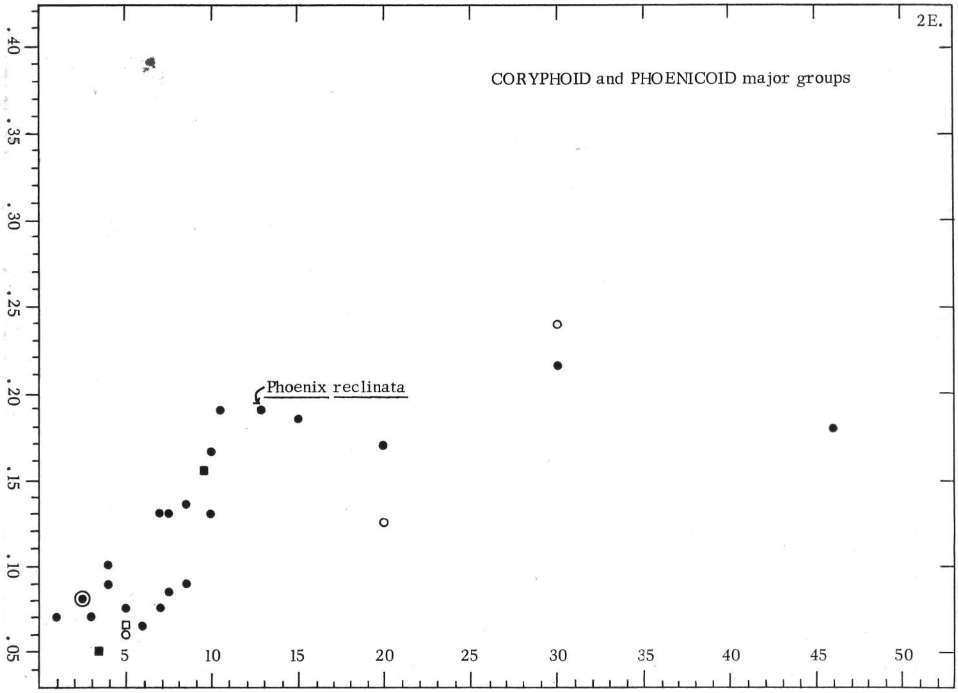
2A–2H. Diameters of wide vessels of metaxylem: Midpoints of ranges (in millimeters) on vertical axis plotted against respective diameters of stems (in centimeters) on horizontal axis. Circles = erect stems. Triangles = scandent stems (lianas). Squares = rhizomatous stems. Concentric circles and triangles = two (in one case, four) coincident points on the chart. Solid markers (and open markers which are concentric with solid markers) = specimens for which the diameter of the stem could be measured. Single, open markers = specimens for which the diameter of the stem had to be estimated. Small arrows to right of circles = specimens taken within the peripheral two-thirds of the diameter of the stem (rather than within the central one-third of the diameter); the midpoints might have been slightly higher if the central part of the stem had been used.


2A.
ALL major groups
.40
.35
.30
.25
.20
.15
.10
.05
5
10
15
20
25
30
35
40
45
56


2B.
LEPIDOCARYOID major group
.40
.35
.30
.25
.20
.15
.10
.05
5
10
15
20
25
30
35
40
45
50


2C.
CHAMAEDOREOID major group
.40
.35
.30
.25
.20
.15
.10
.05
5
10
15
20
2D.
BACTRIS alliance
(of the COCOSOID major group)
.40
.35
.30
.25
.20
.15
.10
.05
5
10
15
20
25


2E.
CORYPHOID and PHOENICOID major groups
Phoenix reclinata
.40
.35
.30
.25
.20
.15
.10
.05
5
10
15
20
25
30
35
40
45
50

