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SPECIAL ISSUE

CULTIVATED PALMS



# AMERICAN HORTICULTURAL SOCIETY

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SPECIAL ISSUE

# CULTIVATED PALMS

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R. BRUCE LEDIN, Guest Editor

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## FRONT COVER ILLUSTRATION

The Christmas Palm, *Veitchia merrillii*, exhibiting its clusters of bright-red, egg-shaped fruit

Engravings provided through the courtesy  
of Mary E. O'Brien, Editor, *Popular Gardening*  
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The Editorial Staff  
and the  
Board of Directors  
of the  
AMERICAN HORTICULTURAL SOCIETY

wish to record  
their appreciation  
to the members of  
THE PALM SOCIETY  
for making it possible  
to produce this handbook on  
CULTIVATED PALMS

## Preface

Nearly all persons [and all books written for popular use] approach palms with a somewhat emotional or poetic attitude. This is due in a large part to the yearning of cold country people for the idea of the tropics—with heat, and light, and all the imagined glories of such lands, and no notions whatever of the accompanying difficulties or drawbacks. You will find no such approach in this handbook!

The idea of preparing such a text was presented by W. H. Hodge to the executive committee of The Palm Society in 1958 when he was president. Action followed immediately with R. Bruce Ledin being appointed as chairman of a committee to prepare and assemble the manuscripts and photographs. Dr. Ledin was assisted by David Barry, Jr., Nat J. De Leon, Mildred E. Mathias, Nixon Smiley, Lucita H. Wait, and others, all of The Palm Society, and by Dr. Hodge as well. Later additions to the committee came in the persons of Harold E. Moore Jr., H. F. Loomis, and Paul H. Allen.

By the time of his death in 1959, Dr. Ledin had assembled an enormous mass of manuscripts and photographs from this country and the important palm centers of the world—a mass, far too large for any single publication, and certainly a monument to himself, for his zeal and skill. He had brought together not only new material but articles already published in places not commonly seen by the gardening public of the country. It remains a testimony to him.

Any handbook that concerns itself with a single plant in its whole generic range must present several treatments of major themes, if it is to be useful to the gardeners, or persons about to be drawn to that particular hobby. It must do three things: Tell what the plants look like taxonomically and horticulturally, and in such a persuasive fashion that old timers will be delighted and newcomers intrigued into action. It must tell how to grow the plants, the full details of planting, feeding, and decorative placement. It should, indeed must, outline the difficulties that may arise, even if not all will come to pass in any one place. And, it might well suggest how to bring the new material into happy combinations with the plant materials already known, and used, and loved.

This is the basic philosophy of the present handbook, which is really the work of The Palm Society members, seen through the press with their help, but chiefly with the skill of James R. Harlow for the American Horticultural Society, and the skills of the printer and of the engravers, who can make or mar any work.

If it does not contain all that Dr. Ledin and his cohorts assembled, it is only because of production costs, and the fact that those portions not used, had to be used either in their entirety or not at all. These materials are not lost but eventually will be published by one or the other of the Societies, all of which will extend the fame of Dr. Ledin and his assistants, into a future that should mean even more to the palm lovers in this country.

B. Y. M.



W. MEIJER

*Cocos nucifera* figured on the old temple Borobudur,  
Central Java, about 600-700 A. D.

# AN INTRODUCTION TO THE PALMS

## The World of Palms

To most people palm trees and the tropics are synonymous. This is understandable. The ancient family of the palms (*Palmae*), including nearly three thousand species of plants, is almost exclusively tropical with representatives to be found in all equatorial regions of the world. Tropical America and tropical Asia share almost equally in having the greatest numbers of these amazing plants while Africa is the continent poorest in species of palms. Among individual countries, Brazil, with endless square miles of wet Amazon basin fit for palms, probably can boast of more kinds than any other—some five hundred species, although Colombia, too, has a flora rich in these plants.

W. H. HODGE

Although primarily tropical, palms are not exclusively so. Thousands of years ago there were palms growing nearly to the Arctic Circle and even during Oligocene and Miocene times the Nypa Palm (*Nypa fruticans*) of tropical Asia occurred as far north as western Europe. A few modern species have even wandered successfully into mild temperate climes where frost or snow may occasionally threaten. These cold-tolerant species are of special interest to temperate horticulture for under cultivation they may thrive in localities where the great bulk of tropical palms cannot be grown. In North America the Cabbage Palmetto (*Sabal palmetto*) persists as a wild plant as far north as Cape Fear in the Carolinas while on the Pacific coast one of the two species of palms commemorating the "Father of our country" (*Washingtonia filifera*) inhabits desert oases in California at practically the same latitude. Similar latitudes elsewhere in the northern hemisphere are reached by several species. The Chinese Windmill Palm (*Trachycarpus fortunei*), perhaps the world's hardiest, grows north to the thirty-fifth parallel in Korea and Japan; a species of *Nannorrhops* (*Nannorrhops ritchieana*) thrives on the desertic plains of West Pakistan and neighboring Afghanistan; while the common Date Palm (*Phoenix dactylifera*) and the European Fan Palm (*Chamaerops humilis*), though now most frequently seen under cultivation, originally inhabited the borderlands of the Mediterranean.

W. H. Hodge, head, Department of Education and Research, Longwood Gardens, Kennett Square, Pennsylvania, is a director and past president of The Palm Society, as well as a member of the editorial board of its journal, *Principes*. Dr. Hodge also serves as a director of the American Horticultural Society and is chairman of its editorial committee.

In the southern hemisphere, under the influence of milder oceanic climates, certain palms find the south temperate zone just as much to their liking. In eastern South America several species of *Butia* inhabit extra-tropical portions of Uruguay and Argentina while to the southwest (at thirty-seven degrees south latitude) the Chilean Honey Palm (*Jubaea chilensis*) in habit and habitat is almost a southern hemisphere twin of California's Washington Palm. Halfway across the world *Jubaea chilensis* has a relative in the strange Kafir Palm (*Jubaeopsis caffra*) with a restricted range on the eastern coast of South Africa, the southernmost native palm of that continent. But the record for growing farther south, though not under the coldest condition, goes to the species *Rhopalostylis sapida* inhabiting the Chatham Islands off the eastern coast of New Zealand at forty-two degrees south latitude. In between these latitudinal extremes some palms climb also into the temperate belt to be found on the upper slopes of high tropical mountains. For example, on the Colombian-Ecuadorian frontier one species of the South American Wax Palm (*Ceroxylon alpinum*) has scaled the massive ranges of the Andes to the unbelievable altitude of thirteen thousand, four hundred and fifty feet!

With but few species growing in temperate latitudes, it is little wonder that palms are strangers to most northern peoples who grow up rather with such trees as pines, oaks, or maples. The potted infant palms of florists' shops give no idea of the majesty of a mature palm tree and it is only after a trip to the tropics or subtropics that one can really appreciate firsthand a palm's stately beauty. And who does not gasp at his first glimpse of savannahs dotted with stubby palmettos, of seacoasts girt with wind-blown coconuts, or of busy city streets colonnaded with the cement-like shafts of royal palms?

Scarcely a handful of the several hundred species of the palms cultivated in the warmer parts of the United States are natives, and of these the majority are wild in subtropical Florida, the Gulf Coast, and the American southwest. Best known are the Cabbage Palmetto, already mentioned; the Saw Palmetto (*Serenoa repens*), that bane of the southern pinelands, yet a species with

an as yet overlooked value as an ornamental plant; the Washington palms of the California-Mexico borderlands; and a number of small attractive species of the Florida Keys including the Silver Palm (*Coccothrinax argentata*) and the Everglade Palm (*Paurotis wrightii*). Most of the palms, however, that rattle their leaves along the parkways, that enhance our southern homes with beauty, or skirt our subtropical sea beaches, are immigrant exotics. In their native lands they claim a vast range of habitats. Depending upon the species, they revel in bright sun or dense shade, in swamp or desert, savannah, seacoast or mountain.

Tropical palms are as variable in habit as in habitat. Although their boles are seldom massive, they may, like the slender but erect trunks of certain Andean wax palms, grow over two hundred feet tall, a stature approaching that of the world's tallest trees. At the other end of the scale, certain palmettos of the Florida pinelands and of the West Indies are dwarfs with prostrate or creeping stems that scarcely rise above the ground at all. Tiniest of all are reed-like species of *Reinhardtia* of the Central American rainforests which look like insignificant herbs of the tropical forest floor. Not all palms are trees. Indeed, some are shrubby. Others, like the rattans, are scrambling vines with stems of an unbelievable length that clamber and sprawl often for five to six hundred feet through the treetops of the wet rainforests of southeastern Asia and the Indies. But the vast majority of palms assume the conventional family aspect of an attractive, unbranched tree culminating in a green feather-duster of large leaves.

Palms are unique among trees. In the great botanical subdivision of the monocotyledons—which includes, besides the palms, such familiar herbaceous plants as orchids and grasses, lilies, irises and cannas—only the palm family has evolved to any substantial degree the arboreal type of growth. Except for a superficial resemblance, the trunk of a palm is quite unlike that of any of our familiar trees. The latter sport a hard central cylinder of wood which regularly increases not only in length by annual growth at the tip of its branches, but also in diameter by means of the cambium layer. Most palms have only a single point of growth activity—the ter-



minal bud. If this is injured the tree will die. Since palms lack cambial activity their trunks cannot increase in diameter. This accounts for the slender and usually graceful form of palms whose taper-less boles can never attain the massiveness of the trunks of woody trees. Such minor increase in diameter as may be observed characteristically in the stems of certain species of palms—including the bulges of the royal or grugru palms, or in the Cuban Pot-belly Palm (*Colpotherinax wrightii*) — is due primarily to increase in size of the original cells, not to the addition of new layers of cells as in most trees. Naturally, under favorable conditions of growth palms produce large cells while under poor growing conditions the cells formed are small. This accounts for minor variations in diameter of many a palm trunk.

Instead of a central mass of hard tissues, palms have a soft spongy heart surrounded by a hard ring of strong protective fibers arranged in vertical bundles which serve primarily as the tree's conductive system for the transportation of water, mineral elements for food making, as well as synthesized foods. This outer rind is often so tough as to repel the blows of all but the keenest ax. Perhaps, for this reason many a settler clearing a tropical forest spares the palms, for they tend to dull his ax all too quickly.

Even the novice can distinguish two groups of palms by their leaf form. In one group, the *feather palms*, the leaf blades are pinnate, looking like enormous feathers; in the other, the *fan palms*, the blades are palmate or fan-like. Whatever the leaf form, a typical part of the leaf is the basal portion or sheath which surrounds the stem or bole at its point of attachment. Some say that our Anglo-Saxon word "palm" (from the Latin *palma*) is possibly derived from the fan-type leaf in which the leaf divisions radiate out like fingers from the human palm. Certainly the old civilizations of the Mediterranean must have noted this resemblance of the human hand and the palm leaf as demonstrated by the common native European Fan Palm of the area (*Chamaerops humilis*). Others claim that the word "palm" is derived from the fact that the leaves of palms were carried in the hands of victors in ancient triumphal processions and were bestowed by hands (e.g.

by the palm) upon those so honored.

The older leaves of palms eventually die and are replaced above by new ones appearing at the growing tip where they are formed by the all-important terminal bud hidden deep within the protective green crown. In some palms these older dead leaves persist for a long period, often for years forming a "shag" or "skirt." Eventually, this skirt decays and drops away. In other palms, the leaves fall almost immediately when they begin to age, leaving a smooth bole ornamented with narrow bands of ring-like scars showing where the old leaves were once attached.

As in all flowering plants, the genealogy and identification of palms must be based upon careful botanical study of their flowering and fruiting structures. Palm flowers are borne in branching, pendant clusters which rise from large boat-shaped spathes readily seen just below the leafy crown of most species. One would hardly grow a palm for its individual flowers. They are most inconspicuous affairs without much color—yellowish, greenish, or white hues are most common—and in a way scarcely more attractive than the tiny blossoms of their cousins—the grasses. But though small and unobtrusive, their numbers are legion and in mass they make up for what they lack in individual size. A person could easily fill a bushel basket or two from the pile of old male flowers that accumulate below some blossoming palms!

Single flower clusters of average palms may measure from two to six feet long, but the enormous terminal flower crown of the Old World Talipot Palm (*Corypha umbraculifera*) may be over twenty feet high, making it one of the largest inflorescences in the whole plant kingdom. Flowers of this palm may number sixty thousand individuals per inflorescence, which is real mass production! Conserving energy over a thirty- to forty-year period, somewhat like a century-plant, the impressive Talipot Palm, unlike most of its relatives, flowers but once, throwing all its strength into one mighty blossoming splurge. Once its fruit is set, the Talipot Palm dies, its job of carrying on the species completed. An even more remarkable, if yet unexplainable thing about the Talipot Palm, is its gregarious flowering: all individuals of the species

in a given region will flower at one time.

Palm flowers, in turn, produce palm fruits which hold the important reproductive structure, the seed. In size, color and structure, palm fruits are as divergent as the familiar dates and coconuts which represent their gamut. They range from the size of a pea to the great mass of the coconut. The latter protects the largest seed in existence save for that of a relative, the famous *Coco de Mer*, or so-called "double coconut" (*Lodoicea maldivica*). Single fruits of this Seychelles species may weigh from thirty to forty pounds apiece.

Even though palms as a family have been available for study as long as any other group of flowering plants, they are much less completely known to science. The fact that they inhabit almost exclusively the tropics, far from man's main centers of botanical research, has not been a help. In addition, individual palm species often have a very restricted natural range which makes it difficult for the botanical field collector who must usually travel on limited funds. Many an island or an isolated mountain range can boast of native palms unknown elsewhere. Hawaii, Mauritius, New Caledonia, and Madagascar, for example, are islands each of which has a number of native palms found nowhere else. Another reason why palms are not better known is that many of these plants are just too big, with a habit of growth that makes botanical study difficult. To classify new plants, botanical centers must acquire dried pressed specimens of each species collected in the field for future study and permanent reference. Most plants or representative parts (leafy branches with flowers and fruits) can be mounted on a standard size (11 x 16 inch sheet) paper mount and placed in a herbarium storage case. But not palms with their single giant stems and leaves whose individual lengths are measured by the yard! Put yourself in the place of a plant explorer finding a Talipot Palm for the first time. How would you go about making representative herbarium specimens of its twenty-five-foot leaves or twenty-foot inflorescence?

Facts like these have stimulated the interest of at least some professional botanists who have determined to give palms the careful study that they truly merit. One of the best known students

and field collectors of palms in our times was the late distinguished dean of American horticulture, Liberty Hyde Bailey, who, after completing a full and active life at Cornell University, decided to study palms. During his "retirement" he built up one of the most complete herbarium collections of these plants to be found anywhere in the world. Dr. Bailey's contributions to our knowledge of palms have been honored in a glade of living palms that bears his name in the Fairchild Tropical Garden at Miami, Florida.

If the average person is unfamiliar with palms in nature, he is usually just as unfamiliar with their economic products. To him coconuts and dates are but novelties obtainable at the corner fruit store or flavorsome ingredients of a favorite cake or pudding, but not generally associated with living palm trees. Little do most people realize that in their countries of origin certain palms constitute the very staff of life of the native peoples. The fact is that in the realm of economically important plants the family of the palms stands second only to the all-important grain-yielding grasses.

Most important of all palms is the Coconut Palm (*Cocos nucifera*), probably native originally to southeastern Asia. Indeed, as a plant with over a thousand uses, it is often listed among the world's ten most important trees. Throughout Oceania and the Indies the coconut is generally found close to the sea. Conditions there seem most favorable for its best development, and it flourishes in greatest luxuriance a few feet above high-water mark. Down through the years humans have greatly increased the territorial domain of this palm. It has become so closely linked to man that, like many another long-cultivated plant, it has lost whatever aggressiveness it ever possessed and succumbs easily to choking undergrowth. How real this plant-man partnership has become is reflected in a Cingalese proverb, which avers that "The coconut will not grow out of the sound of the sea or the human voice; nor, will it thrive unless you walk and talk amongst the trees."

For such care, the coconut responds bountifully. The ripe meat and its many uses are too well known to mention, yet in the Pacific isles the fruit is used not so much by people as by their livestock. All

domestic animals get a ration of coconut meat. Natives of Guam even use this natural food to fatten up a popular delicacy, the abundant land crab. If fresh coconut meat serves primarily the livestock, the milk serves the people and is, on many a tropic isle, the sole beverage of the natives.

The Coconut Palm can boast of producing the original sealed milk bottle. What container could be more convenient, durable or sanitary for a long ocean trip than nature's own milk-filled coconut fruit? Pacific islanders have for years kept their boats stocked for emergencies with this sealed-in combination of food and drink. Perhaps the Spaniards, on their early sailing trips between Mexico and the Philippines, copied this Polynesian habit, thus introducing the coconut to the New World. Bligh's memorable four-thousand-mile voyage in the *Bounty's* open lifeboat from the Friendly Isles to Timor might not have been successful without the nourishment provided by coconuts. In his journal one may find such descriptive entries as: "May 6, 1789: our allowance for the day was a quarter of a pint of coconut milk, and the meat, which did not exceed two ounces to each person: it was received very contentedly . . . ; May 9, 1789: in the morning a quarter of a pint of coconut milk . . . ; and for dinner, I divided the meat of four coconuts, with the remainder of the rotten bread."

The coconut attains its greatest marketable value as copra, representing the sundried kernel. In Polynesia this palm product is practically the only export of substantial commercial value. Nuts to be used in the copra trade are allowed to mature on the tree. When they fall, the meat is pried out and allowed to dry in the sun on mats or platforms. Copra finds its way to the world's industrial centers where its natural oil is converted into a large series of fatty products—especially soap and margarine. The United States alone normally uses twenty million pounds annually.

Milk, copra, and the tough, elastic fibers known as coir—best known to westerners when woven into the familiar coarse brown fiber mats of our doorsteps—all come solely from the coconut fruit. If any other plant produced this variety of economic usables, we would call it important, but the Coconut Palm doesn't

stop with these. As further proof of its usefulness the palm offers other products obtained from every conceivable portion of its vegetable body.

The fresh-cut tender terminal bud ("palm cabbage")—as in most palms—makes an excellent salad. The beverage, toddy, is fermented by Pacific natives from sap that flows from cuts made in young unexpanded flower spadices. Distillation of mild toddy yields a potent alcoholic drink, *arrack*. The leaves, besides serving as the chief roofing thatch in the islands, are also woven into hats, baskets, and mats; or are made into brooms or torches. Imported "porcupine wood," so called because of the dark and light banded appearance of its component fibers, is hard and handsome, excellent for cabinet work and veneers; in its homeland it is the outer fibrous layers of a coconut trunk.

To the Arab the Date Palm (*Phoenix dactylifera*) is just as essential, for on the size of the date harvest may depend the very existence of many a desert tribe. "Honor your maternal aunt, the palm . . ." said the Prophet Mohammed to his followers. How could they fail to follow such advice when to countless millions of desert dwellers in North Africa and the Middle East this palm's carbohydrate-rich fruit, combined with the protein of milk, has long constituted the standard subsistence diet. And so it has been for over five thousand years. The Date Palm is the "Tree of Life" of the Bible, records of its culture in Mesopotamia go back to 3500 B.C., and its form appears modelled in Egyptian art as in the columns of one of the temples at Karnak which dates from 1370 B.C. Scarcely a tree thrives under such inhospitable growing conditions as does this palm. It seems to demonstrate the true meaning behind its old Greek name of *Phoenix*, possessing a plant-like immortality akin to that of the mythical phoenix bird after which it was named.

But each tropical region can boast of its own palm favorites. In Latin America, from Costa Rica to the Amazon, it is the pejobaye or Peach Palm (*Bactris gasipaes*) whose clustered, highly nutritious orange fruits (about the size of peaches) serve as a staple vegetable simply prepared by boiling in salted water. Southeastern Asia has a palm triumvirate which includes the utilitarian Palmyra

Palm (*Borassus flabellifer*) boasting of over eight hundred uses; the food-producing Sago Palm (*Metroxylon sagu*) with its starch-filled pith; and the Betelnut Palm (*Areca catechu*) whose seeds, sliced and enriched with lime and a fresh leaf of the betel pepper, constitute a quid which outranks in importance chewing gum, in both age (Herodotus described it) and popularity (it is chewed by over four hundred million people!). The superbly beautiful native Cuban Royal Palm (*Roystonea regia*), one of the world's finest ornamental trees, is protected by law, for the Cuban country folk derive from the fruit (*palmiche*) the standard food for their stock as well as thatch and boards for their simple homes or *bohios*.

Because they combine uniform size with strength and durability under tropical conditions, the fibrous boles of many palms find a number of constructional uses in hot climes, particularly in areas that are lacking in more conventional timber. Boring insects and termites can make little headway in the fibrous parts of palm trunks, making the latter desirable for timbers used in contact with the ground. In Bahia, hollowed out palms have even been used for water pipes. Among certain genera such as *Borassus*, *Bactris* and *Astrocaryum*, the bundles of fibers, as seen in a cross-section of the stem, are not evenly scattered but rather are located in greatest numbers around the periphery, producing a dense layer of much utility to man. Because of this fiber arrangement in its trunk, the Palmyra Palm of India is often cut so that its sturdy boles may be utilized as heavy posts and timbers in the construction of houses, piers and bridges. Trunks of the American Cabbage Palmetto have been similarly recommended, having been used first by the Florida Seminoles in house construction. Later the colonists found that they made durable wharf pilings resistant to attacks by shipworms. The stoutness of a Palmetto Palm log stockade in Charleston harbor enabled South Carolinians to defeat a British fleet in June 1776, during the American Revolution. Understandably grateful, both Florida and South Carolina have honored this utilitarian native palm by making it their State tree.

In settlers' shacks of Amazonia, crudely split palm trunks take the place of

oak flooring for they resist insect attack and are more lasting than most other available materials. The spiny black trunks of the Peach Palm, already mentioned, contain flexible black fibers which are among the toughest known. From *chonta*, as the dense "wood" of this palm is known, the lowland Indians of South America fashion beautiful bows and arrows, spears and ceremonial daggers. The familiar blowgun of the same continent, a compound structure, has its inner bamboo bore protected by an outer casing made from one of the slender bactrid palms; while the all-important dart, feathered with a tuft of cotton or kapok, is nothing more than one of the sharp black spines from the trunk of one of the tucum palms (*Astrocaryum tucuma*, *A. murumuru*). Wood of yet another species, *Astrocaryum standleyanum*, of Panama, is imported into the United States to be used in the manufacture of fishing poles.

Palm roots, like those of most plants, are inconspicuous structures. Produced continually at the base of the stem of all palms, they sometimes appear as visible aerial props — particularly common among palms of rainforest areas. Because of their uniform size and strength, such prop roots are used occasionally by aboriginal peoples as raw material for basketry.

The leaves of palms are far more important. Although the fibers and waxes that they supply are of greater value to modern industry, such leaves have a much more universal though simple use throughout the tropics as thatch. Palm leaves serve as the shingles of the rustic homes of the torrid zone. Not only are these leaves widely available, but they are also generally impervious to water. On numerous occasions while plant hunting in the tropics, native guides have constructed for the writer an overnight shelter within a very few minutes merely by felling a palm and properly arranging the trimmed leaves over a thatching pole. Even in the heaviest downpour, one can be snug and dry in a hammock under such a simple palm-leaf shelter. More permanent tropical dwellings are more carefully thatched, however, the roofs being woven together with all the care and technique used in making a finely woven basket. In general, leaves of fan palms are more suit-

able for thatch, but even the leaves of feather palms can be manipulated into "shingles" by detaching the pinnae, then folding and tying them carefully over the rafters. Such native thatching will shed water for years and is cool, in addition. Even the white man accepts this as one of the best types of tropical roofing.

Besides keeping one dry, young palm leaves in the bud stage are an excellent emergency food wherever they can be found. The edible portion or palm bud is called "cabbage." Like a cabbage—though a cylindrical one—it is made of tightly packed unexpanded young leaves that are tender, crisp and white. The innermost ones, the tenderest, are naturally the choicest and have the flavor and consistency of fresh cabbage—hence the name. They are eaten either raw or cooked. The so-called "cabbage palms" (*Euterpe*) are well known for their delicately flavored buds, but almost any palm bud may be eaten. To taste palm cabbage, just fell any palm tree; the plant will be killed, but in a food emergency anything goes. Unexpanded spadices—actually the buds of the flowering clusters—of some palms are similarly eaten as food. Best known are *pacayas* (staminate spadices of species of *Chamaedorea*), resembling maize ears even to husks, which are frequently seen in the native markets of Central America.

Commercially speaking, it is the fruit that is the most important part of the palm plant. Many palm fruits are edible, the nutritive portion usually being the kernel or endosperm as in the coconut. But in other fruits, such as that of the Peach Palm, the farinaceous fruit coat surrounding the seed is the portion in demand. Both the external pulp and kernels of palms are the great sources of palm oils, which are called either pulp or kernel oils accordingly. The strategic importance of palms was brought to the fore in World War II when fats, needed as never before for food and explosives—not to mention their use in the manufacture of soaps, tin cans, and sheet metal—were in short supply. The Coconut Palm and the African Oil Palm (*Elaeis guineensis*) are the chief sources of palm oil though there are many other palm species which could become important as sources. There are, for example, at least twenty-five impor-

tant native oil palms in Central and South America alone. Their native Indian names—*babassú*, *tucum*, *ouricury*, *murímurú*, *dendé*, *cohune*, *corozo*, and *bacába*—to name a few, sound like a voodoo chant. Some Latin-American countries have begun to take note of their wealth in oil palms and industry has been investigating the possibilities of one of the American tropics' greatest potential export crops.

The economic possibilities in palm culture have mostly centered in the species supplying oil, but are not limited to them. We think of sugarcane as the principal source of our sugar supply, yet in the Far East, palm trees produce one billion pounds of sugar yearly, to say nothing of alcohol production, an important by-product. More than a dozen sugar-producing palms are known in southern Asia alone. Best known are the Coconut Palm, the Palmyra Palm, Fish-tail Palm (*Caryota urens*), Black Sugar Palm (*Arenga pinnata*), and the Nypa Palm, the latter so widespread in the coastal swamps. The African Wine Palm (*Raphia vinifera*) and the Chilean Honey Palm are also producers of sugary sap. Sugar-yielding palms are a perennial crop that needs no harvesting as do cane and beets, but, unfortunately, only hand labor can be used. These palms are merely tapped like maple trees for their sugary exudate, but instead of the trunk as in the maple tree, it is the flower stalk that is injured to yield a flow of sap. It has been said that the world's saccharine palms, if properly tapped, could produce more sugar than all the other sugar-yielding crops combined!

