PRINCIPES

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PRINCIPES

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Cover Picture

Chamaedorea elatior climbs in the Rare Plant House at the Fairchild Tropical Garden, Coral Gables, Florida. Photo by M. V. Parthasarathy.

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The Natural History of Iguanura geonomaeformis Martius: A Malayan Undergrowth Palmlet

RUTH KIEW

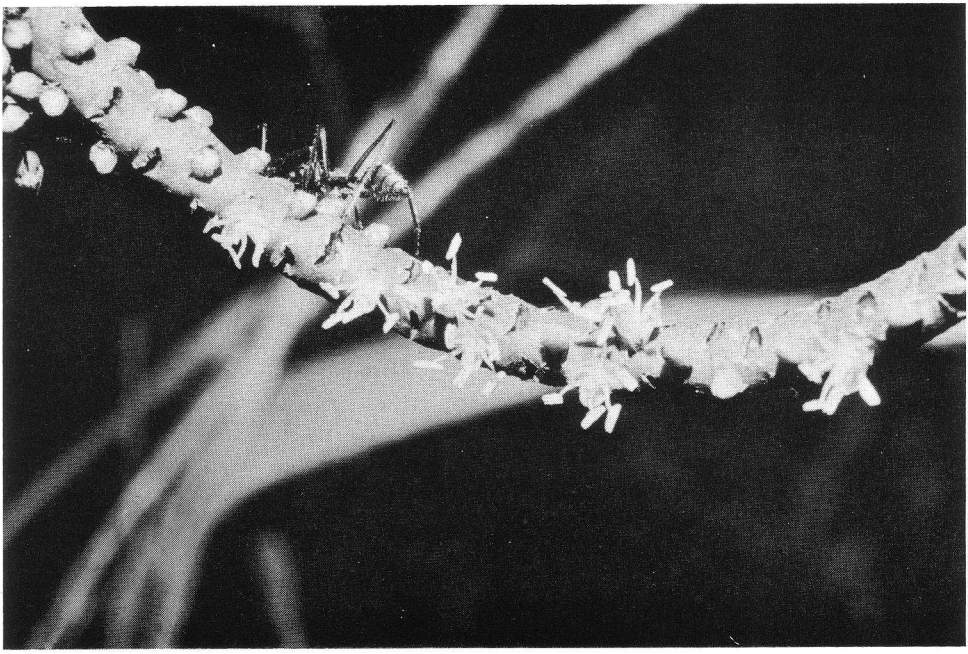
Iguanura Blume is a genus of arecoid palms endemic to the Malayan Archipelago. There are twelve species described from Malaya of which *I. geonomaeformis* Martius was the first to be described in 1845. The specific epithet is apposite, as Martius notes in *Historia Naturalis Palmarum* (1823–50) that these are "Palmae arundinaceae habitu geonomae." The geonomoid palms, however, are still much better known than their equivalent Malayan palmlets.

Iguanura geonomaeformis is very abundant in the undergrowth of lowland rain forests in Malaya and it often dominates the undergrowth, forming thickets of several thousand individuals. I looked for it in numerous forests in Malaya and only failed to find it on the limestone outcrops and mangrove swamps and on the main range above 4000 feet. This species is particularly abundant in the valley bottoms beside streams and in low-lying forest which is seasonally swampy. It is quite restricted in its habitat and unlike the other species of *Iguanura* it does not grow far from streams or on well-drained slopes. None of the species is found on dry ridge tops.

Iguanura geonomaeformis is closely related to *I. wallichiana* Hook f. from which it is only distinguished by having a simple or bifid spadix while *I. wallichiana* has a spadix with three or more branches (generally with nine or ten): the two species cannot be told apart vegetatively. Interestingly *I. geonomaeformis* is, as noted above, of very restricted habitat while *I. wallichiana* is frequently found on slopes. Mixed populations of these two species are found in central Malaya, for example in the National Park in Pahang; elsewhere the populations are exclusively of one species. *Iguanura geonomaeformis* is commonly found at and south of Kuala Lumpur and *I. wallichiana* is found at and north of Fraser's Hill.

I chose to work on *I. geonomaeformis* as it grows in the mountains behind Kuala Lumpur where the University of Malaya has a Field Studies Centre which I was given permission to use. I was able to make almost weekly observations for over a year on the populations growing there.

Iguanura geonomaeformis is a very slender thornless palmlet which seldom reaches six feet tall (Fig. 1). The stem is about one inch thick and has conspicuous annuli (circular leaf scars) at regular intervals about one inch apart; the stem is rough and the outer layers become papery when dried. The base of the stem is supported by a mass of thin fibrous stilt roots and there are often several smaller stems of varying ages sprouting from the base to form a clump of about five stems. The leaf sheaths are tubular but do not form a distinct crownshaft as seen in the elegant ornamental arecoid palms, such as *Roystonea* or *Archontophoenix* which are self-cleaning; rather the leaves do not absciss but remain rotting while hanging from the crown giving the palm a rather scruffy appearance. The leaf sheaths are very fibrous and so remain at the base of the



2. A large forest ant crawling on a spadix with male flowers open.

crown for several years. Neither does the leaf sheath form a long tight tube; it is tubular for only half its length as the thick fibrous sheaths of the successive new leaves force it apart.

The crown supports about eight to ten pinnate leaves when adult and these are generally about three feet long and one foot wide. The pinnae are only rarely regularly arranged and frequently they are of different widths. They are not in opposite pairs nor are there always the same number of pinnae on both sides of the rachis. The leaf opens a very attractive pale pink and quickly turns bronze before becoming rice-green and after about two weeks assumes a dark olive-green colour.

The inflorescences always develop and complete their fruiting among the leaves and in fact this palmlet has the habit and appearance of *Calyptrocalyx spicatus*, which is sometimes cultivated in tropical botanic gardens, except, of course, that it is very much smaller. The form of inflorescence gives its names to the genus as Blume thought it resembled an amphibian's tail (Principes 14:116, 1970; "What's in a name"). The spadix is invariably simple and sometimes narrowly bifid. The flowers are in threes (two male and one female) and are sunk in common pits which are arranged spirally on the spadix. In this species the three flowers are very rarely seen together as they develop in succession with only two flowers visible at any one time. While the first male flower is open, the second male flower is an immature bud half-enveloped in the floral pit and the female flower is embryonic and completely hidden within the pit.

←

1. *Iguanura geonomaeformis* growing in its typical streamside habitat.

When the second male flower is open, the female flower is an immature bud just emerging from the pit. Towards the apex of the spadix the pits contain only male flowers. The spadix is protandrous and the male flowers are ephemeral. The female flowers seem to last longer but it is difficult to tell when fertilisation occurs until the stigmas turn black after one or two weeks. The flowering period for a single spadix lasts between one to three months. Inflorescences are produced continuously and it is not uncommon to find a plant with several inflorescences at various stages from buds to ripe fruits.

Schmid (1970) studied the pollination of a New World arecoid palm, *Asterogyne martiana*, which closely resembles *Iguanura geonomaeformis* in being a small undergrowth palm of wet lowland forest. Schmid concluded that *A. martiana* was insect-pollinated. Though no insect has been demonstrated to transfer pollen from the male to the female flowers of *Iguanura*, it is probably insect-pollinated too. When illuminated by sunflecks in the morning the spadix in male flower is covered with insects including ants (Fig. 2), which sip the liquid (which could be nectar) at the petal bases; flies, bees and wasps gather the pollen; and weevils seem to consume the stamens. The female flower attracts fewer insects: ants, for example, seem to sip the floral liquid.

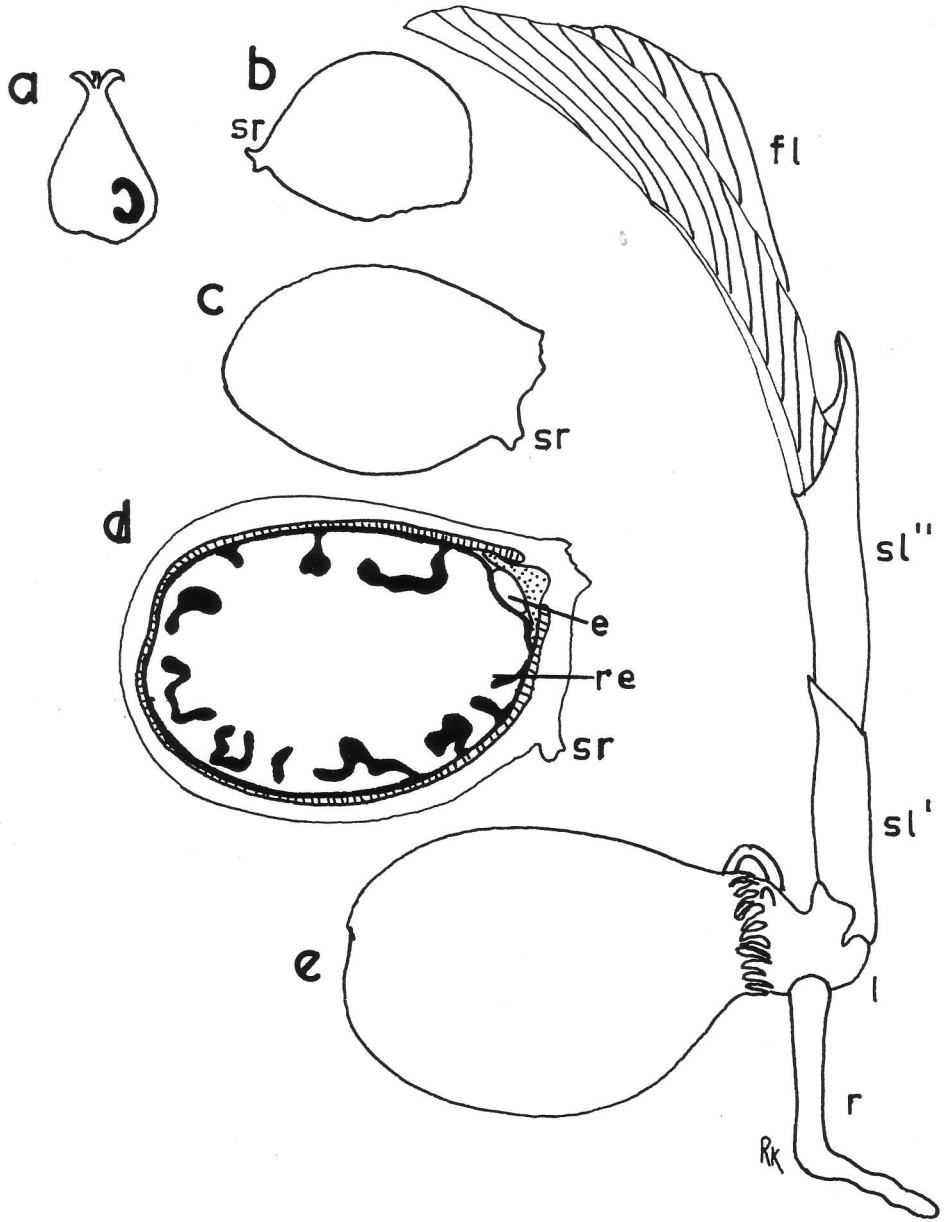
Fruit development after pollination is slow and it takes about six months for the fruit to reach maturity. The ripe fruit resembles a cherry as it is cherry-coloured, globose and has a soft sweet outer layer. The style-remains are basal and it is interesting to watch the development of the fruit as the style-remains are manoeuvred into a basal position by unequal growth (Fig. 3).