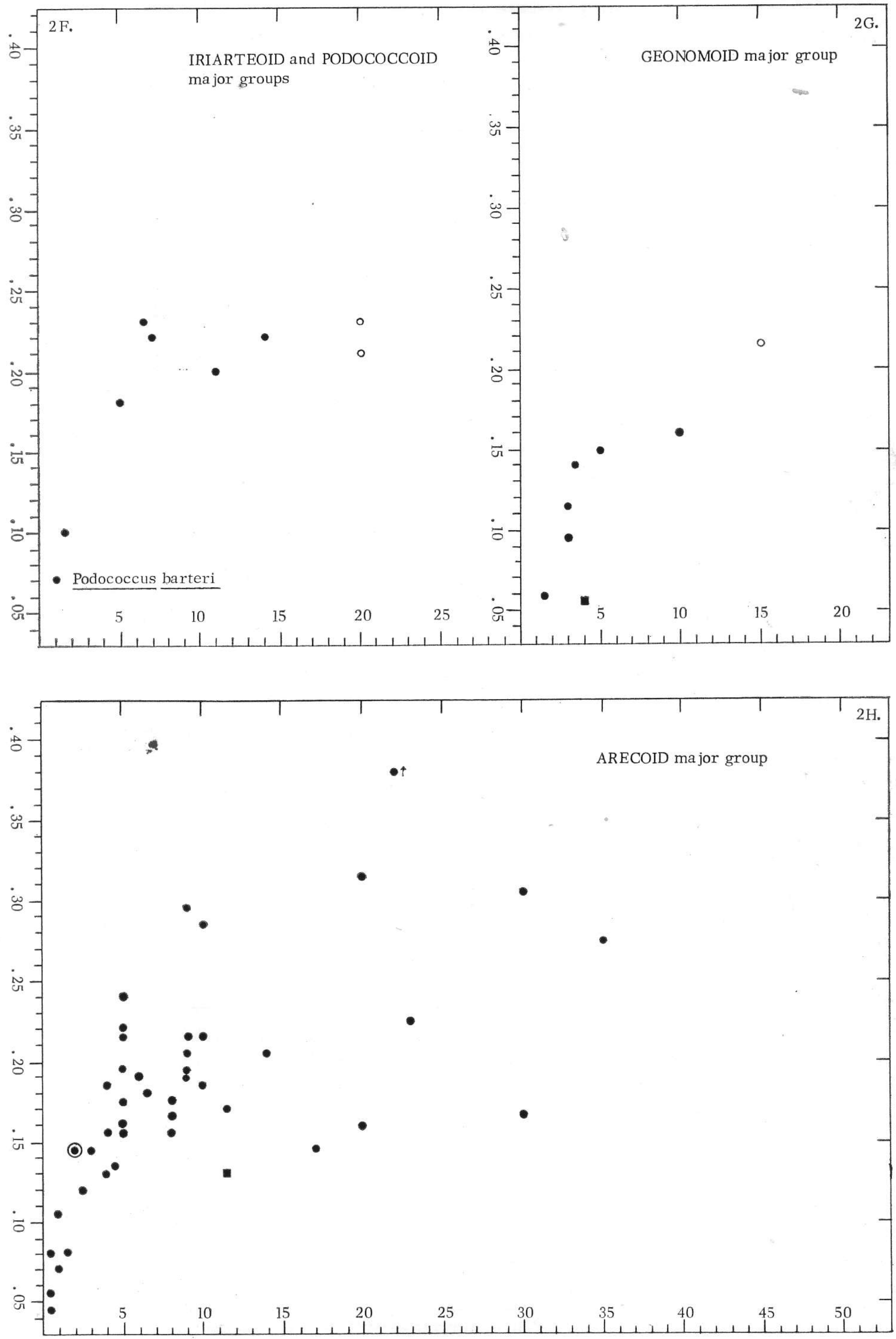

2F.
IRIARTEOID and PODOCOCCOID major groups
Podococcus barteri
2G.
GEONOMOID major group
2H.
ARECOID major group

Table 1. Diameters of wide vessels of metaxylem in stems: Total ranges of measurements and means of sample range midpoints for the three categories of habit

Habit	Number of species	Total range of vessel diameters (mm)	Mean of range midpoints (mm)
Erect	127	.04–.45	.16
Scandent	28	.07–.46	.25
Rhizomatous	11	.03–.18	.09

(Fig. 2A–2D). The diameters of the vessels in stems of the erect-stemmed and lianoid species are similar in range, but the lianas have a higher average value (Table 1). Dicotyledonous lianas also have relatively wide vessels (Carlquist, 1975). The rhizomatous species of palms have relatively narrow vessels for the diameter of the stem, although there is overlap with some of the erect-stemmed species in this regard (Fig. 2A, B, E, G, H). Diameters of the vessels in the stems of the rhizomatous palms are lower in both range and average than in the other two categories (Table 1). The above trends of diameters of vessels in stems of palms relative to habit of the species agree with Tomlinson's (1961) observations in palms and Carlquist's (1975) predictions for monocotyledons in general.

The trends in diameters of vessels among the three habit categories are also reflected in the comparison of diameters of vessels between petiole and stem (Table 2). In species with both organs from the same collection, the petiolar vessels are more uniform in average diameter than are those of the stem among the three habit categories. Vessels from stems of the erect-stemmed and lianoid species are generally wider than the corresponding petiolar vessels, but the converse relationship occurs in the rhizomatous species. The average difference in diameter of vessels between

Table 2. Diameters of wide vessels of metaxylem: Comparisons of midpoints of the ranges for petiole (p) and central part of stem (s). In the species considered, both organs are from the same collection. All measurements are in millimeters

Habit	Number of species	Range of p	Range of s	Mean of p	Mean of s
Erect	81	.04–.34	.05–.32	.12	.16
Scandent	16	.08–.22	.13–.42	.15	.28
Rhizomatous	8	.05–.18	.04–.16	.12	.09

Habit	Range of (p–s)	Mean of (p–s)	Species with p < s	Species with p = s	Species with p > s
Erect	–.15–+.03	–.04	72 (89%)	2 (3%)	7 (9%)
Scandent	–.25–+.05*	–.14	15 (94%)		1* (6%)
Rhizomatous	+.01–+.07	+.03			8(100%)

* This specimen (*Ancistrophyllum secundiflorum*) is unusual within this sample of lianas. For the other 15 lianas, the high end point of the range of (p–s) is –.03 mm.

stem and petiole is greater in lianas than in the erect-stemmed palms.