Although we may readily appreciate the value of palms to tropical peoples, little do we realize the part these trees daily play in each of our own lives. Brazil helps to keep our streets clean by sending us the coarse, stiff fibers called *piassava* from the dried leaf sheaths of the Bahia Piassava Palm (*Attalea funifera*), which supplies the bristles for the stiff brooms used by the "white wing" departments of all large cities. Similar fibers of the piassava type come from the leaves of other palms of Brazil, Venezuela, and Africa. Madagascar exports soft, pliable raffia—actually the upper tissue layer of young, unexpanded leaves of *Raphia ruffia*—important for

its use in basketry, but better known perhaps as the original plant "tie" material of horticulture. The powdery protective wax that thickly covers the younger leaves of the Brazilian Carnauba Palm (*Copernicia cerifera*) is the basic constituent of the finest floor, automobile, and furniture waxes, besides finding an important part to play, also, in the manufacture of phonograph records and carbon paper. From the tough, flexible but slender stems of certain high-climbing forest palms (in the genera *Calamus* and *Daemonorops*) of Malaya, the East Indies, and the Philippines, is derived rattan; the thicker canes are utilized whole in bentwood furniture, while the outer rind of smaller stems is split to yield the familiar material used in the cane seat of the chair you may be using at this very moment.

Add also the products of palm fruits that are used daily in the average home. For example palm oil—the most important single economic product of palms and the constituent of many soaps—though present in the fruits of a galaxy of palms is obtained chiefly from the African Oil Palm. Then there is the shredded coconut in your favorite layer cake, and margarine—popular butter substitute—with its copra origin. Even in this day of modern plastics, the buttons on your new dress may have been machine-cut from the exceedingly hard ivory-like endosperm of the seed of Ecuador's Tagua Palm (*Phytelephas macrocarpa*); while the dark red resin called in commerce "dragon's blood," familiar to the photo-engraver and a constituent of finest varnishes, is obtained from the outer layer of the scaly fruits of Sumatran rattan palms (*Daemonorops*).

To the home owner who is fortunate enough to garden with palms, these plants are important as unusual ornaments. Actually, one does not have to inhabit tropical lands to enjoy palms, although in temperate climes the variety of species available as house plants is small. Seedlings of dwarf species are grown by the thousands for florists to use in dish gardens in the home. Certain of these, like the popular little Parlor Palm (*Chamaedorea elegans*), thrive even under desert atmosphere and shady conditions of the average home, adding in its form a leaf and growth pattern to be found in few other houseplants. In a

greenhouse one can, of course, do even better with palms, but it is the folks who live either within the bounds of or on the fringes of the tropics who can really get to know and grow these lovely plants.

Few, if any other arboreal family of flowering plants, can offer ornamental horticulture the number or great variety of species potentially available among the family of the palms. Consider that there are fan palms and feather palms, climbing palms and creeping palms, short palms and tall palms, slender palms and robust palms. Among these are species suitable for specimen or background plantings, for street trees, for hedges, for patios, for acid soil or alkaline soil, for full sun or deep shade, for sandy sea beach or rugged mountain-side.

Not all palms of ornamental value have yet been introduced into culture. Some yet remain to be discovered. Others that have been introduced still languish as little-known specimens growing in arboretums or botanical gardens. The home owner who desires to plant palms should first familiarize himself with the kinds available by a visit to such gardens. There are few people who can plant an unlimited variety of palms and so those chosen for the home garden should be selected with care.

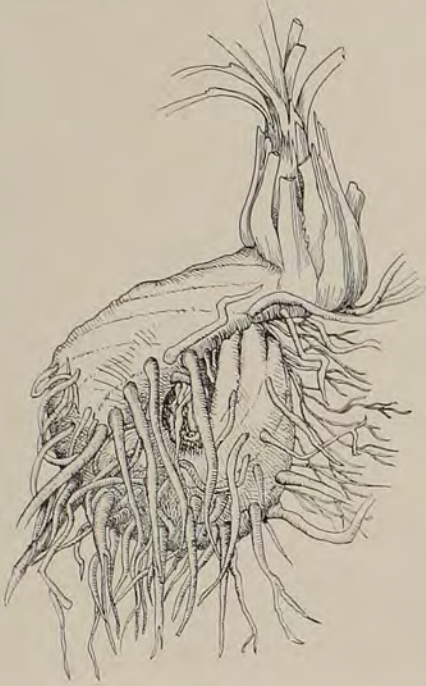
Interest in palms has increased greatly since 1955 with the founding and incorporation of *The Palm Society*, whose avowed purpose is to "study the palm family in all its aspects throughout the world." With a world-wide membership and a creditable young quarterly journal, properly named *Principes*, more and more practical information will become available to the grower and student of palms.

It is easy to see what wonderful plants palms are: they have paraded across the pages of history; they are supplying our civilization with some of its most important plant products; they have long nourished the races of the tropics; and, at the same time, have cloaked the wild and cultivated gardens of those regions with a green elegance unmatched by any other type of plant. Certainly they amply fulfill the billing given them by Linnaeus, when several centuries ago he denominated them *Principes* or the "Princes" of plants.

# Palm Characteristics, Illustrated

GENTES HERBARUM

H. F. LOOMIS



(*Sabal etonia*)  
Underground Stem



(*Roystonea* & *Areca*)  
Single Stem

## PALM STEMS

Clustered Stems  
(*Pinanga coronata*)



G. ADDISON

Branching Stem  
(*Hyphaene thebaica*)



W. H. HODGE

W. MEIJER



(*Plectocomia* sp.)  
Climbing Stem

W. H. HODGE



(*Pseudophoenix vinifera*)  
Swollen Stem

**PALM LEAVES**

Prickly Stem  
(*Acrocomia armentalis*)



W. H. HODGE

Fibrous Stem  
(*Trachycarpus fortunei*)



W. H. HODGE

With Prop Roots  
(*Euterpe dominicana*)



W. H. HODGE



J. CUATRECASAS

W. H. HODGE



(*Manicaria atricha* (pinnation here done by wind)  
Simple Leaves



(Typical of several genera)  
Pinnate Leaf

**PALM LEAVES**

Palmate Leaf  
(*Bismarckia nobilis*)



W. H. HODGE

Costapalmate Leaf  
(*Sabal brمودana*)



W. H. HODGE

W. H. HODGE

W. H. HODGE



(*Latania borbonica*)  
With Hastula



(*Phoenix reclinata*)  
With Pinnae Spines

**PALM LEAVES**

With Pinnae Hooks  
(*Daemonorops* sp.)

With Petiole Spines  
(*Corypha elata*)



W. MEIJER



W. H. HODGE

W. H. HODGE



W. H. HODGE



(*Roystonea sp.*)  
Forming Crownshaft with Deciduous  
Leaf

(*Pseudophoenix vinifera*)  
Leaf Scars As Trunk Rings

**PALM LEAVES**

Leaves Persistent  
(*Washingtonia filifera*)

Leaves Deciduous  
(*Roystonea sp.*)



L. H. BAILEY

W. H. HODGE

W. H. HODGE

W. H. HODGE



(*Corypha umbraculifera*)

Suprafoliar



(*Veitchia merrillii*)  
Intrafoliar

**PALM INFLORESCENCES**

Interfoliar  
(*Cocos nucifera*)



W. H. HODGE

W. H. HODGE



(*Cocos nucifera*)  
Flower Cluster  
With Young Spathe

Perfect (or Bisexual) Flowers

(*Washingtonia robusta*)

W. H. HODGE



(*Cocos nucifera*)  
Fruit Cluster  
With Woody Spathe

Imperfect (or Unisexual) Flowers

(Staminate)  
(*Welfia regia*)

**PALM SPATHES**

**PALM FLOWERS**



L. H. BAILEY



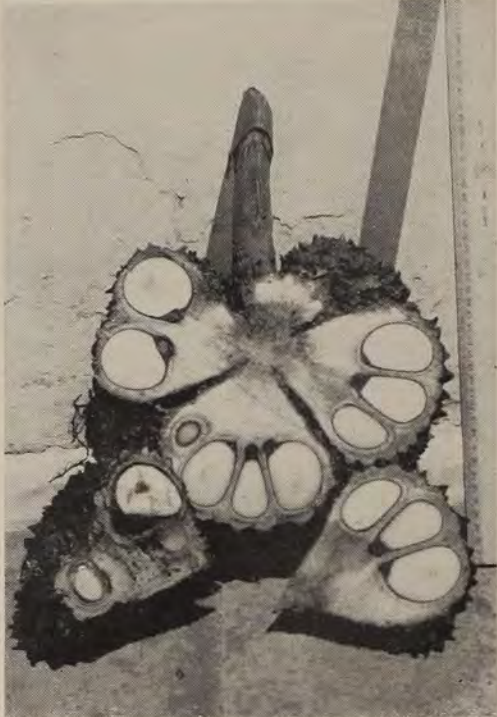
J. CUATRECASAS

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(*Cocos nucifera*)  
Single Fruit (Sectioned)

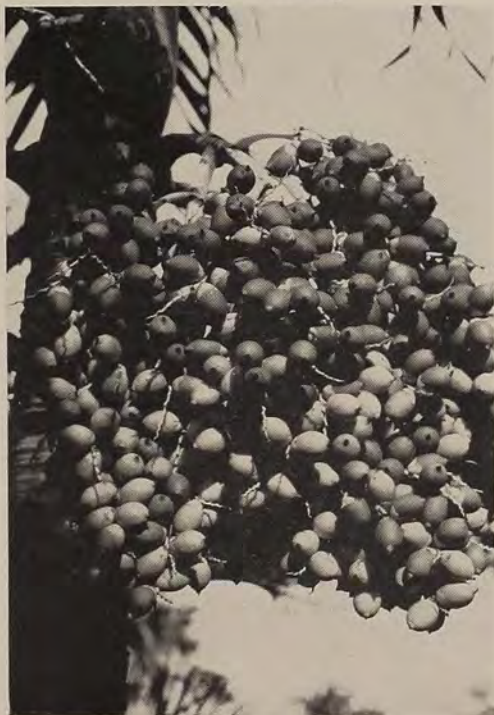
W. H. HODGE



(*Phytelephas seemannii*)  
Compound Fruit (Sectioned)

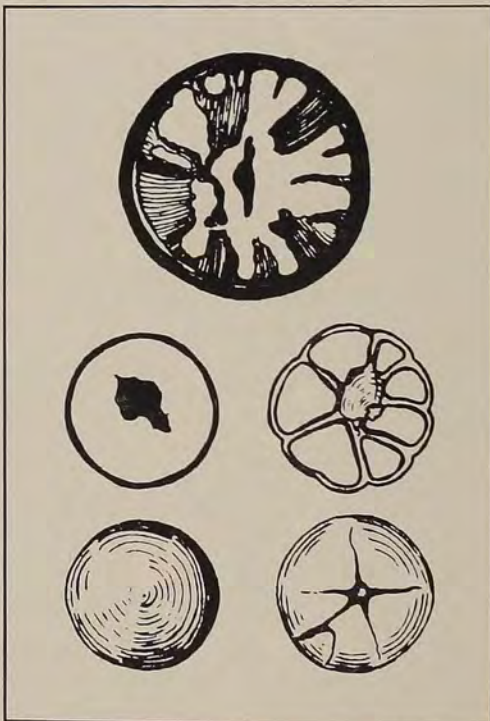
**PALM FRUITS**

Fleshy Fruits  
(*Veitchia merrillii*)



W. H. HODGE

Ruminate Albumen  
(*Euterpe* & *Coccothrinax*)



GENTES HERBARIUM

# Botany and Classification of Palms

## Botany

Palms are a remarkably varied group of plants and so distinctive in aspect that they are rarely confused with other plants. A discussion of their botanical characteristics may well commence with the seed, its germination, and the beginning of a new plant.

The palm seed is composed of a thin outer cover and two internal parts, a large (sometimes massive) endosperm which contains food for the young plant, and a small embryo from which the new plant itself will form. The endosperm may be uniformly white (when termed homogeneous) or it may be marked with dark lines of intruded seed coats (when termed ruminant). Usually it is solid, but in some palms such as the coconut, the center is hollow at maturity. The embryo appears to be undifferentiated, resembling a tiny white plug inserted in the endosperm quite unlike that of a bean with its two prominent cotyledons, tiny leaves, and beginning of a stem and root. The embryo does consist, however, of microscopically distinguishable parts—a portion from which true leaves will develop and a portion from which roots will develop, both enveloped by a single seed leaf or cotyledon which we see with the naked eye.

When the seed germinates, the single cotyledon becomes differentiated into three parts: that which remains and often enlarges within the endosperm to absorb food from the latter (the haustorium); that which breaks through the seedcoat and often elongates considerably (the cotyledonary petiole); and that which encloses the bud and from which both primary root and first leaves arise (the cotyledonary limb). Palms fall into three general categories so far as germination is concerned. In one type of germination, the cotyledonary petiole elongates only enough to bring the limb outside the seed where the limb immediately forms a tubular sheath or ligule from which the first sheathlike leaf arises. Seed of the genus *Archontophoenix* exemplifies this type of germination which may be termed adjacent ligular germination. In a second type, the cotyledonary petiole elongates considerably and the first leaf arises directly from the limb,

HAROLD E. MOORE, JR.

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often at some distance from the seed itself, with no tubular ligule. Seed of the genus *Phoenix* demonstrates this mode of germination which may be termed remote tubular germination. The third type, seen in seed of the genus *Sabal*, has both elongation of the cotyledonary petiole as in *Phoenix* and the formation of a sheath or ligule as in *Archontophoenix*. This type may be termed remote ligular germination. Regardless of the mode of germination, the primary root descends from the cotyledonary limb and is soon replaced by other roots which take over its function. The first one or two leaves consist only of a sheath with no blade. Blades usually develop on the second or third and successive leaves, though their structure is usually simpler than that of the mature leaves.

In addition to the underground roots which anchor the palm to the soil and which absorb food and water, roots sometimes appear from the stem above ground. These aerial roots may never reach the soil as in some species of *Chamaedorea* (notably *C. tepejilote*), or they may serve only an accessory function to the usual roots. In stilt palms, such as *Iriartea*, the roots form a supporting cone with the stem commencing well above the ground. In *Cryosophila*, roots form simple or branched spines on the trunks. Palms with stems that usually remain prostrate at or below the soil surface produce roots along the stem.

Although palm stems do not develop true wood in annual rings in the sense that our common deciduous or coniferous trees do, they always have a hard persistent stem that contains numerous bundles of conducting tissue scattered throughout a softer ground tissue. Most palms reach their maximum girth before the stem begins to elongate upward, accounting for the slow growth of the larger species such as *Attalea* or *Jubaea*. Some species do increase somewhat in girth and may even be swollen in one or more places. A prominent example of secondary thickening is seen in the royal palms. Some palms have the stem very prominently swollen as in the Cuban Pot-belly Palm, *Colpothrinax wrightii*. Stems are mostly single. Frequently, however, they may be clustered through the formation of new shoots from the base, or they may be colonial through production of short underground stems

that produce new shoots at a distance from the original stem. In one genus, *Hyphaene*, aerial branching is normal but otherwise branching is rare and principally induced by injury. In a very few genera exemplified by the rattan palms (*Calamus*), the stem is flexible, elongate, and is a true vine.

Trunks of palms do not have bark as do the elm or maple, hence the surface frequently becomes weathered, seamed, fissured, or fibrous. The surface may be smooth or rough, is usually marked with oblique or circular scars of leaf bases, and may be armed with prickles or root-spines. The South American Wax Palm (*Ceroxylon*) are among the tallest of trees while another palm of Colombia (*Reinhardtia koschnyana*) has very short slender stems the size of a pencil. Some few palms may appear stemless due to their habit of producing underground stems with only the crown of leaves visible. *Nypa* and *Serenoa* are examples of this habit.

Leaves of palms exhibit great diversity in size, shape, and division. The larger ones are the largest in the plant kingdom. Although they differ in origin from the leaves of familiar trees, we may consider the leaf as essentially an axis divisible into three recognizable regions—the sheath, the petiole, and the blade. The sheath is that lowermost portion which partially or completely surrounds the stem. It is often fibrous, sometimes armed with prickles or spines. When the sheaths are elongate, tubular, and congested at the top of the trunk, they appear to form a continuation of the trunk. This apparent continuation is referred to as the crownshaft and is a prominent part of such palms as the royal palms and others in the subfamily ARECOIDEAE.

The term petiole is generally used for that part of the axis above the sheath which is devoid of leaflets. It may, however, be prickly or toothed. Petioles are sometimes nearly round in cross section (*Nypa*), but mostly have a rounded underside and a channelled or concave upper side.

The blade of a palm leaf composes the terminal "leafy" portion of the axis. It consists of the central continuation of the axis, which in the blade is termed the rachis, and leafy tissue which is generally divided into leaflets. Blades fall



into one of several categories. When the individual leaflets are borne along the length of the central axis (here termed rachis), the leaflets are called pinnae and the leaf is said to be pinnate. Palms with pinnate leaves are popularly called feather palms. Royal palms and the Coconut Palm are good examples of pinnate palms. When all the leaflets rise from a single point at the tip of the petiole and the rachis is very much foreshortened, the blade is said to be palmate. The leaflets are most often more or less united at the base in the palmate leaf and are generally referred to as segments. Examples of palmate or fan palms are *Chamaerops* and *Rhapis*. Many genera loosely classed as fan palms are intermediate with the rachis or costa only partially foreshortened. Such blades are said to be costapalmate. *Sabal* is an excellent example of a genus in which the blades are costapalmate. Blades, however, are not always divided into individual pinnae or segments. When the tissue is continuous along each side of the rachis, the blade is said to be undivided. Such undivided blades occur principally in palms with an elongate rachis and are said to be pinnately nerved, but *Licuala grandis* is a fan palm with undivided blades and palmately arranged nerves. The individual pinnae are modified into spines at the base of the blade of *Phoenix* species or into climbing hooks or teeth as in *Desmoncus* and other climbing palms.

Leaves may also be divided into two other groups dependent on the manner in which the segments or pinnae develop and are attached to the axis at maturity. Segments or pinnae are referred to as induplicate when the midnerve of each segment or pinna is lower than the margins at the point of attachment. The individual segments are then V-shaped (trough-shaped) in cross section and the axis continues to the tip of a terminal pinna or segment. The leaves of *Phoenix* illustrate this character, as do those of genera in the subfamily CARYOTOIDEAE and all fan palms except *Mauritia*, *Mauritiella*, and *Lepidocaryum*. In contrast, when the midnerve of each segment or pinna is attached to the axis above the margins, the segments or pinnae are said to be reduplicate. The blade terminates in a pair of segments or pinnae with sometimes an interven-

ing filament representing the end of the axis and the pinnae are inverted V-shaped (tent-shaped) in cross section. Most of the pinnate palms have reduplicate pinnae. Only the three genera of fan palms already mentioned as exceptions have reduplicate segments.

Before the blade expands, the individual segments or pinnae are connected at their tips by two very thin and easily broken to stout and persistent bands of tissue united at the tip in a scarcely visible to prominent hook. These bands are referred to as reins or lorae. When they persist they may be observed as long, often green trailers hanging from the lowest pinnae on each side of the blade in such palms as *Veitchia merrillii*, species of *Chrysalidocarpus*, or from the lowest segments of the costapalmate leaves of *Corypha*. *Dictyosperma aureum* is characterized in part by the persistence of the reins along the margin even in the mature leaf.

Leaf blades are mostly unarmed. Some genera, however, are noted for the prickles that occur on all parts of the stem, leaf, and inflorescence. Very many leaves also have a covering of tiny scales or hairs, at least when young, although these may disappear in age.

Palm flowers are usually very numerous. They are borne on often massive and much-branched structures termed inflorescences (or spadices). The inflorescences appear below the leaves as in the royal palms (then termed infrafoliar), among the leaves as in the Coconut Palm (interfoliar), or above the leaves terminating the trunk as in the Talipot Palm, *Corypha* (suprafoliar). There is a great diversity in the structure of inflorescences, in the numbers and types of bracts (often called spathes) that sheath them in bud and often persist on them, in the kind and amount of branching, and in the distribution of flowers on the branches or branchlets. Both type of inflorescence and the number and type of bracts are important in classification but are often incompletely known except in cultivated species since they are difficult for botanical collectors in remote regions to handle satisfactorily.

The entire inflorescence is sheathed in envelopes called bracts (or spathes) in the bud stage. In the subfamilies COCORDEAE, PHYTELEPHANTOIDEAE, and the ma-

majority of ARECOIDEAE, these bracts number two: an outer bract inserted near the base of the stalk or peduncle of the inflorescence, and an inner bract inserted above the outer. Sometimes the inner is shorter than the outer and enclosed within it; sometimes it is much longer than the outer. The bracts may fall off as the inflorescence expands, or one or both may persist. In many cocoid genera, such as *Cocos*, the inner bract is large and woody; in other groups the bracts may be fibrous and papery. Only one bract is present in *Chamaerops*, *Phoenix*, *Areca*, *Pinanga*, and *Nenga*.

Several bracts are present on the inflorescences of other groups of palms. They may be tubular and sheathing to flat and sword-shaped or shaped like a shell. They may sheath only the base of the inflorescence or they may sheath the principal branches or even the lesser divisions and flower clusters.

Each inflorescence is composed of a supporting stalk or peduncle, a central axis (termed rachis), and normally branches and branchlets of several orders termed rachillae. In some species or even genera, the central axis alone bears flowers and is then technically a spike, but for the most part the inflorescence is a panicle with few to very many branches which may be slender or sometimes thick and crowded with flowers like enormous catkins.

Usually inflorescences appear in the axils of succeeding leaves upward from the base and the tree continues to flower over the period of its maturity, a condition termed polycarpic. Rarely, in *Corypha*, *Nannorrhops*, and some genera allied to *Calamus*, an individual stem flowers only once and dies (monocarpic). In *Caryota* and its allies the trees reach their maximum growth, then commence to flower from the top to the bottom, inflorescences sometimes appearing from below the surface of the soil. These palms are also monocarpic, each stem (or the whole tree when solitary) dying when flowering and fruiting have ceased.

Flowers of palms are amazing in the diversity of their structure and of their distribution on the inflorescence. Least often they are bisexual or perfect; most often they are unisexual, either male (staminate) or female (pistillate). Palms with perfect flowers are said to be hermaphrodite. When both male and

female flowers occur on the same tree, either in the same or in different inflorescences, the plants are said to be monoecious. When male and female flowers occur on different plants, the plants are said to be dioecious. A few species may have both unisexual and apparently perfect flowers on the same plant, a condition referred to as polygamous.

Solitary flowers arranged in loose spirals along the rachillae are frequent in *Sabal* and other genera of CORYPHOIDEAE, *Phoenix* and in some genera of ARECOIDEAE. Sometimes, however, perfect flowers may be arranged in clusters of two or three along the rachillae as in *Erythea*. Rarely, flowers appear in groups of several arranged in lines (acervulae) along the rachillae, the lower flower usually female, the remainder male. Such an arrangement is found in *Mascarena*, *Synechanthus* and a few other genera. The most frequent arrangement is a cluster of two male flowers with a female between, the latter usually developing after the males. The female flowers may abort in a few to many clusters leaving paired or solitary male flowers, especially toward the tips of rachillae. In *Phytelephas* and *Nypa*, female flowers are disposed in the dense heads while the males are crowded on specialized branches.

Most palm flowers are sessile, lacking a supporting stalk or pedicel, but a few genera have some or most species with pedicels or with extended pedicel-like perianth bases. Some are sunken in pits in thickened inflorescence branches.

The basic and least specialized type of palm flower is a perfect flower with four whorls of parts. The outer two of these compose the floral envelope (the perianth). The outermost whorl of three overlapping (imbricate) sepals makes up the calyx; the next whorl of three imbricate petals together forms the corolla. Within the corolla there is a whorl of male organs, the stamens or collectively the androecium. Each stamen consists of a supporting stalk or filament and a pollen-bearing body, the anther. The central whorl consists of three separate female organs or carpels (collectively the gynoecium). The flowers of *Trithrinax* approach this basic plan as closely as perhaps any genus, differing only in having the sepals partially united.

Variations on this basic plan are exceedingly diverse, most conspicuously so

in male flowers. Sepals may be variously united or reduced to mere vestiges. Petals remain imbricate in most female flowers but have become valvate (with margins meeting but not overlapping) in a few genera. Valvate petals are almost the rule, however, in male flowers. Petals also may become united or may be reduced to vestiges.

The usual number of stamens is six. Each is composed of a supporting stalk or filament and a terminal pollen-bearing body or anther. Reduction to three stamens is rare but many to very many (over two hundred) stamens are found in male flowers of certain genera or even groups of genera. Stamen filaments may become variously united with each other or with the perianth; the stamen filaments may be erect or bent inward (inflexed) in bud and the anthers may split (dehisce) to release pollen by slits opening inwardly (introrse dehiscence) or outwardly (extrorse dehiscence).

The female organs or carpels are three and distinct in only a few genera. More often they are partially or completely united into a compound pistil with three ovule-bearing chambers (locules), with one ovule-bearing chamber and two chambers sterile but evident, or with only a single ovule-bearing chamber (a simple pistil). In *Thrinax*, *Schippia*, *Hemithrinax*, and *Coccothrinax*, the gynoecium consist of a single carpel. In a few species of cocoid palms and in the PHYTELEPHANTOIDEAE more than three united carpels occur (up to ten) all of them producing ovules and seeds. In many palms the ovary or portion in which the ovule or egg is produced is small and soft but is capped by a variously thickened upper portion or style with small areas receptive to pollen (stigmas) at the tip. In *Phytelephas*, however, the styles are very long and as many as the locules of the pistil.

Palm fruits are usually indehiscent (not splitting when ripe) with a coat of three more or less defined layers surrounding the seed. The outer coat, called the exocarp, may be smooth, prickly, warty or covered with overlapping scales. The middle layer or mesocarp is usually fleshy, fleshy-fibrous, or fibrous. The inner layer or endocarp which encloses the seed may be thin and membranous or papery to thick and bony. In members of the COCOIDEAE, the endocarp is very

hard and shows three pores below, at, or above the middle. It is difficult to classify some palm fruits according to the usual terminology, but in general they are berries as in *Arenga* (fleshy with usually one to three seeds and no hard endocarp) or drupes as in *Elaeis* (fleshy with a single seed enclosed in a hard endocarp). Fruits like the coconut have been classed as drupes but do not fit the definition strictly, neither are they nuts in the most restricted sense. In *Phytelephas* and *Nypa* the fruits are aggregate (several very closely packed together).