The fruit is about ⅜ of an inch long and inside the soft outer layer is a very tough fibrous mesocarp which encloses a seed with its solid ruminate endosperm. The fruit is probably attractive to birds, just as the cherry is, but I have never seen birds taking the fruits; this is not surprising as the jungle birds are very shy. However the seedlings are never far from the adults and are often found in clusters very close to an adult which suggests that most fruits just fall from the spadix to the ground or are pecked off by birds.

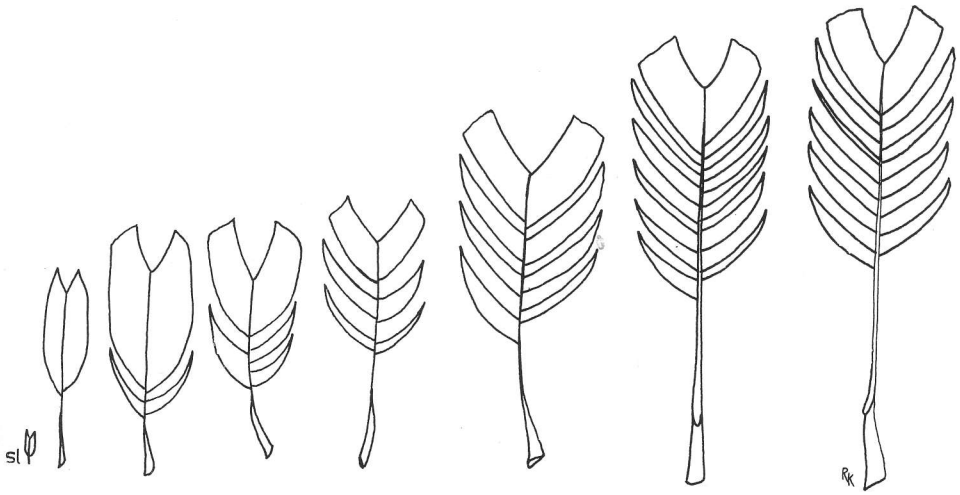
The embryo at this stage is minute—about the size of a pinhead—and is very immature which explains why the seed takes so long to germinate (about two months). The viability is very high, at least 60 percent. Germination very closely follows the pattern for *Areca* (Corner 1966) and *Archontophoenix* (Tomlinson 1960). After about six months, during which the two scale leaves are produced, the first seedling leaf opens, by which time the cotyledon completely fills the mesocarp cavity (Fig. 3).

The first seedling leaf is simple and the plant grows a succession of simple leaves which become larger and pinnatisect at the base until the final adult pinnate leaf is attained (Fig. 4).

In plants with a self-cleaning stem it is relatively easy to measure the rate of growth of the palms by marking the base of the crownshafts as Tomlinson (1963) suggests. However with palms without self-cleaning trunks it is necessary to observe the apical leaf which projects like a rapier from the apex. It was easy to measure the rate of elongation of the sword leaf as these little palms were within my reach and I made almost weekly records. Several interesting points came out of this. The adult pinnate leaves, with a final length of up to three feet, took about six to seven months to emerge from the enclosing apex and to elongate and then open and they



3. Fruit development and germination of *Iguanura geonomaeformis*. a, mature pistil in vertical section × 7; b, young fruit about one month after pollination × 7; c, young fruit about two months after pollination × 4; d, mature fruit in vertical section about seven months after pollination × ⅓; e, seedling about one month after germination × ⅔. sr, stylar remains; e, embryo; re, ruminate endosperm; fl, foliage leaf; l, ligule; sl, scale leaf; r, radicle.



4. A series of leaves from seedling leaf (sl) to the adult leaf form × 1/15.

elongated at a rate of about one inch a week, while the juvenile simple leaves, about one and a half feet long, took at least one year to elongate and open and the leaf elongated at a rate of a third of an inch a week. Since the leaf spends an almost equal time developing in the apical cone as it does elongating as the sword leaf (Corner 1966) it takes one year for an adult leaf to develop completely and two years for the juvenile leaf.

It is very interesting and not wholly expected that these small leaves grow so very much more slowly than the large adult ones. It could be that during the juvenile stage the plant is slowly building up an apex of the final adult size of the stem and increasing the number of leaves in the crown from the single seedling one to eight or more in the adult crown, with a much smaller leaf area for photosynthesis and a less well-developed root system than the adult. Once the adult stage is reached the plant has a good root system and a large photosynthetic surface and so can maintain a steady and more rapid rate of growth.

For the trunked plant it is relatively easy to assess the age of the trunk; since each annulus represents one leaf, one can make a rough assessment that the time of expansion between one leaf and the next is the age represented by each internode. Hence in *I. geonomaeformis*, since the leaves are produced at six-monthly intervals, each annulus adds six months to the age of the trunk. The problem comes in assessing how long it has taken for the palm to begin to form a trunk. I was only able to observe these palms for about a year and hardly saw one juvenile leaf from its first appearance to the final opening stage so that it is difficult to estimate how long it takes. In some arecoid palms, for example in the nikau palm (*Rhopalostylis sapida*), it takes about twenty years for a trunk to be formed and this palm produces adult leaves at a steady rate of three a year (Esler 1969). I think that in these small palms it is probably less, perhaps about ten years, as the final size of the apex is so much smaller.

If this is so it is possible to count the annuli and halve it in the case of *I. geonomaeformis* and add ten years for

the juvenile palm stage to get a rough idea of an individual's age. The maximum number of annuli I have counted is 182 which makes the palm about 100 years old, a surprising age for these tiny palmlets. Individuals with about 100 annuli (about 60 years old) are by no means rare but the majority of the populations have about 25 annuli (about 22 years old).

In every population I examined, quite a high proportion of the population (15%) was represented by seedlings and the remainder of the population ranged from the juvenile to the adult, so that these populations show no indication of declining. Another reason for their success is that the suckering habit makes this palm potentially immortal. The tallest stem, when it dies off, is replaced by the several palmlets at the base.

An important consideration in Malaya is the rate at which the forests are being cut down and how much of the forest on the highly populated west coast has already been very disturbed. I visited several such sites. In places where *I. geonomaeformis* has been totally exposed to full sunlight, such as in clearings and on logging tracks, it and other undergrowth palms such as *Pinanga* and *Licuala* were completely bleached. In other areas where the forest had been drastically thinned out the older leaves were yellow and necrotic but the larger crowns formed enough shade for the smaller palms and seedlings which showed no signs of yellowing. It seems that in these conditions this palm would be able to survive and even compete with the rapidly growing plants which are characteristic of secondary forest. It has been frequently noticed that these forest palmlets are not found in secondary jungle and it has been supposed that this is because they are too tender to survive the presumed tough conditions prevailing in these forests. However palms such as *Licuala* and *Pinanga* have been taken from their natural forest conditions and when grown from seed they can adapt to shady parts of Botanic Gardens all over the tropical world where the humidity is probably much lower and the temperature much higher than in secondary forest. Because *Iguanura* can survive for a long period in very disturbed forest I think that this indicates that when the palm has been wiped out during the sunny phase following the drastic clearing of primary forest or was never present there, it stands a very low chance of recolonizing because its dispersal is not at all efficient. Indeed it is remarkable in the jungle itself that while one valley supports a very dense population of *Iguanura* the next valley may be devoid of it although ecologically it appears identical. This points to poor dispersal mechanism in the genus.

It has sometimes been implied by authors (for example, Corner 1966) that these small forest palmlets, and particularly those small almost herblike neotenic forms with simple leaves, also have the herb character of rapid growth and a rapid turnover of individuals. I hope that this account provides some evidence against this by drawing attention to the particularly slow growth of the juvenile acaulescent stage. No doubt part of the success of these undergrowth palmlets is due to their slow growth which may be a factor involved in the exploitation of such a gloomy environment and survival in deep shade and that their long life allows them to produce fruit over a long period of time, thus ensuring some survival of these palatable fruits. Slow growth and long life may have helped to make them successful in the forest but may also be the cause of their demise in the future when the forest is cut down and adaptation or an adequate dispersal mechanism for recolonization is a prerequisite of survival.

Iguanura has no commercial value, although the aboriginal people in Malaya are said to eat the fruits and use them as inferior betel nuts and to make walking sticks from their stems. Of *I. wallichiana*, M. V. Alvins in 1884 reports he was told by the aboriginals "Anybody don't wished their wife to be confined, they shall eat their roots and flowers." I wonder how reliable this information is but Burkill (1935, 1966) in his dictionary accords this contraceptive value to *I. geonomaeformis*.

None of the species of *Iguanura* has been taken extensively into cultivation although there are a few individuals at the Botanic Gardens at Penang, Singapore and Bogor (Indonesia), where they survive and even fruit in deeply shaded areas near water. Transplanting is not successful but I have found that they will germinate readily from seed and I have healthy seedlings in the tropical houses at the Cambridge University Botanic Gardens grown from seed that I sent by air from Malaya.

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LETTERS

The following letter may be of interest to readers who grow *Howeia*.

