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Contents for October

Cover Picture

A stand of Normanby palms (*Normanbya normanbyi*) on the banks of Wallaby Creek, about 20 miles south of Cooktown, Queensland, Australia. See page 154.

PRINCIPES

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Arenga Fruit as a Food for Gibbons

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Palm fruits have featured as minor food sources in the diets of all the gibbon species whose feeding ecology has been studied: siamang or *Hylobates syndactylus* (Chivers 1974, Raemaekers 1979), white-handed gibbon or *H. lar* (Ellefson 1974, Raemaekers 1977), agile gibbon or *H. agilis* (Gittins 1979), and Kloss gibbon or *H. klossii* (Whitten 1980). Each of these studies has recorded rattan fruits as gibbon foods (*Calamus scipionum*, *C.* spp., and *Daemonorops* sp.) but the palm tree *Arenga* (Caryotoidae) has only been recorded as a food for agile gibbons (Gittins 1979) and Kloss gibbons (Whitten 1980 and Fig. 1).

Methods

Between February 1976 and May 1978 I studied Kloss gibbons in a 200 ha study area in central Siberut, the most northerly of the four Mentawai Islands off the coast of West Sumatra, Indonesia (Fig. 2). I habituated a family group (BG4) comprising a male, female, and their juvenile to my presence and was able to collect detailed feeding and ranging data. In the latter half of the study these were shot by a local hunter and another group (BG10) having the same composition moved into their vacated home range.

Results

On Siberut, *Arenga obtusifolia* is found in the dry lowland and lower slopes of the hill dipterocarp forest types (Whitten 1980) where it can occur at densities of 60 stems of 6 m trunk height and above per ¼ ha. It is absent from swamps and *Dipterocarpus*-dominated ridgetop forests, but was found in forest types that comprised 62% of the habituated group's home range of 31 ha.

The leaf rachis of *A. obtusifolia* is sufficiently stout for a 5 kg gibbon to walk upon and this was generally the mode of entry. Sitting on an old infructescence, ripe rose-red fruit were selected from a ripening infructescence. Gibbons were observed to feed in ten trees of this species representing 4% of the total known food sources.

Of the 61 fruit that were picked by the male of BG4 over four feeding visits, 54 were picked by hand, 52 of them being eaten and two rejected for some reason or simply dropped. Five were picked by mouth when both hands were required to keep a stable position.

Between 2.0 and 3.6 fruit were processed each minute during the feeding visit, each fruit requiring about six biting movements to remove the pericarp before the seed and thin pulp were accessible. Even ripe fruit were extremely tough and I found that considerable effort was necessary to open one using a sharp jungle knife. The male used his long lower canines to remove the pericarp in a similar fashion to that employed by captive gibbons to open walnuts (pers. obs.).

1. A Kloss gibbon feeds on fruit of *Arenga obtusifolia*.

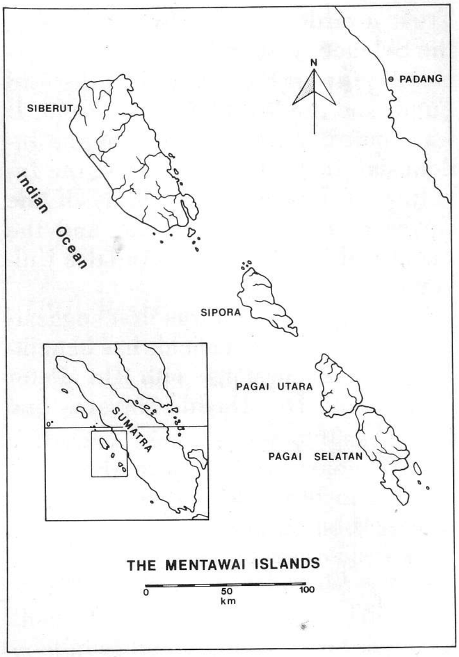
The most recorded feeding visits to a single *A. obtusifolia* tree was four with the first and last visits 112 days apart. As only 22 complete days of feeding records were achieved, these figures should be regarded as a minimum. Mature trees appeared to have infructescences of a wide range of ages (Fig. 1) and it is possible that some ripe fruit are available over a period of years.

Discussion

It is surprising that gibbons eat the fruit of *Arenga* because they contain oxalic acid (Burkill 1935). Furthermore Gimlette (1929 in Burkill 1935) records their use in Malaya as a poison to produce "dyspoena and restlessness from irritation of the mucous membranes and swelling of the mouth, fauces and parts which it touches."

Oxalic acid generally occurs in plants in the form of water-insoluble calcium oxalate (Palmer 1971), which exists as raphides or needle crystals. When eaten or touched these cause intense irritation. Oxalic acid can also occur in some fruit as water-soluble sodium oxalate, levels of which decrease on ripening as it is metabolized by oxidative decarboxylation (Wyman and Palmer 1964). If eaten, sodium oxalate preferentially absorbs calcium from the body forming insoluble, irritant calcium oxalate which affects the mouth, oesophagus and stomach. The decrease in body calcium levels may cause muscular spasms, renal failure, and death (Wade 1978).

Corner (in litt. 1979) reports that his tame pig-tailed macaque (*Macaca nemastrina*) ate the seemingly ripe fruit of a *Caryota* palm known also to contain oxalic acid (Burkill 1935). The monkey was unable to swallow and died after three weeks. Since no muscular spasms were observed it is likely that the active agent was the raphides of calcium oxalate.



2. Map of the Mentawai Islands off the coast of Sumatra. Copyright A. J. Whitten.

Although the form of oxalic acid in the fruit of *A. obtusifolia* is not known, it seems likely that it is the metabolizable sodium oxalate and that careful selection of ripe fruits avoids the possibility of harmful affects. It is interesting that only the male of BG4, the female of BG10 and the female of the habituated agile gibbon group studied by Gittins (pers. comm.) have ever been observed to eat *A. obtusifolia*. Whether this indicates individual differences in tolerance, that other gibbons actively avoided the fruit because of some previous harmful experience, or some other explanation is unknown.

Acknowledgments

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Trust awarded by the Royal Society, the Science Research Council, the Ernest Kleinwort Fund, the F.P. Bedford Fund, and the World Wildlife Fund. It was sponsored in Indonesia by the Indonesian Institute of Sciences, the Institute of Ecology, the Office of the Governor of West Sumatra, and the Faculty of Life Sciences, Andalas University.

This paper, which was first suggested by Dr. John Dransfield, has benefited from discussions with Dr. Peter Waterman, Dr. David Chivers, and Jane Whitten.

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Principes, 24(4), 1980, pp. 147–153

Reversal of Arenga pinnata Spadices into Vegetative Shoots and its Relevance to the Origin of Coconut Bulbils

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Abstract

Two branching *Arenga pinnata* palms standing close to each other in a forest area of Minahasa district of North Sulawesi Province (Indonesia) have aerial shoots (eight in one and six in the other) that have developed from modified inflorescences. There is one more palm growing near Manado that bears over 10 small branches. It is clear that decapitation of the main stem of *A. pinnata* before flowering caused the induction of vegetative shoots. The production of vegetative shoots in the coconut may usually be attributed to other causes. In very exceptional cases, inflorescences are transformed into vegetative shoots as a result of wounding of the stem, a phenomenon similar to that in *Arenga pinnata*.

Arenga pinnata (A. saccharifera) grows in the wild in most parts of Indonesia, particularly in Sulawesi Island (formerly Celebes). In many rural areas, the palm is put to considerable use. The massive spadices at a young stage are cut at the tip and the cut surface pared for the collection of *saguir*, which is a refreshing drink. Some people like it more when it becomes fermented, obviously because of the alcoholic content. Fresh sap is boiled down to obtain brown jaggery which is usually made into cakes in coconut shell molds. The young endosperm is also edible, but requires some treatment before it is palatable. The strong black leaf sheath fiber is used for thatching roofs of houses and compound walls, and also brushes and brooms are made out of them. The rest of the leaf and the stem have no special use.

Arenga pinnata has a single stem that ends in an inflorescence. Flower bunches are produced one after another from leaf axils in a descending order, the youngest and uppermost leaf bearing the bunch just younger than the terminal spadix. The palm continues to produce flower bunches for two to four years until the buds of almost all leaf axils bloom, and then the palm dies. The terminal and a few immediately younger spadices produce only female flowers which develop into fruits. In the next set of about five bunches, the male flowers gradually appear; two such flowers border a female flower. Simultaneously, the size of female flowers in younger bunches decreases. Many of the bunches where both female and male flowers appear also produce fruits. Subsequent bunches produce only paired male flowers and remain barren when the flowers are shed. There is no fixed season for flowering. Usually a palm five to eight years old can commence flowering. Aerial branching or suckering is extremely rare in this species. Two branching palms are briefly reported below.

The branching Arenga pinnata

At the entrance of the forest area about 8 km from Girian, Minahasa

1. A branching *Arenga pinnata* having eight ramifications. A boy stands at the apex of the decapitated trunk.

2. View of the crown of *Arenga pinnata* bearing six shoots.

district of North Sulawesi Province (Indonesia), there are numerous *Arenga pinnata* palms growing in the wild. Two of them standing 10 m from each other, bear aerial ramifications, one having eight shoots and the other bearing six branches. The first palm, whose main stem was severed some five years ago at a height of about 4 m from the ground, is shown in Figure 1. Likewise, the stem of the other branching palm was also damaged before it commenced flowering (Fig. 2). The cause for the chopping off of the stems is not known. No serious pest or disease is known to affect the *Arenga* palm either around Girian forest area or elsewhere in Indonesia. The eight offshoots of the first palm differ considerably in size, the uppermost one being the largest, measuring about 2 m from the base to the growing point (Fig. 3). The other shoots are progressively smaller from the tip of the severed trunk. None of the shoots had commenced flowering when I examined them in January 1979. The leaves of the offshoots appear lean and lanky partly due to the crowding of the offshoots and partly because the palm is canopied by forest trees including *Arenga* palms. The offshoots have developed from a length of the stem covering eight nodes and measuring 1.5 m. The foliar spiral of the main stem is right-handed.

The second palm is taller than the first and the stem was severed at a height of about 6 m. The youngest offshoot seen in Figure 4 should be about one year old as it has not yet formed a clear trunk. While the uppermost shoot still continues to grow, the next oldest one has ended in a spadix seen in Figure 4. Although it is the terminal bud so far as the offshoot is concerned, the spadix is devoid of any female flower. More spadices are likely to appear from this offshoot, and at least three other offshoots are likely to flower very soon.