Seeds vary from the size of buckshot (*Geonoma*) to the largest in the plant kingdom (*Lodoicea*). Each is protected by an outer coat (the testa) which sometimes adheres to the endocarp. The interior consists of solid endosperm and an embryo described in an introductory paragraph.

### Classification

The palms constitute a single family, PALMAE or alternatively ARECACEAE, and a single order, PRINCIPES, among the flowering plants. Because they have only a single seed leaf (cotyledon) they are placed in the Monocotyledon class to which belong such other families as those of the lilies (LILIACEAE), aroids (ARACEAE) and orchids (ORCHIDACEAE).

Several categories are recognized within the family which attempt to show relationships and thus form the basis for a system of classification. In descending order of importance these are the subfamily, the tribe (sometimes further subdivided into subtribes), and the genus. Each genus is composed of one to many species all having in common at least one characteristic; all the various kinds or species of royal palms, for example, belong to the genus *Roystonea*. Genera which have one or more features in common are grouped into tribes. *Ptychosperma* and such related genera as *Veitchia*, *Balaka*, and others are grouped in the Tribe PTYCHOSPERMEAE. This tribe is joined by other tribes such as ARECEAE, CLINOSTIGMEAE, MALORTIEAE, to form the subfamily ARECOIDEAE.

Several attempts have been made in the past century to arrange these subordinate groups of palms in an orderly system within the family. There has not

been and is not yet complete agreement about relationships of palms. Three classifications deserve mention. Sir Joseph Hooker studied palms in great detail for *Genera Plantarum*, a three-volume study of plant genera published by Bentham and Hooker in 1883. Otto Drude differed somewhat from Hooker in his system published in Engler and Prantl's *Die natürlichen Pflanzenfamilien* (1887). Odoardo Beccari's ideas of relationships must be obtained from his several studies of major groups of palms and from a posthumous publication edited by Pichi-Sermolli in Volume 11 of *Webbia* (1955). The schemes proposed by these three botanists may be compared in the following outlines of their systems.

Sir Joseph Hooker divided the family into a series of six tribes and eighteen subtribes, as follows:

*Tribe I.* ARECEAE (including *Nypa* and *Phytelephas*) with twelve subtribes

- |                   |                  |
|-------------------|------------------|
| 1. EUARECEAE      | 7. CEROXYLEAE    |
| 2. PTYCHOSPERMEAE | 8. MALORTIEAE    |
| 3. ONGOSPERMEAE   | 9. IGUANUREAE    |
| 4. IRIARTEAE      | 10. CHAMAEDOREAE |
| 5. WETTENIEAE     | 11. GEONOMEAE    |
| 6. LINOSPADICEAE  | 12. CARYOTIDEAE  |

*Tribe II.* PHOENICEAE with no further subdivision

*Tribe III.* CORYPHEAE with no further subdivision

*Tribe IV.* LEPIDOCARYEAE with three subtribes

1. CALAMEAE
2. RAPHEAE
3. MAURITIEAE

*Tribe V.* BORASSEAE with no further subdivision

*Tribe VI.* COCOINEAE with three subtribes

1. BACTRIDEAE
2. ELAIDEAE
3. EUCOCINEAE

Drude recognized five subfamilies with subordinate tribes, as follows:

*Subfamily I.* CORYPHINAE with two tribes

1. PHOENICEAE
2. SABALEAE

*Subfamily II.* BORASSINAE with only one tribe

3. BORASSEAE

*Subfamily III.* LEPIDOCARYINAE with two tribes

4. MAURITIEAE
5. METROXYLEAE, including subtribes RAPHEAE, CALAMEAE

*Subfamily IV.* CEROXYLINAE with two tribes and several subtribes

6. ARECINAE including subtribes CARYOTEAE, GEONOMEAE, IRIARTEAE, MORENIEAE, ARECEAE
7. COCOINEAE with subtribes ELAIDEAE, ATTALEAE and BACTRIDEAE

*Subfamily V.* PHYTELEPHANTOIDEAE with no tribes including only *Nypa* and *Phytelephas*

Beccari recognized eight subfamilies in his last work, but without complete further subdivision. These subfamilies were the ARECOIDEAE, COCOIDEAE, NYPOIDEAE, PHYTELEPHANTOIDEAE, LEPIDOCARYOIDEAE, PHOENICOIDEAE, CORYPHOIDEAE and BORASSOIDEAE.

The subfamilies recognized by Beccari, with one addition, present perhaps the most satisfactory division of the palms. Further studies are needed to assess all groups and especially to integrate the arecan palms of the New World with the series of tribes Beccari outlined for the arecan palms of the Old World. Until such studies are completed the following key to and synopsis of nine groups that seem to warrant subfamily status may serve to acquaint readers with the principal kinds of palms. (See Page 23.)

### Synopsis of the Subfamilies of Palms

The subfamilies of palms may be grouped in two principal categories, here noted simply as Groups I and II, according to the structure of their leaves—whether the segments are induplicate or reduplicate in bud.

#### Group I

The subfamilies that have leaf segments or pinnae induplicate in bud with the midnerve below and the margins above where attached to the rachis, thus V-shaped in section.

#### *Subfamily* CORYPHOIDEAE

There are thirty-two to thirty-five genera in the CORYPHOIDEAE with about three hundred and thirty species distributed in both hemispheres. Except for the seven genera included in the BORASSOIDEAE and three fan palms of the LEPIDOCARYOIDEAE, all palms with palmate leaves belong to this subfamily. A few representative genera are *Cryso-*

**Key to the Subfamilies of Palms**

- 1. Fruits covered with overlapping scales ..... LEPIDOCARYOIDEAE
- 1. Fruits smooth or sometimes variously roughened but never covered with scales
  - 2. Leaves palmate, costapalmate, or palmately nerved
    - 3. Divisions of the inflorescence with slender branches; flowers mostly with organs of both sexes (bisexual or hermaphrodite) or when unisexual not markedly dissimilar ..... CORYPHOIDEAE
    - 3. Divisions of the inflorescence with thickened often catkinlike branches; flowers always unisexual, the male and female differing markedly in structure and borne in similar or dissimilar inflorescences on separate trees ..... BORASSOIDEAE
  - 2. Leaves pinnate, pinnately nerved, or bipinnate (*Caryota*)
    - 3. Lower pinnae modified into prominent sharp spines and the pinnae induplicate in vernation ..... PHOENICOIDEAE
    - 3. Lower pinnae not modified into spines (but occasionally into short teeth) and the pinnae reduplicate except in CARYOTOIDEAE
      - 4. Leaves twice pinnate with wedge-shaped pinnules that are blunt and toothed at the tip, or once pinnate or pinnately nerved with the pinnae toothed along the margins and at the more or less rounded tip, the pinnae induplicate in vernation; inflorescences terminating the stem and maturing at successive nodes toward the base, the stems monocarpic ..... CARYOTOIDEAE
      - 4. Leaves once pinnate, or pinnately nerved, the pinnae reduplicate in vernation with pointed tips or with blunt or oblique and toothed tips but never toothed along the margins; inflorescences developing at successive nodes upward and the stems polycarpic
        - 5. Sepals and petals well developed in all flowers; fruits mostly distinct though crowded on elongate spikes in a few genera
          - 6. Fruit with a bony endocarp surrounding the seed and the endocarp marked with three distinct pores below, at, or above the middle ..... COCOIDEAE
          - 6. Fruit with a usually thin endocarp surrounding the seed, and the endocarp never marked with three pores even when somewhat bony ..... ARECOIDEAE
        - 5. Sepals and petals rudimentary or lacking in flowers of one or both sexes; fruits crowded in heads
          - 7. Male and female flowers on separate bracted branches in the same inflorescence, the male with only 3 stamens and crowded on short catkinlike branches below the terminal head of female flowers ..... NYPOIDEAE
          - 7. Male and female flowers on separate plants, the male with many stamens and crowded on large branches with only two bracts at the base of the inflorescence, the female in a head with only two bracts subtending the inflorescence ..... PHYTELEPHANTOIDEAE

*phila*, *Paurotis*, *Rhapis*, *Sabal*, *Thrinax*, *Washingtonia*. These palms are marked by their palmate or costapalmate leaves and by their mostly bisexual (hermaphrodite) flowers borne on a usually much-branched inflorescence among or sometimes above the leaves. One to mostly several bracts subtend the inflorescence, and bracts often sheath the principal branches or divisions of the inflorescences. The flowers are small, ar-

ranged singly or in clusters of two or three along the rachillae, and mostly without a supporting stalk or pedicel although pedicels are developed in a few genera. Even when flowers are functionally unisexual they remain rather similar in structure. The three sepals may be distinct or variously united or even reduced to vestiges; the three petals may be distinct but are usually united, at least at their bases, with valvate tips

and rarely are reduced to vestiges; the stamens usually number six though they may be more; the carpels are normally three and distinct or variously united, or they may be reduced to only one in a few genera. The fruits of this group are often fleshy with a smooth or rarely roughened or warty surface but are never scaly. A usually thin endocarp surrounds a single seed which has homogeneous or very rarely ruminate endosperm (*Copernicia*). Often the seed coat is deeply intruded into the endosperm on one side or the seed may be irregularly grooved or lobed.

#### Subfamily PHOENICOIDEAE

The genus *Phoenix*, with about twelve species in Asia and Africa, is the only representative of this subfamily which may be recognized readily by the pinnate leaves with stout spines in place of normal pinnae at the base of the leaf. The pinnae are pointed with untoothed margins. Male and female flowers differ in appearance and are normally borne upon inflorescences among the leaves on separate trees. The inflorescence is subtended by a single papery bract that soon drops off. The peduncle of the inflorescence is flattened and bears at the tip a few to many stiffish simple but sometimes clustered branches. Flowers are small, sessile, and arranged singly along the rachillae. The male flowers have three sepals united into a low toothed cup, three oblique petals slightly united at the base and valvate above, six stamens (very rarely three or nine according to Hooker) and the pistillode minute or lacking. Female flowers have a calyx of united sepals, three rounded overlapping petals, six staminodes, and three distinct carpels. The oblong fruits are one-seeded with smooth exocarp which bears a terminal stigmatic scar, fleshy mesocarp, and thin endocarp. Seeds are linear-oblong, grooved on one side, with the embryo lateral or near the base in homogeneous endosperm.

#### Subfamily BORASSOIDEAE

Seven genera of Africa and Asia are included in this subfamily. They are *Bismarckia*, *Borassodendron*, *Borassus*, *Hyphaene*, *Latania*, *Lodoicea*, and *Medemia*, represented by about forty-two species. The subfamily is characterized by its costapalmate leaves and unisexual flowers of dissimilar structure borne on

thickened branches of large inflorescences which appear among the leaves. Each inflorescence is subtended by several sheathing bracts. Two subgroups may be recognized by the structure of the inflorescence: *Hyphaene*, *Medemia*, and *Bismarckia* have small male and female flowers covered by closely imbricated bractlets on separate but similar catkinlike branches; *Borassus*, *Borassodendron*, *Latania*, and *Lodoicea* have small male flowers in pits of a thick catkinlike inflorescence covered with imbricated bractlets, and larger female flowers seated on stouter branches with fewer bractlets, these mostly clustered about the individual flowers. Male flowers may be solitary, in clusters of three, or several in short spikes hidden by the bractlets. The three sepals are united at least at the base, the petals united at the base and imbricate above, the stamens six to many in number, the pistillode minute. Female flowers are sometimes stalked; the three sepals and three petals are imbricate; staminodes are usually united in a low ring; the pistil is usually trilocular. Fruits are moderate to very large, and one- to three-seeded. The smooth exocarp is marked with stigmatic scars at the tip or at the base, the mesocarp is fibrous or fleshy, the endocarp thin. Seeds have homogeneous or ruminate, sometimes hollow endosperm and the embryo in various positions.

#### Subfamily CARYOTOIDEAE

Three genera and about thirty-eight species of Asiatic palms are included in the CARYOTOIDEAE. *Arenga* (including *Didymosperma*), *Caryota*, and *Wallichia* are unusual among palms in several respects. The leaves are twice pinnate in *Caryota* and each individual pinnule is more or less wedge-shaped with a broad toothed tip. The remaining genera have once pinnate or pinnately nerved leaves with the pinnae somewhat undulate and toothed along the margin and at the more or less rounded tip. Individual trunks reach their full growth and then commence to produce flowers. These appear first on inflorescences at the top of the plant with further inflorescences produced at successively lower nodes until the base is reached. Then the stem dies, or, in the case of single-stemmed species, the whole plant dies. One or several inflorescences may appear at each node, each subtended by several sheath-

ing bracts. Usually many unbranched rachillae are borne from the peduncle but inflorescences of some species are spicate. The flowers are strikingly dissimilar and are usually borne in groups of two male and a central female. The latter develops fully only after the male flowers have fallen or sometimes not at all so that paired or solitary male flowers appear toward the tip of the rachilla. Male flowers have three imbricated or united sepals, three distinct or partly united larger boat-shaped petals, six to many erect stamens and no pistillode. Female flowers have three rounded imbricate sepals, three valvate or basally connate and valvate petals, mostly six to no staminodes, and a two- or three-loculed pistil. Fruit is one- to three-seeded with a smooth exocarp, fleshy mesocarp with stinging crystals, and a thin endocarp. The seeds are oblong-ovoid to globose with homogeneous or ruminant endosperm and lateral embryo.

## Group II

The subfamilies that have leaf segments or pinnae reduplicate in bud with the midnerve uppermost and the margins below where attached to the rachis, thus inverted V-shaped in section.

### Subfamily LEPIDOCARYOIDEAE

The subfamily LEPIDOCARYOIDEAE is immediately recognized by the imbricated scales that cover the fruits. It is composed of about twenty-five genera with about five hundred species principally in Asia and Africa but with a few representatives in the New World. Beccari has divided the subfamily into eight subordinate groups (subtribes of his earlier work) represented by such diverse genera as *Calamus*, *Salacca*, *Raphia*, *Metroxylon*, *Korthalsia*, *Ancistrophyllum*, *Mauritia*, *Eugeissona*. The habit varies from stemless to tall palms or vines (*Calamus*) which are frequently armed with fierce prickles or hooked leaf tips. Leaves may be pinnate or pinnately nerved or rarely palmate (in *Mauritia*, *Mawitiella*, *Lepidocaryum* of the New World). The pinnae are sometimes armed with prickles along the margin and mostly have pointed tips. Inflorescences appear among the leaves or above the leaves (in a few genera plants die after flowering). Several to very many bracts are borne on the inflorescence which may have hermaphrodite

flowers, male and female flowers, or flowers of only one sex. Flowers may be similar or dissimilar in shape and size, the three sepals being generally more or less united, the three petals distinct or variously united, the stamens mostly six but sometimes fewer or more, the pistil completely or incompletely trilobate. The scaly fruits contain one to three seeds with homogeneous or ruminant endosperm.

### Subfamily COCOIDEAE

About twenty-seven genera and six hundred and ten species constitute this subfamily. They are native in the western hemisphere except *Elaeis* and *Jubaeopsis* in Africa and the pantropical *Cocos*. Three rather well defined subordinate groups are recognized: the group which includes *Arecastrum*, *Arikuryroba*, *Attalea*, *Barbosa*, *Butia*, *Cocos*, *Diplothemium*, *Jubaea*, *Jubaeopsis*, *Maximiliana*, *Orbignya*, *Parajubaea*, *Parascheelea*, *Polyandrococos*, *Rhyticocos*, *Scheelea*, and *Syagrus*, is characterized by lack of prickles, female flowers not sunken in the rachillae, and heavy inner bracts; a smaller unarmed group with female flowers sunken in the rachillae includes *Barcella*, *Corozo*, and *Elaeis*; and a third group of genera is characterized by its prickly nature—*Acanthococos*, *Acrocomia*, *Aiphanes*, *Astrocaryum*, *Bactris*, and *Desmoncus*. All the cocoid palms have pinnate or pinnately nerved leaves with the pinnae only rarely blunt and toothed at the tip (notably in *Aiphanes*). Inflorescences appear among the leaves and are subtended by two bracts which may be fibrous, papery or woody. The inner bract is usually much longer than the outer, as in the coconut, and in the group to which the last belongs is woody and persistent. Flowers are usually borne in groups of two male and a central female although the latter may sometimes appear on specialized parts of the rachilla, or the inflorescences may be essentially either male or female. Male flowers have three distinct or united sepals, mostly three valvate or variously united petals, six or more stamens, and often a pistillode. Female flowers are frequently larger than the male with three imbricate or united sepals, three imbricate or united petals, distinct or united staminodes and a one- to seven-celled pistil. Fruits are one- to several-seeded, the exocarp smooth or

prickly but not scaly, the mesocarp fleshy or fibrous, the endocarp bony with three pores below, at, or above the middle. Seeds have homogeneous or ruminant often hollow endosperm.

#### Subfamily ARECOIDEAE

Represented by about a hundred and thirty genera and eleven hundred species in both hemispheres, the subfamily ARECOIDEAE is the most heterogeneous and the most in need of detailed study. The genera have been grouped in a number of tribes by the various workers who have studied them but no subdivision arrangement to date has been truly satisfactory. Some diverse representatives are *Areca*, *Ceroxylon*, *Chamaedorea*, *Geonoma*, *Howea*, *Iguanura*, *Iriarte*, *Oncosperma*, *Ptychosperma*, *Reinhardtia*. The arecoid palms always have pinnate or pinnately nerved leaves with the pinnae pointed or more rarely blunt or oblique and toothed at the tip but with entire margins. Inflorescences are borne among or below the leaves, usually with one or two bracts but in several genera with several sheathing bracts. The peduncle may be long or short, the flower-bearing portion a single axis (spike) or variously and sometimes elaborately branched. Flowers of both sexes are ordinarily borne in the same inflorescence but in a few genera plants are either male or female. The size and structure of flowers, particularly male flowers, varies greatly. In *Pseudophoenix* the functionally male and the hermaphrodite flowers are very similar, in *Chamaedorea* and allied genera the male flowers are superficially similar to but internally different from the females and are of great importance in classification and identification. Male flowers usually have a calyx of three discrete or united sepals, three valvate petals, three or six to very many stamens, and a pistillode of variable size and shape. Female flowers tend to have imbricate sepals and petals, small staminodes, a completely or incompletely trilocular pistil or a unilocular pistil. Fruits rarely have more than one seed and are smooth or sometimes roughened but never scaly outside, marked with basal, lateral or apical stigmatic scars, with fleshy or fibrous mesocarp and thin to bony endocarp not marked with pores. Seeds vary in size and shape, sometimes being grooved (*Ptychosperma*) or slightly lobed. The

endosperm may be homogeneous or ruminant, the embryo basal, lateral or apical.

#### Subfamily PHYTELEPHANTOIDEAE

Four genera and about eight species native in Central and South America are included in the subfamily. Leaves are pinnate with pointed tips and entire margins. Plants are either male or female. The inflorescences subtended by two bracts appear among the leaves. Male flowers have a much reduced perianth, many to very many stamens and no pistillode. They are borne on short variously shaped headlike branches from a generally flattened long and thick axis. Female flowers are very large, borne in heads, and have three or four sepals, five to ten elongate petals, numerous staminodes and a four- to ten-loculed pistil from which very long styles appear. Fruits are aggregated in very large heads, each individual fruit having a slightly to strongly tuberculate outer coat, a fleshy or fibrous mesocarp, fragile endocarp and as many seeds as locules in the pistil. The endosperm is homogeneous and is used as vegetable ivory.

#### Subfamily NYPOIDEAE

*Nypa*, like *Phoenix*, is the sole representative of its subfamily. The single species, *Nypa fruticans*, is native in estuarine regions of Asia. Trunks creep underground so the pinnate leaves appear from the surface of the ground. The pinnae are pointed with entire margins. Inflorescences are borne among the leaves with the female flowers in a terminal head below which several branches bear short rachillae crowded with male flowers. The peduncle, branches, rachillae and head are all subtended by sheathing bracts with open rather flaring orifices. Male flowers are small with three narrow inflexed sepals, three small slightly imbricate petals, three stamens with united filaments, and no pistillode. Female flowers are larger with a perianth of six rudimentary sepals and petals, no staminodes and three distinct angled carpels. Fruits are borne in a dense globose head, each individual being one-seeded, compressed and angled with the stigmatic scar on the pyramidal apex. The exocarp is smooth over a densely fibrous mesocarp and spongy endocarp. The seed has hollow endosperm into which the seed coat intrudes on one side.



# The Native Palms

ROBERT W. READ

Thirteen species of palms are found native in the continental United States. They are mostly confined to the coastal plain of the southeast with eleven species occurring in Florida. One species is native in California and Arizona, another in southeastern Texas. Five of the thirteen species are found nowhere else in the world. They are: the Needle Palm (*Rhapidophyllum hystrix*); Blue Palmetto (*Sabal minor*); Scrub Palmetto (*Sabal etonia*); Saw Palmetto (*Serenoa repens*); and the Cabbage Palmetto (*Sabal palmetto*).

The Coconut Palm (*Cocos nucifera*), also growing wild in south Florida, will not be considered in this discussion because it is found throughout the tropical regions of the world and it has not been proven to be a truly native species of Florida.

People of subtropical regions should consider planting the native palms of the United States that have proved hardy in their area. Most of the species, excepting those of extreme south Florida, will withstand many degrees of frost; some are even more hardy than the common *Phoenix* palms.

A key to the native palms of the continental United States appears on page 29.

## 1. *Coccothrinax argentata*

This genus is found only in the Caribbean area. The leaves are fan-shaped and in most species are conspicuously silvery on the underside. *C. argentata* is the only species of this genus occurring in Florida. It has been called *C. jucunda* and *C. garberi*, but these names are now reduced to synonymy. The palm, also, has often been called *C. argentea* which is a valid species on the islands of the Caribbean but not in Florida. The generic name *Coccothrinax* refers to the berry-like fruits, *coccum*, and to the relationship with the genus *Thrinax*. The

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specific name is from the Latin *argentatus*, meaning silvered, referring to the very silvery-white lower surface of the leaf. The common name is Silver Palm, and it has also been called seaberry palm, and Biscayne palm. The Silver Palm in Florida ranges from south of Palm Beach on the east coast to the Marquesas Keys west of Key West. The species is an extremely ornamental palm, with its bright green and silver fan-shaped leaves. It deserves greater attention in ornamental gardening. Although slow growing, it will withstand drought and will flourish equally well in sand or limestone. As it grows naturally near the open sea, it is very resistant to salt damage. Plants are difficult to transplant at maturity but can be grown from seed.

Trunk from none at all to 20 feet tall, 6 inches in diameter, usually lacking persistent leaf bases. Plants may sometime appear to sucker, as noted by Bailey (1939). Leaves fan-shaped, to 2 feet wide to 2 feet long, under surface silvery-white, upper surface glossy-green, the leaf segments often pliable and somewhat drooping. Inflorescence relatively short, generally not longer than the petiole, the branches short and numerous; flowers perfect with a toothed cup-like base representing a reduced perianth. Fruits black or purple, nearly globular, to  $\frac{3}{8}$  inch in diameter, seeds many, furrowed.

### 2. *Paurotis wrightii*

*Paurotis* is a genus of fan-leaved palms found in Florida, Cuba, Bahamas, Mexico, and Central America, and consists of only one species. Synonyms are *Serenoa arborescens* and *Acoelorrhapha wrightii*. Common name is Everglade Palm, although often called the sawcabbage palm and silversaw palm. The specific name honors Charles Wright (1811-1886), an American botanical collector who discovered the palm in Cuba while making extensive plant collections there. The Everglade Palm is found in southern Florida at several isolated localities. There is a large number of plants of this species in the Big Cypress area north of the Tamiami Trail and in several areas south of the Tamiami Trail to Cape Sable. In Florida it is always found in moist low places, usually shaded by hammock overgrowth. The Everglade Palm is a good palm for use in the landscape. It forms a large clump and will

grow in full sun or shade, with its roots either in water or in dry areas of sand or limestone. It will even tolerate some brackish water. This palm with orange-colored flower clusters, is a beautiful sight when in full bloom. It is hardy to northern Florida along the coast.

Trunks clustered, slender, 4 to 5 inches in diameter and to 25 feet tall, covered with persistent leaf sheaths. Leaves fan-shaped, 2 to 3 feet wide, sometimes silvery beneath, light green on the upper surface; petioles margined with orange-colored teeth. Inflorescences many, longer than the leaves and projecting above the foliage, appearing in early summer; flowers perfect, the perianth in two series. Fruit black, globose,  $\frac{1}{4}$  inch in diameter.

### 3. *Pseudophoenix sargentii*

The genus *Pseudophoenix* is found on islands in the Dominican Republic, the north coast of Cuba, and in Haiti, Bahamas, and the Florida Keys. *Pseudophoenix sargentii* also occurs on keys off the coast of British Honduras and on the North American mainland in Quintana Roo and reportedly in Yucatan, Mexico. *Pseudophoenix*, from the Latin *pseudo*, meaning false, and *phoenix*, referring to the date, indicates some appearance to the genus *Phoenix*. Plants of this species has been for many years known as *P. vinifera* but Bailey (1939) has shown that these are two separate species with *P. vinifera* found only on the island of Hispaniola. The specific name honors its discoverer, Charles Sprague Sargent (1841-1927), director of the Arnold Arboretum of Harvard University. *Pseudophoenix sargentii* is found in Florida only in two localities, Elliott Key and Long Key. It is also found in the Bahamas, on the islands off the north coast of Cuba, and on the north coast of Dominican Republic and Yucatan.

Trunk solitary, conspicuously ringed to 35 feet tall, usually much smaller, to 10 inches in diameter. Leaves feather-like, 3 to 6 feet long, stiff, arching; base of leaf covered with a waxy layer which is easily scraped off. Inflorescence yellowish-green, produced from among the leaves and shorter than the leaves, the branches stiff and at right angles to the main axis; flowers perfect or unisexual. Fruit bright red, 1- to 3-lobed,  $\frac{1}{2}$  to 1-inch in diameter.