Honorable Chairman
Lord Howe Island
Board of Control
Chief Secretary's Building
121 Macquarie Street
Sydney, Australia, N.S.W.

GOLETA, CALIF.,
November 30, 1971

DEAR SIR:

In November 1971 I had the opportunity to spend six days on Lord Howe Island. The purpose of my visit was to inform myself of the natural habitat of the four species of *Howea* palms indigenous to the island. Deigaard Nurseries have grown these palms for the last twenty years as a main operation of their wholesale nursery activity.

At the same time, I tried to find the reason for the continued shortage of seeds and rationing of our orders.

Introduction of artificial (plastic) ornamentals into the decorative market has not proved effective, on the contrary the market for natural *Kentia* palms has increased by leaps and bounds. Today we are faced with the fact of insufficient supply to fill the yearly increasing demand all over the civilized world.

These are my observations derived at during my recent visit: please rest assured that they are not meant as criticism or hasty judgment; on the con-

trary, they could work out and are intended for the profit of the people of Lord Howe Island on the one side—on the other to the benefit of all parties interested in the purchase of *Kentia* seeds.

a) *Kentia* palm growing & seed harvesting on Lord Howe Island during the last years has been on a steady decline. This is due to conversion of palm land into grazing land, land for habitation, golf course, holiday lodges, roads. It will be further decreased by the planned airport and other developments in its wake.

b) Seed crops are annually decreased not only by land conversion, but also by overgrown senile palm trees. Young, thrifty freshly matured trees produce large crops year after year, old trees produce less and less.

In order to raise the output and export, production of *Kentia* palm seed should be pushed into high rank for agricultural products. It could be developed into the number one money producing crop for the Island. The demand is there, the market is established; not that only, but it promises to be better year after year.

Two alternatives to this end seem to be given:

1) Convert some of the grazing land rich in topsoil back to *Kentia* palm production under intensive agricultural management. Row culture with secondary crops in between the rows (vegetables, berries, dwarf fruit trees) to be cultivated with soil tillers and treated with fertilizers and herbicides. Your farm advisors and research people in agriculture and horticulture of Universities and Botanic Gardens could work out details much better than I could. The in-between crops are to help defray the cost of growing the palms into seed production stage.

2) Bring the areas of palm growing now in production into a stage of highest production by rejuvenating the now existing stands. Every year, methodically, cut out a percentage of overgrown, too old unproductive or little productive trees; allow young seedlings to come up, develop. Cultivate them (again with assistance and consultation of highest qualified State personnel) into accelerated maturity. While the young plants grow in the shade of the older ones, there still will be, year after year, the income from these remaining older trees. This method seems to be the most promising.

Finally, in that manner, a well developed scheme of *Kentia* seed production will come about. Certainly, the price for this commodity will regulate itself by demand and supply. It is my opinion that under existing conditions it can go no other way but up. Any price increase as I see it, should first and mainly benefit the people of Lord Howe Island, who harvest and gather the crop. I learned and saw what a physically hard manual job it is, specially with consideration from where and what barely accessible places some of the seeds come from. To find out, I went to the top of Mt. Gower.

To gain an overall picture of the *Kentia* seed production, I went to Mr. Horton Ward, superintendent of Lord Howe Island. I wish to take this occasion to thank him for his information and all-out assistance, for making available to me climate charts of the island, most of all furnishing a guide to certain parts of the island.

It is my hope, that you, Mr. Chairman and your Board will consider my suggestions. They can do a great deal to the benefit of the Islanders, as they certainly would be to the gain of people all over the world, who grow kentias and those who would cherish them in their homes and public places.

Sincerely,
OTTO MARTENS

Tapping The Wild Date

T. Antony Davis
Indian Statistical Institute, Calcutta-35, India

Natural rubber is obtained from the latex that exudes when the mature trunk of *Hevea brasiliensis* is tapped. Tapping the stem of pines such as *Pinus pinaster*, *P. sylvestris*, *P. palustris* and *P. caribaea* yields turpentine. Sugar maple (*Acer saccharum*), when tapped at the proper time, exudes a sugary sap from the stem. Extraction of a sweet fluid from some species of palms has been an ancient practice in the tropics. For example, when the spadices (flower bunches) of *Cocos nucifera*, *Borassus flabellifer* and *Caryota urens* are prepared and pared at the critical stage and maturity, they exude sugary juice. In *Arenga pinnata* as well as *A. wightii*, usually the stalk of the spadix is tapped. But the entire crown of *Corypha elata* is chopped off just when the only flower bunch emerges. The tip of the naked stem is scooped into a shallow depression from which the juice is collected. Sometimes the noble date (*Phoenix dactylifera*) is also similarly treated for obtaining sap. However, with the wild date (*Phoenix sylvestris*), a portion of the tender stem is injured for the extraction of a juice which is rich in sugars, vitamins and protein. An account of the method of tapping the wild date and the importance of the juice thus collected is given below.

The Wild Date

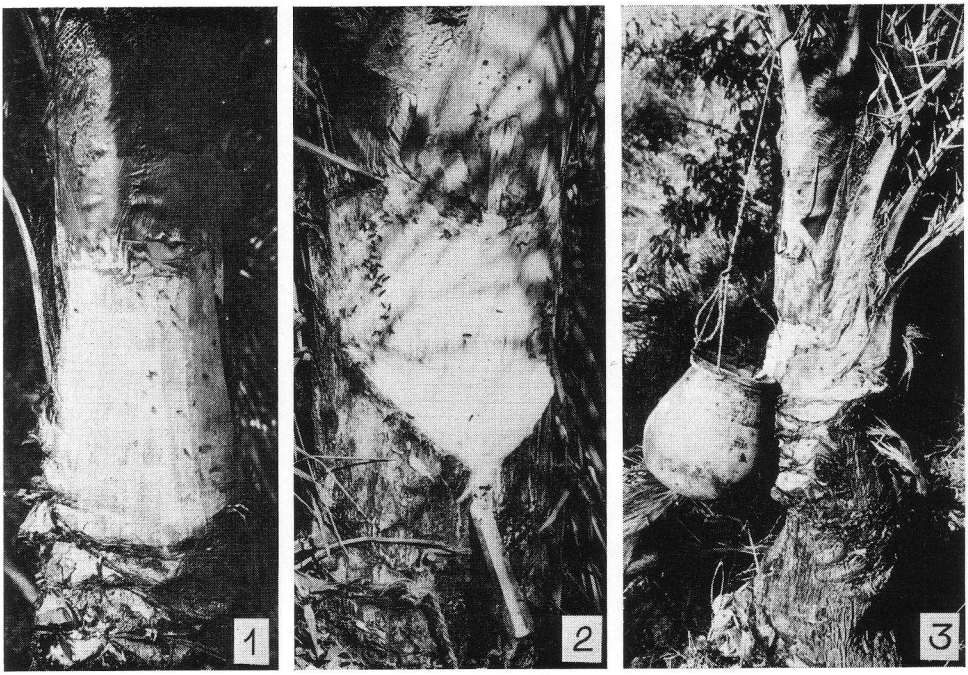
True to its popular name, *Phoenix sylvestris* grows in a wild state throughout India except at the tip of the southern peninsula and in Kashmir. This species also grows densely in Pakistan and Bangladesh, and sparsely in Burma and Ceylon. In some Indian states, there is a growing awareness to cultivate this palm partly because it is extremely easy to grow it on account of its hardiness to drought and neglect, and partly bceause it is useful.

The wild date is a very graceful palm having about a hundred green leaves that form the spherical crown, and bearing persistent bases of dead leaves on the stem which veer in eight spirals either clockwise or counter-clockwise. The palm lives for about 60–70 years, producing a stem about 18–20 meters tall. If the stem is tapped regularly, the overall growth of the palm is reduced, but the trunk with its persistent zig-zag notches looks very characteristic indeed (Fig. 4). There are about 30 million wild date palms now growing in the various states of India.

Method of Tapping

The most important use of the wild date is the extraction of a sweet juice, known also as sweet toddy, or *neera* from the tender stem. Tapping the wild date is very common in the northeastern parts of India and Bangladesh, and is getting popular in other parts of India as well thanks to the effort of the Palm Gur Organization under the Khadi and Village Commission. The tapping season commences in October or November and continues through the colder months up to March or April after which time, with the rise in temperature, the quantity and quality of the sap deteriorate.

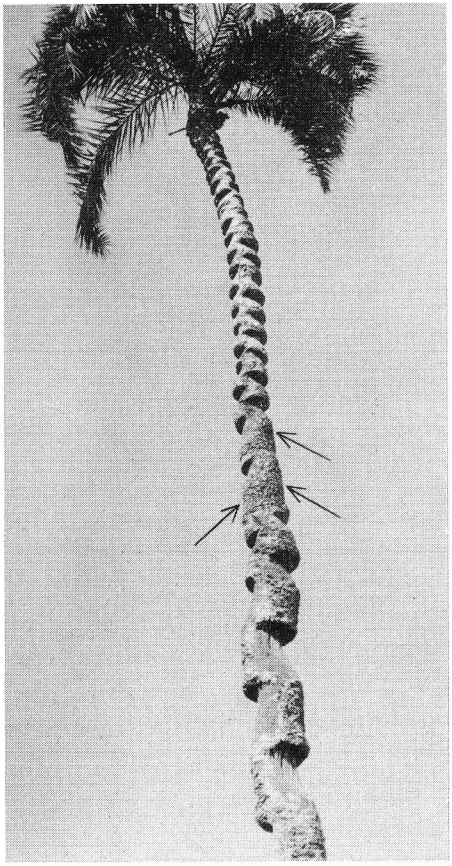
The first stage of the operation consists of the cutting off of all the older leaves up to the leaf-base on one-half of the crown leaving the vertically disposed younger leaves uninjured. Thus, the peripheral layer of the stem on one side



1–3. Stages in the tapping process of the wild date palm as followed in India. 1, The stem is exposed on one side. 2, A broad V is cut and a bamboo tongue is fixed. 3, A mud pot is hung to collect sap.

is exposed. The surface, though brilliant while freshly cut, becomes a brownish tan within a short time due to the presence of tannin and because of oxidation (Fig. 1). Then the palm is left undisturbed for about a week to ten days. After this interval, a layer 15 to 25 cm. broad, 30 cm. lengthwise and one cm. thick in the shape of a broad V is sliced off in thin layers from the exposed surface with the help of a special tapping knife. Between localities, there are variations in the size of tapping area, frequency of tapping as well as the shape of the tapping knife and collection pot. Sap starts trickling from this freshly exposed surface and flows downward, reaching the narrowest portion of the V where a thin, half-split bamboo is fixed with its free end jetting out as a tongue through which the sap flows into a mud pot hung in position (Figs. 2, 3). The presence of ants and flies on the pared surface indicates the flow of sap. The mouth of the mud pot is usually covered with a piece of jute gunny or a set of date leaves mainly to keep away the several species of birds that almost live on this sweet sap during the colder months.