A large number of palm species are clustering, as they produce many suckers from the underground portion of the stem. Such a branching may be regarded as basal axillary branching. In a few other genera like *Hyphaene*, aerial branching is the normal characteristic. Moreover, in *Hyphaene* and *Nypa*, dichotomy or actual forking of the apex has been reported (Tomlinson 1971). Among exceptional cases of branching, division of the apex and branching of the apex due to wounding is most common. According to Morris (1892), branching is the result of injury to the growing point as it happens with the wild date (*Phoenix sylvestris*) where the stem is injured for the extraction of a sweet sap. Lightning occasionally splits the growing point. A few of the palms that survive the shock emit branches. Diseases affecting the growing point may also induce the production of shoots in palms as reported in *Areca* palm by Sinclair (1889). Another instance reported by Quisumbing (1926) from the Philippines is the following. Two coconut crowns were burnt to eliminate rhinoceros beetle infestation. When new leaves appeared after some time, branches appeared on one of the trees. According to Evans (1966), production of seven branches in a *Phoenix roebelenii* recorded by him was the result of a deliberate act by a skilled plantsman. Davis (1962) induced the production of branches in coconut by artificially splitting the growing point of young shoots. Three such twins are reportedly bearing fruits in India.

There is yet another cause for the production of branches in palms. When the terminal bud of coconut is injured, there seems to be a tendency for the adjacent axillary buds that normally develop into spadices to develop

3. The various offshoots differ in height and size.

4. A spadix (s) arises from the apex of one of the offshoots in palm No. 2.

into vegetative shoots. This amounts to the transformation of lateral inflorescence buds into lateral vegetative branches following wounding of the apex. Quisumbing gives example for the phenomenon occurring in a coconut. The present case of branching in *Arenga pinnata* is another clear example for this. When the original stem was damaged and the axillary buds perhaps deprived of an adequate supply of hormones from the terminal leaves to stimulate the dormant axillary buds into flower bunches, they only developed into vegetative shoots to replace the damaged terminal stem. However, since the offshoots have full sets of leaves, some of their axillary buds are expected to grow into floral shoots capable of producing flowers. The presence of a terminal spadix in one such shoot has confirmed the hypothesis. The remaining shoots are also likely to start flowering.

Reversal of flowers and spadices into vegetative shoots in palms has been reported by many investigators. Such shoots are popularly known as bulbils. Recently we (Sudasrip et al. 1978) were able to layer some such bulbil-shoots from two coconut palms at Manado, and to transplant the rooted bulbils as independent palms. As demonstrated by the *Arenga pinnata* palms here reported, it is hoped that at least some of the bulbils will start producing flowers. Similar reversals have been reported in *Elaeis guineensis* (Davis 1959), *Borassus flabellifer* (Davis and Basu 1968) and in *Chrysalidocarpus lutescens* (Davis 1970).

One more *Arenga pinnata* palm producing many small vegetative shoots instead of flower bunches has been noticed at Mapanget village very close to Manado. Here again the transformation of lateral inflorescence buds to lateral vegetative branches followed wounding of the apex.

Acknowledgment

I thank Professor T. A. Davis, UNDP/FAO Coconut Agronomist attached to this Institute for help in the preparation of this article.

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Nurseries Offering Palms

In continuation of the column begun in April (p. 96), the following nursery offers seeds and seedlings of both native and introduced palms with minimum orders of 1,000 seeds per species and 5,000 collectively for seedlings.

Australia

Orchid Gems, 33 Ashgrove Ave., Ashgrove, Queensland 4060, Australia.

Principes, 24(4), 1980, pp. 154–161

Palms in Northeastern Australia II: Species from the Cooktown Area

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Approximately 30 species of palms occur naturally in mainland Australia. Most of these are found only in the moist, closed or "rain" forests of coastal Queensland and species diversity reaches a peak in the tropical closed forests of northeastern Queensland. In Australia the following genera are almost invariably associated with closed forests—*Archontophoenix, Arenga, Calamus, Hydriastele, Laccospadix, Licuala, Linospadix, Normanbya,* and *Ptychosperma.* Species of *Livistona* are more widespread, occurring coastally and in drier areas of eastern, northern, and western Australia; *Carpentaria* and *Gronophyllum* are endemic to the Northern Territory; and *Corypha* is represented in open forested areas of Northern Queensland. *Cocos nucifera* is confined to littoral areas of northeastern Australia and off-shore islands.

The closed forests of eastern Australia, where most of Australia's palms occur, have been the subject of extensive research and have been classified structurally and floristically (Webb 1959, 1968; Everist and Webb 1975). Their disjunct occurrence is shown in Figure 1. In northeastern Queensland (north of Townsville, 19°16′ 146°49′), extensive blocks of closed forest occur at Lockerbie, in the McIllwraith Range (including Iron Range), between Cooktown and Mossman, on the Atherton Tableland, and in the Mt. Spec area.

Species from one of these areas, Iron Range, where there is a high degree of palm diversity, have been described (Covacevich and Covacevich 1978). Thirteen species were recorded from the closed forests and open forests adjoining them at Iron Range.

Cooktown is a small, historically significant town 400 km south of Iron Range (Fig. 1). Within 50 km of Cooktown (Fig. 2), most of the palm species from Iron Range occur with several other species. More palm species (18) have been recorded close to Cooktown than in any other area in Australia. This represents an extremely diverse palm flora by Australian standards.

The study area (Fig. 2, Cooktown and surrounds within a radius of 50 km) supports varied vegetation types—complex notophyll vine forest of the northern part of the Mossman Cooktown "block," isolated pockets of riverine vine forest (along the McIvor and Endeavour Rivers), some semideciduous vine forest (Mt. Cook), and open sclerophyll forest and heaths (in the west and north). Palms recorded in this area are set out below, together with data on their occurrence in the study area and their Australian distribution. They are arranged alphabetically by genus and, within genera, by species.

Archontophoenix alexandrae (Fig. 3d). *Status:* very common. *Occurrence in study area:* Mossman–Mt Amos, Dowling Range closed forest; Endeavour River and McIvor systems. *Australian distribution:* Mackay, NE.Q.–Iron Range, NE.Q. *Notes:* always associated with swamps or drainage lines.

Arenga australasica (Fig. 4d). *Status:* only four trees known in area. *Occurrence in study area:* Mt Cook; Williams Creek, a tributary of the Endeavour River. *Australian distribution:* Tully, NE.Q.–Cooktown, NE.Q.; well known on near coastal islands. *Notes:* found in stony creek beds, sandy and red basalt soils.

Calamus australis (Fig. 3c). *Status:* very common. *Occurrence in study area:* Daintree Mt Amos, Dowling Range closed forest; Mt Cook. *Australian distribution:* Tully, NE.Q.–?Iron Range, NE.Q. *Notes:* found to about 1000 m frequently along tracks and in other clearings.

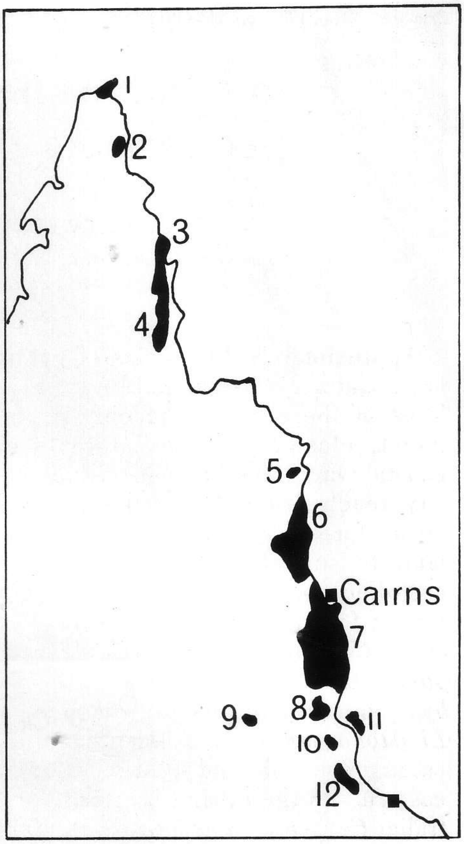
Calamus caryotoides. *Status:* common. *Occurrence in study area:* Daintree–Mt Amos, Dowling Range closed forest; Mt Cook. *Australian distribution:* Tully, NE.Q.–?Iron Range, NE.Q. *Notes:* found to about 1000 m.

Calamus amischus. *Status:* common. *Occurrence in study area:* Mossman–Mt Amos, Dowling Range closed forest. *Australian distribution:* Mossman, NE.Q.–Cooktown, NE.Q.

Calamus moti. *Status:* common. *Occurrence in study area:* Mossman–Mt Amos, Dowling Range closed forests. *Australian distribution:* Mossman, NE.Q.–Cooktown, NE.Q.

Calamus species (Fig. 6d). *Status:* common. *Occurrence in study area:* Mossman–Mt Amos, Dowling Range closed forests. *Australian distribution:* Mossman, NE.Q.–Cooktown, NE.Q.

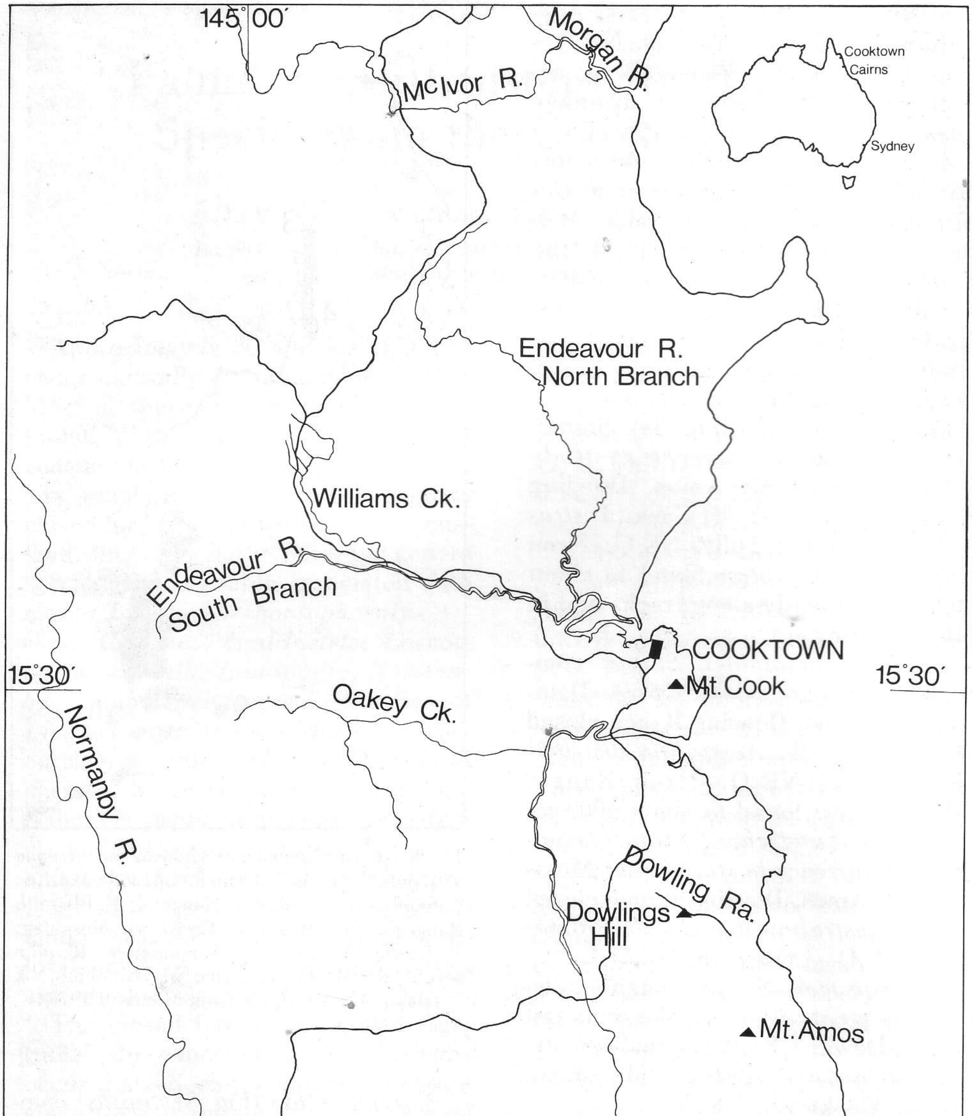
Cocos nucifera. *Status:* very common. *Occurrence in study area:* coastally, throughout the area. *Australian distribution:* coastal northeastern Queensland.