**Key to Native Palms of the Continental United States**

- 1. Leaves pinnate (feather-like)
  - 2. Leaves gray-green; trunk distinctly ringed, upper six feet not a green crownshaft; inflorescence produced among the leaves; flower mostly perfect; fruit bright orange-red ..... 3. *Pseudophoenix sargentii*
  - 2. Leaves dark-green; trunk not distinctly ringed, upper six feet a green crownshaft; inflorescence produced below the leaves; flowers unisexual; fruit violet-blue ..... 5. *Roystonea elata*
- 1. Leaves palmate (fan-shaped)
  - 2. Leaf blade without a prominent midrib projecting into and through the blade and not curving at the tip
    - 3. Long, black, needle-like spines and fibrous sheaths present at base of leaves; inflorescence less than ten inches long and not exceeding the black spines ..... 4. *Rhapidophyllum hystrix*
    - 3. Long, black, needle-like spines absent; inflorescence longer than ten inches
      - 4. Leaf petioles armed with teeth along the margins
        - 5. Teeth on petiole smaller than one-fourth inch, not hooked, or if so pointing toward base; fruit oblong ..... 10. *Serenoa repens*
        - 5. Teeth on petiole larger than one-fourth inch and hooked; fruit round.
          - 6. Trunk solitary, stout ..... 13. *Washingtonia filifera*
          - 6. Trunks clustered, not stout ..... 2. *Paurotis wrightii*
    - 4. Leaf petioles without teeth on margins
      - 5. Inflorescence long, equaling or exceeding leaves; leaves gray-green or green beneath
        - 6. Petiole concave on upper surface for greater part of length, especially at end toward blade which has a short midrib; fruit black. .... 7. *Sabal minor*
        - 6. Petiole convex on upper surface except at lower end; blade with no midrib; fruit white
          - 7. Leaves yellowish-green, blades completely circular in outline; fruit borne on short slender stalks ..... 12. *Thrinax parviflora*
          - 7. Leaves light green or gray-green, blades not completely circular in outline; fruit not borne on slender stalks ..... 11. *Thrinax microcarpa*
      - 5. Inflorescence short, not equaling leaves, not much longer than petiole; leaves very silvery beneath; fruit purple or black ..... 1. *Coccothrinax argentata*
  - 2. Leaf blade with a prominent midrib projecting into the blade
    - 3. Hastula small and narrow, one and a half inches or less long; fruit shiny black, variable in size, from a half to one inch across ..... 6. *Sabal etonia*
    - 3. Hastula larger, over two inches long, gradually long pointed
      - 4. Hastula four to four and three-fourths inches long; fruits shiny black, a quarter to one-half inch across. (North Carolina to Florida) ..... 8. *Sabal palmetto*
      - 4. Hastula five to eight inches long; fruit dull black, five- to seven-eighths inch across. (Southern Texas) ..... 9. *Sabal texana*

4. *Rhapidophyllum hystrix*

*Rhapidophyllum* is endemic and consists of only one species. Its nearest relatives are found in the Far East. The Needle Palm, as this species is known, is a fairly common palm in some parts of the southeast, but because of its resemblance to the Saw Palmetto, it is often overlooked. The name *Rhapidophyllum* refers to the needle-like structures of the

leaf sheath. The specific name *hystrix* means porcupine and also refers to the needles in the leaf-sheaths surrounding the base of the plant. The Needle Palm is very ornamental with its bright green fan-shaped leaves. It does not form a trunk but makes a neat cluster from 3 to 5 feet tall and about as wide. This palm will grow under almost all conditions of soil and moisture, and in sun

or deep shade, although it does best in the shade. It is a hardy palm ranging naturally along the coastal plain from the Carolinas to Florida and on the Gulf Coast west to Mississippi. One of our most winter-hardy palms, it is cultivated as far north as North Carolina.

No visible trunk, forming a cluster 3 to 5 feet tall. Leaves fan-shaped, blades  $1\frac{1}{2}$  to 3 feet wide, upper surface bright green, under surface sometimes silvery-gray. Petiole long and slender, the sheaths at the base with interwoven spines and fibers, the needle-like spines erect, sharp, 6 to 8 inches long. Inflorescence small, not exceeding the sheath-fibers and usually hidden, purple in color, male and female flowers appear to be borne on different plants. Fruit red, 1- to 3-lobed, covered with dense pubescence, hidden by the needles and fibers.

#### 5. *Roystonea elata*

This genus of large single-trunked palms is much cultivated around the world for its formal effect. Species now included in this genus were originally associated with *Oreodoxa*. The name *Roystonea* honors General Roy Stone, United States Army Engineer who served in Puerto Rico during the Spanish American War.

*Roystonea elata*, the Florida Royal Palm, has also been known as *R. floridana* and *R. regia*, the latter name being used for the Cuban Royal Palm. It is found in moist hammocks in Florida from the Big Cypress area north of the Tamiami Trail in Collier County to the Everglades National Park in Dade and Monroe Counties, but it has never been found on the Florida Keys. This palm was formerly found in Little River near Miami and in Central Florida but it is now extinct in these two localities. William Bartram was the first to write about it when he came upon a group of these palms while traveling on the Saint John's River in 1774. The epithet *elata* comes from the Latin and means elevated or tall.

Trunk stone-gray, faintly ringed, 90 to 100 feet tall, to 2 feet in diameter, the upper part or crownshaft 8 to 10 feet and consisting of sheath-like leaf bases. Leaves 10 to 12 feet long, produced on top of the green crownshaft; leaflets 2 to 3 feet long. Inflorescence produced immediately below the crownshaft, short,

with numerous drooping branches; flowers male and female in the same cluster. Fruit violet-blue, to  $\frac{1}{2}$  inch long.

#### 6. *Sabal etonia*

The genus *Sabal* includes the cabbage palms of the United States, so called because of the large bud which is edible. *Sabal palmetto* is the species most frequently used for ornamental purposes and is much used in street planting; it is one of the trees often remaining when lots are cleared for building. The other species also should be more frequently left standing since they are hardy palms and require little or no care. This palm appears on the state seal of South Carolina. The flowers of *Sabal* are perfect. The common name of *Sabal etonia* is Scrub Palmetto although it is often called the corkscrew palm. The specific name refers to the area from which it was first collected, the Etonia scrub in Lake County, Florida. This is another of our endemic palms, found only on dry pinelands and sand scrub from Marion County in Central Florida to Dade County.

Trunk S-shaped, subterranean, rarely erect to 8 feet. Leaves fan-shaped, with many filaments and a strong recurved midrib; petioles about equalling the blade, 3 feet or less. Fruit shining black, shell firm at maturity,  $\frac{1}{2}$  to 1 inch in diameter. Seeds brown, flattened top and bottom.

#### 7. *Sabal minor*

This species is known also as *S. adansonii*, or *glabra*, both of which are synonyms. An erect form of *S. minor* is also erroneously known as *S. deeringiana* and *S. louisiana*; this palm sometimes forms a trunk and has been then thought to represent a different species. Bailey (1944), however, considers the trunked and trunkless forms to be the same species.

Common name is Blue Palmetto, although it is often called dwarf, scrub or bush palmetto. This palm has the largest range of any of our native palms, occurring in lowlands, pastures, prairies, and fields from northeastern North Carolina to southern Florida and west to eastern Texas, including Louisiana, southwestern Arkansas, Alabama, and Mississippi. The tree-like forms are found in parts of southern Louisiana and eastern Texas.

The Blue Palmetto has frequently been cultivated here, in Europe, and elsewhere. It is usually a small palm and is generally very neat in appearance. It is hardy and very useful where a dwarf species is desired.

Trunk usually lacking, but in the areas mentioned having a short trunk to 15 feet and 24 inches in diameter. Leaves fan-shaped, 3 to 5 feet wide and as long, stiff and flat or sometimes broken over, midrib absent or only slightly prolonged into the blade. Inflorescence very long and stout, erect, towering above the foliage, branched at long intervals. Fruit  $\frac{3}{8}$  inch in diameter, black and glossy.

#### 8. *Sabal palmetto*

*Sabal palmetto*, known as the Cabbage Palmetto, includes *S. jamesiana*, a juvenile form found in dense hammocks in the Miami area of Florida. The specific epithet, *palmetto*, is probably a diminutive of the Latin *palma* or Spanish *palmito*, meaning small palm. The Cabbage Palmetto is another species endemic to the United States. The Cabbage Palmetto is one of the most common palms of the southeastern United States; it is found from southeastern North Carolina, at Cape Fear, along the coast of South Carolina and Georgia, and throughout peninsular Florida westward to the vicinity of St. Andrews Bay, Florida.

Trunk short or very tall, to 90 feet and 15 to 20 inches in diameter. Leaf bases sometimes persistent, leaving a criss-cross pattern on the trunk. Leaves fan-shaped, large, 3 to 6 feet long, usually broader than long, divided into many slender, hanging segments, with numerous thread-like fibers; midrib extending through blade. Inflorescence from among the leaves, equaling or exceeding them, about 2 to 2½ feet long. Fruit globular,  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter, shining black, shell thin at maturity.

#### 9. *Sabal texana*

This species is found only in southeastern Texas and northern Mexico along the Rio Grande River. It is commonly called Texas palmetto or Rio Grande Palmetto, and in Mexico *palma de micharo*. It was not originally distinguished from *S. mexicana* of Mexico and Guatemala. It is very similar to *S. palmetto* but is shorter and stouter with larger leaves and fruits, the latter quite fleshy.

Trunk to 50 feet tall and 1½ to 3 feet in diameter. Leaves fan-shaped, 3 to 5 feet wide and as long, divided into narrow segments and the midrib extending into the blade. Inflorescence shorter than or about equaling the leaves, to 7 and 8 feet long. Fruit globose  $\frac{5}{8}$  to  $\frac{7}{8}$  inch in diameter, frequently 2- and 3-lobed, dull black, having a sweet pulp when ripe.

#### 10. *Serenoa repens*

The genus *Serenoa* is dedicated to Sereno Watson (1826-1892), an American botanist at Harvard University and an authority on the flora of North America. There is only one species in this genus and it is native only to the southeastern United States. *Serenoa repens*, the Saw Palmetto, is found very commonly throughout the pinelands and scrub areas of southeastern United States. It is probably the most plentiful palm in its range. The Saw Palmetto is distributed along the coastal plain from southeast South Carolina to south Florida and the Keys, west to southern Mississippi and southeastern Louisiana. This species may be found with several forms. On the lower east coast of Florida, south of West Palm Beach, are Saw Palmettos with silvery-white leaves growing among plants with very green leaves. Many gradations in leaf color from gray-green to very glaucous white are found in the Miami area. While the Saw Palmetto is most commonly seen growing with the trunk on the ground, it will sometimes grow erect either upright or leaning. It is sometimes left when a building lot is cleared as it can be very useful in landscape design.

Trunk mostly horizontal, often branched, creeping along the surface of the ground and rooting on the underside; sometimes erect or leaning. Leaves fan-shaped, stiff, midrib absent; the petioles are armed with saw-toothed edges. Inflorescence from among the leaves, long and branching, with many flowers; flowers perfect, the perianth in two series. Fruit fleshy, purple, to one inch long.

#### 11. *Thrinax microcarpa*

The genus *Thrinax* is wholly American, ranging from southern Florida and the Keys to the Bahamas, and throughout the West Indies and parts of Central America. The name is derived from the Greek word for fan and refers to the

fan-shaped leaves although some are round.

The Brittle Thatch Palm, [also called thatch palm, or silvertop thatch palm] is the most widely spread of the *Thrinax*. It is found in Florida throughout the Keys and Cape Sable, and it is also found in the Bahamas, Cuba, Jamaica, Hispaniola, Puerto Rico, Yucatan, and British Honduras. The specific name refers to the small fruit. This species has also been known as *T. keyensis* and *Simpsonia microcarpa*, but both names have been reduced to synonymy. The Brittle Thatch Palm is not used as much as it should be in the landscape. It is a highly ornamental palm with its gray-green leaves and long clusters of small white fruits looking like snow-berries. It will tolerate very poor growing conditions.

Trunk to 15 feet, to 14 inches in diameter, rough, pale brown, sometimes enlarged at the base by masses of small roots. Leaves fan-shaped, 2 to 3½ feet wide, light green above, lighter-colored to silvery-white beneath; petiole base embedded in woolly webbing; leaf shape usually not a complete circle, but more like an inside-out umbrella. Inflorescence shorter or almost equaling the leaves. Flowers perfect. Fruit white, berry-like, round, ¼ inch or less in diameter, sessile or produced on an inconspicuous disk-like fruit-base.

#### 12. *Thrinax parviflora*

*Thrinax parviflora* [See above, also] is known as the Key Thatch Palm, [also called Jamaica thatch palm, thatch palm, and silktop thatch palm]. The specific epithet refers to the small flowers. This is a widespread species, ranging from the Florida Keys to the Bahamas, Cuba, Jamaica and Haiti; it is also reported from coastal Yucatan and British Honduras. It has also been called *T. wendlandiana* and *T. floridana*, but these names have been reduced to synonymy. Key Thatch Palm is a desirable small palm and is becoming quite popular in South Florida for both public and private areas.

Trunk to 30 feet but usually smaller, to 10 inches in diameter above the base, pale brown, very lightly or not at all ringed; as in *T. microcarpa*, the base may be enlarged by masses of roots. Leaves fan-shaped, 3 or more feet across, smaller in old trees; yellowish-green and

shiny above, lighter green beneath; petiole base embedded in woolly webbing; leaf usually makes a complete circle in outline. Inflorescence not quite equaling the leaf, bearing many white, fragrant perfect flowers. Fruit white, berry-like, round, to ⅜ inch in diameter, borne on elongated slender pedicels to ⅜ inch long.

#### 13. *Washingtonia filifera*

This western palm is dedicated to President George Washington (1732-1799). Two species are now recognized in this genus and are native to the southwestern United States and Mexico in desert areas. Only *W. filifera* is native to the United States. This species is commonly known as Washington Palm although it is often called desert palm, California washingtonia, and California fan palm. It is often confused with the Mexican species, *W. robusta*, which is the very tall, more slender palm commonly planted around Los Angeles and in southern California as well as in Florida as a street tree. The native species does not grow as well along the coast, while the Mexican species does well; however, *W. filifera* is cultivated in dry areas such as Palm Springs, California. The specific epithet applies to the thread-like fibers which hang from the leaves. *W. filamentosa* is a synonym. This species is found in groves or as small isolated clumps in rocky stream beds, near springs, and about water holes in the open desert in a narrow broken line along the foothills of the Little San Bernardino Mountains in southern California, and in a deep canyon in the Kofa Mountains, Yuma County of western Arizona. There are also a few stations in northern Lower California.

Trunk massive, to 65 or 75 feet tall, to 3 feet wide at the base, only slightly narrower above, cylindrical, reddish-brown, usually covered with dead, pendant leaves which will form a huge skirt. Leaves fan-shaped, to 6 feet long and 5 feet across, cleft into 60 or more drooping divisions with many thread-like filaments; petioles usually longer than the blade giving the crown an open effect, armed with many well-separated sharp, usually hooked teeth which are smaller or absent near the blade. Inflorescence to 12 feet long, drooping beyond the leaves; flowers perfect. Fruit ½ inch in diameter, ovoid, black, berrylike.

# The More Commonly Cultivated Palms

HAROLD E. MOORE, JR.

The correct and certain identification of palms must be made from mature plants with flowers and fruits; however, in cultivation only a limited number of palms is seen away from special collections. About thirty genera would include those species that are more commonly seen in dooryards, in gardens, along streets, and by shores in the warmer parts of the continental United States.

Special characteristics which singly or in combination eliminate all but one or a few genera of these more common palms are noted in the following lists on page 35 which are divided immediately into the two principal groups, those with palmate leaves (the fan palms) and those with pinnate leaves (the feather palms).

*Acrocomia*, a genus native from Mexico and the West Indies to Paraguay and Argentina, includes, perhaps, as many as thirty interesting species. Trunks are solitary, armed at least when young with abundant sharp long prickles. The leaves are also prickly with large pinnate blades often ragged in appearance. Pinnae are slender and pointed, generally borne in several ranks along the rachis. The inflorescences appear among the leaves subtended by two bracts, the outer short, the inner large, woody and generally prickly. The many stiff simple branches of the inflorescence bear female flowers below, male flowers in pits above, the latter having 6 stamens. The round or depressed thin-shelled fruit to 1½ inches wide contains a single seed enclosed in a bony endocarp with 3 pores. Endosperm is ruminant.

*Acrocomia armentalis*, *A. hospes*, *A. mexicana*, *A. totai*, and a few others are sometimes grown. They are all distinguished by technical characters. Species of other prickly genera, such as *Astrocaryum*, *Bactris*, *Desmoncus*, are rare outside special collections.

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**Archontophoenix**, with two species widely cultivated in tropical regions is native to Queensland. They are solitary palms with spreading pinnate leaves above a prominent crownshaft. The ringed trunks are often enlarged at the base but are relatively slender above, reaching a height of more than 100 feet, a diameter of 8 or more inches. The 8-12 leaves bear 50 or more narrow pointed pinnae in regular arrangement on each side, these pinnae with 3-4 nerves on each side of a prominent midrib but without a prominent marginal nerve. The petiole is short, 4-6 inches long, the blade 5 or more feet long. Much-branched inflorescences encased at first in 2 papery bracts are borne below the leaves. Clusters of 2 male and a central female flower are borne throughout the inflorescence, the male flowers with 3 small pointed sepals, 3 larger pointed irregular petals and 8-24 stamens about a short pistillode. Fruits are globose to ellipsoid, about 9/16 inch long or less and coral-pink to red when mature. The seed has ruminate endosperm.

*Archontophoenix cunninghamiana* has broad pinnae green below and lilac flowers. *A. alexandrae* and its variety var. *beatricae* have narrower pinnae pale below and white or creamy flowers. Both species are cultivated in California and Florida.

**Arecastrum** is a South American genus of one species and several varieties. Solitary stoutish gray-brown ringed and seamed trunks terminate in a loose crown of light green glossy pinnate leaves, the sheaths of which do not form a crownshaft. More than 100 pointed pinnae on each side of the rachis are arranged in groups of 2 to 4 and in as many planes, giving a ragged appearance to the foliage. Petioles are fringed with fibers at the base but are not otherwise armed. Large inflorescences, each under a pointed, deeply grooved, woody bract, bear quantities of bright yellow flowers, the males with 6 stamens and flat petals. The fruit is orangish, somewhat fleshy, 1- or rarely 2-seeded with a bony 3-pored endocarp enclosing the irregular seed which has homogeneous endosperm.

*Arecastrum romanzoffianum* is widely cultivated, often as a street tree. Two varieties, var. *australe* and var. *botryophorum* may be in cultivation.

**Arenga** is a genus of some 12 species of Asia and the Pacific Islands. Stems are single or clustered, small to large, often covered with persistent black fibrous sheaths. Leaves are pinnate, the pinnae with irregularly toothed margins and blunt tips and often "eared" at the base. Trees flower from the top down, then die. The inflorescences are compound in some species, simple in others, with several bracts subtending each peduncle. The male flowers have distinct sepals, large petals, numerous stamens and appear before and on each side of the female. Fruit is yellow or red, fleshy, 1-3-seeded, with irritant properties. The seed has homogeneous endosperm.

*Arenga pinnata*, the Black Sugar Palm, is a large tree with gray-black needle-like fibers among the leaf sheaths. The leaves have 100 or more narrow glossy dark green pinnae on each side in several ill-defined planes. Massive inflorescences have but one peduncle with ropy branches to 2 or more feet long. *A. engleri* is a small cluster palm with fragrant flowers and red fruit. Some other species may occasionally be seen but identification is difficult.

**Butia** is a genus composed of perhaps 13 species native from Brazil to Argentina. All are single-trunked, of moderate size with pinnate leaves, the sheaths not forming a crownshaft but the petiole bases long persistent. Pinnae are pointed at the tip; petioles are strongly toothed for most of their length. The inflorescences emerge from among the leaves, each with a smooth woody brown inner bract. The flowers are distributed in groups of 2 male and a central female along the simple branches of the inflorescence, the male with 6 stamens and flattish petals. Fruit is ovoid to ellipsoid, with bony 3-pored endocarp enclosing 1-3 seeds with homogeneous endosperm.

*Butia capitata* is the species most commonly cultivated. It is variable with a number of named botanical varieties and horticultural forms. In the United States it is hardy into South Carolina. Rarely seen are *B. bonnetii*, *B. eriospatha*, *B. leiospatha*, and *B. yatay*.

**Caryota**, a genus of approximately 12 species in Asia and the Pacific Islands, differs from all other palms in having leaves twice pinnate at maturity. The individual pinnules are wedge-shaped



**I. Leaves palmate:**

*Chamaerops*, *Coccothrinax*, *Erythea*, *Latania*, *Licuala*, *Livistona*, *Paurotis*, *Pritchardia*, *Rhapis*, *Sabal*, *Thrinax*, *Trachycarpus*, *Washingtonia*.

Stems clustered: *Chamaerops*, *Licuala* (some), *Paurotis*, *Rhapis*.

Stems solitary: *Chamaerops* (when pruned), *Coccothrinax*, *Erythea*, *Latania*, *Licuala* (some), *Livistona*, *Pritchardia*, *Sabal*, *Thrinax*, *Trachycarpus*, *Washingtonia*.

Petioles with toothed margins:

Teeth fine: *Latania*, *Trachycarpus*.

Teeth coarse: *Chamaerops*, *Erythea*, *Licuala*, *Livistona*, *Paurotis*, *Washingtonia*.

Petioles with smooth margins: *Coccothrinax*, *Pritchardia*, *Rhapis*, *Sabal*, *Thrinax*.

Leaf-segments 2-several-nerved: *Licuala*, *Rhapis*.

Leaf-segments 1-nerved: *Chamaerops*, *Coccothrinax*, *Erythea*, *Latania*, *Livistona*, *Paurotis*, *Pritchardia*, *Sabal*, *Thrinax*, *Trachycarpus*, *Washingtonia*.

Leaves with a prominent costa extending into the blade for 2 to several inches:

*Erythea*, *Latania*, *Licuala*, *Livistona*, *Pritchardia*, *Sabal*, *Washingtonia*.

Leaves with the petiole essentially blunt at the tip, the costa none or very short: *Chamaerops*, *Coccothrinax*, *Paurotis*, *Rhapis*, *Thrinax*, *Trachycarpus*.

Fruit:

White: *Rhapis*, *Thrinax*.

Blue or blue-green: *Livistona*, *Trachycarpus* (with blue bloom).

Red, purple or black: *Coccothrinax*, *Licuala*, *Paurotis*, *Pritchardia*, *Sabal*, *Trachycarpus*, *Washingtonia*.

Green or brown: *Chamaerops*, *Erythea*, *Latania*.

**II. Leaves pinnate:**

**(pinnately nerved or divided)**

*Acrocomia*, *Archontophoenix*, *Arecastrum*, *Arenga*, *Butia*, *Caryota*, *Chamaedorea*, *Chrysalidocarpus*, *Cocos*, *Dictyosperma*, *Howeia*, *Jubaea*, *Mascarena*, *Phoenix*, *Ptychosperma*, *Rhopalostylis*, *Roystonea*, *Veitchia*.

Prickly palms: *Acrocomia* and allied genera.

Stems clustered: *Arenga engleri*, *Caryota mitis*, *Chamaedorea* (some), *Chrysalidocarpus*

*lutescens*, *Phoenix* (some), *Ptychosperma macarthurii*.

Stems solitary: *Acrocomia*, *Archontophoenix*, *Arecastrum*, *Arenga* (some), *Butia*, *Caryota* (some), *Chamaedorea* (some), *Chrysalidocarpus* (some), *Cocos*, *Dictyosperma*, *Howeia*, *Jubaea*, *Mascarena*, *Phoenix* (some), *Ptychosperma* (some), *Rhopalostylis*, *Roystonea*, *Veitchia*.

Leaves twice pinnate: *Caryota*.

Leaves pinnately nerved but not divided: *Chamaedorea* (some).

Lower pinnae spinelike: *Phoenix*.

Pinnae toothed along the margin and at the tip: *Arenga*.

Pinnae blunt and toothed at the tip: *Arenga*, *Caryota*, *Ptychosperma*, *Veitchia*.

Pinnae pointed: *Acrocomia*, *Archontophoenix*, *Arecastrum*, *Butia*, *Chamaedorea* (most), *Chrysalidocarpus*, *Cocos*, *Dictyosperma*, *Howeia*, *Jubaea*, *Mascarena*, *Phoenix*, *Rhopalostylis*, *Roystonea*.

Fruit with a bony 3-pored endocarp: *Acrocomia*, *Arecastrum*, *Butia*, *Cocos*, *Jubaea*.

Fruit without a 3-pored endocarp: *Archontophoenix*, *Arenga*, *Caryota*, *Chamaedorea*, *Chrysalidocarpus*, *Dictyosperma*, *Howeia*, *Mascarena*, *Phoenix*, *Ptychosperma*, *Rhopalostylis*, *Roystonea*, *Veitchia*.

Inflorescence borne below a well developed crownshaft: *Archontophoenix*, *Dictyosperma*, *Mascarena*, *Ptychosperma*, *Rhopalostylis*, *Roystonea*, *Veitchia*.

Inflorescence among the leaves: *Acrocomia*, *Arecastrum*, *Arenga*, *Butia*, *Caryota*, *Chamaedorea*, *Chrysalidocarpus*, *Cocos*, *Howeia*, *Jubaea*, *Phoenix*.

Inflorescence with several bracts: *Arenga*, *Caryota*, *Chamaedorea*, *Mascarena*.

Inflorescence with 1-2 bracts:

Inner bract woody, persistent;

Bract grooved: *Arecastrum*, *Cocos*.

Bract not grooved: *Acrocomia*, *Butia*, *Jubaea*.

Bracts mostly papery, deciduous: *Archontophoenix*, *Chrysalidocarpus*, *Dictyosperma*, *Howeia*, *Phoenix*, *Ptychosperma*, *Rhopalostylis*, *Roystonea*, *Veitchia*.

with broad toothed tips. Stems are solitary or clustered, slender or stout, low or tall, often partially clothed with persistent fibrous sheaths. They flower from the top downward, then die. The inflorescences are subtended by several bracts about a single peduncle which terminates in many simple branches. The flowers are arranged in groups of 3 along the branches, the males opening first. These have a low calyx, prominent petals and numerous stamens. The fruit is generally purplish or black, 1-3-seeded, fleshy, with irritant properties. Seeds have ruminate endosperm.

The cultivated plants are difficult to identify with certainty owing to presumed hybridity and a poor understanding of the wild species. *Caryota urens*, The Fish-tail Palm, a large single-stemmed species, and *C. mitis*, a small cluster palm, are the most common.