The first 24 hours of this process yields the maximum flow of a superior quality sap. On the second day, the cut surface is gently scraped to ensure continuous flow of the sap. The cut surface is again freshened next day by mild scraping, and the dripping continues for another day. After three days, the tree is given a short rest period of three or four days, on the expiration of which another deep layer of about one cm. is pared off from the exposed portion as in the first instance which ensures a good flow of better quality juice. On the two



4. Permanent tapping marks on a wild date.

subsequent days, the practice adopted during the first week is repeated. Likewise, the tapping goes on for a continuous period of four or five months and the injury on the stem gets deeper and deeper. This mark remains permanently on the trunk since the palm belongs to the monocotyledonous group of plants which are devoid of thickening of older organs.

Because of the mechanical injury inflicted on one side, the palm grows more vigorously on the opposite side during the next approximately eight months, and so the crown is pushed slightly to the direction of the injury. This becomes handy for the tapper to make use

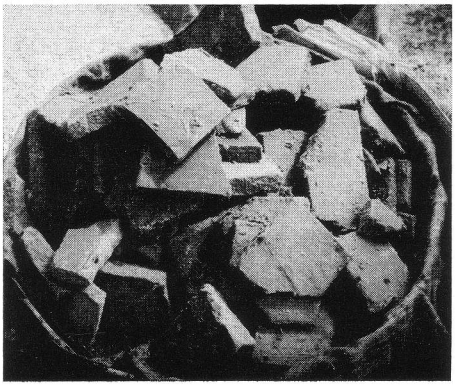
5. Older tapping notches enable the tapper to climb and work comfortably on the trunk.

of the opposite side to commence the operation during the next season. During the third year, tapping is done on the side and above the first tapping. Palms which are tapped year after year bear the deep scars along opposite sides in a zig-zag manner. It becomes easier to assess the age of such palms. The one in Fig. 4 bears 54 such marks with three escapes indicated by arrows. Thus, with about ten years of growth of the trunk not visible in the picture and adding three years for the development of the crown, the age of this palm can be reckoned as 67 years. However, not many palms are tapped for such long periods. The depressions become very handy for the tapper to climb the trunk and to rest during the operations (Fig. 5).

The Palm Juice

Freshly obtained sap of the wild date is clear as water, very sweet having 12–15 per cent sugars and is a delicious

6. Enjoying a glass full of energy and health.



7. A basket full of palm jaggery displayed in a market.

drink rich in vitamins. A glassful forms the breakfast for many villagers during the season (Fig. 6). Application of lime in the receiving pots delays the fermentation of the juice. The fermented juice, popularly known as toddy, is also taken by those who like to get intoxicated. When the sweet juice is boiled, a thick syrup is obtained which is consumed in various ways. Sufficiently boiled down juice condenses into the palm jaggery which is moulded in suitable blocks. The jaggery finds a good market (Fig. 7) as it is either directly consumed or used in the preparation of sweets. It is often more expensive than the crystal sugar made from cane juice.

On an average, a palm during one season can yield about 40 kg. of jaggery valued at eighty Indian rupees (U. S. $11.00). Of the about 30 million wild date palms in India, at least 20 million can be tapped, which would, apart from earning considerable foreign exchange, give employment to a million tappers and other artisans connected with this industry. Besides *Cocos* which is usually tapped for toddy (see *Principes* 7:70–79, 1963), *Borassus* and *Caryota* are also potential sources of palm jaggery like the wild date, and the present production in India is one hundred thousand tons of jaggery per year. The Palm Gur Organization through its over 2600 Palm Jaggery Cooperatives is endeavouring to bring more palms under the clutches of man. It has also been made possible to bottle fresh juice for distribution as soft drinks in cities like Bombay, Poona and Delhi. This nature's beverage is more wholesome and refreshing than commercially available soft drinks.

The Carnauba Wax Palm (Copernicia prunifera). I. Botany

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This paper is the first of a series intended to present much of the information contained in the author's unpublished thesis entitled *The Carnauba Wax Palm (Copernicia prunifera) and Its Role as an Economic Plant* (1970).

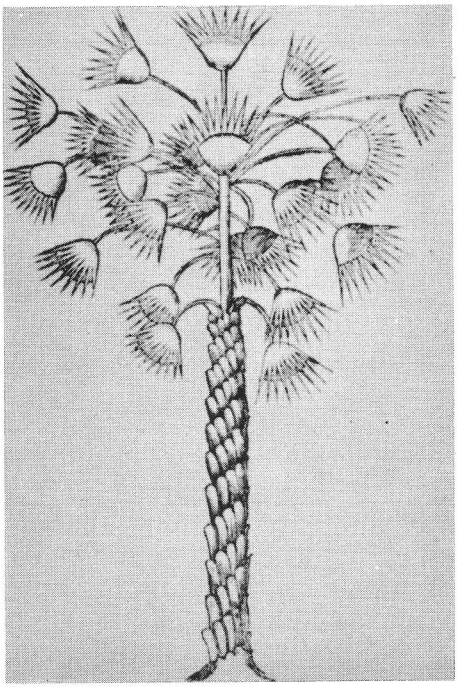
Naming of the Species

The common name "carnauba" is derived from a Tupi Indian word meaning literally "tree that scratches." This designation was no doubt used by the Brazilian Indian group because of the spiny petioles and residual leaf bases which cover the lower portion of the trunk.

General agreement exists that the earliest published reference to carnauba is found in the 1648 work by Marcgravius and Piso entitled *Historia naturalis Brasiliae.* In a later work published in 1658, Piso provided the first illustrations of this plant, one of which is reproduced in Fig. 1.

The descriptions and illustrations provided by Marcgravius and Piso led to the inclusion of an account of carnauba in Ray's *Historia Plantarum* (1688). This in turn was picked up by Miller in the eighth edition of *The Gardeners Dictionary* (1768) and given the designation *Palma prunifera.* This naming of the species was overlooked for nearly two hundred years until Moore (1963) reinstated the species name *prunifera.*

In Brazil, Arruda da Câmara in 1810 gave the binomial *Corypha cerifera* to carnauba, but this was revised to *Copernicia cerifera* by Martius in 1838. An attempt to honor Arruda da Câmara as the discoverer of carnauba wax was made by Macedo (1867) when he proposed that it be renamed *Arrudaria cerifera.* This change, however, was not adopted, and carnauba carried the scientific name *Copernicia cerifera* until Moore corrected the specific epithet to *prunifera.*



1. One of the earliest known illustrations of carnauba. From Piso (1658).

2. Nine-year-old carnauba palms which have not yet produced trunks due to premature leaf harvesting. Photo courtesy S. C. Johnson & Son, Inc.

Botanical Description

The recent revision of *Copernicia* by Dahlgren and Glassman (1961) provides a comprehensive description of *C. prunifera*. Since this paper is focused on man's use of the carnauba, only the parts of the plant which are relevant will be considered, such as the stem, root, fruit, and leaf.

Trunk. In Brazil two common terms are used to refer to the trunk. When the tree is young and has yet to put forth a stem free of leaf bases it is referred to as *cuandu*, a word which also refers to a Brazilian type of porcupine. When the tree reaches maturity the upper portion of the stem is smooth and free of leaf bases through natural leaf fall. It is then referred to as *lavada* which translates as "cleaned."

Normally the carnauba has a single trunk. However instances of damage to the terminal shoot through insect activity result in branching. There are photographic records of trees exhibiting four and five such branches (Andrade and Salgado, 1945, and Min. Agr., 1929).

Growth-rate. Under normal conditions, where leaves are not harvested, the carnauba grows at a rate of about one foot per year (Kitzke, 1954a). The effects of harvesting leaves are significant as shown by Kitzke's research in Brazil. Trees planted side by side were grown under conditions of complete protection, and of regular harvesting of leaves. After 21 years the protected trees measured about 7.5 meters to the top of the crown while the trees subject to leaf cutting measured some three meters to the same point. In cases where harvesting of leaves has been initiated at too early an age, and where such practices have been continued, it is possible to have trees of nine years of age which still have not produced a trunk.

The number of leaves produced by a mature tree each year is on the order of 46 to 60. Indications are that leaf fall occurs about one year after leaf emergence takes place; therefore, the crown of a mature tree is made up of leaves one year of age and younger. It has also been found that petiole lengths increase as the tree becomes taller and older (Kitzke, 1954a).

The subject of growth-rate naturally leads to speculation concerning the life-span of the carnauba. While early estimates put the life-span at up to 200 years, Kitzke estimates that 75 years would be a reasonable figure. The question of the effect of constantly harvesting leaves is an interesting one. No quantitative data are available, but continued harvest may arrest senescence and prolong the life-span.

Root. The root system of the carnauba is typical of palms in general. The mature tree has a large clump of innumerable branching roots, some of which extend laterally a distance of several meters.

The carnauba seedling initially pro-

3. The white carnauba, a form of *C. prunifera*. Photo courtesy of S. C. Johnson & Son, Inc.

duces a long juvenile "tap" root which serves as a temporary organ of anchorage and water absorption. It is this long root which has probably led to the mistaken belief that the carnauba cannot successfully be transplanted.

The underground stem of the seedling immediately begins to form adventitious roots, usually three or four within the first year. As the diameter of the stem below ground increases, so does the number of adventitious roots. In this way the fibrous root system typical of palms is formed (Kitzke, 1951).