1. Northern Queensland showing occurrence of disjunct "blocks" of rain forest. 1, Lockerbie; 2, Shelburne Bay; 3, Iron Range; 4, McIllwraith Range; 5, Mt. Webb; 6, Cooktown–Mossman; 7, Cairns–Atherton; 8, Kirrama; 9, 40 mile scrub; 10, Wallaman Falls; 11, Hinchinbrook Island; 12, Mt. Spec (from Monteith 1979).

Corypha elata (Fig. 5). *Status:* common in pockets. *Occurrence in study area:* Normanby River system only. *Australian distribution:* along rivers of Princess Charlotte Bay, NE.Q. and of the Gulf of Carpentaria. *Notes:* favors drier open forested areas, invariably associated with rivers or lagoons; often in sand or clay.

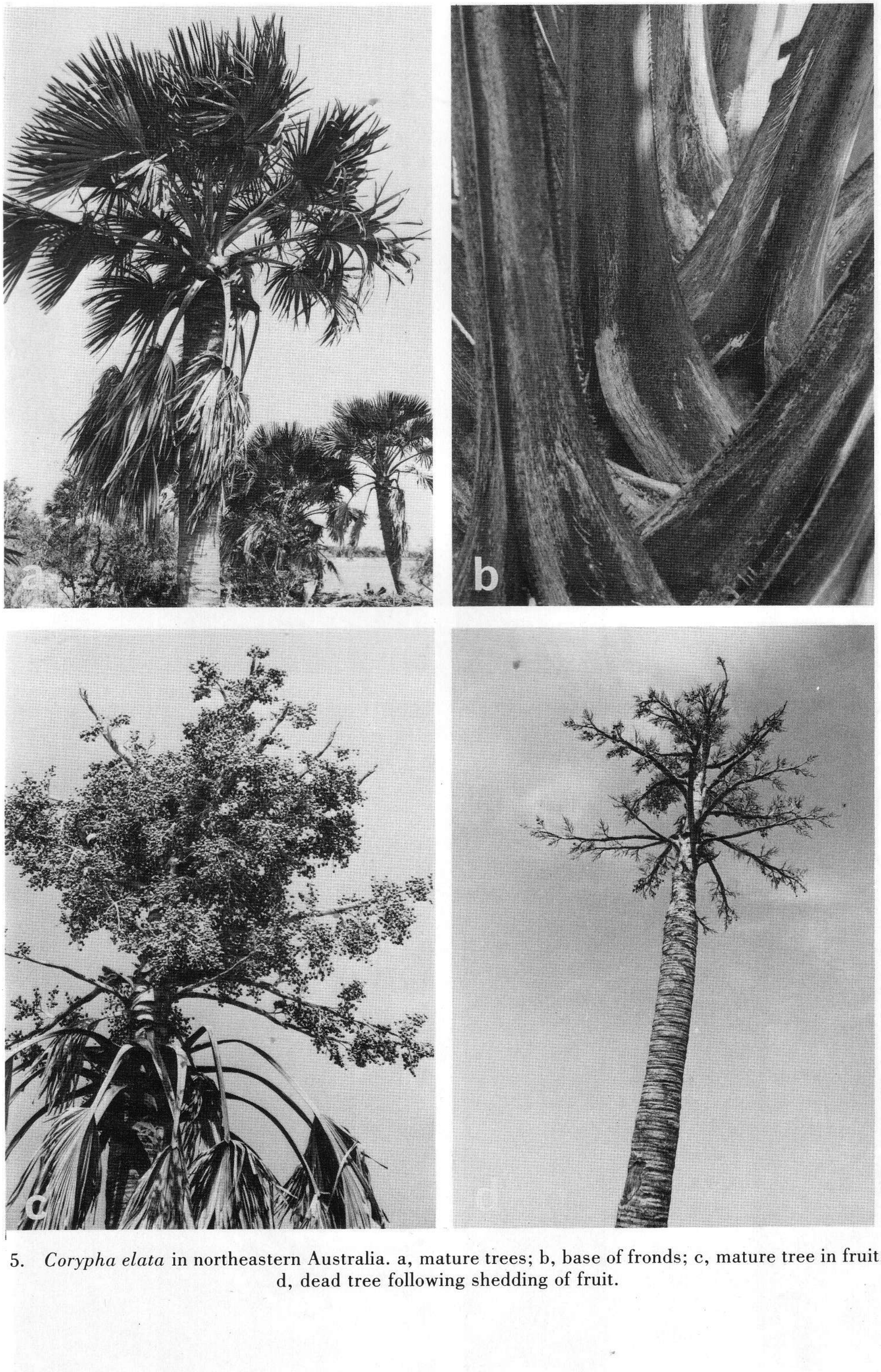
Hydriastele wendlandiana (Fig. 4c). *Status:* common in pockets. *Occurrence in study area:* Endeavour and



2. Map of the study area.

3. Palms of northeastern Australia. a, *Licuala ramsayi* stand; b, *Linospadix intermedia* (?); c, *Calamus australis*; d, *Archontophoenix alexandrae*.

4. Palms of northeastern Australia. a, *Nypa fruticans*; b, *Normanbya normanbyi*; c, *Hydriastele wendlandiana*; d, *Arenga australasica*.



5. *Corypha elata* in northeastern Australia. a, mature trees; b, base of fronds; c, mature tree in fruit; d, dead tree following shedding of fruit.


a
b
c
d

McIvor River systems. *Australian distribution:* Tully, NE.Q.–tip of Cape York Peninsula and some Torres Strait islands. *Notes:* found only at low altitudes, usually along creeks.

Laccospadix australasica (Fig. 6a, b). *Status:* common. *Occurrence in study area:* Daintree–Mt Amos, Dowling Range closed forest. *Australian distribution:* Innisfail NE.Q.–Mt Amos, NE.Q. *Notes:* usually above 700 m.

Licuala ramsayi (Fig. 3a). *Status:* very common. *Occurrence in study area:* Mossman–Mt Amos, Dowling Range closed forest; a pure stand occurs near Cedar Bay. *Australian distribution:* Tully, NE.Q.–Iron Range, NE.Q.; ?Jardine River. *Notes:* frequently associated with drainage lines and swampy areas.

Linospadix intermedia (?) (Fig. 3b). *Status:* common. *Occurrence in study area:* Mossman–Mt Amos, Dowling Range closed forest. *Australian distribution:* Atherton Tableland, NE.Q.–McIllwraith Range, NE.Q. *Notes:* usually above 200 m.

Livistona species (? *decipiens*, ? *benthamii*). *Status:* common. *Occurrence in study area:* north area of the Endeavour River.

Livistona muelleri (Fig. 6c). *Status:* very common. *Occurrence in study area:* throughout open forest in the area. *Australian distribution:* Cairns, NE.Q.–tip of Cape York Peninsula. *Notes:* often found in dense stands of clay soils.

Normanbya normanbyi (Fig. 4b). *Status:* common. *Occurrence in study area:* Mossman–Mt Amos, Dowling Range closed forest. *Australian distribution:* Mossman, NE.Q.–Mt Amos, NE.Q. *Notes:* found up to 500 m always in dense closed forest.

Nypa fruticans (Fig. 4a). *Status:* dense stands in two localities. *Occurrence in study area:* McIvor and Morgan River estuaries. *Australian distribution:* Ingham, NE.Q.–tip of Cape York Peninsula; not in all estuaries. *Notes:* always associated with brackish water.

Ptychosperma elegans. Status: very common. *Occurrence in study area:* Mossman–Mt Amos, Dowling Range closed forest; riverine forests of Endeavour and McIvor River systems. *Australian distribution:* Mackay, NE.Q.–Iron Range, NE.Q. *Notes:* a lowland closed forest species, often very close to the coast.

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6. Palms in northeastern Australia. a,b, *Laccospadix australasica*; c, *Livistona muelleri*; d, *Calamus* species.

Principes, 24(4), 1980, pp. 162–169

The Palm-Leaf Sail of the Warao Indians

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For hundreds and possibly thousands of years the Warao Indians have made their home in the extensive 22,500 km² wide swampland of the Orinoco Delta on the east coast of Venezuela, South America. Currently the tribe numbers an estimated 16,000 individuals in whose language the self-denomination Warao means "boat people." Contemplating the thoroughly aquatic Delta with its network of innumerable rivers and drainage canals it is hardly surprising to find the dugout canoe so intimately associated with these people. Without boats human existence in the Orinoco Delta would be nearly impossible, for the Warao spend much of their life traveling, transporting, fishing, and foraging on board their multipurpose craft.

Until the late 1920s the Warao had remained nonagricultural swamp foragers who provided for themselves by exploiting the wild animal and plant resources of their habitat. Principal among the plant foods were those obtained from palms like *Mauritia flexuosa*, *Manicaria saccifera*, *Euterpe* sp., and *Jessenia*, and throughout the historic era missionaries, travelers, and ethnologists have repeatedly marveled at the high degree to which Warao economy has been adapted to the palmetum of the Orinoco Delta.