Figures 2B to 2H suggest that for the erect-stemmed species, the diameter of the vessels may be positively correlated with the diameter of the stems (up to a certain diameter of stem) within some of the taxonomic groups of palms. At least, the narrower vessels in the groups tend to occur in the most slender species. For example, most of the chamaedoreoid palms are very slender, and all of them have narrow vessels in the stem; but the stout *Hyophorbe* species (the two widest stems in Fig. 2C) have some of the wider vessels in this major group. When all of the species are plotted together (Fig. 2A), the points appear more widely scattered and this relationship is less clear. This situation indicates that the relationship between diameter of stems and diameter of vessels is not simple, for the sample of stems is heterogeneous in various factors that were not considered —for example, number of vascular bundles per unit cross-sectional area of stem, number of wide vessels per vascular bundle, form of the perforation plates, and perhaps other anatomical or physiological aspects of the water-conducting system of the plant.

The lepidocaryoid major group (Fig. 2B) contains the widest vessels in the stems among all the groups of palms. Maximum diameters of over 0.4 mm were observed in four species of the lianas. (In stems of the other major groups of palms, maximum diameters of over 0.4 mm were observed only in *Roystonea oleracea* of the arecoid major group.) Vessels in the stems of the lepidocaryoid lianas have a higher average and range of diameters than in the other habit categories, but some of the lepidocaryoid trees also contain remarkably wide vessels.

The diameter of vessels in stems of palms does not show a consistent relationship to the form of the perforation plates except that the small, slender species with erect stems tend to have the narrowest vessels and the most primitive perforation plates within their respective major groups (Klotz, 1977, 1978). This trend for palms compares with Carlquist's (1975) observation in the secondary xylem of dicotyledons that the primitive vessel elements (i.e., those with scalariform perforation plates) tend to be narrower than vessel elements in dicotyledons as a whole. In contrast, the general lack of correspondence of diameter of vessels with form of perforation plates in palms agrees with Cheadle's (1943) conclusion that in monocotyledons there is "no readily available evidence . . . to indicate that the diameter of vessels increases (or decreases) during specialization as measured by other characteristics." For example, the cocosoid lianas (*Desmoncus* spp.) and the lepidocaryoid lianas (e.g., *Calamus* spp.) tend to have wide vessels (Fig. 2B, D), but the two groups differ markedly in the form of their perforation plates, which are scalariform in *Desmoncus* but simple in the lepidocaryoid lianas (Klotz, 1977, 1978).

Carlquist (1975) noted in the secondary xylem of dicotyledons that "relatively few vessels with scalariform perforation plates are exceptionally wide." This generalization may also apply to the primary xylem of palms. The frequency distribution of diameters of vessels in stems of palms is skewed toward the narrower diameters (Klotz, 1977); and, as mentioned above, the slender species of erect-stemmed palms tend to have the narrowest vessels and most primitive perforation plates within their respective major groups. However, the converse of this generalization is not true in palms, for many of the wider vessels in the stems of palms have scalariform perforation plates—for example, in some of the arborescent species of the lepidocaryoid and arecoid major groups and in the scandent genus *Desmoncus* of the cocosoid major group.

Further investigation of the significance of vessel diameters in palm stems should consider the characteristic maximum height of the species. The height to which water can be transported adequately in a palm depends on the conductive efficiency of the vessels, a property that is determined largely by their diameter—i.e., wide vessels are much more efficient than narrow vessels (Zimmermann, 1978). Although data on height of stems were not obtained for this study, the author's impression is that the very slender palms with erect stems (mostly species of forest understory) are generally shorter than the species with wider stems. This study has shown that the most slender species have the narrowest vessels. Thus, the narrowest vessels in stems of palms occur among the shorter species. On the other hand, the widest vessels in stems of palms occur in the group containing the species with the longest stems—i.e., the lepidocaryoid lianas, of which some species reach a length of over 100 meters (Moore, 1973, personal communication). Stems of many lianoid palms attain much greater lengths and have markedly wider vessels than stems of the erect-stemmed species of comparable diameter. The relatively narrow vessels of the stems of rhizomatous palms are adequately efficient in conduction because the vertical distance of water transport is slight and because the horizontal (or axial) distance is reduced by the presence of adventitious roots near the leafy crown.

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Principes, 22(3), 1978, pp. 107–109

Palm Fruits in the Diet of the Oilbird, *Steatornis caripensis*

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British Museum (Natural History), Tring, Hertfordshire, England

The oilbird, *Steatornis caripensis*, subsists entirely on fruit. It forages for this fruit by night and during the day it roosts in caves where it also breeds. It plucks and swallows the fruit whole, digests the edible pericarp, and regurgitates the seed intact. Many, probably most, of the seeds are regurgitated in the caves, where they may accumulate into deposits many feet thick.

We have studied the oilbird's diet in Trinidad, W.I., from 1957–1961 (Snow, 1962) and visited the Caripe cave in Venezuela in 1976 and the Los Tayos cave of eastern Ecuador (3°6′ S, 78° 12′ W) in July, 1976.