Fruit. Flowering of the carnauba occurs randomly throughout the year. This is not common in the genus *Copernicia* which is normally synchronous and may be the disruptive effect of leaf harvesting injury. Botanical maturity or first-flowering occurs between the ages of 12 and 15 years. The small ovoid fruits are light to medium green initially, ripening to a dark purple to black color. They have a whitish pulp which, when ripe, has a sweet although somewhat astringent taste, and contains a single large seed.

Leaf. The fan-shaped leaf of the carnauba has in mature trees about 60 leaf divisions. The central division is about 90 cm. long. Both surfaces of the leaf have a coat of wax, which can be processed to become the carnauba wax of commerce.

Varieties

Taxonomic studies of varieties of *C. prunifera* have not been completed although there is some preliminary information. The common carnauba described above is representative of the total population.

Three other types of carnauba are reported. The white carnauba (Fig. 3) is distinguished by the distinctive shape of the crown. The name is derived from the roots which are said to be lighter in color than those of the common form. Despite being valued for its medicinal use, it is said to be rare and the existence of a single specimen in a large *carnaubal* is considered fortunate. It has been stated that another distinguishing characteristic of the white carnauba is that the petioles make a pattern around the trunk spiralling to the left, rather than to the right. This is not valid however because the common carnauba occasionally exhibits the same pattern.

Another reported type is the giant carnauba, which is designated because of its height of up to 15 meters. Whether this is in fact a true variety has not been determined. It may merely represent the potential height to which any carnauba would grow if the leaves were not harvested.

Based upon research carried on by S. C. Johnson & Son, Inc. at Raposa near Fortaleza, Brazil, there is evidence of one additional type. It is based on a significantly smaller leaf size and has been designated "small-leaf" (Kitzke, 1955b).

Related Species

In addition to *C. prunifera*, two other species occur naturally in South America: *C. tectorum*, which is found chiefly in the savannas of Venezuela; and *C. alba*, which has a distribution centered on Paraguay.

Prior to Beccari's study of New World palms in 1907, it was generally believed that *C. alba* and *C. prunifera* were a single species, and they were combined under *C. cerifera*. The taxonomic revision to two species went unnoticed in several studies subsequent to that date and this has caused considerable confusion in the literature.

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Palms in Dallas, Texas

GORDON D. HINTZ

One does not normally consider Dallas, Texas, to be a palm growers' paradise. However, several species do quite well here in spite of winter cold and intense summer heat. The purpose of this article is to acquaint the members of our society with our conditions and how they affect the growth of palms in Dallas.

Dallas lies in North Central Texas approximately 260 miles inland from the Gulf of Mexico. The close proximity of the Gulf has a moderating effect on our weather, actually causing a semi-monsoonal type of climate. In spite of this, each year we are visited by what we call "blue northers" of varying intensity which annually bring us our coldest weather. The "blue norther" is an Arctic front which is capable of plunging temperatures many degrees in a few short hours. More often we are visited by Pacific cold fronts, with more moderate temperatures. The Pacific fronts account for much of our rainfall.

The chart in Table 1 gives the major climatic data for Dallas. From my observations, the most destructive climatic condition to the growing of palms here, is the cold desiccating winds of the Arctic fronts. Protection, whether it be a wooden fence or a south wall, is a must in trying to grow any but the most hardy species.

The cold severity data is worthy of further explanation. Since duration of cold is important in palm culture, the chart shows that in the Decade 1960–1969, there was an average of three days per year when the temperature failed to rise above freezing during the entire day. Freezing conditions occurred on an average of thirty-seven days per year, generally at night, with thirty-four of these days having temperatures above freezing at some time during a 24-hour period.

The data also shows that the Decade 1940–1949 experienced lower minimum temperatures, but each decade had some minimums below 10° F. In spite of these extremes, there are mature specimens of *Washingtonia filifera* and *Sabal texana* living and fruiting today which were planted prior to 1940.

We normally get a gradual cooling down of temperatures in the late Fall. This allows tender plants to "harden off" to the cold. Freezing temperatures on an actively growing palm are much more damaging than if the palm were dormant.

Most of Dallas County lies in the Texas blackland belt, a narrow strip running from Oklahoma south to near San Antonio. The soil is a heavy, black alkaline clay. It is quite shallow in some areas with outcroppings of white caliche sedimentary rock. Since the soil is tight, considerable sand and peat moss has to be worked into it to keep it friable. My palms have not shown any ill-effects from this soil and seem to thrive in it.

Planting location is a prime consideration. A good portion of Dallas is on low, rolling topography. The best winter protection occurs on the south slopes with good air drainage. Exposed, hill-top sites should be avoided, as well as frost-pockets. These can be termed micro-climatic considerations and they are important. In choosing a site around a home, preference should be given to the south side of walls and solid fences for the more tender species. Areas be-

TABLE 1. *Climatic data for Dallas, Texas*

Decade	Minimum Temperature	Number of years in which minimum temperature was			
		20–32° F.	15–19° F.	10–14° F.	below 9° F.
COLD SEVERITY					
1960–1969	8° F.	2	3	3	2
1950–1959	7° F.	1	5	2	2
1940–1949	2° F.	1	1	4	4

	Average number of days per year when temperature was at a	
	maximum of 32° F. or below	minimum of 32° F. or below
1960–1969	3	37
1950–1959	2	33
1940–1949	4	34

Coldest temperature on record since 1913 is –3° F. in January, 1930

OTHER WEATHER DATA

Average mean temperatures (1931–1970)
- January 45.5° F.
- July 85.0° F.
- Annual 65.9° F.

Average annual precipitation (1931–1970)—34.90 inches
Date of average first freeze in Fall—November 22
Date of average last freeze in Spring—March 18
Normal sunshine—66% of possible

tween houses retain day-time heat longer and thus remain warmer during the night. Naturally, trees will act as a partial blanket when the air is calm. Only the most hardy species should be planted in open, exposed areas.

The following species are presently being grown in Dallas. I do not say that this is a total list, but these are the more commonly seen palms.

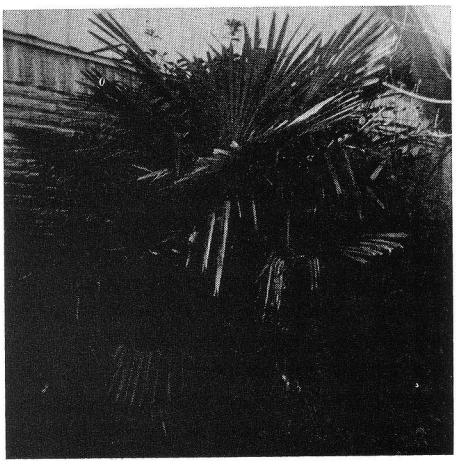
Sabal minor. The dwarf palmetto is the only palm native to Dallas County. It is completely hardy here. Local nurseries do not handle it because it is so slow growing, which is unfortunate since it does make such a beautiful plant. Fig. 1 shows several plants growing in a

1. *Sabal minor.* A beautiful clump of several plants. Numerous seedlings can be found around the base of these palms.

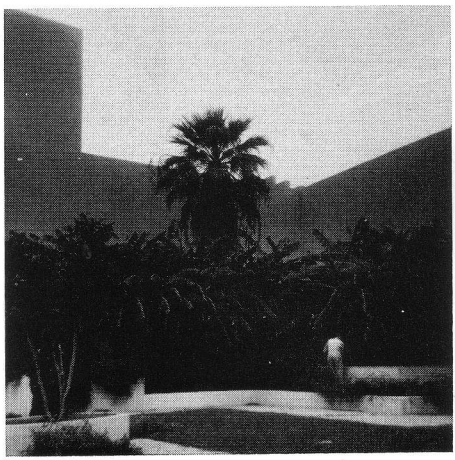
2. *Trachycarpus fortunei.* A group growing at Marsalis Park Zoo. Some of these are producing fruit.

clump near the Flamingo pond at the Dallas Marsalis Park Zoo.

Trachycarpus fortunei. I would class the windmill palm as being as hardy as the dwarf palmetto. It is carried by most nurseries and is the most common palm seen in Dallas. Figs. 2 & 3 show some examples of this very beautiful species.

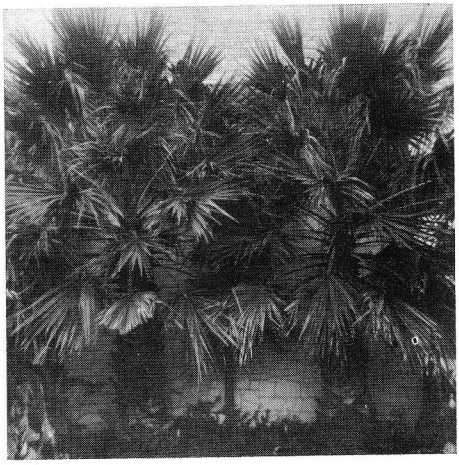


3. *Trachycarpus fortunei* growing at the author's home.



4. The tallest palm in Dallas is this *Washingtonia filifera* growing in Fair Park. The wall behind the tree is approximately 35 feet high; banana plants are in the foreground.

Washingtonia filifera. This palm is quite hardy, once established. In some severe winters, frond burn can occur, particularly in young plants. Figs. 4, 5 & 6 show examples growing in the city. Both the *Washingtonia* in Figure 4 and the *Sabal* in Fig. 7 were planted for the Texas Centennial in 1936. Seedlings grown from these trees appear to be



5. *Washingtonia filifera.* Seedling trees from the tree in Fig. 4.

6. A seedling from the *Washingtonia filifera* in Fig. 4 planted in 1965 at the author's home.

7. *Sabal texana* growing in Fair Park. This tree is approximately 25 feet tall.

more cold hardy than those grown elsewhere and transplanted to Dallas. *Washingtonia* is found quite regularly in local nurseries, but many are the *W. robusta* which is tender and frequently lost during severe winters. The *W. filifera* is our fastest growing palm as evidenced by the six year old plant in Fig. 6.

Sabal texana. The Texas palmetto is very hardy but found mainly in commercial plantings, such as at motels. It is extremely slow growing, but is a beautiful tree with the dull green costapalmate leaves. (See Fig. 7). This species deserves wider usage. Seedlings from the Fair Park tree are growing in various Dallas Parks.