*Chamaedorea* contains more than 100 species native from Mexico to South America. Members of the genus are very diverse in size and habit. Stems are slender, dwarf to moderate, single or clustered, generally reedlike, with undivided but pinnately veined to pinnate leaves. No true crownshaft is formed and the inflorescence, though sometimes persisting below the leaves, appears first among them. Three to seven more or less tubular bracts sheath the base of the peduncle which continues into an unbranched or branched flower-bearing portion. The male and female flowers appear on different plants. Male plants have inflorescences sometimes quite different in appearance from those of female plants. Flowers are small, of considerable diversity in structure and arrangement. Fruit is often small, somewhat fleshy, 1-seeded, red or blackish when mature, with irritant properties in the flesh. The seed always has homogeneous endosperm.

Many species are cultivated outdoors and indoors. They are often confused in horticulture since they are distinguished by difficult technical characters. Most common are the following: *Chamaedorea elegans* (*Collinia elegans*), which often goes by the invalid name *Neanthe bella*, is a single-stemmed species with pinnate leaves and yellow flowers; *C. ernesti-augusti* (*Eleutheropetalum ernesti-augusti*), often confused with the similar *C. geonomaeformis*, has un-

divided leaves and orange flowers, the female on an unbranched spike, the male in a much-branched inflorescence; *C. erumpens*, a cluster palm with pinnate leaves, short-stalked inflorescence, and black fruit; *C. microspadix*, confused with the last but recognized by its red fruit and large whitish flowers, the males in clusters. Among others less common in horticulture are *C. brachypoda*, *C. oblongata*, *C. radicalis*, and *C. tepejilote*.

*Chamaerops* is a genus with only one variable species, *C. humilis*, which occurs wild from Portugal and the Atlantic coast of Morocco through the Mediterranean region reportedly as far as Persia. The stems are normally clustered, rarely solitary (though sometimes appearing so because of pruning in cultivation). They reach a height seldom exceeding 10 feet, a diameter of 6 inches, and are usually covered with persistent blackish or brownish fibrous sheaths and petiole bases. Numerous fan-shaped green or silvery leaves over a foot in diameter are divided more than halfway to the base into about 30 segments which are 1-nerved and again rather deeply divided into pointed tips. Slender to stout straight teeth pointing toward the blade arm the petiole which may reach a length of 3 feet, a width of 1½ inches at the base and is blunt at the tip with a narrow ligule on the upper side. The small branched inflorescence is subtended by a single complete bract. Bright yellow flowers are essentially similar in appearance—small with 3 sepals and 3 petals—but are differentiated into male and female which normally occur on different plants. The male flowers have 6 fertile stamens and no remnant of carpels, the female have 3 carpels within a ring of stamen filaments which normally have sterile or no anthers. Fruits are fleshy, varying from yellow to brown in color, globose to oblong and date-like in shape and size. Beccari lists several varieties based on differences in size, color of leaves, shape and size of fruits.

*Chrysalidocarpus* is a genus limited to the islands of Madagascar, the Comores, and Pemba. There are about 20 species, mostly moderate palms with solitary or clustered stems, sometimes a partially developed crownshaft, and a crown of pinnate leaves. Pinnae are pointed, nu-

merous, and regularly arranged or borne in several planes. Much-branched inflorescences appear among the leaves enclosed by 2 unequal bracts, the inner one elongate and soon deciduous. Flowers are small, those of the two sexes borne in groups of 3 and essentially similar in appearance with 3 sepals, 3 petals, the male with 6 stamens, the female with only rudiments of stamens. Fruit is yellowish or red, the seed with homogeneous endosperm.

*Chrysalidocarpus lutescens* (*Areca lutescens* of horticulture) is the only species as yet much cultivated in the United States. It has slender clustered sometimes branched stems to 2 inches in diameter and to 15 or more feet high, glossy green leaves with 30 or more pinnae on each side in one plane and yellowish inflorescences. A partially formed crownshaft is usual.

*Coccothrinax* is a genus of more than 30 species similar in most respects to *Thrinax* but with the inflorescences generally much shorter than the leaves, the fruit purple or black at maturity containing a grooved or lobed seed with homogeneous or slightly ruminant endosperm.

*Coccothrinax argentata* (*C. jucunda*, *C. garberi*) is native and sometimes cultivated in Florida. It is a small palm variable in habit from one habitat to another. It has been confused with *C. argentea* from the Dominican Republic which is rare at present as are several other species seen especially in collections. The origin and names of these are often much confused in cultivation.

*Cocos nucifera* or the Coconut Palm is the only species now retained in the genus. It is widespread in cultivation. Trees are solitary with roughened often somewhat leaning trunks of moderate to large size and lacking a crownshaft. Leaves are large with more than 100 regularly arranged rather strongly folded pointed pinnae to 3 feet long, 2 inches wide on each side of a rachis often 15 or more feet long. The inflorescence, borne among the leaves, is subtended by a heavy woody grooved inner bract. The branches of the inflorescence are stiff and rather short with one or a few female flowers larger than the male at the base, yellow male flowers with flat petals and 6 stamens above. The fruit is very large with a thick fibrous coat over a

thick 3-pored endocarp enclosing the seed. The latter contains milky endosperm when immature, a layer of white homogeneous endosperm about a hollow center when mature.

*Dictyosperma*, native in the Mascarene Islands, has two species. They have solitary roughened closely ringed brown or greyish longitudinally fissured or seamed trunk to 40 feet high or more, 6-7 inches in diameter from an often enlarged base. The crown is composed of 15-20 spreading green leaves which are sometimes reddish when first expanding. Light green leaf sheaths densely covered with grey scales are congested in a tubular crownshaft 2½ to 3 feet high which is somewhat thickened at the base. Petioles are short on mature individuals, about 6-8 inches long, 2½ inches wide. The leaf rachis is 7-8 feet long and on each side bears 50-70 regularly arranged subopposite slender pointed leaflets to 2½ feet long, 1½ inches wide. The midnerve is prominent, flanked on each side by 1-2 slender central nerves and a distinct but not thickened marginal nerve. Rachis and petiole are covered with soft scales when young and leaflets have a line of prominent twisted brownish scales on the midnerve below. Inflorescences are borne below the leaves enclosed in 2 flattened bracts, one within the other. These drop off as the flowers mature. Peduncles are short, 1-2 inches long, and continue in a green erect rachis 6-8 inches long which bears simple branches to 18 inches long from the sides and front but few from the back which remains close to the trunk. In flower, these branches are yellowish, becoming green in fruit. Orangish or yellowish flowers are borne densely on the branches in groups of 3, a male on each side of a female which opens only when the males have fallen. Male flowers have a short calyx of 3 sharply pointed sepals and 3 petals about 5/16 inch long within which 6 stamens appear. The purplish-black fruit about ½ inch long is bullet-shaped in a persistent cupule of green sepals and petals.

*Dictyosperma album* is cultivated in many collections and elsewhere. The second species, *D. aureum*, is rare in cultivation. It is distinguished from the first by the leaves which usually have the tips of the leaflets united by a green strand along the outside and by characters of the flowers and fruit.

*Erythea* consists of eight species of erect single-stemmed hermaphrodite fan palms which are native in Mexico and Central America. The leaves are divided to or beyond the middle into numerous stiffish 1-nerved segments with bifid tips. The petioles are normally armed with small to coarse teeth and at the tip extend only a short way into the blade. Inflorescences are borne among the leaves and often equal or exceed them. The peduncle and each of the several primary divisions is subtended by one or more tubular bracts. Flowers are white or creamy, borne in clusters of 2-3 along branchlets of the inflorescence. The 3 sepals are distinct, the petals sometimes shortly united at the base, the 6 stamens united in a ring by the bases of their filaments, the 3 carpels united by their styles. Fruits are subglobose and rather large, mostly  $\frac{3}{4}$  inch long or more with the skin yellow, variegated, or black. The seed has a deep intrusion of the seed coat on one side but otherwise has homogeneous endosperm.

Several species are cultivated, especially in California. Those with green leaves are *Erythea edulis*, with strongly costapalmate leaves and black fruits an inch or more long, and *E. aculeata*, with scarcely costapalmate leaves and yellow fruit less than an inch long. Species with leaves bluish on one or both sides are *E. elegans*, *E. brandegeei*, and *E. armata*. These are distinguished by technical differences.

*Howeia* is a genus of two species confined to Lord Howe Island off the coast of Australia. Trunks are slender, to 30 feet high, 6 or more inches in diameter, ringed and solitary. The pinnate leaves have short fibrous sheaths that do not form a crownshaft. Pinnae are regularly arranged, pointed and numerous. The inflorescences, borne among the leaves, consist of 1 to several long slender unbranched spikes with flowers sunken in the axis in groups of 2 male and a central female. Each spike is protected by a papery bract inserted just below the flowering portion. Male flowers have shining sepals and petals and 30-70 stamens. Fruits to 2 inches long are ellipsoid, becoming reddish and containing a single seed with homogeneous endosperm.

Both species of *Howeia* are extensively cultivated, usually under the name *Ken-*

*tia*, but they are mostly seen as greenhouse palms except in California and rarely in Florida. *H. belmoreana* has arching leaves with short petioles, the pinnae standing nearly upright, and inflorescences of a single spike. *H. forsteriana* has leaves with a long petiole, spreading blades with more or less horizontal pinnae, and inflorescences of 3-8 spikes from a single peduncle.

*Jubaea*, the Chilean Honey Palm, consists of a single species, *J. chilensis* (*J. spectabilis*) which is cultivated with some success in southern California. Trunks are very stout, to 4 feet in diameter, and uniform, reaching considerable height. Leaves are grey-green, pinnate, numerous, spreading, the open sheaths not forming a crownshaft. The pinnae are numerous, about 90 on each side, pointed and regularly disposed in one plane in the large blades 8-9 feet long. Petioles to 3 feet long are fringed with fibrous processes at least near the base. Inflorescences 2-3 feet long among the leaves are each subtended by a large pale brownish smooth woody inner bract which is orange inside. The branches of the inflorescence are simple, stiff, with flowers in groups of 3, the male with 27-30 stamens and concave petals. Fruit about 1 inch long is 1-seeded; the seed with homogeneous endosperm is enclosed in bony 3-pored endocarpe.

*Latania* consists of three species, all native to the Mascarene Islands, and all now cultivated. The stout solitary trunks may reach a height of 40 feet or more at maturity and are then brownish and irregularly ringed. Leaves are palmate, very large, often 6 to 8 feet across, and stiff, divided nearly halfway to the base into numerous 1-nerved broad segments which are again pointed or very briefly two-pronged at the tip. The petiole is roughened toward the base with minute scattered teeth discernible to the touch; at the top it ends in a ligule on the upper side but on the under side the slender pointed tip continues into the blade. Trees are either male or female. Inflorescences of both sexes appear among the leaves. They are sheathed with pointed more or less tubular bracts, but the male has several hand-like divisions with finger-thick branchlets covered with overlapping bractlets from which the pale flowers with 15-30 or more stamens

emerge. The female has fewer and stouter branches with large flowers prominent above the overlapping bractlets. The large (to 3 inches long) obovate or obovate green or yellow-green fruits contain 1 to usually 3 seeds which are variously sculptured, more than an inch long, with homogeneous endosperm.

*Latania loddigesii* is distinguished by the bluish cast in young or newly unfolded leaves and by the seed which is twice as long as broad with strongly reticulated ridges at the top. *L. borbonica* (often called *L. commersonii*) has leaves with a reddish or purplish cast when young and pear-shaped seed somewhat longer than broad with curved ridges on upper side. *L. verschaffeltii* has leaves yellowish when young and the seed obovate, lobed and beaked at the top, ridged centrally and covered with stiff hairlike projections. It is believed but not definitely shown that hybrids occur in cultivation.

*Licuala* is a large genus of shade palms native in the humid hot forests of tropical Asia and the Pacific Islands. The usually slender and low stems may be solitary or clustered, naked or partially covered with fibrous leaf sheaths. Leaves are palmate, undivided and toothed along the margin in *L. grandis* but mostly divided to the base into a number of several-nerved segments which are blunt and shallowly toothed at the tip. The petiole is armed with stout teeth at least near the base and is pointed at the tip, extending into the blade or central segment as a short costa. Inflorescences from among the leaves are subtended by tubular bracts as is each of the several branched divisions. Flowers are hermaphrodite with a 3-lobed calyx, a corolla of united petals, 6 stamens, and 3 carpels united by their styles. The fruit is a globose to ellipsoid berry often red in color. The seed has a deep intrusion of the seed coat into homogeneous endosperm.

Only a few of the more than 70 species in this genus are cultivated. *Licuala grandis* is easily recognized by its solitary stem and undivided pinnate fan-shaped large leaves. *L. spinosa* has divided leaves with about 18 narrow segments. A few other species are rare even in collections.

*Livistona* is a genus of some 20 or more species of single-stemmed trees

often reaching considerable heights and diameter to a foot or more. The trunks are rough and brown or sometimes smoothish and rather prominently but irregularly ringed, at first covered with old fibrous sheaths and split petiole bases, then bare except for old leaves retained below the crown. Leaves are palmate, large and variously divided, sometimes to the base, into 1-nerved segments which are again split into pointed tips. The petioles are generally armed with few to many stout curved teeth but on occasion are nearly smooth. They terminate in an elongate ligulate hastula above, but below are pointed and continue into the blade as a short to long costa. Inflorescences are elongate from among the leaves, subtended by tubular inflated pointed sheaths along the peduncle and at the base of each of several primary branches. The latter are divided into slender branchlets along which the yellowish flowers are borne singly or in groups. The sepals are nearly distinct or united into a deeply 3-toothed cup, the 3 petals are united at the base, the stamens are 6, the carpels 3 united by their connate styles. The globose to reniform 1-seeded fruit is generally a shade of blue or blue-green when mature. The seed has homogeneous endosperm into which the brown seed coat is intruded on one side.

*Livistona chinensis* has bright green strongly arched leaves 4 to 5 feet long with slender pendulous segment tips more than 1 foot long and blue-green orange-fleshed fruits on a yellow infructescence. The species is often seen in cultivation and is known as the Chinese Fountain Palm because of its graceful leaves. *L. rotundifolia* and *L. australis* are also sometimes seen, the one with nearly round stiff leaves little divided, coarse sheaths, and a somewhat shiny brown prominently ringed trunk, the other with leaves divided to the base into narrow segments which give it a ragged appearance. The trunk of the second is brown and rough.

*Mascarena* has three species from the Mascarene Islands, and is very closely related to *Hyophorbe*. Trunks are generally short and stout, sometimes swollen, ending in a prominent crownshaft and a rather compact crown of stiffish pinnate leaves, the pinnae pointed, regularly and

closely placed. Inflorescences subtended by several deciduous bracts are borne below the leaves. The peduncles are stout, the many branchlets slender with flowers borne in lines, each line consisting of a lower female and several male flowers. The flowers are small, yellowish, similar in appearance with the sepals united basally, the petals free above a short united base. Male flowers have a rudimentary ovary and 6 stamens, female flowers have only staminodes and a tricarpellary ovary. The fruits are plumlike with a single large seed containing homogeneous endosperm.

*Mascarena lagenicaulis* (*Hyophorbe amaricaulis* of horticulture) and *M. verschaffeltii* are cultivated. The former has a swollen trunk narrowed at the top, pinnae with 3 strong nerves and fruit an inch long. The latter has a stout variously swollen trunk not conspicuously narrowed at the top, pinnae with only the central nerve prominent and fruit 9/16 inch long or less.

**Paurotis**, a genus of only one species, *P. wrightii*, is native in the Caribbean area from the Bahama Islands, Florida, and Cuba to Mexico, British Honduras and Honduras. Slender trunks to about 15 feet high, 3 inches in diameter, are clustered and usually covered with rusty to dull brown or greyish persistent fibrous leaf sheaths and petiole bases. The palmate leaves are rather stiff and decidedly fan-shaped, 1½ feet in diameter or more divided about halfway to the base into about 40 1-nerved segments which are again split nearly half their length or even more into slender stiff points. Blades are rather glossy medium green above, paler, duller green or sometimes nearly silvery below. They are borne on rather slender petioles 1-3 feet long, to ½ inch wide, armed along the margins, at least near the base, with stout curved or hooked yellow-brown often dark-tipped teeth. Tips of the petioles are blunt with a short upturned ligule on the upper side, nearly blunt but very shortly pointed and lacking a ligule below. Long slender inflorescences are borne from the axils of upper leaves and generally exceed the leaves. They are erect or arching with hanging densely short-hairy branches which are yellow-green or pale green as are the small hermaphrodite flowers. The base of the inflorescence and of each branch is en-

closed within one or several smooth tubular green sheaths. Flowers are borne in groups of 3 at most nodes, the sepals 3, petals 3, stamens 6, and carpels 3 united only by their styles. Only one carpel ordinarily matures into a globose shining black fruit (red when immature) slightly less than ½ inch in diameter with abortive carpels basal. The seed has homogeneous endosperm.

**Phoenix** consists of about 12 species of pinnate palms in Africa and Asia readily distinguished from other genera by the lower pinnae which have been transformed into stiff spinelike processes. The pinnae are induplicate in bud (with the midrib at the bottom and the margins uppermost where attached to the rachis) and the rachis continues through a single terminal pinna. Stems are very short to moderately tall, solitary or clustered, rough and marked by spiralled scars of old leaves. The inflorescences, borne among the leaves, are enclosed in single deciduous bracts and consist of an often elongate flattened peduncle which terminates in a cluster of few to many stiff simple branches. Sexes are usually separate, the male flowers being distinguished from the female by the presence of 6 stamens and differently shaped petals. The fruit is often ellipsoid, fleshy, 1-seeded. The seed has homogeneous endosperm into which the seedcoat intrudes on one side.

The species of *Phoenix* appear to hybridize in cultivation. Often it is difficult to identify cultivated plants with any one particular species. The most commonly grown are *P. canariensis*, a large single-trunked palm with a crown of many large spreading green leaves; *P. reclinata* with clustered slender trunks, orangish petioles and inflorescences; *P. dactylifera*, the Date Palm; and *P. roebelenii*, an attractive dwarf species with single or multiple stems and small flat glossy leaves.

**Pritchardia** is a genus of fan palms with its greatest development in the Hawaiian Islands, where more than 20 species occur, and a few species in the Dangerous Archipelago and the Fiji Islands. The trunks are solitary, of moderate size, smooth when mature. The leaves are shortly costapalmate, rather flat, stiff and strongly pleated, divided scarcely to the middle into 1-nerved segments

briefly bifid at the tip. The petioles are smooth, extending in a triangular point into the blade as the costa on the under side. Inflorescences rise from among the leaves and may be either upright or pendulous, the peduncle, sheathed with slightly inflated tubular bracts pointed and flaring at the tip and terminating in a few bractless branches which bear flowers singly. The flowers have a tubular 3-lobed calyx, 3 separate petals which fall as the flower opens exposing the 6 stamens which have their filaments united basally in a ring. The ovary consists of 3 carpels united by their styles. Only one carpel matures into a nearly globose brownish 1-seeded fruit with abortive carpels at the apex. Seeds have homogeneous endosperm.

*Pritchardia pacifica* with the inflorescence shorter than the leaves and *P. thurstonii* with the inflorescence pendulous and exceeding the leaves in length are the species most commonly cultivated. Other species have been introduced recently but are rare and not seen as mature specimens.

***Ptychosperma*** is a genus principally of New Guinea, Australia, and adjacent islands. Trunks are of small to moderate size, solitary or clustered, ringed, with a slender crownshaft below the crown of pinnate leaves. Pinnae are always blunt and toothed at the tip but may be slender to wedge-shaped in outline, few to numerous, regularly or irregularly arranged. The midnerve and marginal nerves are the most prominent. Inflorescences subtended by 2 deciduous papery bracts are borne below the leaves. They are variously branched with flowers in groups of 3. The male flowers have low rounded sepals, boat-shaped petals and many stamens. Fruits are generally bright red to black, small, egg-shaped or rounded, containing a grooved seed with homogeneous or ruminate endosperm.

*Ptychosperma elegans* is a common cultivated palm. It normally has a solitary trunk of moderate size and small round red fruits, the seed with ruminate endosperm. *P. macarthurii* (*Actinophloeus macarthurii*) has clustered slender stems and egg-shaped red fruits, the seeds with homogeneous endosperm. Several other species and presumably also hybrids are cultivated but their identity is much confused.

***Rhapis***, a small genus of palms native

in southeast Asia, is characterized by unarmed low slender stems forming loose clumps or colonies. The palmate leaves are very deeply divided into 1-2 or usually 5-12 2-several-nerved segments. These are blunt and shallowly but sharply toothed at the narrow tip. Fibrous-netted brownish or blackish leaf-sheaths are long-persistent on the stems and the petioles are smooth. Each plant generally bears small flowers of one sex only. These flowers are borne on sparingly branched inflorescences from among the leaves, the main axis and each principal branch subtended by a dry tubular bract. The functionally male flowers have a cuplike 3-toothed calyx and a tubular flaring 3-cleft corolla enclosing 6 stamens and 3 non-functional carpels; the superficially similar female flowers have both calyx and corolla 3-lobed, stamens reduced to vestiges, and 3 carpels which mature into 1-3 separate globose to obovoid fleshy fruits. The seed has homogeneous endosperm.

The most commonly cultivated species is *Rhapis excelsa* (*R. flabelliformis*) which differs from the less frequent *R. humilis* in having leaf segments  $1\frac{1}{2}$  inches wide or more at the middle and broad at the tip as opposed to segments less than  $\frac{3}{4}$  inch wide and narrowed at the tip. *R. excelsa* also has much coarser leaf-sheaths than *R. humilis* and is generally more robust with stems as much as 15 feet high, 2 inches in diameter.

***Rhopalostylis***, a genus of 3 species, is native in New Zealand, on Norfolk Island and in the Kermadec Islands of the South Pacific. All are solitary palms with slender ringed trunks and compact crowns of pinnate leaves above a more or less swollen short crownshaft. The pinnae are numerous, regularly arranged, pointed with a prominent midnerve and 2-3 slender lateral nerves. Inflorescences subtended by 2 papery deciduous bracts are borne below the leaves. They are small with short stiff simple or compound branches bearing male and female flowers in groups of 3. The male flowers have 3 short sharp sepals, 3 petals and 6 stamens about a conspicuous pistillode. Fruit is nearly round to ellipsoid, to nearly  $\frac{3}{4}$  inch long, red, with a single seed having homogeneous endosperm.

*Rhopalostylis sapida* from New Zealand is the species most frequently culti-

vated. It has a small inflorescence 2 feet long or less. *Rhopalostylis baueri* of Norfolk Island has a large inflorescence and is rare in cultivation.

**Roystonea** is a genus including several species of large solitary unarmed palms with inconspicuously ringed slender, columnar, or variously swollen trunks generally 1 foot or more in diameter and a prominent green crownshaft below a large spreading crown of pinnate leaves. The pinnae are numerous, pointed, glossy, and more or less regularly arranged, but in one or several planes. Inflorescences are borne just below the crownshaft, enclosed at first by two thin bracts the inner of which is long (often 3 feet or more) and conspicuous but both soon falling off as the much-branched axis expands. Flowers of both sexes are borne together in 3's with a male on each side of a later-developing female, the males with 6 stamens. The small red-purple fruit with fleshy pulp contains a rounded seed with homogeneous endosperm.

*Roystonea regia* of Cuba and the closely related (or perhaps identical) *R. elata* of Florida are commonly cultivated as avenue trees or in formal arrangement because of their rapid growth and exceptional beauty. Their leaves are ragged in appearance because the pinnae are borne in several ranks along the rachis. *R. oleracea*, a native of Jamaica, is rare in the United States but is cultivated in the tropics elsewhere. The leaves of this species appear flat because the pinnae lie in one plane only.

**Sabal** is an American genus of about 26 species of fan-leaved palms native in the southern United States from North Carolina to Texas along the coast, in the Caribbean area, Mexico, parts of Central America, and northern Colombia. The trunks are sometimes underground and appear to be absent (*S. minor*, *S. etonia*), but are generally stout, solitary and often tall, brown in color, longitudinally fissured, roughened and fibrous without definite rings when mature but usually protected by persistent split petiole bases when young. Leaves are costapalmate, often markedly so and then curved toward the tip, variously divided sometimes nearly to the base into 1-nerved bifid segments. The petioles are smooth along the margins, continued in a pointed hastula and ligule at the top above, pointed and continuing into

the blade below. Inflorescences are borne among the leaves, the long peduncle and each major division with tubular sheaths. The divisions are branched into slender whitish branchlets on which the white hermaphrodite flowers are borne singly, not clustered. Elongate sepals and petals surround 6 stamens and a trilobular ovary, one cell of which develops into a somewhat flattened blackish fruit with stigmatic remains at the base. The seed is slightly hollowed at the bottom and has homogeneous endosperm.

Several species are cultivated. *Sabal minor* (often called *S. adansonii*) is native to southeastern United States and generally has little or no visible stem, smallish nearly flat leaves and erect or arching inflorescences from the crown with blackish fruits to 1/2 inch across. *S. palmetto* develops a trunk, has strongly arched leaves, and fruits about the same size as those of *S. minor*. Less commonly cultivated species are *S. peregrina*, *S. viatoris*, and *S. umbraculifera*.

**Thrinax**, a genus of some 10 species, is native in the Caribbean region of America. The trunks are generally slender, often tall, reaching a height of 30 feet or even more, and smooth with grayish or brownish bark rather clearly but irregularly ringed except below the leaves where there is usually a shag of old fibrous leaf bases and petioles. Leaves are palmate, often stiffly fan-shaped but sometimes with segments drooping at the tips. The blades are divided past the middle into numerous 1-nerved segments which are again very briefly divided into pointed tips. Long slender petioles are smooth along the margins and terminate in an essentially blunt hastula with up-turned ligule on the upper side, none below. The inflorescences appear among the leaves, generally in an upright position in bud, and often exceed the leaves in length. They are composed of a long tubular-bracted peduncle and a number of pendulous branches each of which is subtended by a tubular bract. The branches are divided into slender branchlets which are pale in flower but become yellowish in fruit. The small white hermaphrodite flowers are not clustered in groups but are scattered along the branchlets; their sepals and petals are reduced to small teeth, the stamens are 6, the gynoeceum is unilocular developing



into a small globose whitish fruit containing a globose seed with homogeneous endosperm, apart from an intrusion of the seed coat on one side.

Two species native to the south of Florida are the most frequently cultivated. *Thrinax microcarpa* is distinguished by its sessile flowers and fruits (lacking any stalk) and by its leaves which are commonly silvery below. *T. parviflora* (often called *T. wendlandiana*) has flowers and fruits on distinct stalks and green leaves.