The fate of seeds taken by oilbirds into caves depends on the nature of the cave. In Trinidad all the seeds taken into two sea caves must be lost, as are the seeds taken into the inland dry limestone caves. But a small proportion of seeds taken into limestone caves with streams may be washed out again and so dispersed.

In Trinidad the main study of the oilbird's food was made at a small colony in the Arima valley in the Northern Range between April, 1957, and September, 1961. Here catching trays were erected below four nest sites that are also roosting perches. The trays were emptied weekly and collected a total of 112,717 seeds, of which 58,176 were palm seeds. The species concerned, and their proportions of the total palm seeds, were: *Euterpe langloisii* Burret 78%, *Bactris cuesa* Crueger ex Griseb. & H. Wendl. 11%, *Jessenia oligocarpa* Griseb. & H. Wendl. 8%, and less than 1% each of *Livistona chinensis* (Jacq.) R. Br. ex Mart. (introduced), *Roystonea oleracea* (Jacq.) Cook and *Geonoma vaga* Griseb. & H. Wendl. There were also small numbers of another *Bactris* species, a *Desmoncus* sp., and an *Aiphanes* sp. In addition, there were 660 unripe *Bactris*-type fruits, regurgitated whole. These fruits were small and soft, without a seed.

Euterpe langloisii had no clearly defined fruiting season and was present in every sample. *Jessenia oligocarpa* was also always present, in much smaller numbers than *Euterpe*, except for one period from January to March, 1960, when it completely failed. A few *Roystonea oleracea* were found in the samples in all months of the year. *Bactris cuesa* on the other hand was seasonal with a fruiting peak from June to September except in 1958 when the peak extended from July to November. Eighteen seed samples taken in seven different months from the four other occupied oilbird caves in Trinidad showed the same palm species represented in approximtaely similar proportions.

During a three-day visit in May, 1976, to the Caripe oilbird cave of Venezuela, freshly regurgitated seeds of *Euterpe* and *Jessenia* were collected, identical in appearance to the seeds of *Euterpe langloisii* and *Jessenia oligocarpa* from Trinidad. Since this visit Dr. B. Tannenbaum has collected seeds of *Bactris* and *Roystonea* that again appear identical to the seeds of *Bactris cuesa* and *Roystonea oleracea* of Trinidad.

Information on the diet of the oilbirds inhabiting the Los Tayos caves of eastern Ecuador at 550 m was collected during three visits in the second half of July, 1976.

A random sample of 460 seeds from the top foot of seed deposits showed 34% to be palm seeds; as palm seeds are the most indestructible of those deposited by the oilbirds, the true figure is probably slightly lower than this. The total of 149 palm seeds was made up of 55% *Socratea* sp., 30% *Euterpe* sp., *Morenia caudata* 8%, and *Jessenia bataua* 7%. On the three visits 428 freshly regurgitated seeds were collected of which 89% were palms, almost entirely *Euterpe* although the other three species of palm were also represented. A small seed sample collected from the Yaupi oilbird caves 33 km E.N.E. of the Los Tayos caves, at an altitude of approximately 290 m, included all the same palm species found at the Los Tayos caves.

The total consumption of palm fruits by oilbirds must be considerable. A single night's consumption by a nestling oilbird ranges from 20 fruits when 30 days old to 86 when 56 days old, which represents one-third to one-quarter of their body weights. An adult bird, which weighs less than a 56-day-old young, probably takes in the region of 50 fruits per night throughout the year, of which 15 to 25 will on average be palm fruits. The oilbird population of the Los Tayos caves was estimated as 2,000, that of Caripe as up to 20,000, and the total oilbird population in Trinidad was estimated at 1,460 birds, so millions of palm seeds are taken in a year by just these colonies. While most of the seeds will die in the caves, some will be washed out by streams and some regurgitated by adult oilbirds during a night's foraging. An example of this was seen beneath a *Dacryodes* sp. (Burseraceae) tree half a mile from the Los Tayos caves where a number of *Jessenia bataua* seeds were found germinating. The seeds of *Dacryodes* outnumbered all other seeds in the caves and there was little doubt that the *Jessenia* had been brought by the oilbirds to this rather unsuitable dry ridge at 600 m.

The oilbird is likely to be both an effective short-range and long-range dispersal agent. In its nightly foraging it ranges up to 15 or even 30 miles. Occasionally vagrant oilbirds appear well outside their normal range. For instance a single first-year male has been trapped in Panamá, the nearest known colony being in western Colombia (Wetmore, 1968); and one was recently found near Quito (F. Ortiz, pers. comm.), again outside its normal range.

Besides palm fruits, oilbirds take all but a very small fraction of their fruits from two other families, the Lauraceae and Burseraceae. The fruits taken from these three families have several common characteristics: they all have firm nonsucculent pericarps enclosing a single seed and they are all sufficiently small for an oilbird to pluck and swallow the fruit whole. The pericarp of these fruits, besides being low in water content, is high in nutritive quality. Analysis of the dried pericarp of *Bactris cuesa* and *Jessenia oligocarpa*, respectively, showed the following composition: protein 13% and 5%, fat 39% and 26%, carbohydrates 48% and 69%. Four Lauraceae fruits and one Burseraceae fruit that have been analysed show a pericarp composition equally high in protein and fat.