Butia capitata. This palm is sold under the name of *Cocos australis* in Dallas nurseries. It has only been readily available for the past five years. It appears to winter well, but only time will tell if it is completely hardy. It is the only pinnate-leafed palm available to us in quantity at the present time.

Other species. Occasionally, one sees *Phoenix canariensis* and *Erythea armata*, but their occurrence is rare. I have both of these (plants and seedlings) but it is much too early to comment on their potential hardiness. *Chamaerops humilis* is now starting to appear in nurseries and this one should prove hardy. Other species currently undergoing test for winter-hardiness are *Jubaea chilensis*, *Phoenix dactylifera*, *Sabal palmetto*, and *Sabal etonia.* Seeds of *Serenoa repens* have been planted and I hope to soon obtain seed of *Rhapidophyllum hystrix.* The latter two should adapt to our climate. I would be most happy to hear from other members who may have suggestions of other species to test.

Palm culture is increasing in Dallas, mainly through the efforts of the Dallas Park Department. As these plantings increase, the public becomes more aware of the beauty of palms and their place in any landscaping plan. Our hope is that someday Dallas will truly become a "City of Palms."

PALM LITERATURE

Wallace and his Palm Trees of the Amazon*

"Darwinus alter" was the recognition given to Alfred Russel Wallace when he was presented for his Doctor's degree at Oxford, for he independently but cooperatively had sponsored Darwin's theory of organic evolution by natural selection. Like Darwin he assembled a cabinet of insects as a lad and at twenty-one when he met Henry Walter Bates at Leicester his future was destined for travel and natural history collecting. He had no great liking for teaching, land surveying, or assisting an architect, each tried in turn. Wallace had read Darwin's *Voyage* and Humboldt's *Personal Narrative* and talked with Edward Doubleday of the British Museum, but it was *A Voyage up the River Amazon, including a residence at Pará* by the American naturalist William Henry Edwards (who later wrote the beautifully illustrated *Butterflies of North America*) that drove Wallace accompanied by Bates to take passage for Brazil in the barque *Mischief* in 1848.

Wallace made excursions in Brazil partly in company of Bates, partly on his own account, up the Rio Negro to the second cataract at Juaurite on the river Vaupes, farther than any other explorer had succeeded in penetrating until 1881. He sent back insects and birds to be sold for him by his agent Stevens, but his personal collection was lost at sea when the *Helen*'s cargo took fire soon after his leaving for home. "In the small tin box which I had saved from the wreck," wrote Wallace, "I fortunately had a set of careful pencil drawings of all the different species of palms I had met with, together with notes as to their distribution and uses." It is this portfolio of drawings and notes that Wallace determined to publish at his own expense, "as a small popular volume" finally entitled the *Palm Trees of the Amazon* with, as he said, "an account of their uses and distribution, and figures of all the species from my sketches and specimens of fruits. I arranged with Mr. Walter Fitch of Kew, the first botanical artist of the day, to draw them on stone, adding a few artistic touches to give them life and variety, and in a few cases some botanical details from species living in the gardens. In one of the drawings [Plate XXXVI] a large native house on the Uaupes is introduced, with some figures which, I am sorry to say, are as unlike the natives as are the inhabitants of a London slum. I arranged with Mr. Van Voorst to publish this small volume, and it was not thought advisable to print more than 250 copies, the sale of which just covered all expenses." (*My Life*, pp. 313, 321, 1905).

Berthold Seemann, German botanist on the voyage of the H.M.S. *Herald* and best known for his classic on the flora of Fiji, published his *Popular History of the Palms and their Allies* three years after Wallace's little volume appeared. In his book Seemann quoted the "enterprising traveller Mr. Wallace" on many occasions indicating his source. The same year Philip Henry Gosse, who lived and wrote of his year spent in Alabama, published, anonymously, his charming *Wanderings through the Conservatories at Kew*, quoting long sections from "Mr. Wallace's beautiful book" as he strolled through four chapters on palms.

Bear in mind that L. H. Bailey, who had occasion to refer often to Wallace's "notable book" in his papers on palms, quotes Richard Spruce as saying "the

* Facsimile reprint. Coronado Press, Box 3232, Lawrence, Kansas 66044. $12.50.

most striking fault of nearly all the figures of the larger species is that the stem is much too thick compared with the length of the fronds, and that the latter bear only half as many pinnae as they ought to have" (*Gentes Herbarum* 3:9. 1933).

Prof. H. Lewis McKinney, who has followed Wallace through the archives if not on the rivers of the Amazon, has provided a short introduction to the reprint. He remarks that eleven of Wallace's fourteen presumed new palms were admitted to be valid by Dahlgren in 1936. John Longhurst of the Coronado Press says that it was difficult to locate a bright copy of Wallace's book for reprinting, and that he made an effort "to improve the appearance of the original by our time exposures in the camera to compensate for weak lettering caused by deterioration over the years." Detail and most of the shading have unfortunately been lost for many of the plates and the map bears slight resemblance to the frontispiece of the original edition. The registry of the text, however, held up well. In today's market the price of the reprint is attractive and here is a hard-to-find little classic on American palms that readers of *Principes* will want for its intrinsic interest and commentary.

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HENDERSON, RANDALL. Palm Canyons of Baja California. 71 pp. 11 photos, 2 maps. La Siesta Press, Glendale, 1971. Available from La Siesta Press, Box 406, Glendale, California 91209. Price $1.95.

This small paperback brings together eight articles on palm canyons in northern Baja California by Randall Henderson which appeared in Desert Magazine from January of 1946 to July of 1951. Included are visits to the following canyons: Cantu, Cloudburst Canyon, Tajo, Guadalupe, La Mora, Palomar, Santa Isabel, and Agua Caliente. There appears to be some problem with the location and Mexican name for Cloudburst Canyon.

Walt Wheelock introduces the book with comments on current road conditions and concludes the book with a six page biography of Randall Henderson.

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CLASSIFIED SECTION

PLATES FROM DR. DAHLGREN'S PALM INDEX—Broken sets of plates of this work, 400 or fewer plates, are available on a "first come first served" basis to members of The Palm Society. Send self-addressed sticker, $1.50 in U. S. stamps (or $2.00 foreign) to cover shipping and packing costs, to LOUIS O. WILLLIAMS, Field Museum, Chicago, Illinois 60605.

Errata:

Volume 9, page 111, column 2, line 23 *for* sylvatica *read* sylvicola.
page 155, column 2, line 34 *for* sylvatica *read* sylvicola.

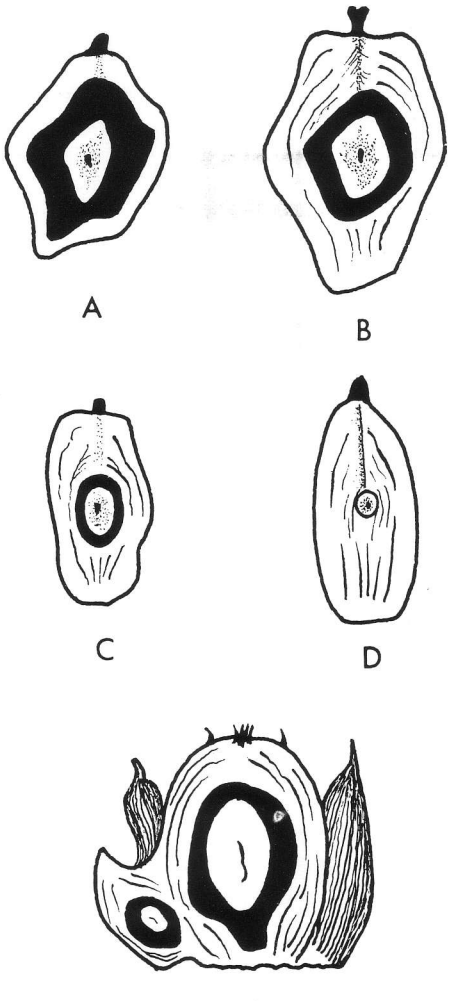
Volume 15, page 103, column 1, line 25 *for* australasicus *read* australasica.
page 104, column 2, line 33 *for* Singapore *read* Buitenzorg (now Bogor).

The Cultivars of the African Oil Palm

LILLIAN EHSANULLAH

The most common horticultural form of the African oil palm, *Elaeis guineensis*, is the 'Dura' which has spherical thick-shelled fruit and is found in large groves in West Africa and Latin America, and in plantations in the Far East. In the latter area the fruit is usually larger and the shell very thick, and it is known as the 'Deli Dura' of Sumatra. The difference between the bunches (or *bangas* in Nigeria) of the ordinary African 'Dura' and the 'Deli Dura' is that the spikelets of the former end in long spines while the latter have short spikes. Another form is the rare 'Pisifera' which produces predominantly sterile fruit, but a few fertile fruit will identify it as these are without shell and have pea-like kernels.

An important discovery was made in the Congo, namely that the 'Dura' used as a mother plant could be crossed with the 'Pisifera' as pollen parent. The resulting hybrid was called 'Tenera' or 'Lisombe' in the Congo and it produced an elongated or ovoid thin-shelled fruit with more oil-bearing mesocarp than the 'Dura.' At present the 'Tenera' form is preferred for the Latin American and the African plantation industry. Malaysia is also changing to 'Tenera.' The 'Tenera' fruit has a dark-colored fiber ring around the shell which is absent in the 'Dura.' The length of 'Dura' and 'Tenera' fruit is 2–5 cm. or more, and the weight is 3–30 g. and over. The shell thickness in 'Dura' is 2–8 mm. and in 'Tenera' 0.5–4 mm.; the mesocarp content in the former is 35–65 percent and in the latter 55–96 percent. The trunk of the plantation 'Tenera' is thicker and shorter than the grove 'Dura' and the leaf span is larger. The grove palms grow at a higher density than the plantation palms, and this causes the former



1. Fruit forms. A, African 'Dura'; B, 'Deli Dura'; C, 'Tenera'; D, 'Pisifera'; E, 'Poissoni' or 'Diwakkawakka.' A–D adapted from Hartley, E after Janssens in Hartley, drawings by Miss Razia Ehsanullah.

2. 'Dura' oil palms between Aba and Owerri, Nigeria. Epiphytes and cuts from wine-tapping can be seen on the trunks. In the center of the red (dark) bunches is a yellow-green (lighter) 'Virescens' bunch. Photo Mrs. L. Ehsanullah.

to grow rapidly to about 80–100 ft. in their fight for adequate light. The commercial plantation palms are usually allowed to grow up to about 58 ft. after which they become too tall for economical harvesting and are therefore cut down and replaced.