Among the different kinds of palm *Manicaria* (*temiche*, *timiche*, *timití*, *truli*, *ubussú*) ranks second only to *Mauritia* in importance to the daily lives of the Warao. The four known species of the genus *Manicaria* are palms that occur from Central America, across Trinidad, the Orinoco Delta, and the Guianas down to the lower Amazon River. Throughout this vast region they occur as very conspicuous and abundant swamp plants, sometimes in forests interspersed with other growth and at other times as colonies, or *temichals*, of considerable density. In the Orinoco Delta the palm grows dispersed or clustered, mostly in the 60 km-wide tidal zone along the seaboard, precisely in the region where the majority of the Indians live.

I have previously detailed the palm's value as a source of food, raw material, and medicine (Wilbert 1976). In a recent issue of this journal I described the manufacturing process of a *temiche* cap from the saclike spathe of the *Manicaria* (Wilbert 1980). But here I should like to document an ingenious naval invention of the Warao who employ the large leaf of *Manicaria* to sail before the wind.

The outstanding characteristic of *Manicaria* is its leaves, renowned as among the largest in the plant kingdom and the biggest entire leaves that grow on palms. Leaves of 9 to 10 m in length and 1.5 to 2 m in width are not unusual, and 15 to 20 contemporaneous suberect leaves can often be seen together with several persistent dead ones hanging down the stem. The younger blades of inner leaves are undivided, whereas those of the outer ones tend

1. *Manicaria* palm at the edge of an open field with one inner leaf of undivided blade; surrounding leaves are wind-torn with irregularly pinnatisect blades.

to become wind-torn and irregularly pinnatisect.

For obvious reasons the Warao choose for their *Manicaria* sail an undivided inner leaf. In view of the palm's ubiquity, finding a leaf requires little effort and cutting it, with a single blow of a bush knife, even less. The Indian takes the leaf to his boat and sits down in the midsection of the ca-

2. *Manicaria* leaf sail braced against a strut in the midsection of a fishing canoe. The Indian is seated on his paddle, which he will need for the return trip, and holds the leaf sail with his left hand.

noe. He then braces the bottom of the upright leaf against a strut and his foot or in a so-called step attached to the floor of the dugout, while holding on to the rachis with one hand. Depending on the strength of the wind, two overlapping leaves may be held up as a single sail. If there is a large number of

3. Adolescent Warao and young boy sail their dugout by means of a *Manicaria* leaf sail. Paddles serving as improvised seat and rudder will be used to propel the vessel on the way back.

passengers on board or if a heavy load needs hauling, two or more such sails are raised in the prow section of the boat.

The Orinoco Delta is situated between 8° and 10° North Latitude, subjected, that is, to the northeastern trade winds. More than 30 percent of

4. Sailing toward a favorable spot to fish with net, young helmsman maneuvers to avoid collision of his craft with author's oncoming motorboat.

the wind direction frequencies are northeasterly to easterly with an average velocity of 5 kph. Conditioned by strong Amazonian offshore currents, most of the rivers draining the Orinoco Delta are diverted to flow in a northeasterly direction, open, that is, to the trades. These are the winds

5. Sailing cargo boat with three leaf sails. A dozen passengers and a heavy load of firewood are visible. (Photo by Peter T. Furst.)

Warao take advantage of when sailing inland from the coast. In comparison, wind frequencies and velocities from other directions of the wind rose are less significant, although they do blow at times (from 1 percent to 7 percent) with velocities of 1–3 kph. I have clocked canoes 6 m long with two paddlers but no sails going 3 kph, at full speed. Canoes with *temiche* sails go at least as fast if not faster and, of course, for a longer period of time.*

The full work capacity of the *temiche* sail becomes especially evident when several of them are used on cargo boats. For instance, with two or three crewmen, seated or standing, attending to their sails in the bow, the load being pushed before the wind may consist of as many as a dozen passengers and a heavy cargo of firewood. To see a boat like this go by at a good speed and with no human effort other than the helmsman keeping course by means of a paddle held vertically as a rudder leads one to realize that the *temiche* sail of the Warao represents critical navigational tackle, despite its elementary nature. *Manicaria* leaf sails are as efficient as they are handy, free, and uncomplicated. In fact, the leaf sail and the idea of employing it for wind-powered navigation are so natural in this environment of windswept rivers that one wonders whether sailing is indeed a post-Columbian innovation along the northern seaboard of South America or whether it might not be an autochthonous invention after all. True, the Warao term for the *Manicaria* sail is *yawihi wera*, derived from *yawihi*, *temiche*, and *wera*, the Spanish word for sail (*vela*). And yet, it would seem ironic that navigators

* I am grateful to Dr. Elwin V. Svenson and Dr. H. Dieter Heinen for their assistance with the nautical experiments in the field.

6. Dugout canoe on land with fixed step for leaf sail. (Photo by Peter T. Furst.)

like the Warao, with centuries of experience in wind and water, would have to await the coming of the Europeans to become inspired by their small-boat sails.

For this as well as for a related ethnohistorical question, there exists no conclusive answer at this point. I am referring to the fact that the Warao have been known to cross the Caribbean Sea to go to Trinidad and, possibly, other islands. There are Indians still living in the Delta who have participated in such voyages but none of those I queried recalled using *temiche* sails on their way across the sea, not even on the way home when the wind favored their course. Overseas voyages took place usually between July and September when the trade winds are calm and the waves small. There is some weak evidence for the existence of the knowledge of aboriginal sailing in the Caribbean (Edwards 1965). This, however, is inconclusive, and no new light can, unfortunately, be shed on this question from the point of view of Warao navigation. Irrespective of whether the sail originated with the Warao or whether it was adopted from other Indians or Europeans, however, nowadays at least, navigating by means of *temiche* sails is a serious nautical tradition among the Warao. For centuries, the palm's spectacular leaf has served the Warao well in their windswept world.

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WHAT'S IN A NAME?

Nengella (neng éll a) combines *Nenga* with the suffix *-ella,* originally a diminutive. Other such names are *Phlogella* (flo géll a) combined with *Phloga, Haitiella* (háy tee éll a) after the island of Haiti, *Iriartella* (ír ee are téll a) combined with *Iriartea, Mauritiella* (maw rít ee éll a) combined with *Mauritia,* and *Zalacella* (zá lack éll a) combined with *Zalacca.*

Neodypsis (née oh díp sis) is derived from the Greek *neos* (new) and the generic name *Dypsis.* Some other names that similarly incorporate *neo-* are *Neonicholsonia* (née oh níck ole só nee a) named after George Nicholson (1847–1908), once Curator of the Royal Botanic Gardens at Kew, England, and editor of *The Illustrated Dictionary of Gardening* (1884–1887), and *Neowashingtonia* (née oh wásh ing tóe nee a) based on *Washingtonia* (see *Principes* 2: 20, 1958) named after George Washington (1732–1799).

Paralinospadix (pára líe no spáy dix) prefixes the generic names *Linospadix,* to which it is related, with the Greek *para* (beside, near, by). Names similarly derived are *Paragulubia* (pára goo lóo bee a), *Parajubaea* (pára jew bée a), and *Parascheelea* (pára shé lee a).

Pichisermollia (pée kee ser mów lee a), a replacement name for *Gigliolia,* is modified from the name of Rodolfo E. G. Pichi-Sermolli (1912–), an Italian botanist who has worked largely with ferns but who revised and published a manuscript on arecoid palms left by Odoardo Beccari (*Subfamiliae Arecoidearum Palmae Gerontogeae Tribuum et Generum Conspectus*).

Pritchardiopsis (pri chár dee óp sis) combines the generic name *Pritchardia* with the Greek suffix *-opsis* (having the appearance of, like) because of its resemblance to that genus.

Trichodypsis (trý ko díp sis) is derived from the Greek root *trichos,* from *thrix* (hair), and *Dypsis,* thus "hairy *Dypsis*" from the abundant hairs on the inflorescence.

H. E. MOORE, JR.

Principes, 24(4), 1980, pp. 170–173

Twin Staminate Inflorescences in Borassus flabellifer L.

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Most pleonanthic palms are characterized by the production of only one inflorescence primordium in the axil of each leaf and its development into an inflorescence. However, an exceptional case of the production of a double spadix in a leaf axil was reported in *Cocos nucifera* by Davis (1957). In recent years, multiple inflorescences are known to occur in six out of fifteen major groups of palms (see Moore 1973, Fisher and Moore 1977). Fisher and Moore (1977) have studied normal multiple inflorescences in eleven genera of palms, namely species of *Aïphanes, Arenga, Calyptrocalyx, Catoblastus, Chamaedorea, Howea, Morenia, Paralinospadix, Ravenea, Wettinia,* and *Wettiniicarpus.* They (Fisher and Moore 1977) predicted that "More examples of multiple inflorescences will become known as collectors pay better attention to the important but often poorly collected inflorescence of palms." Davis (1979) observed about six distinct inflorescences from each node in a staminate *Chamaedorea* species and five or six in *Howea forsterana.*

In the course of ontogenetic studies on the inflorescences of *Borassus flabellifer,* a rare case of the occurrence of two male inflorescences in the axil of each leaf was encountered. As there was no earlier report on this aspect for this taxon, the observations are presented here.

Materials and Methods

The materials for the present study were collected from a healthy staminate (male) plant in the village Aavadaialpuram, Tirunelvely district of Tamil Nadu, India. This plant (Fig. 1) had reached a height of more than fifty feet. Outer foliage leaves of the crown were removed and the inflorescences carefully collected. Peduncular bracts of these inflorescences were excised to facilitate clear observation.

Observations

Borassus is dioecious. Normally, a single inflorescence primordium is initiated in the axil of each leaf. This primordium develops into an inflorescence and the whole event is completed in three consecutive years. During the first year, organization of the inflorescence primordium is followed by the formation of a prophyll and several tubular peduncular bracts on a spiral course and in an acropetal sequence. Production of primary branches with rachillae and initiation of floral primordia occur in the second year. The rest of the development is accomplished in the third year, and the inflorescence emerges from the subtending leaf sheath. The basal part of the inflorescence remains as a compressed solid stump—the hypopodium. The prophyll and proximal peduncular bracts of the inflorescence are sterile. The distal bracts subtend one primary branch each. Two or more cylindrical rachillae are borne on a primary branch. Bracts of rachillae are spirally arranged and they are connate and adnate with the central axis forming pits. Each pit encloses a cluster of staminate (male) flowers arranged in a cincinnus.