The high nutritive quality of the fruits on which oilbirds and other frugivores feed is probably the result of coevolutionary interaction between the trees and their dispersal agents (Snow 1971). Probably fruiting seasons have also been affected by this interaction. Thus in Trinidad the fruiting seasons of 20 species of *Miconia* (Melastomaceae) are staggered throughout the year, so that some fruit is always available (Snow, 1965). It seems that as a result of competition between the different tree species for dispersal by frugivorous birds there is a selective advantage in fruiting at a time when as few other species as possible are in fruit. A similar situation was found in the ten species of Lauraceae on which oilbirds feed, but not in the palms. At least two palm species, *Jessenia oligocarpa* and *Euterpe langloisii*, produce fruit throughout the year. Their fruit ripens slowly over a period of months, and individual trees may have bunches of fruits at different stages of maturity. It would be interesting to make detailed studies of fruiting seasons of other kinds of palms whose fruits are eaten by birds, to see whether there are any cases of staggered fruiting seasons among congeneric species. In trees that have prolonged flowering and fruiting seasons, extending over most of the year, species-formation should be less easily achieved than in trees with short flowering and fruiting seasons, as overlapping flowering seasons will inhibit reproductive isolation. It may be significant in this connection that, unlike the Lauraceae, the main palm species on which oilbirds feed are not closely related but are all in different genera.

Acknowledgment

We should like to thank Dr. H. E. Moore, Jr. for the identification of palm species and for criticism of this manuscript.

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(*Continued from page 93*)

the amount of fertilizer he needs, and has reduced his watering. It also makes a wonderful bed in which fallen seeds germinate.

After a delightful lunch outdoors at a dockside restaurant, we went to see the extraordinarily large palm collection of longtime member Randy Fuller. If he can get it he has it! He has a wonderful collection of antique cars too, especially Franklins, so we had much to enjoy there. New member John Henning has a rapidly growing collection, with help and guidance from Randy Fuller. In fact, Randy is responsible for quite a few new members in the Naples area, as is Hank Taylor. Hank was our guide in Naples.

Some members then went on to Sarasota to spend the night and meet next morning at the home of Dr. and Mrs. Byron Besse to admire their delightful location, planted with both palms and a large cycad collection. Libby Besse then took the group to the Marie Selby Botanical Garden, small in physical size but large in collection of epiphytes, in which they specialize. Their display house is a fascinating place. They have some smaller palms, like *Reinhardtia*, that enjoy the warm, humid atmosphere provided for the orchids, gesneriads, and even a pitcher plant.

TEDDIE BUHLER

PALM BRIEFS

Fly and Drive for Mexican Palms

Nothing is more irresistible to me than a new road that opens up a huge area of West Coast Mexico that had been inaccessible. During the Christmas holiday of 1975, I decided to fly to Guadalajara, rent a car, and make a loop trip via Tepic, Puerto Vallarta, Manzanillo, and back to Guadalajara. For forests of wild palms, tropical beaches, spectacular mountains, oak forests, and a variety of plant communities, I have seen nothing to equal the beauty of this four-day trip. With a few extra days for leisurely exploring it would have been fabulous. I had made reservations for the plane and car, but not for rooms, so I slept in the car. Not recommended, so plan ahead.

Guadalajara north to Tepic is along the West Coast highway and a delightful, though long, day's drive. The fertile plain surrounding the town of Tequila has been converted from maguey to sugar cane as far as the eye can see and a lovely crop to view. Magdalena is famous for opals, including some rare lavender beauties that can be bargained for in local cafes. Plan de Barrancas is the start of the descent into a huge barranca and it is interesting to note the change in vegetation and temperature as one descends. Before reaching Tepic the road passes through a recent lava flow. Stop a moment here to look at the plants that are growing in the lava. There are few adequate motels in Tepic. It was very cold here at night, and no heat or hot water. It was amazing to see the palms and lush tropical plants under cultivation in the motel grounds.

Tepic to Puerto Vallarta is an easy day's drive over a good new road. Unfortunately, there are no shoulders so it is very difficult to find a safe place to pull off the road to investigate a great variety of strange and lovely flowering plants along the road. After leaving Compostela and crossing the ridge of the Sierra, the first wild palms come into view. These are *Orbignya guacuyule*, and they grow in great forests near the sea. These palms are tall with stiff pinnate fronds about 4 m long. They are a beautiful palm related to the coconut and easily recognized by dead fronds hanging down the side of a clean greyish trunk with no crownshaft. Occasionally we saw *Sabal rosei*, which was always growing alone, almost always in association with a strangler fig. These were of medium height and with dark green, very costapalmate leaves. None were in fruit. Once in awhile we would see *Acrocomia mexicana*, a very pretty palm with its slightly greyish feathery fronds. These were usually growing in twos and looked as if they might have been planted around some of the homes. Where the road meets the sea there is

1. *Orbignya guacuyule* north of Manzanillo, Mexico.

a wonderful lagoon worth a stop. Here we saw over 30 species of land, sea, and water birds in just a few minutes. If you are planning on going south from Puerto Vallarta, the next day fill up with gas, as the only station is in the northern part of town. You may want to make Puerto Vallarta your base, as it has a big jet airport and most of the really wonderful palm sites are just to the north and to the south.