Crosses between the American oil palm *Elaeis oleifera* (HBK) Cortes and *E. guineensis* Jacquin cv. 'Pisifera' have been planted in the Congo and these produce a thin-shelled 'Tenera' form of fruit without a fiber ring. One disadvantage of the hybrids was that the leaves developed to huge dimensions, and if the palms were used for plantations they would have to be grown at a low density. It is hoped, however, that the procumbent and slow-growing habit of *Elaeis oleifera* would make the hybrids useful for easier and longer harvesting in the plantations, but inheritance of procumbency has not yet been established.

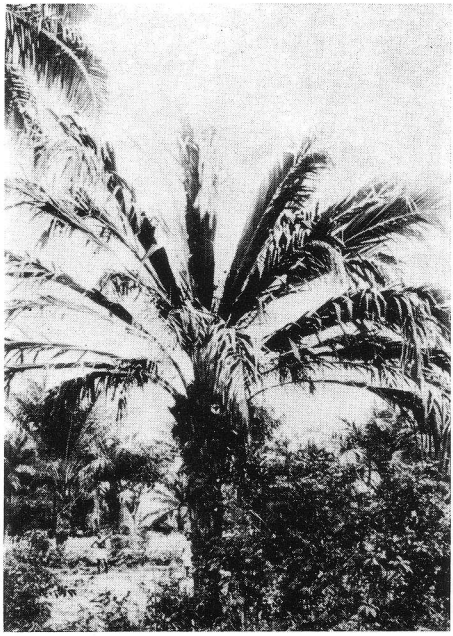
An unusual type known as 'Idolatrica' is found mostly in western Nigeria and Dahomey. It differs from other cultivars in that instead of being at right angles to the rachis the leaflets are attached at an acute angle and adhere to

3. 'Tenera' oil palm plantation at the Nigerian Institute for Oil Palm Research, Benin, Nigeria. Photo courtesy N.I.F.O.R.

each other most of the way up the rachis. The leaves are also a darker green and less drooping than the other types. The fruit is used for fetish rites in West Africa and the oil, which is said to seethe and bubble during preparation, is reserved for medicinal purposes. This palm is therefore known by such names as the king palm, the tabu palm, and the juju palm—the word *juju* means "black magic" in West Africa. It is not tapped for wine and is often planted as an ornamental palm. Branched oil palms are also considered sacred and are not harvested.

An abnormal fruit type is the rare 'Poissoni' or 'Diwakkawakka' in the East Indies, also called mantled fruit. The "mantle" surrounds the main part of the fruit and consists of 6–10 supplementary carpels—often containing both kernel and shell—which have developed from the rudimentary stamens of the female flower. This fruit is 3–4 cm. long. For the plantations, however, the ordinary type of fruit is preferred.

There is a great variety in the color of the skin or exocarp which is usually more pigmented than the mesocarp or pulp. The ordinary or more common type is 'Nigrescens' which in its unripe state is black to violet on the upper part and white where it is attached to the bunch. Purvis has proposed two names, viz. 'Rutilo-Nigrescens' and 'Rubro-Nigrescens,' but intermediate types are found. On the former, more than half of the upper part of the ripe fruit is reddish-black and the lower part is a lighter red. Ripe 'Rubro-Nigrescens' has a garnet-brown cap, changing to red or Indian orange at the base. Ripe 'Deli' fruits are usually a paler orange. I was lucky to see a yellow-green 'Virescens' bunch lying among red 'Nigrescens' bunches on the road between Aba and



4. 'Idolatrica' oil palm. The fused pinnae make it easily distinguishable from other cultivars. Photo courtesy Institut de Recherches pour les Huiles et Oléagineux (I.R.H.O.).

Owerri in East Central State of Nigeria in 1965. This type is so rare in Nigeria that in a grove area only 50 of 10,000 bunches were 'Virescens.' When unripe, the fruit is bright green on the upper half and yellow at the base, and at maturity it changes to reddish-orange all over except the apex which remains green. These fruit contain traces of an anthocyanin which may be different from that found in 'Nigrescens.' Like the 'Idolatrica' and also the 'Poissoni,' the green-fruited 'Virescens' are associated with fetish beliefs. When the green fruits had been gathered in certain places the fruits would be abandoned and thus would give rise to several 'Virescens' palms grouped together.

The mesocarp of 'Nigrescens' and 'Virescens' fruits contains carotene. Fruits at the exterior of the bunch may have twice as much carotene as those from the interior. The fruits of grove palms have been found to contain more carotene in their oil than the plantation palms. The "white" oil palm, named 'Albescens' by Beccari, has a very low carotene content. These fruits are very large and pale ivory at the base when unripe, turning to a greenish-yellowish white at maturity. The tip is either green and is known in the Congo as 'Albo-Virescens,' or dark brown and known as 'Albo-Nigrescens'; the former is the rarest. 'Albescens' is even rarer in Africa than 'Virescens' and in Angola is found in the proportion of 3 to 10,000.

In Brazil, the 'Virescens' type is known as *dende da almas* or *perriquito*, the 'Rutilo-Nigrescens' as *creoulo*, and the 'Rubro-Nigrescens' as *caboclo*. 'Tenera' and 'Pisifera' are rare in the Brazilian groves outside the main palm belt in Bahia state; the former is called *sombra* and the latter *dende caroco de quiabo* or *cafune*. The large-fruited 'Dura' in these groves are known as *assu*, the small-fruited as *mirim*.

For inheritance studies in the Congo and at the Nigerian Institute for Oil Palm Research, Benin, Nigeria, the oil palm has been classified under (1) shell or no shell and/or fiber ring: three forms; (2) presence or absence of supplementary carpels: two types; (3) presence or absence of anthocyanin or pigmentation of the exocarp: two types; (4) presence or absence of carotene in the mesocarp on ripening: two types. As all these characters are independently inherited there are eight types or type-combinations, and 24 type-form combinations of the oil palm fruit. There is still some doubt regarding the inheritance of the various characters. In intravarietal crosses the following four characteristics are known to breed true: 'Dura,' 'Pisifera,' 'Nigrescens,' and 'Albescens.' The 'Tenera' is a heterozygous hybrid which does not breed

true, and the rest of the characters may be heterozygous and may or may not breed true.

An unusual type of oil palm has been found in the Ivory Coast and Dahomey which produces vegetative shoots instead of inflorescences in the axils of its leaves. These oil palms have been termed viviparous by P. Henry. Sometimes the shoots can be rooted and will then produce similar viviparous palms.

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PALM BRIEFS

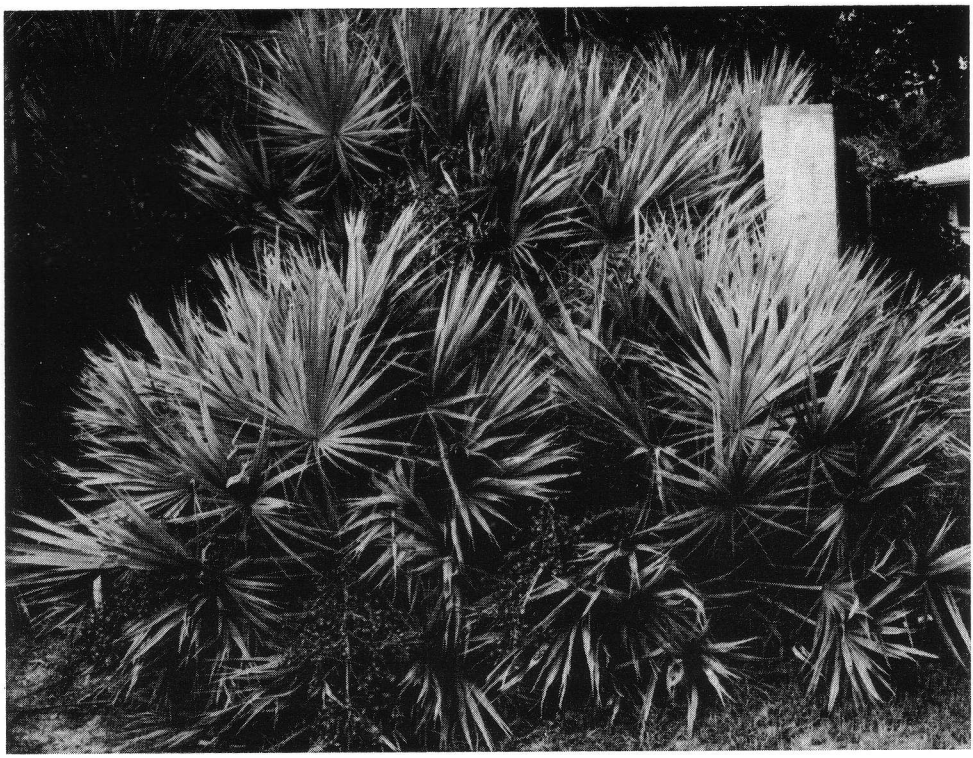
Fruiting in the Saw Palmetto

Never mind the lilies of the field. We are to consider the almost indestructible saw palmetto (*Serenoa repens*). Does it have possibilities as an ornamental, or is it only an unsightly weed that commonly grows in thickets and is a nuisance? If there were but one form of it, and only one growth habit, there might be a ready answer to that question, but it is an extremely variable palm, depending upon environment and other factors not yet comprehended or even investigated. Some forms of it are quite elegant, while others fail to inspire admiration.

In Florida casual observers seldom know the saw palmetto under more than two of its many guises. They have seen it in seemingly endless extensions under pines or other trees, in low thickets of nearly uniform height that appear half blighted or starved, and the very embodiment of monotony; or they have seen tight "islands" of it scattered in high pineland or in open spaces pastured chiefly by grasshoppers; or growing so thickly on dry sand dunes along the Atlantic littoral in Florida that only yuccas and xerophytic prickly pear succeed in gaining a sparse foothold at wide intervals or else not at all. So an indelible impression is made on these observers, most of them travelers doing all their observing from moving cars.