In the abnormal case, two staminate (male) inflorescences are found in each leaf axil. They have a common hypopodium which is very similar to that of a normal inflorescence (Fig. 2). Each of the two inflorescences individually resembles a normal inflorescence in size, shape, and weight. Even the number, size, and shape of prophylls and the other bracts are similar to those of a single inflorescence. The primary branches and rachillae also appear normal. Moreover, flower formation follows the usual course and all the flowers remain fertile. There is no tendency for suppression of any floral or other parts in these inflorescences. On tapping, these inflorescences give out sugary sap as in normal inflorescences. The twin inflorescences reveal the same stage of growth during ontogeny. They grow and mature simultaneously, each having its own prophyll and primary axis. Since several inflorescences are double in the crown, the latter appears very dense (Fig. 1).

1. Crown of *Borassus flabellifer* showing double staminate (male) spadices.

It was not possible to trace the early ontogeny of these abnormal inflorescences because of nonavailability of material since the owner of the palm refused to part with it for microtomy. Therefore, the stage at which the ontogenetic deviation sets in has to be decided by a comparison of the primordium of this abnormal inflorescence with that of normal ones. The proximal part of the primordium of abnormal inflorescence is organized into a hypopodium as in a normal inflorescence. Its distal part, which remains meristematic, instead of developing into a single inflorescence, produces two separate inflorescences. The formation of primary axis, prophyll, peduncular bracts, primary branches, rachillae, and flowers commences in a normal way in these two inflorescences.

Discussion and Conclusions

The structure and organization of multiple inflorescences in palms are not the same in all the taxa studied so far. In *Cocos nucifera* (Davis 1957), there is a common outer spathe (bract) enclosing the entire double inflorescence. Further, a great number of unusually large female flowers are borne on such an inflorescence. On the other hand, the twin inflorescences in *Borassus flabellifer* neither arise in the

2. One double staminate (male) spadix detached from the tree.

axil of a common bract nor do the flowers exhibit an unusual large size.

Fisher and Moore (1977), who examined the ontogeny of normal multiple inflorescences in eleven genera of palms, pointed out that in all the instances, the primary bud apex always organizes a central inflorescence. The lateral bud apices, initiated centrifugally on either side on the flanks of the hypopodium, develop into additional inflorescences. Moreover, the central inflorescence flowers first at any flowering node while the flowers on the laterals open later (Fisher and Moore 1977). In *Borassus flabellifer*, on the contrary, the individual inflorescence of the twin does not reveal any deviation either during development or in the time of flowering. On the basis of its organization and behaviour, it is inescapable to conclude that the primary bud cleaves once producing two meristematic loci. And the subsequent destiny of the two apices, apparently, is exactly similar as is evidenced by the size, structure, and mode of flowering at any given time.

The causes for the origin of multiple inflorescences are so far not elucidated. In some taxa, it is a regular feature (Fisher and Moore 1977). In others, it appears to be rare and abnormal—a freak (Davis 1957, and present study). At least in *Borassus* of the present study, it is not due to the attack of insects, fungal infection, or physical damage. Extensive and intensive histochemical studies of the growing apices alone could indicate the probable biochemical gradients involved in directing the production of such inflorescences—both as a regular feature and as a freak.

The term hypopodium is used for the basal part of the inflorescence between the region of its attachment and the insertion of the prophyll (Fisher and Moore 1977). The basal portion of the multiple inflorescence is also called by the same term which seems quite appropriate.

Production of multiple inflorescences in *Borassus flabellifer* is decidedly advantageous to the plant, mainly because there is an increase in production of pollen and a greater chance of pollinating more pistillate (female) flowers to effect more fruit set. We agree with Fisher and Moore (1977) on this point also.

Summary

Double staminate (male) inflorescences have been noted in one individual of *Borassus flabellifer*. These two spadices have a common hypopodium. Both the spadices of a unit are exactly similar to each other and each one simulates a normal inflorescence structurally and functionally. Suppression of floral or other parts is not en-

countered. The observations made have been evaluated in the light of the previous work.

Acknowledgments

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HAROLD E. MOORE, JR.
1917–1980

Harold E. Moore, Jr., Liberty Hyde Bailey Professor of Botany at Cornell University, and Editor of PRINCIPES since 1957, died suddenly on October 17 after a brief illness. For Hal, the editorship of PRINCIPES was a labor of love. Those who knew and loved him should know that while ill at home and in the hospital he prepared this issue and did all but the final checking of the page proof. He has also edited manuscripts for January and April. We will publish a tribute to Hal later. Friends may send remembrances to the Harold E. Moore, Jr. Memorial Fund, Cornell University.

JOHN DRANSFIELD
NATALIE W. UHL
Associated Editors

Errata

Page 17, column 1, line 34, for *lauterbachiana* read *lauterbachii*.
Page 27, column 1, line 9, for *lauterbachiana* read *lauterbachianum*.

Principes, 24(4), 1980, pp. 174–178

Population Densities of Myndus crudus Van Duzee (Homoptera: Cixiidae) in Relation to Coconut Lethal Yellowing Distribution in Florida[1]

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Abstract

The geographical distribution of lethal yellowing (LY) disease of coconut palms, *Cocos nucifera* L., in Florida is described. Based on paired sampling within and outside the LY-infected area of the mainland, *Myndus crudus* Van Duzee (Homoptera: Cixiidae), a planthopper suspected to be a vector of LY agent, was 40× more abundant in the infected area ($P < 0.01$). The coincidence in the distribution of LY disease with high population density of *M. crudus* increases this insect's status as a suspected vector.

A planthopper, *Myndus crudus* Van Duzee (Homoptera: Cixiidae) (Fig. 1), has been under scrutiny as a possible vector of lethal yellowing (LY) disease of coconut palms, *Cocos nucifera* L. in Jamaica (Eden-Green 1978, Eden-Green and Schuiling 1978) and Florida (Tsai 1975, 1977). *Myndus crudus* was referred to the genus *Haplaxius* Fowler in these reports. Kramer (1979) recently synonymized *Haplaxius* with *Myndus* Stål. Literature on LY disease has been reviewed by Sherman and Maramorosch (1977). A study was undertaken to determine whether high population densities of *M. crudus* coincide with the range of LY on the Florida mainland.

Distribution of LY in Florida

Coconut palms are grown in Florida primarily as landscape plants in the coastal areas and islands of the southern portions of the state. The distribution of coconut and of LY in Florida can be discussed in relation to four geographical areas described below, and illustrated in Figure 2. I arrived at estimates of numbers of palms and LY cases through inspections of the areas and through personal communication with Florida Department of Agriculture Plant Inspectors and Agricultural Extension Agents familiar with the areas in question.

The Florida Keys. This crescent of some 30 islands is about 200 km long (Fig. 2). There were perhaps about 50,000 coconut palms on the Keys before 1955. A severe epidemic that killed about 15,000 (i.e. 75%) of the coconut palms on the island of Key West occurred between 1955 and 1960 (Martinez and Roberts 1968). The disease persisted on this island until 1968 (Seymour 1976).

In 1969, LY was observed on Key Largo, about 160 km from Key West (Seymour 1976). Since then, LY has spread in a desultory pattern, appearing and in some cases recurring on some islands, including Key West, while other islands populated with coconut palms have remained free of the disease.

The Lower East Coast. This area is a band of about 25 km wide extending about 250 km along the southern por-

[1] Florida Agricultural Experiment Station Journal Series No. 2226.

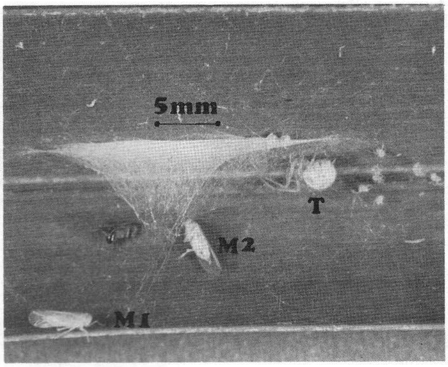
tion of the Florida east coast and includes offshore islands and the isolated coastal settlement of Flamingo at the southern tip of the mainland (Fig. 2). There were formerly perhaps 300,000 coconut palms in this largely urbanized area. The frequency of coconut palms dwindles north of Martin County to a thousand or fewer in Brevard County. The lower east coast area is bordered on the west by the interior areas, described below, which are largely devoid of coconut palms.

LY was first reported on the lower east coast in Miami in 1971, and had been reported as far north as northern Palm Beach County by 1973 (McCoy 1976). Since then, LY has continued to spread erratically within the lower east coast area and has extended its range north a few km into southern Martin County. About 100,000 coconut palms and thousands of other LY-susceptible species have been destroyed south of Martin County.

Areas north of the Palm Beach County line have been largely free of LY. There are about 30,000 coconut palms and thousands of palms of other LY-susceptible species in Martin County. As of January 1980, 50 cases or fewer have been observed in the county and these were within four km of the southern boundary.

The Interior. Between the east and west coasts is a vast area about 180 km at its widest point consisting mostly of wetlands and pine flats. Native palm species, none of which are known to be susceptible to LY, are present. The cabbage palmetto, *Sabal palmetto* (Walt.) Lodd., is particularly common, forming extensive stands in parts of the interior. The human population is sparse, and the few coconut palms in the interior are around habitations. A few cases of LY have been observed among these isolated coconut palms.

The West Coast. The west coast is less urbanized than the east coast. There are about 25,000 'Jamaica Tall' coconut palms in coastal areas of Collier County. A few cases of LY were reported there in 1974 and fewer than five cases since then. The next county to the north, Lee County, has at least 30,000 coconut palms. North of Lee County, coconut palms dwindle to a few hundred in Manatee County. As of January 1980, LY has not been observed north of Collier County.