*Trachycarpus* consists of fewer than 10 species native to Asia. Stems are solitary or rarely clustered and usually covered with dark fibrous sheaths and petiole bases except in *T. martianus*. The palmate leaves are divided more than halfway to the base into many 1-nerved briefly bifid segments. The petiole is margined with short sawlike teeth and at the tip extends scarcely at all into the blade. Inflorescences are borne among the leaves, subtended by rather inflated bracts at the base and each of the several branched divisions with similar but smaller bracts. Trees usually bear flowers of one sex only, these being small, clustered in groups of 2-3 along the branchlets. Male flowers have 3 scarcely united sepals about half as long as the petals, 6 stamens and 3 small pistilodes; the females are similar but fleshier with smaller stamens and 3 distinct carpels, only one of which usually develops into a bluish fruit containing a seed hollowed on one side, with homogeneous endosperm.

The species commonly seen in cultivation is *Trachycarpus fortunei* which is planted as far north as Virginia on the East Coast, Vancouver Island on the West Coast.

*Veitchia* is a genus of 18 species native in the Pacific Islands from Fiji to the Philippines. All are single-stemmed trees of moderate to large size, sometimes 100 feet high, with a prominent crownshaft below a spreading or arching crown of pinnate leaves. The numerous more or less regularly spaced but sometimes 2-ranked leaflets are widest at the middle tapering to a narrow base and an obliquely irregularly toothed or sometimes apparently but not truly pointed tip. Male and female flowers are borne on branches of a much ramified white inflorescence which appears below the

leaves and is encased in two papery bracts which soon fall. In some species groups of a central female and two lateral male flowers occur throughout the length of the branches, in others the female flowers are borne only near the base of the branches, the upper flowers being paired or solitary males. Male flowers are larger than the female with 3 low sepals, 3 rather boat-shaped petals, and 24-140 stamens surrounding a slender pistillode. Fruit is orange-red or red at maturity seated in a yellow cupule of perianth parts and various in size from about  $\frac{1}{2}$  inch to nearly 3 inches in length. The seed has homogeneous or ruminant endosperm.

Five species are cultivated, one widely. The latter, *Veitchia merrillii*, has seeds with ruminant endosperm and for years was called *Adonidia merrillii*. The bright red fruits are more than an inch long.

*Washingtonia* has two species native in southwestern United States and northwestern Mexico. Both species are tall fan palms with trunks clothed in a "skirt" of persistent leaves in their native habitat. In cultivation, these "skirts" are often cut or burned or, in Florida, drop naturally revealing a longitudinally roughened and fissured brown fibrous bark without obvious rings. *Washingtonia filifera* of Arizona and California has a very stout trunk of nearly uniform diameter. *W. robusta* of Mexico has a large base which tapers into a rather slender trunk above. Leaves of both species are large, shortly costapalmate, divided more than halfway to the base into 50 or more 1-nerved segments each of which is rather deeply split into pendulous narrow pointed tips. The long petiole is armed with stout hooked teeth and is triangular at the top with a large pale ligule above, but lacking a ligule and extending into the blade as a short costa below. Inflorescences from among the leaves usually exceed the leaves, arching outward with pendulous sword-shaped bracts and branches of white or creamy hermaphrodite flowers, these not clustered in groups. Sepals and petals are chaffy, stamens are 6, the ovary is composed of 3 carpels united by the styles, only one normally developing into an ovoid or obovoid blackish or brownish fruit about  $\frac{3}{8}$  inches long. The seed has homogeneous endosperm.

# Palm Portraits

(Arranged alphabetically by botanical names)



W. H. HODGE

## *Acrocomia armentalis*

*A clump growing in the wild near Cienfuegos, Cuba. The bizarre, spiny, spindle-shaped trunks of this sun-loving palm make it an unusual ornamental.*



NIXON SMILEY

*Aiphanes acanthophylla*

Curiously ruffled leaflets and sharp black spines on the trunk and petioles are characters of several species of *Aiphanes*. (Fairchild Tropical Garden, Miami, Florida.)



H. W. CAULFIELD

*Archontophoenix cunninghamiana*

*A group growing in the Brisbane Botanic garden. The piccabeen palm of Queensland, the King Palm, is an elegant slender tree to sixty feet with conspicuously ringed trunks. (Brisbane Botanic Garden, Brisbane, Queensland, Australia.)*



NIXON SMILEY

***Areca catechu***

*The Betel-nut Palm is one of the most important economic palms of the Old World tropics. Probably more people chew betel nuts than any other masticatory. The slender erect boles and attractive crowns make this an outstanding ornamental palm, hardy in south Florida. (Lancetilla Experiment Station, Tela, Honduras.)*



UNIVERSITY OF FLORIDA, AGRICULTURAL EXPERIMENT STATION

*Arecastrum romanzoffianum*

*A popular palm with graceful arching leaves, the Queen Palm is common in southern Florida, southern California, and in the tropics.*



JUAN V. PANGHO

*Arenga pinnata*

*A large handsome palm of Malaya. The pinnate leaves are dark-green above and whitish beneath. Flowering progresses from the top of the stem downwards; once completed, the palm dies. In its native Malaya, the sugary sap yields toddy. (Philippine Islands.)*



W. H. HODGE

*Bactris gasipaes*

*The slender trunks of the tropical America Peach Palm are the source of a tough fibrous "wood" called chonta. The fruits serve as an important vegetable. (Lancetilla Experiment Station, Tela, Honduras.)*





H. F. LOOMIS

***Bismarckia nobilis***

*A majestic fan palm of Madagascar, especially attractive because of its massive blue-green leaves. (U. S. Plant Introduction Station, Miami, Florida.)*



D. M. A. JAYAWEERA

***Borassus flabellifer***

*One of the world's most important palms with over eight hundred uses in the Old World tropics. (A fine avenue, planted in 1887, at the Royal Botanic Gardens, Peradeniya, Ceylon.)*



GENTES HERBARUM

*Brahea dulcis*

*A Mexican species, sometimes planted in southern California. Stout, short trunks, attractive fan-shaped leaves, and an affinity for calcareous hills are characteristics of the Rock Palm. (Southern Mexico.)*



W. H. HODGE

### *Butia capitata*

*Bluish or silver-gray foliage characterize the South American Jelly Palm, so called because of the acid pulp of its fruits which can be utilized in jelly making. A slow-growing species, it is noted for its hardiness; the specimen shown having withstood twelve degrees Fahrenheit. (U. S. Plant Introduction Station [Barbour Lathrop], Savannah, Georgia.)*



W. H. HODGE

*Calamus siphonopathus*

*The rattan palms of the genus Calamus (the largest genus of palms) are climbing plants which scramble high into the tree tops of Old World tropical forests by means of hooks and spines on the leaves and stems. The tough, flexible stems yield rattan of commerce.*



GENTES HERBARUM

*Calyptronoma dulcis*

*A pinnate leaved palm of a little-cultivated genus, native to the American tropics. (Trinidad Mountains, Santa Clara Province, Cuba.)*



W. H. HODGE

***Caryota urens***

*This Fish-tail Palm, so called because of its unusual leaf segments, attains a height of forty to sixty feet at maturity and is an unusual ornamental when well grown. Flowering begins near the top and proceeds down the trunk. This species thrives in moist soils. (Atkins Garden of Harvard University, Cienfuegos, Cuba.)*



GEORGE DE GENNARO

***Chamaedorea cataractarum***

*A single-trunked species of a genus noted for its variety of small ornamental palms. Their attractiveness and shade-loving habits make the Chamaedorea species useful in patio, greenhouse, or home. Plants are either male or female; the latter often produce attractive red fruits.*





GEORGE DE GENNARO

*Chamaedorea costaricana*

*A clustering species whose attractive green bamboo-like trunks make it adaptable to pot culture.*



GEORGE DE GENNARO

*Chamaedorea ernesti-augusti*

*An unusual species with leaves reminiscent of those found in the genus Geonoma. This species makes an unusual plant for tub or pot culture.*



GEORGE DE GENNARO

*Chamaedorea klotzschiana*

*A single-trunked species with the leaflets distributed in groups; well adapted to container culture.*



NIXON SMILEY

***Chamaerops humilis***

*One of the best fan palms, especially where a small bushy, hardy, slow-growing palm is required. Its suckering habit usually produces several trunks forming pleasing groupings, as is shown in the illustration. (Fairchild Tropical Garden, Miami, Florida.)*



NIXON SMILEY

***Chrysalidocarpus lutescens***

*One of the best low-growing feather palms, forming attractive clumps of smooth yellow-ringed trunks capped with graceful arching leaves and producing unusual violet-black fruits. A tender species, it can be cultivated outdoors only in the tropics and Southern Florida, but is much prized for indoor pot culture. (Southern Florida.)*



ROBERT W. READ

*Coccothrinax argentata*

*This slender native species of subtropical Florida is notable for its charming, thin fan-shaped leaves, glossy pale green above and silvery beneath. (Wild plant on Bahia Honda Key, Florida.)*



DAVID FAIRCHILD

### *Cocos nucifera*

*The world's most important palm and included among the world's ten most important trees. Besides its economic value the Coconut Palm is an outstanding horticultural subject and because of its tolerance of salt water, is especially useful for seaside or beach plantings. (A plantation at Penang, Malaya.)*



W. H. HODGE

*Cocos nucifera*

*One of the world's biggest seeds, coconuts are only half buried when planted in the seed bed. (Fairchild Tropical Garden, Miami, Florida.)*

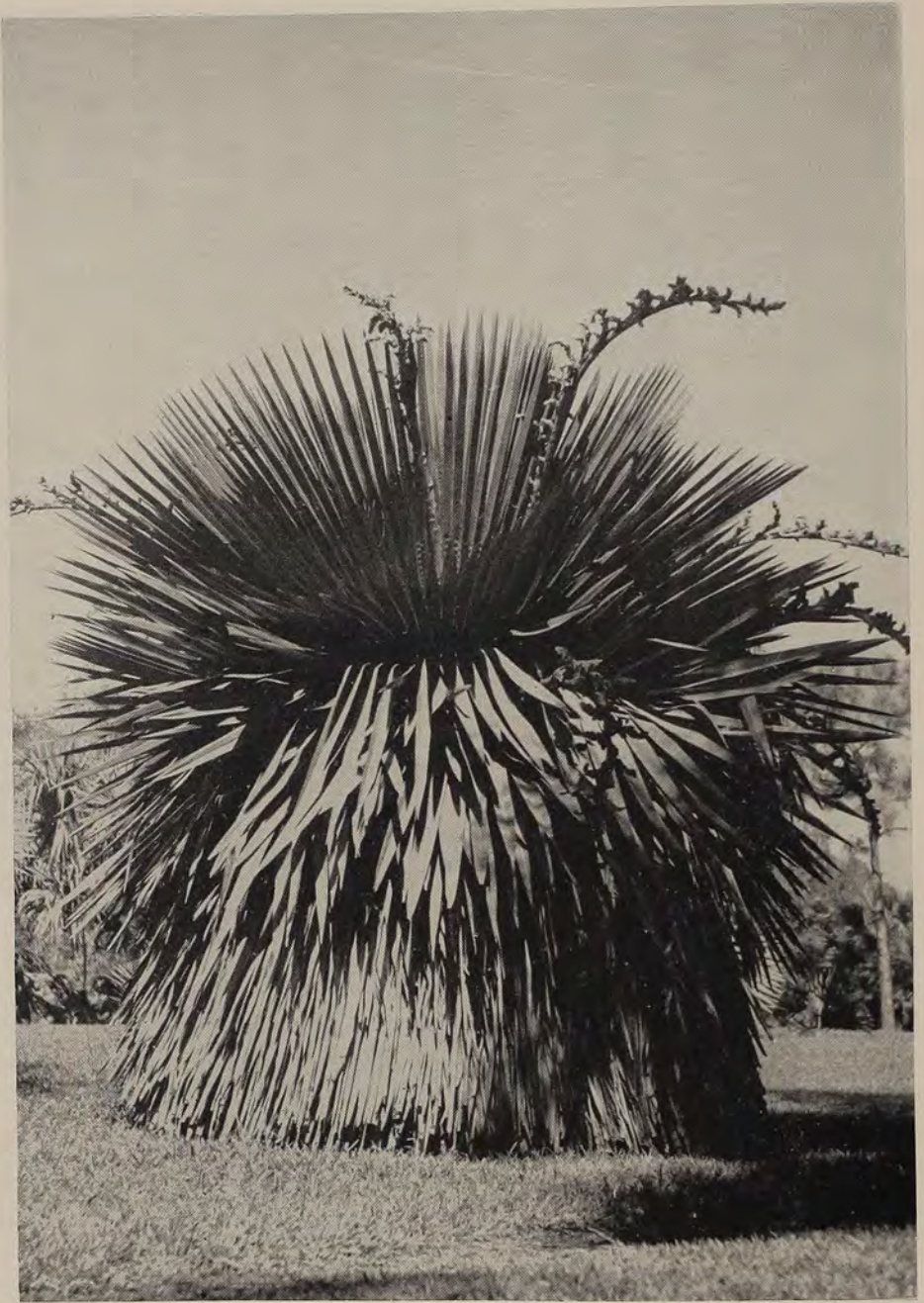




W. H. HODGE

*Cocos nucifera*

*Halved coconuts, lying in the hot Ceylon sun to dry to form copra, display their economic importance as one of the world's chief sources of fatty oil.*



KENT GATTERI

***Copernicia torreana***

*Persistent old leaves form the "petticoat" of this Cuban species, one of the newer palm introductions in southern Florida. The Petticoat Palm is a rather slow-growing species; it inhabits the dry serpentine barrens of central Cuba. (Fairchild Tropical Garden, Miami, Florida.)*



D. M. A. JAYAWEERA

*Corypha umbraculifera*

*The national floral emblem of Ceylon, the Talipot Palm is noted for the giant proportions of its heavy trunks and enormous fan-shaped leaves (sixteen feet in diameter). (The avenue shown was planted in 1927 at the Royal Botanic Gardens, Peradeniya, Ceylon.)*



NIXON SMILEY

*Corypha umbraculifera*

*A Talipot Palm in flower at the Federal Experiment Station, Mayaguez, Puerto Rico. Like a century plant, the Talipot Palm flowers only once in its life, produces fruit, and then dies.*



C. X. FURTADO

*Cyrtostachys lakka*

*The startling red sheaths, slender stems, and fine clustering habit make the Sealing Wax Palm of Malaysia one of the most desirable palms for culture. Unfortunately, they are very tender and can only be grown in frost-free lands. (Singapore Botanic Gardens, Singapore, Malaya.)*



RAY FISHER

***Dictyosperma album***

*The Princess Palm of the Mascarene Islands are elegant feather palms of fairly rapid growth and clean appearance. Frequently seen in the tropics, they may also be grown in southern Florida. (Miami, Florida.)*



WILLIAM HERTRICH

***Erythea armata***

*Long, pendent interfoliar inflorescences characterize the Blue Hesper Palm of Mexico. Like other species in this genus they have been much used for street planting, suited as they are to open sites and well-drained soils. (Huntington Botanical Gardens, San Marino, California.)*



G. HAMPFLER

***Howea belmoreana***

*One of the best known and best loved ornamental palms is the Belmore Sentry Palm. The gracefully curved dark green leaves and slow growth favor the species as a greenhouse subject though it thrives outdoors in protected sites in Florida and southern California. (Conservatory specimen at Longwood Gardens, Kennett Square, Pennsylvania.)*





G. HAMPFLER

***Howeia forsteriana***

*Because of its faster growth habit, the Forster Sentry Palm is more popular in the trade of the two sentry palms here illustrated. It is otherwise similar to the preceding species. Both are native to the Lord Howe Islands off the coast of New South Wales, Australia. (Conservatory specimen at Longwood Gardens, Kennett Square, Pennsylvania.)*



D. M. A. JAYAWEERA

***Hyphaene thebaica***

*The Doum Palm, of arid plains and desert in Africa, is the classical example of a palm with branching stems. Because of this unusual habit it is grown in many gardens in the tropics and is even hardy in subtropical Florida. (Royal Botanic Gardens, Peradeniya, Ceylon.)*



NIXON SMILEY

*Latania loddigesii*

*One of several species of fine fan palms native to the Mascarene Islands. The Silver Latania, though slow-growing, is prized for its large distinctive leaves which sport a heavy silver bloom. (Fairchild Tropical Garden, Miami, Florida.)*



NIXON SMILEY

***Licuala grandis***

*An elegant forest palm from New Britain Island, prized for its unusual fan-shaped leaves and its slender habit. It thrives in shade and although tropical, it is hardy in southern Florida. (Atkins Garden of Harvard University, Cienfuegos, Cuba.)*



C. X. FURTADO

***Licuala spinosa***

*Clustering habit and attractive deep parted leaves characterize many of the species of Licuala, native to the Old World tropics. Certain species are proving hardy in southern Florida; almost all are fine greenhouse or tub palms. (Singapore Botanic Gardens, Singapore, Malaya.)*



NOLAN KINER

***Livistona australis***

*The hardiest (to twenty degrees Fahrenheit) and one of the tallest of the fountain palms, it is a handsome species for garden or street use. It is commonly planted in both Florida and southern California. (Balboa Park, San Diego, California.)*



NIXON SMILEY

*Livistona chinensis*

Although less hardy than the preceding species, the Chinese Fountain Palm is the best known fan palm in cultivation in this country. A good tub plant, it will also thrive outdoors as demonstrated by the fine specimen illustrated. (Fairchild Tropical Garden, Miami, Florida.)



WILLIAM HERTRICH

***Livistona decipiens***

*A lesser known species of the fountain palms notable for the graceful arch of the pendulous pinnae. Hardy in southern California. (Huntington Botanical Gardens, San Marino, California.)*





D. A. M. JAYAWEERA

***Lodoicea maldivica***

*A rarely cultivated tender palm of the Seychelles Islands noteworthy for its giant fruits. Trees are dioecious and very slow-growing, the male tree here shown having been planted in 1850. (Royal Botanic Gardens, Peradeniya, Ceylon.)*



W. H. HODGE

*Lodoicea maldivica*

*A fine crop of fruits on a female tree of the "double coconut." Each fruit (up to eighteen inches long) contains a giant two-lobed, coconut-like seed, the largest seed in the plant world. (Royal Botanic Gardens, Peradeniya, Ceylon.)*



NIXON SMILEY

***Mascarena verschaffeltii***

*A curious spindle-shaped trunk with infrapolar flowering, combined with an attractive crown, have made this species (as well as its close relative Mascarena lagenicaulis) a popular ornamental in south Florida gardens. (U. S. Plant Introduction Station, Miami, Florida.)*



GENTES HERBARUM

***Mauritia setigera***

*As gregarious palms, the various species of Mauritia often form large stands on wet savannahs in the American tropics. Tender palms of the deep tropics, they have yet to be introduced into ornamental horticulture. (Trinidad Island, British West Indies.)*



H. F. LOOMIS

*Nannorrhops ritchieana*

*The Mazari Palm, from the arid mountains of Pakistan and Afghanistan, has a bushy habit like the Saw Palmetto of our own South. A relatively new introduction, it may prove especially noteworthy because of its expected hardiness. (U. S. Plant Introduction Station, Miami, Florida.)*



W. H. HODGE

*Orbignya cohune*

*All over the tropics a palm thatched hut is the favorite native home. These Honduran examples are covered entirely with leaves of the native Cohune Palm growing in the background. (Tela, Honduras.)*



W. H. HODGE

*Paurotis wrightii*

*To many, this species from the Florida Everglades, is the most attractive native palm of the United States. The densely clustered trunks with their fibrous sheaths and lovely fan-shaped leaves, combine to make the Everglade Palm a highly desirable ornamental, which, however, thrives best in low constantly wet soil. (Daytona Beach, Florida.)*



NIXON SMILEY

***Phoenix canariensis***

*The Canary Island Date Palm is one of the finest and hardiest palms especially prized for specimen or roadside plantings. In the United States this species is to be found wherever palms can be generally grown. (Fairchild Tropical Garden, Miami, Florida.)*





U. S. DEPARTMENT OF AGRICULTURE

*Phoenix dactylifera*

*Dates have been grown by man for over five thousand years. Fruits weigh down the old interfoliar inflorescences as maturity is reached to form the large clusters illustrated. Good varieties of the Date Palm are propagated vegetatively by suckers, seen at base of the tree. (Indio, California.)*



W. H. HODGE

***Phoenix reclinata***

*The freely suckering habit of this, the best known ornamental palm of tropical Africa, makes the Senegal Date Palm "a natural" for large impenetrable hedges or screens where plenty of space is available. The same palm, thinned and allowed to mature, forms stunning clumps of multiple trunks.*

*(Fairchild Tropical Garden, Miami, Florida.)*



NIXON SMILEY

***Phoenix roebelenii***

*The small size and slender soft pinnae make the Dwarf Date Palm one of the best of the ornamental date palms, much prized as a pot plant for indoor decoration but also a good subject for outdoors in partial shade. (Fairchild Tropical Garden, Miami, Florida.)*



H. W. CAULFIELD

***Phoenix rupicola***

*The Drooping Date Palm is similar to the preceding species in size and habit. It has the same horticultural uses. (Brisbane Botanic Garden, Brisbane, Queensland, Australia.)*



NIXON SMILEY

***Pritchardia pacifica***

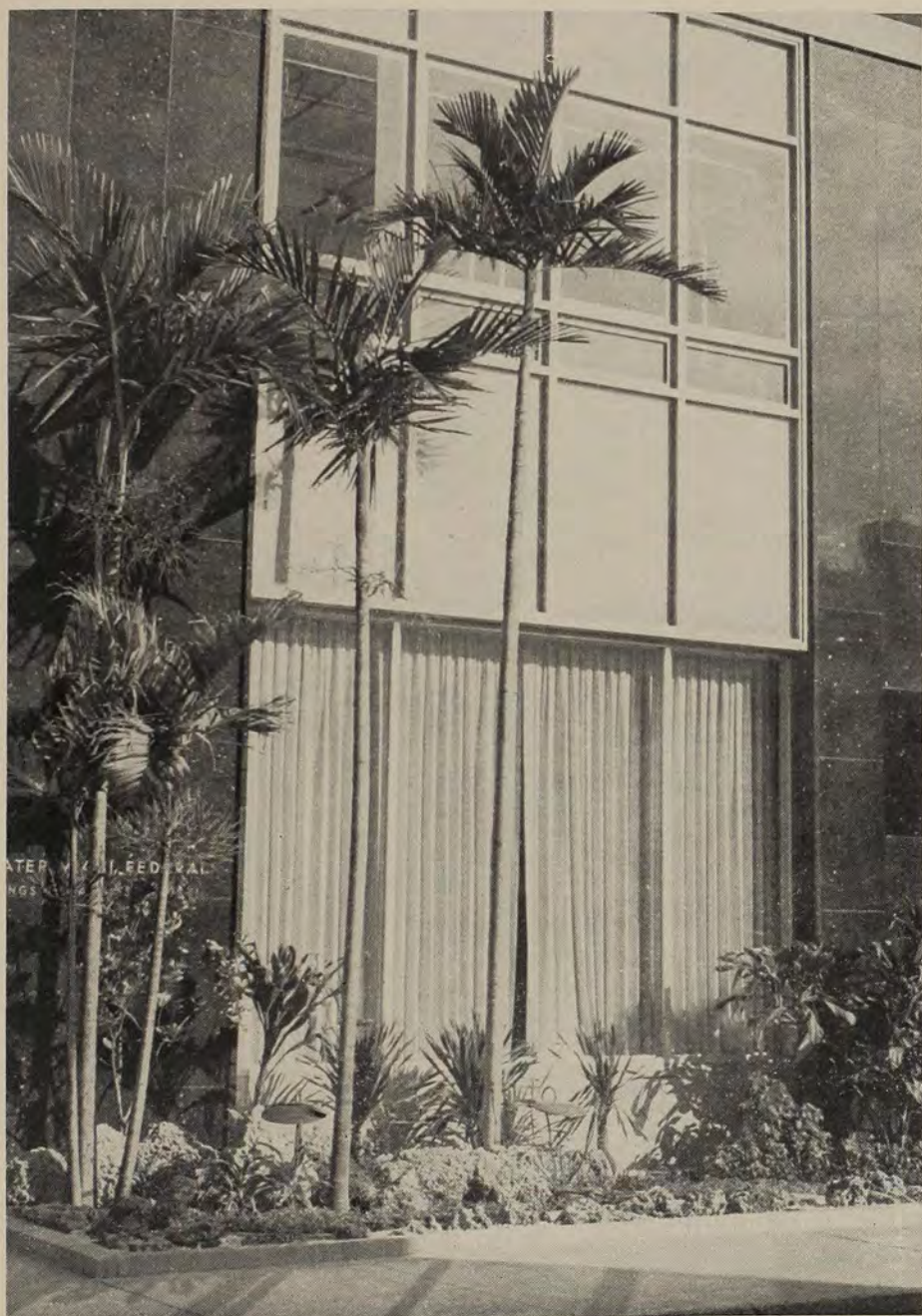
*An attractive Polynesian fan palm, highly recommended for tropical gardens but hardy in this country only in Hawaii and subtropical Florida. (U. S. Plant Introduction Station, Miami, Florida.)*



NIXON SMILEY

***Pseudophoenix vinifera***

*From the Greater Antilles comes this feather-leaf Cherry Palm with heavy clusters of showy red cherry-sized fruits. Trunks of this species are especially desirable being bottle-shaped (in youth) and with prominent rings formed by the quickly deciduous leaves. (U. S. Plant Introduction Station, Miami, Florida.)*



DOUGLAS KENNEDY

***Ptychosperma elegans***

*The small size, delicate trunks, and showy red fruit of the Solitaire Palm have made it a popular and desirable ornamental in the small home grounds of the tropics and subtropics. Its use in limited space of a sidewalk garden designed by Jonathan Seymour is here demonstrated. (Fort Lauderdale, Florida.)*



WILLIAM KUENZEL

***Ptychosperma elegans***

*Four very tall specimens of the Solitaire Palm are used very effectively in the commercial landscape of a restaurant's corner garden designed by Fred-eric Stresau. (Fort Lauderdale, Florida.)*

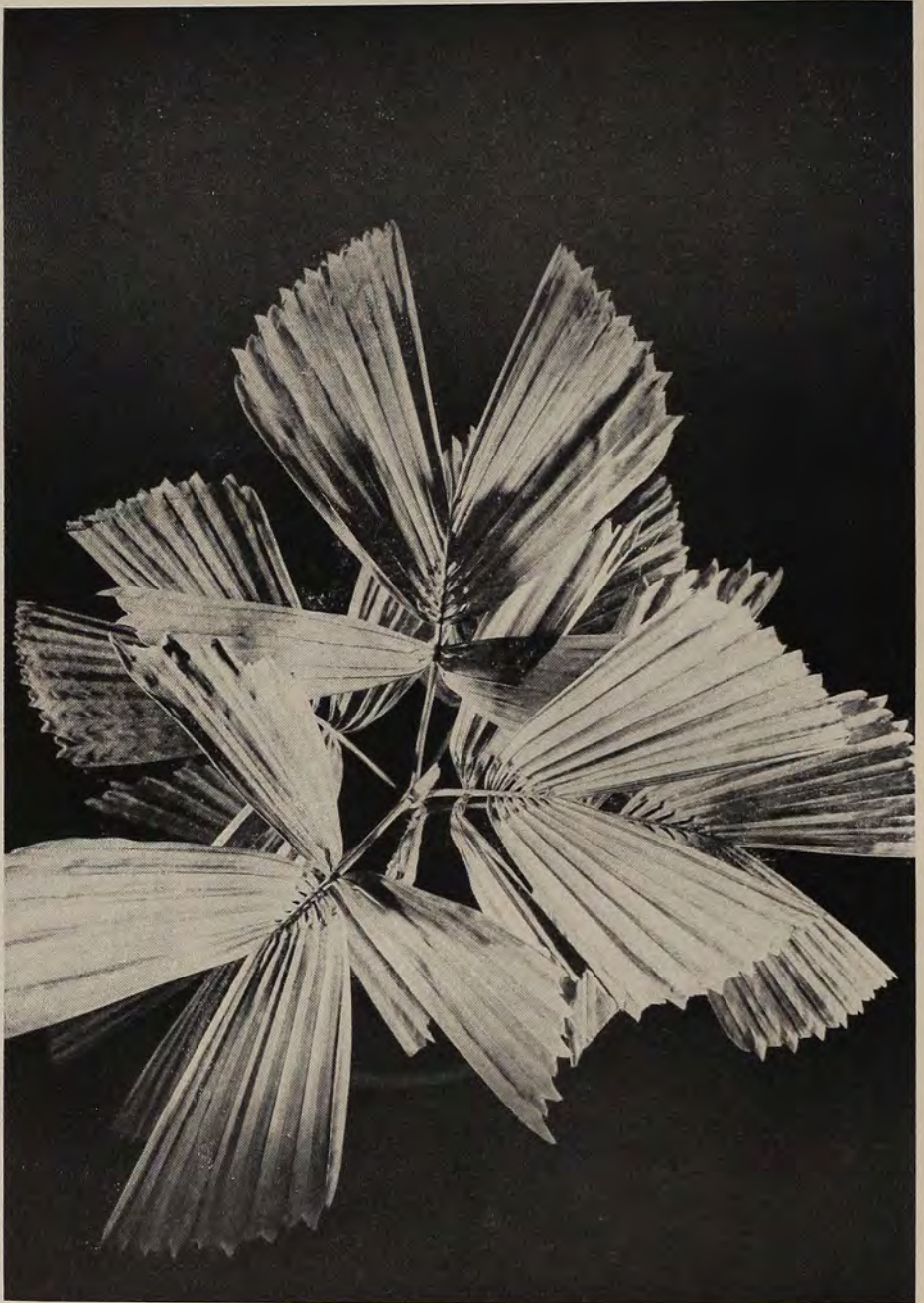




WILLIAM KUENZEL

***Ptychosperma macarthurii***

*The clustered trunks and small size of the Macarthur Palm make it very useful for either garden or tub culture. (Miami, Florida.)*



G. HAMPFLER

***Reinhardtia gracilis* var. *rostrata***

One of several little-known ornamental palms of Central America with "windows" in the leaves. The dainty habit of these insignificant shade-loving palms of the forest floor will undoubtedly make them desirable for pot or patio culture wherever they can be grown. (Specimen at Longwood Gardens, Kennett Square, Pennsylvania.)