Puerto Vallarta to Manzanillo is over a brand new excellent road. A few words of warning. Get an early start and have a full tank of gas and watch your time as there is little traffic on the road and it is said to be very dangerous at night due to robbers. In spite of other articles to the contrary, there are no reliable places to stay or to get gas or food. We know, as we ran out of gas and had to get Club Med to sell us some—no mean achievement. One of the most interesting parts of the trip is a great mountain chasm about an hour to the south of Puerto Vallarta. Here we saw a forest of *Cryosophila nana*, a fan palm growing as an understory palm in a dry deciduous forest. It was a rather scruffy looking palm with few fronds and few leaves. It was thin-trunked, about 3–4 m tall with long petioles, and was not in flower. It was above the road cliffs and hard to see. Worth the whole trip was the forest of *Orbignya guacuyule* near Melenque, just north of Manzanillo. Some of these huge specimens reached 50–70 m and resembled the *Ceroxylon* that I had seen in the Andes of Columbia on the Palm Society trip the year before. All were in heavy green to greenish-orange fruit with about 200 fruit in a bunch and each fruit about the size of the fruit of the peach palm, *Bactris gasipaes*. Some of the trees seemed to be in bad shape as if they had lethal yellowing and a Mexican we spoke to remarked upon this condition. Juvenile specimens were abundant and the leaves are used locally for thatch.

Melenque to Guadalajara is over a tortuous old mountain road. We were very glad there was no fog and that our car was small. We left the sea and drove through lovely fields of sugar cane and then began the three hours of climbing the sierra. Just over the summit was an extensive oak forest. On the high plains we stopped for lunch in the pleasant town of Autlan and enjoyed our lunch overlooking a plaza lined with large *Ficus* and streets lined with old *Arecastrum romanzoffianum*. The rest of the drive to Guadalajara is across the lovely high plateau. An alternate route from Manzanillo to Guadalajara passes south along the sea and a lagoon beside great coconut plantations. When the road leaves the sea and turns east, it passes through the town of Colima at the foot of this still active volcano.

Whatever route you follow it will be a trip to remember for the beauty and wildness of the land and palms.

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NOTES ON CULTURE

Windmill Palm Survives Winter of 1976 in Maryland Garden

The windmill palm, *Trachycarpus fortunei*, has proved remarkably hardy as documented by its survival in the garden of Mr. Harry U. Winters of Hagerstown, Maryland.

Mr. Winters planted a small windmill palm less than one foot high in the spring of 1970. To give it the best possible chance for survival, he located it on the southeast side of his home on a slight hill that would provide protection from wind and allow for cold air drain-

1. *Trachycarpus fortunei* in garden of Mr. Harry Winters, Hagerstown, Maryland.

age. In the following winters he erected a plastic-covered wood frame around the palm, which covered it much like a small greenhouse. As weather moderated in the spring, he would remove this cover for the next season's growth.

Hagerstown is located on the colder edge of Zone 7a of the U.S.D.A. Plant Hardiness Zone Map with an average minimum dropping to or below 0° F. The winter of 1976, however, proved a real test for the palm when, on January 17, the temperature dropped to 8° below zero and remained below the freezing mark for several days. The palm was completely defoliated at those temperatures and appeared lifeless until spring.

The leaf bud apparently was undamaged, because the tree began to shoot forth first one badly burned leaf, then another, and another, until the palm at this writing (November, 1977) sports 19 fronds. The accompanying photograph shows a complete recovery from last winter's cold. The palm measures 36 inches around the trunk, is seven feet tall, with fronds three feet long and over three feet wide.

I believe the crucial factor in the palm's survival was the protection provided by the frame, which protected the leaf bud from cold and wetness. Similar individuals in the milder metropolitan area of Washington, D. C., appear dead or nearly so.

Those society members who live in marginal palm-growing areas may be motivated to experiment as did Mr. Winters by using similar methods of protection on this and other palms.

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WHAT'S IN A NAME?

Alloschmidia (ál oh schmíd ee a) is a combination of the Greek prefix *allo-* (other, another) and the surname of M. Maurice Schmid, a French botanist who worked in New Caledonia for a number of years. *Schmidia* Wight, named after Bernard Schmid, precludes the use of the name again, hence the prefix.

Asterogyne (ass tér oh jý nee) was published without explanation of the name, which combines the Greek word for star (*aster*) with the word for woman or female (*gyne*). It is likely that the name was suggested by the pattern of the corolla in the pistillate flower. The corolla lobes were described as recurved and imbricate in a starlike fashion.

Balaka (ba lá ka) is the Fijian spelling of the vernacular name for plants of the genus, which is, however, pronounced mbalaka in Fijian, the letter b standing for the sound mb in English.