1. Palm leaflet with *Myndus crudus* resting (M1), and *M. crudus* (M2) caught in web of a spider, *Theridion* sp. (T).

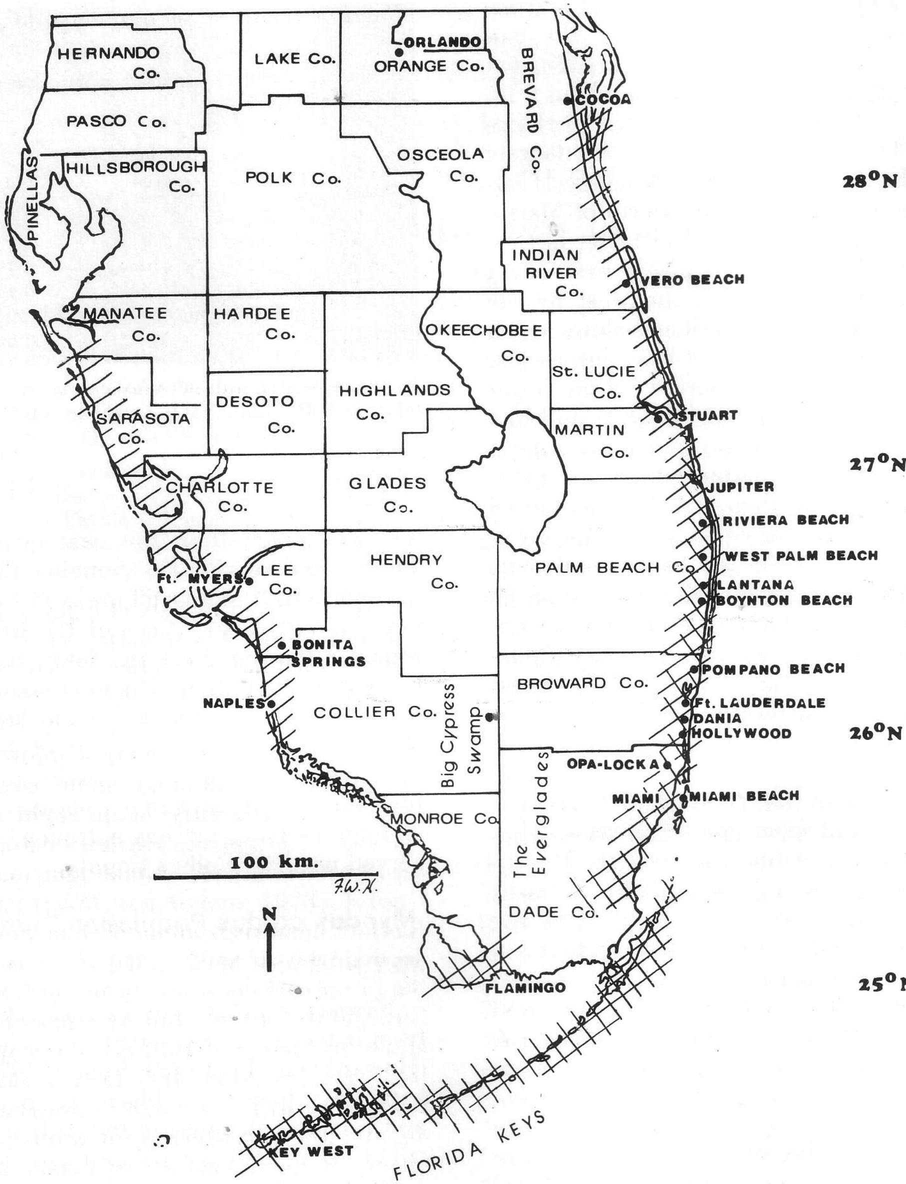
Myndus crudus Population Study

Methods and Materials

Myndus crudus can be collected from leaves of many species of palms (Howard and Mead 1980, Reinert 1977) including those of cabbage palmetto and coconut. Because of the wide distribution of cabbage palmetto on the Florida mainland, this palm was selected as the host for sampling *M. crudus*.

An adhesive material (Stikem[2]) was applied to an area of about 300 cm^2 on

[2] Michel & Pelton Co., 5743 Landiegan St., Emeryville, California 94608. Mention of a trademark or proprietary product does not constitute a guarantee or warrant of the product by



2. Range of coconut palms (hatching), distribution of lethal yellowing disease (cross-hatching), and localities (dots) where *Myndus crudus* populations were sampled in southern Florida.

the lower surface of a randomly chosen frond of each cabbage palmetto sampled. Specimens of *M. crudus* captured in the adhesive were collected 20–45 days after application of the adhesive.

The localities sampled were on the

the University of Florida, and does not imply its approval to the exclusion of other products that may be suitable.

Table 1. Means of Myndus crudus *per collecting location in and outside the lethal yellowing-infected area of Florida*

Collecting period (Number of days, season, year)	Location in LY-infected area	*M. crudus*	Location in LY-free area	*M. crudus*
(30) Summer 1978	Ft. Lauderdale	55.6	Naples	0
(20) Summer 1978	Hollywood	44.5	Stuart	4.7
(20) Summer 1978	Dania	19.4	Big Cypress Swamp	0.1
(30) Winter 1979	Lantana	6.0	Naples	0.4
(30) Winter 1979	Pompano Beach	34.2	Bonita Springs	0.2
(34) Winter 1979	Riviera Beach	7.4	Stuart	0.2
(34) Spring 1979	Boynton Beach	21.0	Ft. Myers	0.3
(45) Spring 1979	West Palm Beach	25.9	Vero Beach-Cocoa	0
(45) Summer 1979	Opa-locka-Miami Beach	25.7	Orlando	0.2
(45) Summer 1979	Ft. Lauderdale	4.3	Naples	0.2
$\bar{x}$ ----------	LY-infected area	24.4[a]	LY-free area	0.6[a]
SD --------		16.8		1.4

[a] Statistically significant ($P < 0.01$) using a paired t-test.

Florida mainland (Fig. 2). In each locality, 10 palms, each at least one km from another, were randomly selected. Localities inside the LY-infected area were paired with localities outside it. For each pair of localities, the sampling was simultaneous; i.e., the adhesive was applied in both localities on the same day and collections were made in both localities on a later day. Sampling periods were in the summer of 1978, and the winter, spring and summer of 1979. The significance of the difference in the mean of *M. crudus* from inside and outside the LY-infected area on the mainland was tested by a paired t-test.

Results and Discussion

There were about 40× as many *M. crudus* in samples from the LY-infected portion of the lower east coast as in samples from elsewhere on the mainland ($P < 0.01$) (Table 1). This enhances the insect's status as a suspected vector of LY. Although population densities are higher in the LY-infected area, the insect is distributed in southern Florida at least as far north as Orlando (Table 1).

The range of LY has been fairly stable for five years. The spread of the disease has been almost entirely within the generally infected area south of Martin County, although about 25–30 cases have recently been reported within four km of the southern boundary of the county. St. Augustine grass, *Stenotaphrum secundatum* (Walt.) O. Kuntze, comprises about 80% or more of the turfgrass used in urban lawns in the lower east coast area south of Martin County. In all but the extreme southern portion of Martin County and in the west counties, Bahia grass, *Paspalum notatum* Flugge comprises about 70% of turfgrass (unpublished observations supported by communication with county agricultural extension agents). This may be significant, since nymphs of *M. crudus* develop on roots of grasses, St. Augustine grass being a particularly favorable host (Eden-Green 1978, Reinert 1977, 1980).

I conclude from this study that on the Florida mainland the population density of *M. crudus* is higher in the area that is generally infected with LY than elsewhere. This supports our previous conclusions (Howard and Mead 1980) that *M. crudus* is the most suspect vector of LY agent.

Acknowledgments

I wish to thank G. A. Hutchinson for technical assistance. The following provided estimates of numbers of palms, LY cases, etc., in particular geographical areas: G. H. Gwin, Florida Department of Agriculture and Consumer Services; and R. G. Curtis, M. Iverson, C. A. Lowery, R. E. McCoy, S. A. Rose, R. H. Whitty, and R. H. Zerba of the Institute of Food and Agricultural Sciences of the University of Florida. Mr. Jim DeFilippis photographed *Myndus crudus* and *Theridion* sp.

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Notice

Copies of The Palm Society's *By-Laws* and the *Guideline for Affiliates* can be purchased for $1.00 each from the Secretary of the society, Mrs. Pauleen Sullivan, 3616 Mound Ave., Ventura, CA 93003.

Principes, 24(4), 1980, pp. 179–180

Lethal Yellowing in Texas Phoenix Palms[1]

R. E. McCOY, M. E. MILLER, AND D. S. WILLIAMS

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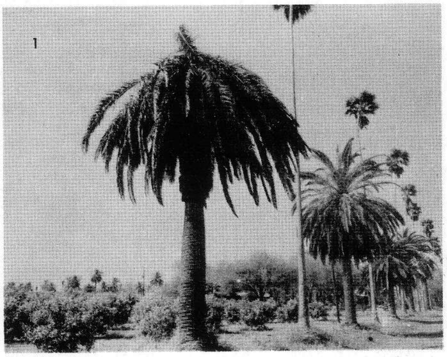
A rapidly spreading, lethal disease of *Phoenix canariensis* and *P. dactylifera* was noted by local plant pathologists in the Brownsville, Texas area approximately two years ago. Since that time, many of these palms have died in this area and the disease has spread 70 km inland up the Rio Grande Valley. Within disease foci, *Arecastrum romanzoffianum, Washingtonia robusta, W. filifera,* and *Sabal texana* appear to be unaffected by the disease.

Symptoms of the disease are identical to those seen in *Phoenix* palms affected by lethal yellowing in Florida (Fig. 1) (4). Initial symptoms are death of the central whorl of young fronds in the middle of the crown, death of adventitious roots at the base of the trunk, and necrosis of immature inflorescences within their enclosing spathes. This is followed by an off-coloration to a duller, grayer shade of green in the fronds. Fronds turn brown and desiccate beginning with the oldest basal fronds and moving upwards into the crown. Approximately four months is required to complete the progression from initial symptoms to death of the affected palm.

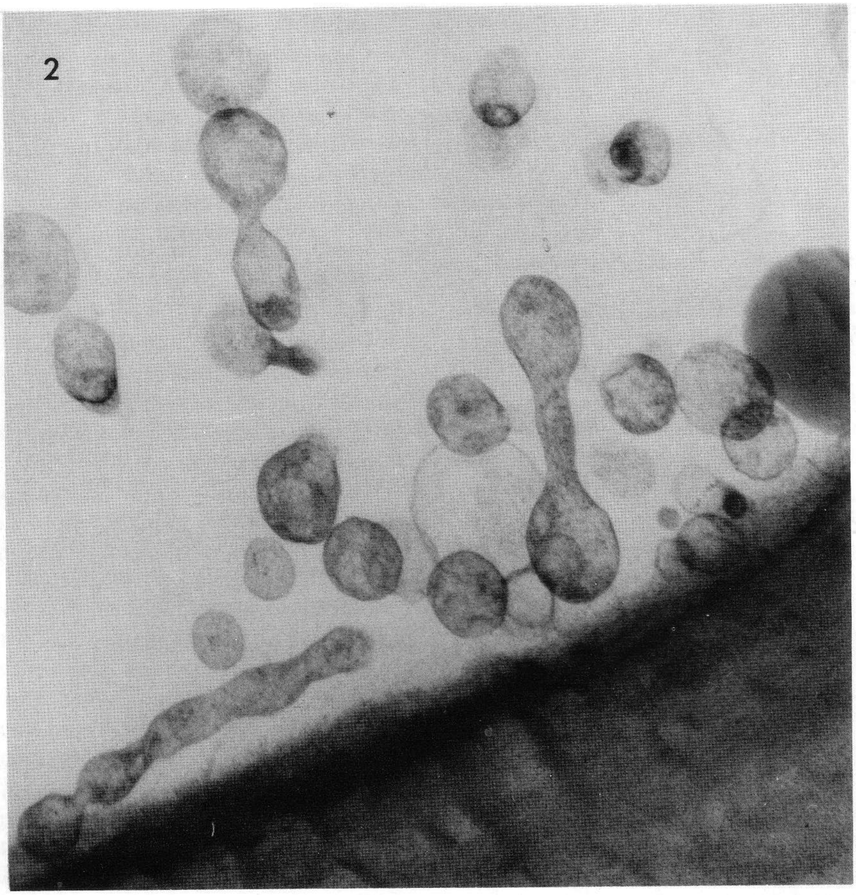
Tissue samples from the hearts of dying *Phoenix* palms in Texas contained mycoplasmalike organisms when examined by transmission electron microscopy (Fig. 2). The identity of symptoms and pattern of spread, the presence of mycoplasmalike organisms, and conformity to the lists of susceptible and resistant palm species in Florida all indicate that this disease is lethal yellowing.