UNIVERSITY OF FLORIDA, AGRICULTURAL EXPERIMENT STATION

***Rhipidophyllum hystrix***

*One of our North American native species (Carolinas to Florida) which should be more frequently seen in cultivation. The Needle Palm is low growing in habit and its desire for semi-shade should make it a useful species for special locations in the garden.*



W. H. HODGE

***Rhapsis excelsa***

*The multiple cane-like trunks and small size (to fifteen feet) make this species of Lady Palm from southern China the very best palm subject for hedges. (Fairchild Tropical Garden, Miami, Florida.)*



KAN YASHIRODA

***Rhapsis excelsa***

*The "different" leaf outline and texture of the Lady Palm make it interesting for a patio or house plant, in addition to its usefulness as a hedge plant as shown in the preceding illustration. (The subject here is growing in Japan.)*



KAN YASHIRODA

***Rhapsis humilis***

*Another species of the Lady Palm grown in Japan as a pot subject.*



NOLAN KINER

***Rhopalostylis sapida***

*Stiff upright pinnate leaves held from a peculiar crownshaft have given the common name, the Feather-duster Palm, to this species. A New Zealand species, it is hardy in southern California. (Santa Barbara, California.)*



GENTES HERBARUM

***Rhyticocos amara***

*A close relative of the Coconut Palm, this species of the Lesser Antilles will also endure salt spray so should make a welcome addition to seaside plantings. (Martinique, French West Indies.)*





NIXON SMILEY

***Roystonea elata***

*A massive but superb palm for ornamental use. The young specimens here shown demonstrate the Florida Royal Palm's preference for moist and preferably rich soils. (Fairchild Tropical Garden, Miami, Florida.)*



W. H. HODGE

***Roystonea oleracea***

*A fine avenue of a cabbage palm, the Caribbean Royal Palm, at the Royal Botanic Gardens, Peradeniya, Ceylon. Not so frequently planted, this species has taller trunks (which are not enlarged above the base) than the more familiar *Roystonea regia*.*



W. H. HODGE

*Roystonea regia*

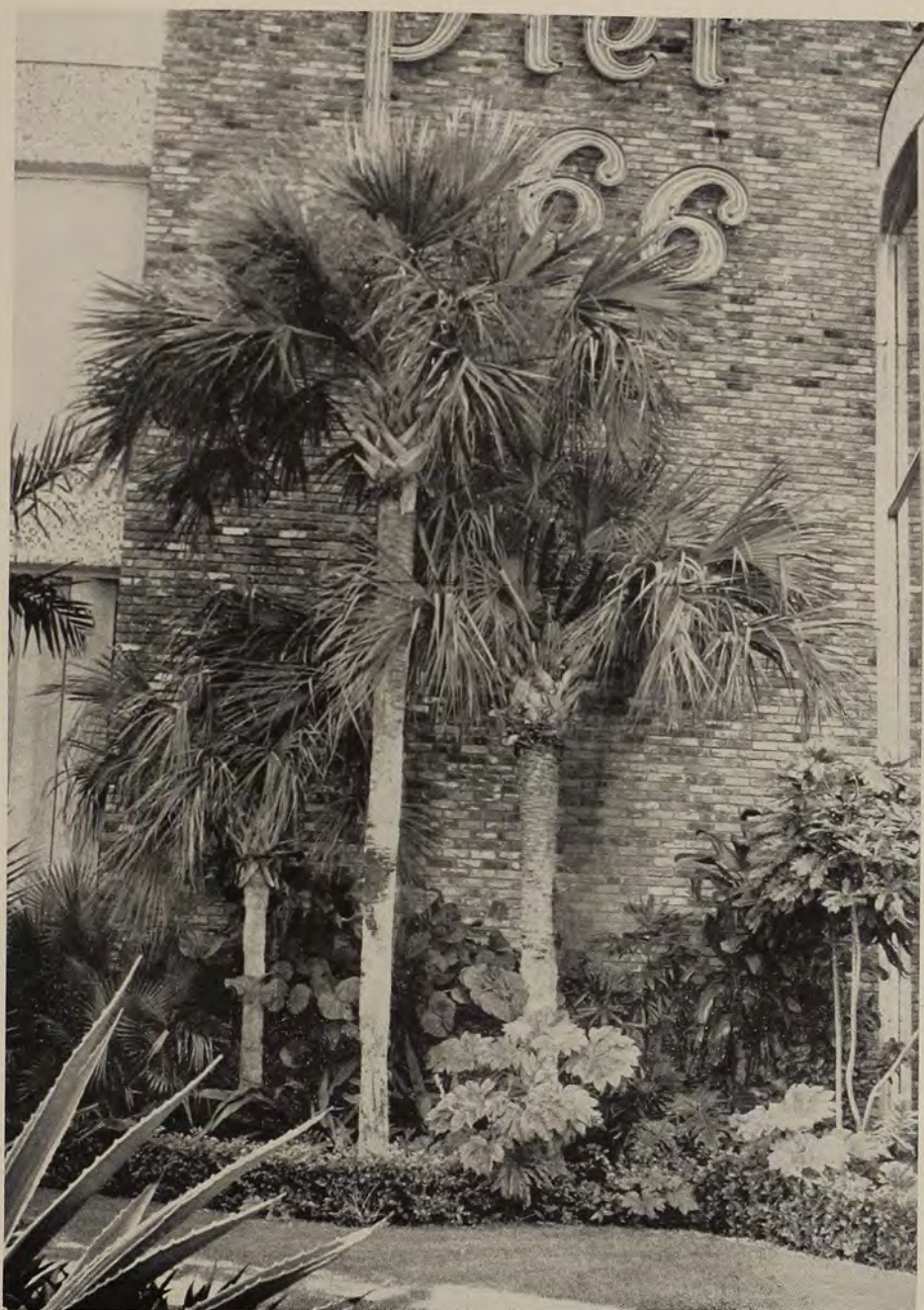
*The national tree of Cuba, the fast growing Cuban Royal Palm is superb as a street tree. Its boles differ from the preceding species in being bulged usually above the base. (Lancetilla Experimental Garden, Tela, Honduras.)*



DENT SMITH

*Sabal etonia*

*A trunk-less palm native to peninsular Florida, the Scrub Palmetto is often used in the landscape. (Daytona Beach, Florida.)*



WILLIAM KUENZEL

### *Sabal palmetto*

*The native Cabbage Palmetto or common palmetto of the southeastern United States is much used in both garden and street plantings. Here three specimens of different heights are very effectively used in a commercial landscape of a restaurant's garden designed by Frederic Stresau. (Fort Lauderdale, Florida.)*



DENT SMITH

***Sabal palmetto***

*A natural grove of the Cabbage Palmetto or the common palmetto makes a tropical accent on the border of a golf course. (Daytona Beach, Florida.)*



UNIVERSITY OF FLORIDA, AGRICULTURAL EXPERIMENT STATION

***Sabal umbraculifera***

*The Hispaniolan Palmetto is the most massive of the palmettos. Thriving on fairly light soil it makes an attractive specimen plant when a large crown and heavy columnar trunk are desired. (Southern Florida.)*



NIXON SMILEY

***Syagrus coronata***

*The Licuri [or ouricuri] Palm is an important economic species of the dry lands of eastern Brazil where its fruits, resembling small coconuts, are the source of an important palm-kernel oil. Smaller specimens of the genus, such as Syagrus weddelliana, are important ornamental palms. (Fairchild Tropical Garden, Miami, Florida.)*





H. F. LOOMIS

***Thrinax morrisii***

*This is one of about a dozen species of handsome small fan palms of southern Florida and the West Indies. Most would be appealing subjects for the smaller garden. Morris' Peaberry Palm is native to Anguilla and Anegada Islands. (U. S. Plant Introduction Station, Miami, Florida.)*



ROBERT W. READ

***Thrinax parviflora***

*The Key Thatch Palm is an ornamental West Indian palm whose natural range extends into subtropical Florida. Several specimens are shown here in the Florida Keys left standing after native vegetation was removed.*



W. H. HODGE

*Trachycarpus fortunei*

*The Chinese Windmill Palm of eastern Asia is probably the hardiest species in the whole family of palms. As such it can be grown on our coasts as far north as Virginia and Vancouver. The tree illustrated, overlooking the roadstead at Hampton Roads, Virginia, has withstood winter temperatures of five degrees Fahrenheit.*



NIXON SMILEY

***Trithrinax brasiliensis***

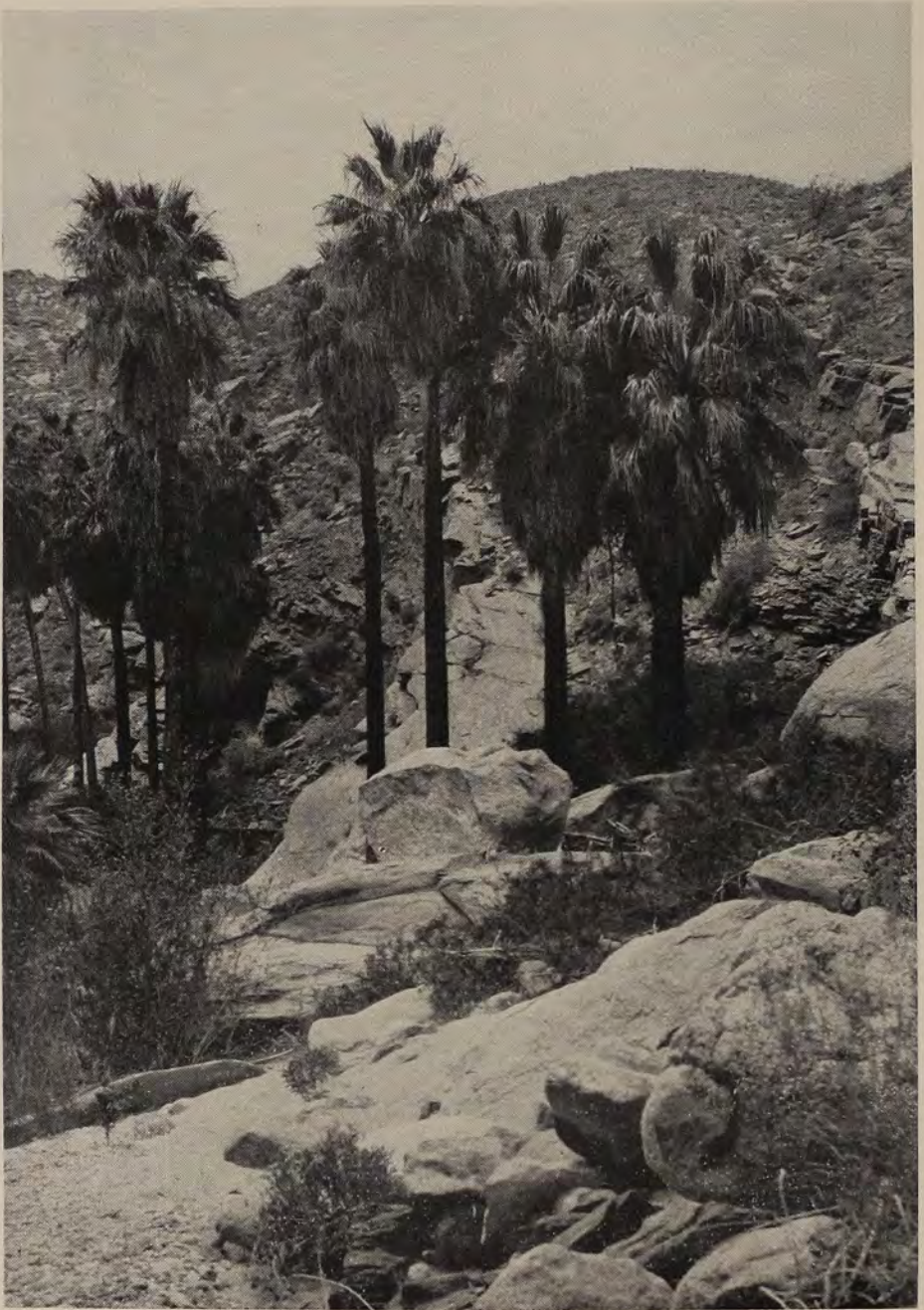
*Several species of this genus of fan palms from southern South America are fairly hardy and are grown both in subtropical Florida and southern California. Of special interest are compact habit, spiny leaf sheaths, and attractive inflorescence. (U. S. Plant Introduction Station, Miami, Florida.)*



NIXON SMILEY

### *Veitchia winin*

Several species of this genus of Pacific Island palms are receiving increasing attention among Florida gardeners on account of their slender trunks, fine crowns, attractive crownshafts, and colorful clusters of red berries. Most popular is *Veitchia merrillii*, shown elsewhere in this handbook. *Veitchia winin*, though less well known, illustrates the fine ornamental points of this genus. (Fairchild Tropical Garden, Miami, Florida.)



PETER BISSET

*Washingtonia filifera*

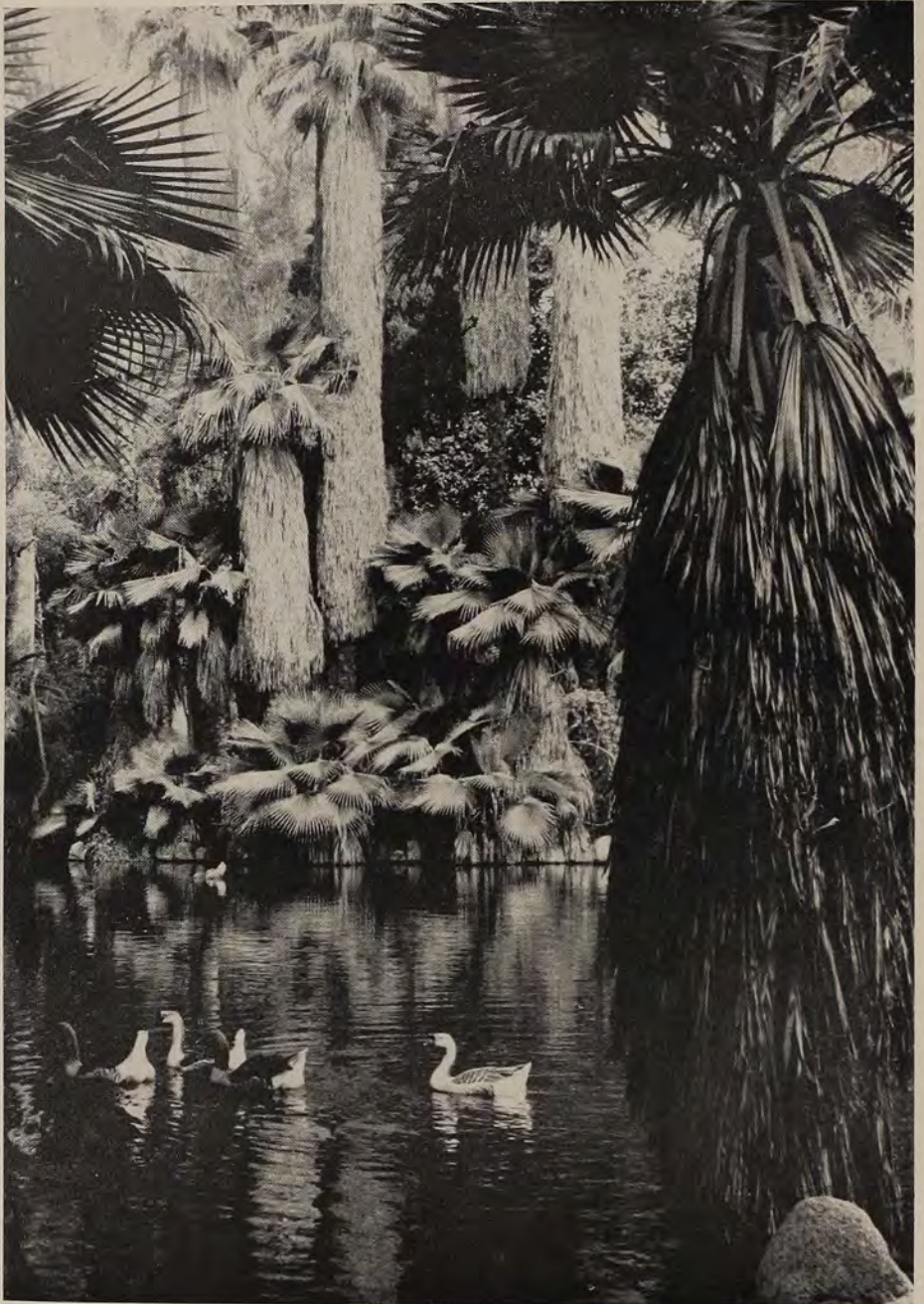
*This native American species inhabits desert oases of southern California. The specimens of the Washington Palm shown are in Palm Springs Canyon, California.*



UNIVERSITY OF FLORIDA, AGRICULTURAL EXPERIMENT STATION

***Washingtonia robusta***

*The Mexican Washington Palm is a slenderer species than the preceding and with smaller and greener leaves. It is also a more rapid grower though apparently not as hardy as the California tree.*



W. H. HODGE

***Washingtonia robusta***

*When undisturbed, the old leaves of the Washington palms persist for many years hanging down to form "skirts" or "petticoats." An old attractive planting in the Los Angeles State and County Arboretum, Arcadia, Calif.*





GENTES HERBARUM

*Zombia antillarum*

*A still little-known but interesting Haitian cluster palm of ornamental value because of its interesting trunks and showy white fruits. (The specimen here shown in its native habitat is damaged in several places by insects and does not present its admirable characters.)*

*Delicate sprays of Copernicia glabrescens form the main line. Heavy heads of beige sorghum cane lead the eye to the figure. Cream colored millet spikes and fuzzy pods of lipstick bush give variety. Dull brass cymbal on a butternut wood bowl.*

*Arrangement by  
Mora Lincoln*



HENRY J. RAHMLow



KENT GATTERI

## ***Palm Materials***

### ***in Decorative***

*Supple fronds of Chamaedorea elatior make a frame for three unopened spathes of Phoenix reclinata in a vibrant orange color, and one open, one spilling strands of creamy buds. A bit of dried palm frond echoes the outer curve (lower left) and those of the bright green immature Chamaedorea inflorescence. Egyptian bronze vase.*

*Arrangement by  
Stella Simmons*

Three cream colored inflorescence of *Phoenix reclinata* bursting from their orange colored spathes, with an unopened spathe curving above them. An inflorescence of the climbing *Chamaedorea elatior* (center foreground) — green rachillae and tiny bright yellow flowers. Dark shiny green *Rhapis* leaves (bottom); yellow-green of a half opened fan palm leaf (top).

Arrangement by  
Stella Simmons



KENT GATTERI

## Arrangements

HENRY J. RAHMLOW



Main lines created from strips of palm spathe, cured at home. Fine cluster of *Raphia ruffia*, with finger-like pieces of dried flower stems attached, forms the center of interest. *Chrysalidocarpus lutescens* is the wide curved piece at upper left; delicate sprays are dried date palm fruits. Brown vase, walnut blocks.

Arrangement by  
Mora Lincoln



*Trees, shrubs, and palms have been planted together, resulting in a garden that appears to be cut out of a tropical jungle. (Erickson Estate, Nassau, Bahamas.)*

#### **Views of palms in the landscape**

*The area in the main sections of this illustration was cleared, leaving the Florida native Saw Palmetto, *Serenoa repens*, to act as an elaborate, no maintenance border.*



NIXON SMILEY



*A section of the palm collection at the Fairchild Tropical Garden, Miami, Florida.*

***Views of palms in the landscape***

*An example of the use of mature palms in landscaping the home grounds.  
(Garden in Naples, Florida, designed by Thomas Church.)*



NIXON SMILEY

# CULTURE OF THE PALMS

## Preparation and Germination of Palm Seeds

Among the several thousands of palm species only the Coconut, Date and African Oil Palm have great commercial importance. Several other species are of minor value, while the majority of palms are planted as ornamentals or for their botanical interest. Little has been written on the preparation and germination of palm seeds in general; most references relate to those few species cultivated for their commercial products. While much can be learned from these papers it is the vast group of non-commercial palms that holds most of our interest.

Naturally, the ideal palm seeds for planting are those from fully ripe fruits, planted within several days of harvesting under conditions that will induce rapid germination. These conditions are not always attainable, however, for the seeds of many species have to be shipped great distances, and the care they receive before arrival at their destination has much to do with the results obtained after planting.

The three factors most injurious to palm seeds up to the time they are planted are (1) extreme drying out, causing the embryos to shrivel and reducing viability in proportion; (2) the formation of surface molds, many of which seem able to penetrate readily to the embryos and affect their viability; and (3) excessive age. Under the best conditions most palm seeds are short-lived, several months at most, and seeds obtained from individuals or institutions who make a practice of drawing them from stored bulk collections should be under suspicion.

Cutting through the seed coat and examining the embryos to see if they are greatly shrunk or discolored from the white to creamy-white seen in viable seeds may make it possible to avoid the planting and long care of worthless samples.

The first step in preparing fresh palm seeds for planting or shipping should be the removal of the moist flesh that covers most of them. They should then be thoroughly washed and allowed a day or two of air drying, after which they are ready for planting or mailing. For the latter, airmailing is desirable if any great distance is involved. For this the seeds should be placed in tightly closed plastic bags mixed with half to an equal

H. F. LOOMIS

*Harold F. Loomis is a director of The Palm Society and a member of its editorial board and has long served as a director of the Fairchild Tropical Garden. Prior to retirement, Mr. Loomis was, for a number of years, in charge of the United States Department of Agriculture's Plant Introduction Station at Miami [Coconut Grove], Florida, where is to be found one of this country's outstanding collections of palms.*

mass of peat moss or sphagnum moss moistened enough that the seeds cannot dry out further but not sufficiently wet to induce the start of germination. To forestall the development of mold in the bags it may be desirable to dust the seeds lightly with a small amount of one of the powdered fungicides, such as Fermate, Spergon, Zerlate, or similar compounds. Seeds packed in this way should then be wrapped with enough insulation to keep out freezing temperatures on any flights expected to reach high altitudes. Planting or starting pre-planting treatment of shipped seeds cannot be done too soon after they are received.

The wide variety of conditions under which palm seeds germinate in nature is evidence that no single artificial method can be devised or recommended for sprouting the seeds of all the palms. Except where germination peculiarities are known for certain species and special treatment can be given, methods that have proved satisfactory for the majority of species usually are followed. There has been one basic method of germination, namely, to plant the seeds in soil or other medium and keep them moist until they sprout. Many refinements of this fundamental procedure, however, have been added and followed with some consistency by palm growers.