Not everyone penetrates countryside much farther removed from a highway than an average golf course extends. A city park is wilderness enough for many people, and only a minority have seen the saw palmetto in low moist hammocks, in undeniable swamps and along the banks of streams with its feet in the water. Nor is this adaptability and wide variability known to all lifelong Floridians by any means. To be on the safe side, one might refer to the different forms as "kinds" rather than races or varieties, for at present no botanical varieties are recognized and of course there is but the one species. For example, two kinds have each a different color of the palmate foliage, one green and the other distinctly bluish, and these contrasting colors are constant. The bluish form often compels admiration and also gives rise to a burning desire to have it in the garden, which, though possible, is easier said than done.

Plant nurseries do not stock the saw palmetto for several reasons. For one thing, there seems to be a notion among customers that the saw palmetto is not worth hard cash since it grows wild by the useless millions and therefore is a highly undesirable plant, a sort of black sheep of the palm family; and certainly nurserymen do not care to waste time in efforts to overcome prejudice, whether



1. A fruiting plant of *Serenoa* at the home of Dent Smith, Daytona Beach, Florida.

mistaken or not. Another reason for not stocking the palmetto, though it would be free for the digging in countless numbers, is that digging it from the wild is always a precarious business, likely to result in a large percentage of loss and thus making the labor too costly and the outcome too doubtful. Then why doesn't some enterprising nurseryman grow the palmetto from seed, even though slow growth might minimize the possibility of profit, and even though he would have to preach some fiery sermons in order to create a demand for the product? The answer is simple: in most years there are no seed to harvest.

In October, 1971, there was a superabundant crop of fruit on the saw palmettoes in some localities and perhaps throughout a large part of its range, and of course in each fruit was a presumably viable seed. Trillions of seeds, very likely, but who knew it, who could care in any case, apart from some raccoons, foxes, rats and other such fanciers of the extremely juicy fruits? The really startling thing about this bumper crop was that virtually no seed had been seen for several years, perhaps four or five—at least in the large area that came within survey. Flowering had occurred with seasonal regularity, but during the last twenty years well-developed fruit with good seed resulted in substantial quantity in but five of those years. The seed years seem to be not confined to cycles of fixed intervals, but do seem to depend on the depredations of insects. The saw palmetto is very floriferous and the

2. A closer view of fruit from the plant in Figure 1.

3. The saw palmetto in a rather different habitat along Spruce Creek, inland from Daytona Beach.

flowers delightfully fragrant, and usually the inflorescences are pretty well festooned with ants, small wasps, bees and dipterous insects. Possibly the agent responsible for the failure to fruit is known to an entomologist, but not to this observer.

The thought persists that the lack of plentiful seed may be the main reason so few attempts have been made to cultivate the saw palmetto. Amazingly enough, very few Florida residents have ever so much as glimpsed either its fully developed fruits or the seed, and that despite having seen innumerable plants hither and yon almost daily. It brings to mind the Manhattan tycoon with an office overlooking the Statue of Liberty out in the bay; he sees it every day, but wouldn't think of going there to look at it close up. But the analogy is somewhat lame, for the saw palmetto is commonly devoid of fruit to look at. The fruits, when there are any, are about as large as medium olives and closely resemble them; and when they finally ripen, turning from green to purplish black almost overnight, they quickly drop and disappear, borne away no doubt by animals.

A few adventurous palmateers may have missed a chance during the abundant seed-year just past to germinate seed of saw palmetto and grow a rare palm. Rare? Yea, verily, if grown from seed and cultivated without unnecessary kindness, one of the rarest of all palms.

—Dent Smith

Coconut Disease

An article in the News Bulletin of the Division of Plant Industry, Florida Department of Agriculture, Gainesville, Fla. states that an English scientist, Norman Grylles, has succeeded in establishing a link between the "lethal yellowing" of coconut palms in Jamaica and Florida with the whitefly, *Aleurodicus dispersus*. Lethal yellowing, after apparently having been eradicated on Key West in the mid-1960s, has reappeared on Key Largo, half-way between Key West and Miami, most alarming to all those who admire the coconut. DPI specialists are supervising the spraying of all nurseries in Monroe County, and trying to pull down and burn all coconuts which appear diseased. This is the only known treatment for infected trees. Malayan Dwarf coconuts seem to be resistant to the yellowing, and it is suggested that they be used for new plantings and to replace diseased palms which have been destroyed.

* * *

Natural Palm Oasis to be Developed

Riverside County (Calif.) has received a Department of the Interior grant to develop a 520-acre natural palm oasis northwest of Indio into a regional park. Acquisition cost of the park site was listed at nearly $93,000. The oasis is one of only a few of its kind in the United States, county officials said.

NEWS OF THE SOCIETY

Biennial Meeting

The Biennial Meeting of The Palm Society is to be held in Mexico City, June 21–26, 1972. This is planned as a gala affair. Bring the kids for an educational vacation and reserve the dates on your calendar as follows:

Wednesday, June 21—Arrival. Cocktails and reception in the evening.

Thursday, June 22—Meetings with talks by international members and business meeting. Banquet in the evening.

Friday, June 23—Tour of the pyramids.

Saturday, June 24—Tour of Mexico City including Chapultepec Park, Anthropological Museum, Botanical Garden, plantings of *Phoenix* and *Trachycarpus*.

Tuesday, June 27—Tour to Cuernavaca and Taxco for more tropical palms and historical sights.

Wednesday, June 28—Departure for home or for side tour.

A post-meeting trip is being planned to Tikal, Guatemala, where a diversity of palms grows among the magnificent Maya ruins. The group will depart from Mexico City on June 26 for Guatemala City, overnighting there. On the 27th. fly to Tikal, overnighting in accommodations there and returning to Guatemala on June 28. Persons interested should write for further details to Dr. Jerome P. Keuper, Florida Institute of Technology, Melbourne, Florida 32901.

Details of post-meeting tour and of hotel arrangements will be announced later. Tours on June 24 and 25 may be reversed depending on final decisions.

PLAN TO BE THERE

JEROME P. KEUPER,
President

After fifteen years' service to the Society, your executive secretary has resigned and your president has appointed another long-time member, Mrs. T. C. Buhler, 1320 S. Venetian Way, Miami, Fla. 33139 to take my place. Mrs. Buhler is an accomplished gardener and ardent grower of palms. She also is experienced in office work and keeping records. She will be a fine executive secretary, I am sure.

It has been a great pleasure to me to work for the Society. The contacts with members both in this country and abroad, the friendships made and the many interesting experiences have made it all most worthwhile. I shall continue to run the Seed Bank and do other volunteer work, thus keeping in touch with many of you and with the Society's activities. I thank you all for your many kindnesses and attentions.

Sincerely,
LUCITA H. WAIT

Lucita Retires

For just under fifteen years Mrs. Lucita H. Wait, has been, in the words of the retiring president Dr. John Popenoe at the 1970 biennial meeting, "the one who runs The Palm Society." This she has done, first in her capacity as Executive Secretary and later as its elected Secretary. She has not only "run" it, but has also done a vast amount of work for it, much of it routinely necessary and perhaps not always very enjoyable. During

Lucita Wait and the Seed Bank occupy the guest bedroom of her home in Miami.

the last two or three years, she has felt the increasing workload too demanding of her time and energies, and at last has reluctantly submitted her resignation to take effect as of December 31, 1971—not, however, without first having found a capable successor in an old friend, Mrs. Theodore C. Buhler also of Miami, who is now officially the Executive Secretary.

Mrs. Wait—well, it may seem starchily formal not to call her "Lucita" as a good many of our members already do, but to others it might seem ingenuous—Mrs. Wait has announced her intention to continue the work of the Seed Bank, in the belief that she can accomplish more with it now that she has been relieved of her other responsibilities. This is something she really enjoys, for she feels it is extremely helpful to many people and that it advances the interests of the Society. Also it brings her into contact with people, which is a moot point because she likes people. Maybe not all people, but apparently "palm people," plant people, birders, nature lovers, music lovers, and perhaps young lovers if they behave themselves, and probably several other kinds of people. This accounts for her having actually liked to write and receive letters, hundreds of them, bales of them, from palm fanciers, palmocrats and assorted palm buffs from all around the globe. All this correspondence has resulted in securing many new members who would never have been obtained by an indifferent response to a letter, and surely the Society is deeply indebted to her for this one activity as well as for all the other efforts on its behalf.

Mrs. Wait began her work with the Society in April, 1957. For some years prior to that she had held posts at the Fairchild Tropical Garden as Librarian

and as Curator of the Palm Products Museum. She was also editor of the FTG *Bulletin*, and in fact still has a hand in it. But her association went back much further than that, even before the Garden was formally planned and organized, to a day in April, 1936. Then, when it became a reality, she served as a volunteer worker in several capacities and on various committees, and eventually accepted the full-time position at the Library and Museum. So, in Lucita Wait, the Society acquired the services of someone who had lived with the palms for years, and always on good familiar terms, for the palms were the most outstanding and abundant plants in the Garden, and moreover the great favorites of both Colonel Montgomery, its founder, and Dr. Fairchild, for whom it was named.

Asked what the future now holds for her, Mrs. Wait philosophically responded that she could not say in the absence of a crystal ball, but that there's the Seed Bank, for one thing. She has always been interested and active in gardening, and so it fits right in with that proclivity. And there is the Tropical Audubon Society in which she is the Chairman of Speakers and a director, and then there are concerts and also the possibility of travel. But whatever she elects to do, she may be sure that the members of this Society will not forget her efforts to increase its meaning and stature. Our everlasting thanks go to her.

—DENT SMITH

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

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CIRCULATION:		
A. Total no. of copies printed	1000	1000
B. Paid circulation		
1. Sales through dealers & carriers, street vendors etc.	0	0
2. Mail subscriptions	687	687
C. Total paid circulation	687	687
D. Free Distribution by mail, carrier or by other means		
1. Samples, complimentary, and other free copies	50	50
2. Copies distributed to news agents, but not sold	0	0
E. Total Distribution (Sum of C & D)	737	737
F. Office use, left-over, unaccounted, spoiled after printing	263	263
G. Total (Sum of E & F-should equal net press run shown in A)	1000	1000

I certify that the statements made by me above are correct and complete. Signed, Mrs. Theodore C. Buhler, Executive Secretary.