The movement of lethal yellowing from Florida or the Caribbean to Texas is a major jump in the geographical range of this dread palm disease. The potential of lethal yellowing to eradicate plantings of susceptible palm species totally has been demonstrated more than amply in Florida and Jamaica. Its potential for rapid spread has been pointed out previously (1,2,3); however, the importance of imposing and enforcing regulations against the movement of susceptible palms from affected areas to disease-free regions must be emphasized again. The most likely avenue for the spread of lethal yellowing to Texas is



1. Dying and healthy *Phoenix* palms interplanted with tall, unaffected *Washingtonia* palms.

[1] Florida Agriculture Experiment Station Journal Series No. 2273.



2. Mycoplasmalike organisms within a phloem sieve element of a dying *Phoenix* palm from Texas, ×26,000.

the importation, by man, of infected palms or vector insects. The presence of lethal yellowing threatens eradication of susceptible *Phoenix* palms from the lower Rio Grande Valley and increases the potential for spread to other previously unaffected areas.

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Principes, 24(4), 1980, pp. 181–182

PALM BRIEFS

Some Early Historical References to Palm Cabbage

Palm cabbage—also known as hearts of palm or (in Latin America) palmito—is a familiar food in certain parts of the tropics and subtropics, especially in the New World. A review of its contemporary use has already appeared in this journal (Hodge 1965). More recently cabbage-producing palms have been featured as one of the world's underexploited tropical plants (Anonymous 1975).

It is probable that palm cabbage has been enjoyed by mankind for centuries. However its use is a minor one and probably, because of this, early records of its past utilization are scant and are limited at present to certain early historical writings. Strangely, in the New World, where the cabbage of a number of genera[1] is currently eaten, I know of only one early historical reference to its past use. That is in the recently published 18th century chronicle of Miguel del Barco (Barco 1973). Spanish chroniclers of the 16th and 17th centuries seem not to have known of this edible palm product. Amerindians of the New World tropics had of course no true written language to record such a use nor have we yet found the use of palm cabbage featured by them pictorially on any of their artifacts.

Because writing first developed in ancient Old World civilizations (where, incidentally, the leaves of palms served as one of the first "papers") it could be expected that the earliest written references to palm cabbage use might be found there, and such proves to be the case. Although the Greek physician Dioscorides (Gunther 1959), in the first century A.D., mentions the medicinal benefit of eating "the white marrow of ye stalk of a palm" ("Phoenix elate") mention of an earlier use of palm cabbage for food precedes that by at least 400 years.

Recently while rereading the amazing account of the Greek expedition into Persia (early 4th century B.C.). . . . "the March of the Ten Thousand," by the Greek general and historian Xenophon (Xenophon 1949), I ran across what may be one of the earliest references to the eating of palm cabbage. In this case the species involved was the economically important date palm (*Phoenix dactylifera*), one of the palms most frequently featured in the records and art of the Old World. The Greek forces were travelling through "villages in the country of Babylon," in the Euphrates River valley, then as now the heartland of date culture. Of the use of dates and the date palm Xenophon writes (in chapter 3 of book II):

> "Going forward, then, they arrived at the villages where the guides told them they could get supplies. There was plenty of corn there and date wine, and a sour drink made from boiled dates. As for the dates themselves, the sort which one sees in Greece were set aside for the servants, while the ones reserved for the masters were choice fruit, wonderfully big and good looking. Their colour was just like amber, and they used to dry some of them and keep them as sweets. There was also available a drink which, though sweet, was apt to give one a headache. Here, too, for the first time the soldiers ate the 'cab-

[1] Including *Acrocomia, Astrocaryum, Bactris* (*Guilielma*), *Brahea* (*Erythea*), *Cocos* (as an introduced species), *Euterpe, Geonoma, Hyospathe, Iriartea, Prestoea, Roystonea, Sabal, Socratea*, and *Welfia*.

1. Date palms featured on the famed 6th century mosaics in the Basilica St. Apollinaris the New, Ravenna, Italy.

bage' from the top of the palm tree, and most of them were greatly impressed with its appearance and its peculiarly pleasant taste, though it also was extremely apt to cause headaches. Any palm tree from which the 'cabbage' had been taken out withered away entirely."

Xenophon's last sentence describes succinctly what happens to any palm when its cabbage is harvested, and that is the major reason why the widespread use of this underexploited palm product may never prove to be really practical.

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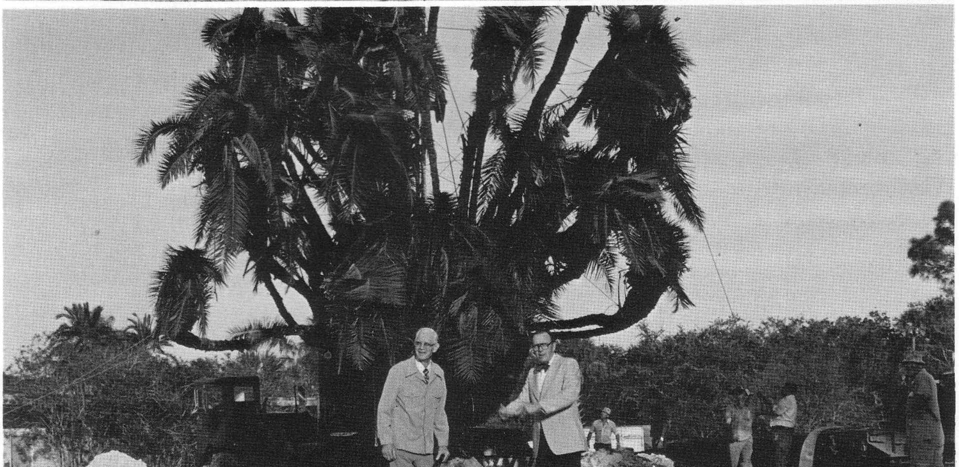
NOTES ON CULTURE

As Christmas trees go, the 40-foot-tall, 20-ton palm that took a prominent place on the Florida Institute of Technology campus at Melbourne, Florida in time for the 1979 holidays is as unusual as it is beautiful.

There was a Santa involved in the arrival of the huge *Phoenix reclinata* palm at F.I.T. Donating the 64-trunked tree was Norman S. Lund of West



1. Before and after. Above, an F.I.T. moving crew prepares the *Phoenix reclinata* for removal. The highway in the background is to be widened, work that threatened the tree; below, Norman Lund (left) and Dr. Keuper (right) with the palm in place on the F.I.T. campus. Photos by R. Goldberg.

Melbourne, who helped shape both the university and the Space Coast.

"This tree was here in 1940 when I bought this place. It was only a small thing then," Lund said of the four-foot plant then in front of his home.

By the time an F.I.T. crew moved the plant, it could be handled only with the aid of a huge crane. Moving through the streets of West Melbourne and Melbourne to the F.I.T. campus, the tree required a police escort because its canopy spread across two lanes.

The move fulfilled a long-standing request by university President Jerome P. Keuper that the palm someday become a part of the campus. Since 1970, Dr. Keuper has secured more than 200 species of palms—more than 2000 trees in all—for F.I.T.'s collection.

"I told him I couldn't part with it," Lund said of his earlier response to Dr. Keuper. Over the years Lund also rejected several purchase offers, including one from a Disney World landscaper. The tree is currently valued at $10,000.

The 83-year-old Lund, an F.I.T. trustee for more than a decade after the school was founded, decided to part company with the tree only after widening of Highway 192 into Melbourne threatened it. Lund has decided to move from his home near the highway, possibly to another area of Florida.

Ironically, it was a highway project that brought Lund to the Melbourne area. He was a foreman on work that saw the city get its first paved highway (U.S. 1) in 1925.

"To begin with, people were taller than the tree," Lund recalled, explaining that over the years winter visitors to his home had their photograph taken beside the tree.

As the tree and the Space Coast population grew, Lund headed an organization of chambers of commerce that made preparations for the U.S. Space Program. He was also an active developer.

2. Between. When the palm was moved toward the campus, a police escort cleared the way. Photo by R. Goldberg.

He found the tree's ever-expanding fountain of greenery increasingly useful in shielding his home from noise and vehicle lights along the highway.

His chickens provided fertilizer for the tree, and a septic tank drainfield was placed so that "in good times and bad the tree always had moisture." But he noted, "I stopped fertilizing it when it looked like it was going into the telephone wires."

Despite his affinity for greenery—he is still active in a business that makes skin-care products from aloe plants—Lund said, "Dr. Keuper is a palm expert, but I'm not. I had a hard time remembering the name of that tree."

Dr. Keuper, a physicist and former aerospace executive who taught himself the art of palm collecting, placed Lund's *Phoenix reclinata* in the center of the university's quadrangle of offices and classrooms.

Principes, 24(4), 1980, pp. 184–185

PALM LITERATURE

PLUCKNETT, DONALD L. Managing Pastures and Cattle Under Coconuts. 364 pp. Westview Press, Boulder, Colorado. 1979.

Increasing interest in tree-based tropical agricultural systems, most commonly referred to as "agroforestry," has stimulated new evaluation of palms as promising candidate species. The objective of this book is to survey the state-of-the-art of cultivating coconuts and raising cattle on the same plot of land, and to identify research needs for improvement of the system.

After an introductory chapter, the coconut and its cultural requirements are discussed as a prelude to chapters on cover crop management, and intercropping with annual and perennial crops. The latter is particularly important for small farmers in the early years of a plantation when income is needed, but grazing is not recommended. The remaining chapters of the book focus on pasture and cattle management. Natural pastures are discussed in detail; important species are described and line drawings included. Planted pasture species with soil-improving qualities to benefit the coconut palms are given similar detailed treatment. Cattle management practice is the subject of a separate chapter, providing examples of successful systems and recommended carrying capacities under various grazing systems. The two final chapters deal with the special problems of small farmers, who are the major producers of coconuts around the world, and research and future prospects for the system.