Calyptrogyne (ka líp tro jý nee), according to Hermann Wendland, takes its name from the Greek word for lid or cover (*kalyptra*) and the word for woman or female (*gyne*) because the upper part of the corolla in the pistillate flower is pushed off like a lid or cap.

Korthalsia (kor thâl see a) was named after Pieter Willem Korthals (1807–1892), a Dutch botanist and explorer in Indonesia from 1831 to 1837, who collected many palm specimens now in the herbarium at Leiden.

Lavoixia (lav wáh zee a) is named after M. Lucien Lavoix and his children who discovered the genus in 1965.

Liberbaileya (lée burr báy lee a) was taken from the name of Liberty Hyde Bailey (1858–1954), who studied and collected palms for many years, amassing one of the best herbarium collections of the family.

Mackeea (mack ée a) honors Dr. Hugh S. MacKee and his wife, Margaret E. MacKee, who have collected widely in New Caledonia and whose exemplary specimens, including the first of this genus, have contributed much to our understanding of the island's palms.

Maxburretia (máx boo rét ee a) was derived from the name of Karl Ewald Maximilian Burret (1883–1964) who, from about 1925 nearly to his death, worked on palms at the botanical museum in Berlin.

Oncosperma (ón ko spér ma) comes from the Greek *onkos* (bulk, mass, tumor) and *sperma* (seed). Blume apparently took the name because of a groove filled with spongy material on the base of the seed.

Pinanga (pih náng ga) is a latinization of the Malay word *pinang* used for several kinds of palms. Blume probably took the name from Rumphius, who used it in his pre-Linnaean book on plants of Amboina and adjacent regions, *Herbarium Amboinense*.

Tectiphiala (téck tee fie áh la) combines the Latin *tectus* (covered, concealed) and *phiala* (a broad, flat-bottomed drinking vessel) because of the shape of the bracts subtending the flower clusters and the manner in which they are at first covered by staminate buds.

Veillonia (vey óh nee a) takes its name from M. Jean-Marie Veillon, a New Caledonian botanist at O.R.S.T.O.M., who was a co-collector of the type specimen.

PALM LITERATURE

DRANSFIELD, J. 1977a. *Calamus caesius* and *Calamus trachycoleus* compared. Gard. Bull. Straits Settlem. 30: 75–78, fig. 1–2.

Calamus trachycoleus, cultivated in Borneo, differs from *C. caesius*, which it much resembles, in an important growth form that makes it superior as a plantation rattan.

———. 1977b. A dwarf *Livistona* (Palmae) from Borneo. Kew Bull. 31: 759–762, fig. 1–2.

The first dwarf species of *Livistona* is described as *L. exigua* from Brunei.

———. 1977c. The identity of "rotan manau" in the Malay Peninsula. Malaysian Forester 40: 197–199.

Calamus giganteus Becc. is shown to be identical with *C. manan* Miq., which may usually be distinguished from *C. tumidus* by its habitat as well as morphology. The vernacular name *rotan manau* applies to *C. manan*, an important source of furniture rattan.

———. 1977d. A note on the genus *Cornera* (Palmae: Lepidocaryoideae). Malaysian Forester 40: 200–202.

The genus *Cornera* is shown to be not distinct from *Calamus* and its three species are listed with their names in *Calamus*.

DRANSFIELD, J. 1978. The genus *Maxburretia* (Palmae). Gentes Herb. 11: 187–199, figs. 1–6.

Maxburretia is circumscribed to include *Liberbaileya.* Three species are treated: *M. rupicola*, *M. gracilis*, and a new species from Thailand, *M. furtadoana.*

LASSER, T., A. BRAUN, AND J. STEYERMARK. 1974. Catálogo de las plantas que crecen en el Jardin Botánico del Ministerio de Agricultura y Cria, Caracas. Acta Botanica Venezuelica 9: 9–61.

Pages 44–48 contain a listing of palms grown in the botanical garden in Caracas.

MOORE, H. E., JR. 1978a. The genus *Hyophorbe* (Palmae). Gentes Herb. 11: 212–245, figs. 1–19.

The five species of this genus are endemic to the Mascarene Islands, where they are rare or close to extinction in the wild state. All five are described and illustrated, including the first adequate description of *H. amaricaulis*, now known from one individual but long confused in horticulture with *H. lagenicaulis*.

MOORE, H. E., JR. 1978b. *Tectiphiala*, a new genus of Palmae from Mauritius. Gentes Herb. 11: 284–290, figs. 1–4.

A previously undescribed genus from Mauritius related to *Acanthophoenix* and other oncospermate palms is described with the single species *Tectiphiala ferox*.

MOORE, H. E., JR. 1978c. New genera and species of Palmae from New Caledonia. Gentes Herb. 11: 291–309, figs. 1–10.

A second species of *Chambeyronia*, *C. lepidota*, is described as new together with four new monotypic genera —*Alloschmidia glabrata*, *Lavoixia macrocarpa*, *Mackeea magnifica*, and *Veillonia alba.* All are arecoid palms and all are restricted to the northeastern part of the island.

UHL, N. W. 1978a. Floral anatomy of *Maxburretia* (Palmae). Gentes Herb. 11: 200–211, figs. 1–5.

The floral anatomy of the three species of *Maxburretia* is compared in a companion paper to that of Dransfield above. Details of anatomy support the new circumscription of the genus.

UHL, N. W. 1978b. Floral anatomy of the five species of *Hyophorbe* (Palmae). Gentes Herb. 11: 246–267, figs. 1–7.

———. 1978c. Leaf anatomy in the species of *Hyophorbe* (Palmae). Gentes Herb. 11: 268–283, figs. 1–5.

These two papers provide anatomical studies of all species in the small genus *Hyophorbe*, complementing the systematic study of Moore above.

UHL, N. W. AND H. E. MOORE, JR. 1977a. Correlations of inflorescence, flower structure, and floral anatomy with pollination in some palms. Biotropica 9: 170–190, figs. 1–8.

Pollination is compared in six genera of palms that exhibit different modes of wind and insect pollination and is related to the morphology and anatomy of flowers.

UHL, N. W. AND H. E. MOORE, JR. 1977b. Centrifugal stamen initiation in phytelephantoid palms. Amer. J. Bot. 64: 1152–1161, figs. 1–20.

An unusual centrifugal pattern of stamen development is demonstrated for *Palandra* and *Phytelephas* and by ex-

trapolation to *Ammandra.* These genera appear to be unique among the palms in this respect.

UHL, N. W. AND H. E. MOORE, JR. 1978. The structure of the acervulus, the flower cluster of chamaedoreoid palms. Amer. J. Bot. 65: 197–204, figs. 1–16.

The anatomy and development of the distinctive flower cluster known as an acervulus demonstrates that it is basically a cincinnus.

H. E. MOORE, JR.

NATURAL HISTORY NOTES

An Unusual Inflorescence in Elaeis guineensis

The African oil palm, *Elaeis guineensis* Jacq., is noteworthy for the occasional development of inflorescences that are intermediate in some degree between the usual staminate or pistillate inflorescences. One such was noted on a plant growing in the Botanical Garden of the Botany Department, University of Poona, Poona, India (Fig. 1). It has usual pistillate rachillae 4 inches long, ½ inch in diameter, with 8–14 flowers on each (Figs. 1, 2) throughout the inflorescence, but near the tip had several rachillae 3½ inches long, ½ inch in diameter that bore only staminate flowers (Fig. 3). Similar abnormal inflorescences were also observed on other plants of the species. Such an unusual situation apparently has not previously been illustrated in PRINCIPES.

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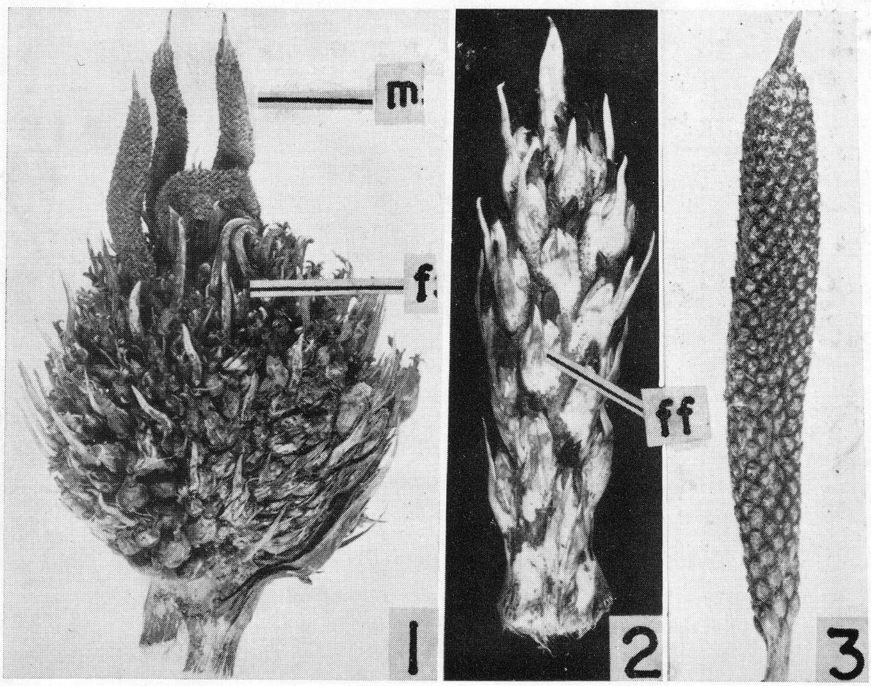

1–3. *Elaeis guineensis.* 1. An abnormal inflorescence bearing pistillate rachillae (f) in the basal part and four staminate rachillae (m) in the upper part. 2. A rachilla with pistillate flowers (ff). 3. A rachilla with staminate flowers.

PHOTO GALLERY

Jerry Keuper happily embraces the largest *Coccothrinax crinita* that Dent Smith has ever seen, here shown at Florida Institute of Technology in a newly dug hole not yet filled with soil. Photograph courtesy of Dent Smith.