Plucknett has provided an excellent example of the blending of the state-of-the-art on one hand, with a practical "how-to" manual on the other. The book is richly illustrated with some forty pages of photographs and contains a very comprehensive bibliography. Complementary to this book is P. K. Ramachandran Nair's *Intensive Multiple Cropping With Coconuts in India*, published by Paul Parey, Berlin, 1979.

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University of Houston
Houston, Texas

UHL, N. W. AND H. E. MOORE, JR. 1980. Androecial development in six polyandrous genera representing five major groups of palms. Ann. Bot. (London), ser. 2, 45: 57–75.

Differing patterns of stamen initiation indicate that polyandry has arisen separately in each major group of palms.

VANDERMEER, J. H. 1979. Hoarding behavior of captive *Heteromys estianus* (Rodentia) on the fruits of *Welfia georgii*, a rainforest dominant palm in Costa Rica. Brenesia 16: 107–116.

The way in which *Heteromys* store fruits of *Welfia* is described and its implications explored.

YEATON, R. I. 1979. Intraspecific competition in a population of the stilt palm, *Socratea durissima* (Oerst.) Wendl., on Barro Colorado Island, Panama. Biotropica 11: 155–158.

Intraspecific competition occurs between adults and juveniles of this species and large individuals tend to be regularly distributed and infrequent.

PALM PORTRAIT

Moratia cerifera

White-waxy leaf sheaths and inflorescence bracts, stiff, arching leaves, and a much-branched inflorescence with small red flowers characterize *Moratia cerifera* H. E. Moore, a New

1. *Moratia cerifera* photographed between 500 and 600 meters elevation on Mont Panié in the company of an *Araucaria*.

Caledonian palm only recently described in *Gentes Herbarum* 12: 122, 1980. It occurs on soils derived from schists on Mont Panié at elevations of 500 to 900 meters, either in the forest or exposed as the individual pictured here. It also has been found at two other localities in the northeastern sector of the island; at one of them, a solitary individual grows beside a stream at only about 10 meters above sea level.

The trunks of *Moratia* may exceptionally reach a height of 20 m and a diameter of 18 cm, though they are usually much lower and more slender. The new growth is often orange but becomes brown in age. Frequently the leaf sheaths are orange beneath the cover of white wax outside as well as orange inside. Leaf blades may reach a length of 1.7 m and bear as many as 36 pinnae on each side. The fruit is nearly globose, 12–14 mm in diameter, and the surface is very minutely roughened when seen under high magnification. As yet, completely mature fruit has been sought but not found.

Moratia cerifera has been known for nearly a decade but for much of that time had been confused with the palm now known as *Alloschmidia glabrata* (Becc.) H. E. Moore. It is most closely related to *Cyphokentia macrostachya* Brongn., which also has white-waxy leaf sheaths, but differs in several characteristics of flower and fruit. The generic name (pronounced *more áh tee a*) is taken from that of Philippe Morat, a French botanist and student of monocotyledons, who was one of the collectors of the type specimen and organizer of the expedition on which it was obtained. The specific epithet, meaning "wax-bearer," was suggested by the waxy coats which, incidentally, melt when specimens are exposed to high heat.

HAROLD E. MOORE, JR.

NEWS OF THE SOCIETY

The Biennial Meeting, June 14–22, 1980

About 150 members of The Palm Society converged on Hilo, Hawaii on Saturday, June 14, 1980, those 115 or so from the "outside" to be met by local members with leis in traditional Hawaiian style. Registration at the Hilo Lagoon Hotel was followed by an informal cocktail reception. A brief account follows for those who must follow our footsteps vicariously.

Sunday, June 15

Travelling in two chartered buses with personable guide-chauffeurs, we spent Sunday in Hilo, visiting Kuaola Farms, operated by members Mr. and Mrs. Jules J. Gervais, Jr., to see anthuriums grown commercially and the Gervais' budding palm collection, and Hirose Nursery, where Mrs. Hirose provided not only a handsome garden for inspection but seeds and refreshments. Luncheon at the K K Tei was a Japanese-style meal in a garden setting, followed by a chance to work off some of the abundant food at Akaka Falls State Park, where waterfalls are set off by handsome plantings along the trails. The buses then took the group to the garden of Mr. and Mrs. Toshio Imoto, where a splendid *Amherstia nobilis* was an added attraction to 67 labelled palms, a cooling punch, and a chance to see how large and handsome *Areca catechu* can become in a dozen years or so in Hawaii.

The grand finale of the day was a visit to Onomea Garden and the palm collection of Mr. and Mrs. Donn Carlsmith with its ca. 275 species. The route from the Imoto home to the Carlsmith home led along the coast where *Archontophoenix alexandrae* planted years ago has become naturalized (as we also saw it elsewhere in the Hilo area). Onomea is expanding from a nucleus of mature palms, including striking *Clinostigma samoense*, into newly planted former cane field. A heavy rain held off long enough for everyone to assemble under an awning for cocktails and alfresco dinner livened by a group of singers

Treasurer's Report

Calendar Year 1979

Income		
Membership dues		$20,138.83
Subscriptions		1,014.70
Seed bank revenue		10,682.01
Publication		2,389.53
Palm sale		25,907.95
Miscellaneous		526.17
Interest		877.97
Total income		$61,537.16
Disbursements		
Printing publication	$13,482.24	
Seed bank	3,798.03	
Word processing	538.82	
Printing & plate maintenance	2,307.84	
Postage	1,425.52	
Salary	4,800.00	
Office supplies	2,023.25	
Contribution-lethal yellowing	1,000.00	
Miscellaneous	1,583.88	
Bank charge	11.67	
Cost of palm sale	21,927.72	
Payroll tax	256.02	
Total disbursements		$53,154.99
Net receipts		$ 8,382.17

THE PALM SOCIETY
BALANCE SHEET
DECEMBER 31, 1979

Assets		
Petty cash	$ 265.31	
First National Bank of South Miami	6,673.80	
Coral Gables Federal Saving	4,729.22	
Coral Gables Federal Saving—certificate	10,491.62	
Total Assets		$22,159.95
Liabilities		
Payroll tax accrued		$ 206.20
Fund balance		
Fund balance, January 1979	$13,571.58	
Net receipts	8,382.17	$21,953.75
Total liabilities & fund balance		$22,159.97

and a dancer and impromptu performances by some society members.

Monday, June 16

Monday's program was full in the morning, more leisurely in the afternoon. We first visited the home of Mr. and Mrs. Hajime Tanaka, where palms dominate the plantings and form a miniature tropical forest among fields of sugar cane. Moistened physically by rain but spirits not dampened, we continued to the office of W. H. Shipman Ltd., where the late Herbert C. Shipman had planted many unusual palms. By a fortunate set of circumstances we were able to follow this visit with one to Mr. Shipman's estate, where he lies buried among majestic mature palms, passing enroute an area where he had planted one coconut for each year of his life on his 70th birthday. And last on the morning's agenda was a tour of the Hilo Tree Nursery where a *Colpothrinax wrightii*, perhaps the only one outside Cuba, was an impressive sight along with *Calyptronoma dulcis*, *Acoelorrhaphe wrightii*, and others introduced many years ago by L. W. Bryan, formerly District Forester. A relaxed afternoon visiting the city of Hilo, cocktails, and a buffet supper hosted by the Hilo Chapter of the society across the lagoon from our hotel at Wailoa State Park closed the day.

Tuesday, June 17

Aboard buses again, we transferred operations to Kona on the other side of the island by way of a stop to see *Pritchardia beccariana* and Volcanoes National Park, where a special viewing of a film on volcanoes had been arranged. Further stops were made at Black Sands, where *Pritchardia affinis* in fruit led to mass trespassing, and Manuka State Park for a box lunch with many palms to admire. A last halt provided an opportunity to visit the City of Refuge National Park at Honaunau where formerly breakers of taboos or defeated warriors could find asylum and absolution. Then the trail led onward to Kona Lagoon Hotel in time for a swim before the Biennial Membership Dinner, complete with *poi*, a brief formal meeting to announce new officers, and an illustrated talk on palms of New Caledonia by Harold E. Moore, Jr.

Wednesday, June 18

After a morning spent viewing gardens and nurseries in the Kona region, members dispersed temporarily, some to stay on Hawaii, others to visit Maui, Oahu, or Kauai before a final two days on Oahu, where we were based at the Ala Moana Hotel.

Friday, June 20

Different buses and different but informative drivers carried members to the Lyon Arboretum of the University of Hawaii, where Dr. Sagawa, the Director, and Raymond Baker, Gardener, provided orientation to the research palm collections. The arboretum has a rich palm complement with many unusual specimens now fruiting. Fruits of a number had been gathered and placed in buckets for the taking and those who took refuge in the gazebo from a light rain were treated to refreshments served by the Friends of the Arboretum. A buffet dinner at the hotel was followed by an introduction to a younger garden, the Pacific Tropical Botanical Garden on Kauai, provided by its Director and Palm Society Board Member, Dr. William L. Theobald.

Saturday, June 21

The Wahiawa Botanical Garden, a unit of the Honolulu Botanical Garden

System, with collections of *Pritchardia* species and New Caledonian palms of special interest was the initial stop on a day-long tour of gardens and nurseries on the island of Oahu.

Sunday, June 22

Foster Botanical Garden in Honolulu was the focus of a morning in Honolulu after which members went their separate ways, some home, some to Kauai for a tour of the Pacific Tropical Botanical Garden, some to remain in Oahu.

Throughout the eight days, Hawaiian hospitality was everywhere evident. Those of us who attended the meeting are deeply indebted to all our hosts in the islands and to Ms. Gladys Ewart of Metropolitan Travel, Inc. who everywhere made life easier for us with her arrangements for hotels, transport, meals, and the sundry details that so diverse a group can require.

Formalities were kept to a minimum, but new officers and directors were elected and are listed in the masthead on page 142. A new face among officers is that of Dick Douglas who joins Paul Drummond, Ruth Shatz, and Pauleen Sullivan (see *Principes* 21: 37–39, 1977 and 22: 144, 1978 for biographical sketches). Dent Smith was elected an honorary member, Lucita H. Wait was elected to the Advisory Council, and Myron Kimnach automatically joined that group on expiration of his term as director. The following committees were approved by the Board of Directors: Nominating—Warren Dolby, Edward M. McGehee, James Specht (chairman); Promotion—William J. Hemmer, DeArmand Hull, James Mintkin (chairman), Lynne Stewart; Publication—Donn Carlsmith, Harold E. Moore, Jr., William L. Theobald (chairman). Changes in dues and subscriptions were approved.

H. E. MOORE, JR.

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