At the United States Plant Introduction Station, near Miami, Florida, newly received palm seeds are cleaned, if this has not already been done, and planted within twenty-four hours of arrival. Seed pans or large flats are lightly filled with a heat-sterilized mixture of one part rubbed peat moss and three parts screened woods sand. This is tamped down smoothly and the seeds scattered evenly over the surface, firmed into the mixture and covered with an additional amount to a depth of a quarter to a half inch. The pans are labelled and a record of planting entered in a germination book. Planted containers are placed in a small greenhouse where the winter temperature is not allowed to fall below forty degrees Fahrenheit, but no heat is provided to keep it above this level. Summer temperatures on sunny days may go ten to twelve degrees above the outdoor maximum. Seed containers are watched closely and never allowed to dry out, nor are they allowed to become soggy through overwatering. Ger-

mination is recorded as occurring on the first day a leaf-shoot appears above the soil surface. Exact germination data have been kept for all palm introductions for the twelve year period ending in 1958, and are summarized below showing the species planted and the number of days until germination was recorded.

Species	Germination (days)
<i>Acanthophoenix rubra</i>	71
<i>Areca catechu</i>	79
<i>Astrocaryum mexicanum</i> *1	38
<i>Bentinckia nicobarica</i>	75
<i>Butia capitata</i>	142
<i>Chamaedorea erumpens</i>	222
<i>Chrysalidocarpus lutescens</i>	31
<i>Coccothrinax crinita</i>	37
<i>C. fragrans</i> (2)**	45-237
<i>C. miraguama</i>	104
<i>C. pseudorigida</i>	48
<i>Cocos nucifera</i>	119
<i>Colpotherinax wrightii</i>	55
<i>Copernicia burretiana</i>	37
<i>C. cowellii</i>	37
<i>C. gigas</i>	73
<i>C. hospita</i>	37
<i>C. torreana</i>	22
<i>C. vespertilionum</i>	14
<i>Corypha umbraculifera</i> (2)	52-108
<i>Dictyosperma album</i> *2	84
<i>D. aureum</i>	75
<i>Drymophloeus beguinii</i>	26
<i>Elaeis guineensis</i> (2)	64-147
<i>Erythea pimo</i> *3	193
<i>Euterpe longibracteata</i>	24
<i>Gaussia attenuata</i>	43
<i>Geonoma longipetiolata</i>	74
<i>Hyophorbe indica</i>	75
<i>Jubaea chilensis</i> *4	113
<i>Licuala amplifrons</i>	70
<i>L. grandis</i>	122
<i>Livistona cochinchinensis</i> *5	31
<i>Mauritia flexuosa</i>	56
<i>Maximiliana elegans</i>	147
<i>Metroxylon amicarum</i>	94
<i>Orbignya cohune</i> *6	67
<i>O. phalerata</i>	71
<i>Phoenix reclinata</i>	42
<i>P. roebelenii</i>	39
<i>Pritchardia lowreyana</i>	45
<i>Pseudophoenix vinifera</i>	23
<i>Ptychoraphis augusta</i> (2)	29-68
<i>Raphia pedunculata</i>	81
<i>Rhopalostylis sapida</i>	73
<i>Rhyticocos amara</i>	62
<i>Syagrus campicola</i>	293
<i>S. comosa</i> (2)	99-316
<i>Thrinax ekmanii</i>	99
<i>Veitchia joannis</i>	82
<i>Wallichia caryotoides</i>	89
<i>Zombia antillarum</i>	48

\*Synonyms under which seed was received: 1*Hexopetion mexicanum*. 2*Dictyosperma furfuraceum*. 3*Acoelorrhaphis pimo*. 4*Jubaea spectabilis*. 5*Livistona hoogendorpii*. 6*Attalea cohune*.

\*\*Figures in parentheses indicate two separate plantings.

A different method of palm seed germination is that of Edwin Johnston, Vero Beach Tropical Garden, Vero Beach, Florida, who began importing commercial quantities of many palm seeds from all over the world some years ago. He has consented to the inclusion of a resumé of his method here but did not have his notes available for exact germination data.

Mr. Johnston's principal departure from accepted procedures has been to plant the seed in flats of coarse moist sand placed one above the other in a small unlighted and unventilated building with an iron roof where daily temperatures were estimated as going to at least a hundred and twenty degrees in the summer. Exceptionally good and rapid germination of most viable seeds was obtained here. With certain hard seeds he found that filing or scarifying had little effect but that placing the seeds in a controlled temperature water bath, maintained at a hundred and fifty to a hundred and sixty degrees, for two or three weeks hastened germination when the seeds were removed and planted in the germination house. He has sprouted up to ninety-five per cent of such notoriously difficult seeds as *Acrocomia* and *Astrocaryum* species.

Since germination of the seeds Johnston planted occurred in the dark the seedlings had to be removed from the trays as soon as they came above the sand surface and planted in the light to allow their normal development.

Mr. Johnston has experimented with controlled heat cables either below the seeds or above the sand in which they were planted. He considers that the best results were obtained with the cables above the sand but these results were not as good as with seeds planted in his germination house. Comparing a divided shipment of Doum Palm seeds (*Hyphaene thebaica*) planted under heat cables and in the iron-roofed germination house, sprouting was obtained in approximately two weeks in the house but required two to three months in the cable-heated bed.

Possibly a considerable part of the success of the Johnston method may be attributed to the great daily temperature fluctuation the seeds are exposed to during the hours of sunlight and darkness. So far as is known no one has attempted to germinate palm seeds by a similar

method or one with a continuously maintained temperature.

Nat J. De Leon, of Miami, Florida, has been germinating palm seeds on a considerable scale for several years and in *The Palm Society Bulletin* No. 5, May 1956, reported results of using a controlled temperature cable set at eighty-three degrees beneath four kinds of palm seeds. In slightly less than two and a half months excellent germination was obtained with two species, good germination with one and none from ten seeds of *Corozo oleifera*, generally considered difficult to sprout. With samples of the same seeds planted at the same time at the Fairchild Tropical Garden without bottom heat, no germination was evident on the surface of the pots in the same period of time and examination of the seeds showed only one species that had broken the seed surface.

Mr. De Leon has continued his germination studies but starts by soaking all seeds in water for several days before planting them in pots containing a mixture of equal parts of peat moss, sand, and vermiculite with the pots plunged in a bed of peat moss above the heating cable. Germination data obtained with this method are shown below.

Species	Germination (days)
<i>Areca concinna</i>	43
<i>A. latiloba</i>	27
<i>Arenga caudata</i>	65
<i>Astrocaryum standleyanum</i>	148
<i>Bactris ottostapfeana</i>	57
<i>Bentinckia condapanna</i>	30
<i>Bismarckia nobilis</i>	39
<i>Caryota cumingii</i>	317
<i>Chamaedorea glaucifolia</i>	89
<i>C. schiedeana</i>	44
<i>C. sp. (C. corallina)</i>	95
<i>Chrysalidocarpus lucubensis</i>	150
<i>C. madagascariensis</i>	145
<i>Clinostigma ponapense</i>	48
<i>Copernicia glabrescens</i>	18
<i>Diplothemium maritimum</i>	73
<i>Erythea brandegeei</i>	44
<i>Geonoma longipetiolata</i>	119
<i>Latania verschaffeltii</i>	32
<i>Licuala spinosa</i>	31
<i>Loxococcus rupicola</i>	49
<i>Mauritia flexuosa</i>	126
<i>Oncosperma fasciculatum</i>	46
<i>O. tigillaria</i>	44
<i>Pseudophoenix vinifera</i>	33
<i>Ptychosperma angustifolium</i>	43
<i>P. hosinoi</i>	39
<i>P. ledermannianum</i>	60
<i>Raphia gracilis</i>	115
<i>Sabal glaucescens</i>	59
<i>Salacca edulis</i>	24
<i>S. rumphii</i>	24
<i>Socratea durissima</i>	55



## Viability of Palm Seeds

A palm seed has a thin seed coat within which lies an embryo, the young plant body, and the endosperm or albumen upon which the embryo feeds until it can absorb nutrients through its own developing root system. It is unlike many dicotyledonous seeds which go into a state of dormancy until conditions are favorable for germination. Instead, the embryo of the palm seed, which is always next to the thin surrounding seed coat, begins to shrink and dry up when conditions are unfavorable. It is the length of time required to complete this shrinking process with which we are concerned—the longest period that can safely elapse between maturation and planting of the seed.

NAT J. DE LEON

Exact time periods are difficult to give because of many variable factors. Several general rules, however, can be applied to palm seeds. Those coming from palms of subtropical areas, from areas having distinct hot and cool seasons or wet and dry seasons, and seeds with thick endocarp remain viable for some time. Two to three months is usual for this group which includes *Acrocomia*, *Archontophoenix*, *Arecastrum*, *Arikuryroba*, *Attalea*, *Borassus*, *Brahea*, *Chamaerops*, *Coccothrinax*, *Colpothrinax*, *Copernicia*, *Dictyosperma*, *Elaeis*, *Erythea*, *Howeia*, *Hypphane*, *Jubaea*, *Mascarena*, *Nannorrhops*, *Opsandra*, *Orbignya*, *Paurotis*, *Phoenix*, *Pseudophoenix*, *Rhapis*, *Sabal*, *Scheelea*, *Serenoa*, *Syagrus*, *Thrinax*, *Trachycarpus*, and *Trithrinax*. As seeds become older there will be a proportionate decrease in germination.

Palms from those parts of the tropics where changes in temperature and rainfall are slight and palms from low swampy areas bear seeds that are very short-lived, remaining viable from two to three weeks. Here the decrease in germination falls off sharply toward the maximum length of time. Genera known in this class include *Actinorhytis*, *Areca*, *Balaka*, *Bentinckia*, *Bismarckia*, *Calyptracalyx*, *Calyptronoma*, *Chambeyronia*, *Clinostigma*, *Cyrtostachys*, *Didymosperma*, *Drymophloeus*, *Eugeissona*, *Euterpe*, *Gronophyllum*, *Iguanura*, *Iriarteia*, *Jessenia*, *Linospadix* (*Bacularia*), *Loxococcus*, *Mauritia*, *Metroxylon*, *Nenga*, *Normanbya*, *Nypa*, *Oenocarpus*, *Oncosperma*, *Orania*, *Pinanga*, *Podococcus*,

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*Ptychoraphis*, *Raphia*, *Rhopaloblaste*, *Roscheria*, *Salacca*, *Socratea*, *Stenersonia*, *Veitchia*, *Verschaffeltia* and *Wettinia*. Seeds of these genera give us the most germination trouble.

There is, however, an intermediate class of palms from tropical areas. These palms bear seeds which remain viable for about four to six weeks. Genera of intermediate nature are *Aiphanes*, *Arennga*, *Astrocaryum*, *Bactris*, *Caryota*, *Chamaedorea*, *Chrysalidocarpus*, *Corypha*, *Cryosophila*, *Diplothemium*, *Geonoma*, *Heterospatha*, *Latania*, *Licuala*, *Livistona*, *Phytelephas*, *Pritchardia*, *Ptychosperma*, *Reinhardtia*, *Rhopalostylis*, *Roystonea*, and *Synechanthus*.

Most of the species within a genus react in a like manner. In genera where there are a great many species, however, we may expect exceptions to the rules. Thus we find that *Pinanga kuhlii* seeds remain viable longer than those of most species in this genus. We also find that seed of *Chamaedorea erumpens* remains viable longer than its intermediate range would suggest.

It is interesting to note, in going over lists of palms that have long been cultivated in south Florida, that nearly all of the species that are well established belong to genera in the long and intermediate classes of viability. The reasons are rather apparent, for during the days of active seed introduction air transportation was in its infancy and costs were prohibitive. This same situation reveals itself in other tropical botanical gardens. When great distances had to be crossed, only those seeds capable of remaining viable for some time germinated. Nowadays, with good air transportation reaching most areas of the world, we have been able to obtain good seeds of many palms in the short-lived group.

The above information applies to seeds handled in the customary manner; that is cleaned, placed in a container, and shipped. It does not apply where efforts are made to prolong viability by protecting seeds from the drying effects of air. The material most frequently used for protection is dry peat moss. The practice at the Singapore Botanic Gardens for a long time has been to pack palm seeds in dry peat moss enclosed in small tins and send by sea mail. Sometimes the seeds germinate enroute and the

young sprouts die due to lack of moisture, but seeds of even some of the shortest-lived palms such as *Pinanga* may be received in good condition after eight to ten weeks in transit. Germination is usually thirty to fifty percent. The late David Fairchild, when on his expedition to the East Indies, sent seeds packed in peat moss by air. Though air transportation was less highly developed than it is today, seeds of many of his rare palms germinated.

When good air transportation is available seeds may be picked fresh and sent direct by airmail without packing material. Unless unduly delayed, such seeds should germinate. When delays in shipping are expected or when air facilities are not well established, seeds should still be packed in dry peat moss soon after collection despite the added effort and expense.

Seeds should be sown as soon after collection as possible to obtain the fastest possible germination. The older the seeds, the longer they will take to germinate, providing they are still viable. In old seeds the shrinking of the embryo has already begun. It therefore takes extra time for the embryo to absorb water and regain its original proportions. The Fairchild Tropical Garden received a shipment of *Arennga pinnata* seeds collected in Cuba. The seeds were quite fresh and germinated within two months. At the same time, the writer received seeds of this palm from North Borneo. There was an interval of five weeks between the date of collection and the date of receipt. Before sowing, some of the embryos were examined. They had already begun to shrink. The actual time of germination with the addition of bottom heat was six months. At one month intervals, some of the embryos were again checked. By the fourth month, they appeared to be well proportioned and filled the cavity again.

Although viable, seeds of most palms will not germinate during the winter months in subtropical areas unless they are placed in a glasshouse or other means of applying warmth are used. They will, however, remain viable until spring if the germinating medium is kept slightly moist. Too much moisture will cause seeds to rot.

# Propagation of Palms

STANLEY C. KIEM

Plants in general can be propagated by a number of different methods such as cuttings, layering, budding, grafting, root suckers, etc., as well as by seeds. Some palms can be multiplied by divisions and suckers, but seeds are the only means of propagating most, as the majority of palms usually remain single-stemmed plants with one terminal bud. Also, like most other monocotyledons, they cannot be grafted or budded or the stems rooted as cuttings. Without true bark and a cambium layer which will heal over with a callous to form new tissue, it is impossible to cut off a trunk of a palm and expect it to re-establish itself as a new plant. Palms usually have only a single terminal bud at the tip of the stem with no axillary buds. If the bud is injured or becomes diseased in any way, the plant will die unless, of course, it is a type that might develop suckers from the base.

Propagation by seeds is more convenient than any other means, but sometimes seeds are unobtainable for a specific palm. In the case of a suckering palm, such as *Phoenix dactylifera*, vegetative propagation is the only way to ensure the maintenance of a particular clone or variety of date, since seedlings would be very likely to produce plants slightly different from the parent.

Some genera of palms normally have a clumping type of growth; that is, over a period of time they develop several stems which are joined at the base in the ground. A partial list of palm genera that sometimes develop clumps or suckers are: *Arenga*, *Astrocaryum*, *Bactris*, *Calamus*, *Caryota*, *Chrysalidocarpus*, *Chamaerops*, *Chamaedorea*, *Desmoncus*, *Geonoma*, *Licuala*, *Oncosperma*, *Paurotis*, *Rhapis*, *Phoenix*, and the *Actinophloeus* group of *Ptychosperma*. Sometimes clumps are compact as in the *Actinophloeus* group of *Ptychosperma* and with most of the *Chrysalidocarpus* species, where the bases of the stems are crowded tightly together. Another group of cluster-forming palms such as *Rhapis*, *Bactris*, and some species of *Chamaedorea*, develop a "runner" that may grow out as much as several feet from the parent plant before the upright stems are formed.

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Theoretically, any palm that will develop suckers or off-shoots with roots can be divided and a new plant created. Actually, however, it is practical to make divisions of palms in only a very few instances. Seeds are usually comparatively easy to obtain and to ship from one place to another, while propagations from suckers or offsets are time-consuming and difficult to make and are often bulky and unwieldy to transport. Newly separated divisions also tend to be very delicate immediately after they are detached and before they are established with a permanent root system in a new location.

Sometimes viable seeds of a particularly rare or desirable suckering palm, such as *Rhapis*, are very difficult or impossible to obtain. In such a case, the extra work and time needed to take off a sucker or to divide the plant is justifiable, but only after careful consideration. Cutting off a major section of a palm is a severe shock to both parts, and unless the person doing the work is careful, either part of the plant, or both parts could easily be lost.

The technique of dividing a palm consists mainly of the following: 1. After making certain that the risk to the parent plant is justified, carefully dig down about the off-shoot or stem to be taken off and check to see if it has already developed roots of its own. 2. If it has no roots of its own, the general practice is to cut partially through the stem that joins the division to the parent plant and then to replace any soil removed. This serves to cut off part of the food supply of the offset and thus encourages it to begin new roots of its own. A plentiful supply of fertilizer and water during this time will help to form new roots quickly. 3. When the portion to be removed has its own roots, a sharp spade or pruning shears can be used to sever any remaining connection and the division can then be carefully dug out. Meanwhile, be careful to keep with it the largest possible ball of undisturbed earth and roots. 4. After the division is potted or placed in its new location, it is best to remove from one-half to three-quarters of the leaf area, depending upon the amount of roots which were transferred with it. The new plant should be tied to a stake and watered regularly to prevent drying out. A tem-

porary shade and applications of liquid fertilizer will also help in the successful establishment of the new plant. A fungicide, such as one of the copper compounds, can be used to treat the exposed stem surface which has been cut as a means of discouraging fungus infections, particularly of the parent plant.

When large numbers of roots are taken off with the division, as in dividing *Chamaedorea* or *Rhapis* clumps, the whole operation can be greatly simplified and done at one time with only normal precautions being taken. Also, as in most other transplanting, divisions can be established easiest during the warm spring and summer months when the plants are in vigorous growth.

Unusual as it may seem, it is possible to marcott, or "moss off" the top of a very few palms, namely some of the species of *Chamaedorea*. Quoting from O. F. Cook's article entitled "Household Palms and Related Genera" in *The National Horticultural Magazine* 22:89, 1943:

"An experiment of marcotting was tried by Albert W. Close and proved entirely successful. The process of marcotting is simple, merely wrapping a ball of sphagnum moss and burlap around the trunk, tying it on and keeping it moist. In a few months after roots have begun to grow, the lower trunk can be cut away and the palm set in new soil."

Although Dr. Cook mentions marcotting as being done only with *Chamaedorea elegans*, the writer is sure it can also be duplicated with any *Chamaedorea* that would normally develop adventitious roots on the stem, such as *Chamaedorea tepijilote*.

Seeds can be sown in flats or seed pans in a soil mix approximately two to three inches deep. After the seeds germinate, it is best to grow them in fifty to seventy per cent shade. Warm moist conditions will encourage fast growth, especially if liquid fertilizer is applied periodically. Exposure to full sunlight or dry winds will set back young seedlings considerably. It is best to protect the young seedlings, both in the seed pan and in individual pots, from too much exposure or from heavy rains that might wash the soil from the pots. If slat protection is unavailable a spreading tree can sometimes be used as a substitute. Although sprouting palm seeds need to be kept

moist, care must be taken not to keep the soil soggy as there is then danger of losing the seedlings from rot and damp-off fungus.

It is usually best to take palm seedlings from the seed pan about the time the first leaf is fully developed or as the second leaf begins to emerge. This is the time the root system is just beginning to develop and few if any rootlets will be lost in transplanting. Also, the young seedling is still receiving nourishment from the endosperm of the seed which helps to tide it over until it establishes itself in an individual pot. If potting is delayed too long beyond this stage, the seedlings often suffer shock and have a tendency to die back.

When many seeds are sowed thickly in a seed pan or flat it is even more important not to delay in potting seedlings, because the root systems will grow together in a tight mass, making it almost impossible to separate them without loss of the small rootlets.

Most seeds will germinate fairly uniformly; but some seeds, especially those that are a bit old, will sprout a few at a time with some coming up months after the first ones. Then it is best to pot the seedlings as they sprout instead of waiting until they have all germinated.

When seedlings are taken out of the seed pan they should be potted into as small a pot as will accommodate the roots with sufficient allowance for several months growth. Seedlings should not be jammed and twisted into too small a pot; but neither should the very young seedlings be overpotted to the extent that the soil may remain too wet and become compacted before the next shift is made. In larger stages young palm plants can hardly be over-potted if the soil mix and growing conditions are ideal. Usually two and one-half-inch and three-inch pots will take care of the first potting, except for those palms that develop a long root system prior to the sprouting of the first leaves. These sometimes need up to eight-inch pots. The soil mixture used in the smaller sized pots should be loose and porous, preferably with a large percentage of organic matter such as leaf mold or peat moss. Good drainage as well as sufficient aeration must be provided if optimum root growth is to be expected.

Small seedlings when first transplanted from the seed pan will grow best under greenhouse conditions with about seventy per cent shade. When they are shifted into larger pots, four-inch to six-inch, most of them need more light and the shade may be reduced to fifty per cent. Exceptions are palms that are particularly sun-loving, such as *Copernicia*. These will grow much faster in full sun from six-inch pots on. As they become large enough to be shifted to eight-inch pots or to four- to five-gallon cans, most palms can be put in full sun for much of the day after they have become gradually accustomed to it to prevent sunburn. When in comparatively sunny locations, the foliage will not develop as dark green or lush as the shade grown plants; but plants will become hardened in preparation for planting and seem much better able to withstand low temperatures.

Young palms, like most tropical and subtropical plants, grow much faster during warm weather. During the cool winter months new growth of roots and leaves almost stops, while during the spring and summer growth is comparatively rapid if the necessary nutrients and moisture are available.

Young tender palm seedlings benefit greatly from controlled temperatures in a greenhouse or hot house during the winter, but if this is not available they generally will do quite well if protected from hard frosts or strong dry winds. In many cases, drying winds seem to cause much more burning of tender leaves than actual low temperatures so it is advisable to give as much protection from winds as possible.

Most palms do not seem to require a particular soil mixture as long as it has approximately the proper texture, drainage, and nutrients. More care is justified in preparing the soil for very young seedlings in small pots since they tend to be much more sensitive to extremes in texture and drainage than older established plants. A suitable soil mixture for young palms can be made up of the following: three parts "hammock sand" (or sandy muck, preferably neutral or slightly acid), two to three parts peat moss, one part fine grit, coarse sand, or Perlite (for drainage). Add a small amount of sheep manure and balanced chemical fertilizer to provide sufficient nutrients.

Although in many cases the pH is difficult to control, a neutral or slightly acid soil is preferred, except in instances of palms known to prefer alkaline soil.

In discussing the water requirements of young palms, the writer would like to quote from *Choice Stove and Greenhouse Plants*, 2nd Edition, by Benjamin Samuel Williams, London, 1876, the following advice from an English palm grower over 75 years ago: "Most stove palms should be provided a strong moist heat and be potted in equal parts of peat and loam, to which should be added a good portion of sand. Drain pots well and supply them liberally with water. Those requiring especially moist conditions may benefit from plunging in warm water, if such a convenience exists." He goes on further to caution against allowing the soil to become completely dry, as this would damage the roots of many palms considerably.

In some ways the key to watering lies in the soil mix. The soil mixture must be loose enough to provide good drainage and allow sufficient aeration so that roots are encouraged to grow rather than remain static and rot off. If the soil becomes solid and compact about the roots and is heavily and regularly watered meanwhile, the roots can easily become rotted and the plant will begin to die back.

The amount of water needed will vary greatly according to the size of the plant and its root system; how fast it is growing; or, if it is dormant (as during cool weather), the size of the container, the porosity and water-holding capacity of the soil, and the extent that it is exposed to the drying effects of sunlight and wind. All the above should be taken into account rather than trying to specify that a certain size pot needs so much water at certain intervals. Generally, watering should be frequent enough and in large enough amounts to maintain an even, moist condition.

Although many palms can exist on very little feeding, much better growth can be obtained if an adequate amount of nutrients is made continually available to the roots. Usually enough organic and chemical fertilizer can be included in the soil mixture, and if this is supplemented with regular applications of liquid fertilizer the palms should have adequate nutrients. Any balanced

soluble fertilizer can be used. Palms seem to respond especially to organic fertilizers such as sheep manure if they are balanced with the other elements obtainable in commercial chemical fertilizers. A commercial fertilizer mixture, six parts of nitrogen, six of phosphoric acid, and six of potassium, is quite satisfactory in most cases. Usually minor element sprays are not needed but they are sometimes useful in correcting nutritional deficiencies that might show up.

When palm seedlings are ready to be shifted from the pots in which they were established as seedlings, they should be given sufficient room with each repotting. The size of the root system may be used as a guide to repotting. Plants should be repotted as soon as the pot becomes fairly well filled with roots and before they become root-bound and stunted. It is necessary to allow the roots room enough to develop in the larger container without becoming root-bound before the next shift is anticipated. With normal growth, they can usually be shifted from two and one-half-inch pots to four-inch pots; then from four-inch to six-inch, and from six-inch into five-gallons tin cans or large pots or tubs of equivalent size. If a palm seedling is an especially fast grower, it could conceivably be moved from a four-inch pot into a four- or five-gallon can, but only if it shows rapid top growth with correspondingly developed roots. Beyond the four-inch pot size, it is difficult to over-pot palms if one is careful to provide a well drained soil with adequate sun and ventilation. Nevertheless, over-potting in a compact, water-retaining soil and placing the plant in a damp shady location can prove disastrous. Those palms that develop thick large roots usually need much more growing space than those that have many small fibrous roots.

When shifting from one container to another, unnecessary shock can be avoided if one is careful to have the soil moist so that it does not drop off the roots and leave the feeding rootlets exposed to bruising. Also, it is important to pot the plant so that the soil is not above the root crown. Planting too deep can hold back young plants considerably and even kill those that are especially tender. It is well to place drainage material in the

bottom of the pot to allow excess water to drain out easily and to discourage roots from growing through the hole into the soil beneath. When a major part of the root goes down through the drainage hole and is broken off when the pot is taken up for shifting a severe setback if not the death of the plant may be caused. When roots are damaged to any extent during repotting, it is best to cut off a portion of the leaves and move the newly shifted plant to a more shaded location until it has a chance to recover from the shock.

There are some palms that may be difficult to grow as seedlings, such as *Calyptrocalyx*, *Nephrosperma*, *Oenocarpus*, *Orania*, *Rhopaloblaste*, *Stevensonia*. Although relatively little is known about the cultural requirements of these palms, the following points should be kept in mind: 1. These palms seem to be more sensitive than most to pH in that they prefer an acid soil to one that is alkaline. 2. Keep the soil mixture evenly moist at all times. If the soil in which they are planted is allowed to dry out thoroughly, they often do not recover from the damage to the roots. 3. If leaves become chlorotic, minor element sprays and neutral iron and manganese soil treatments sometimes help if the deficiency has not developed too far. 4. If possible, keep in a warm moist atmosphere, but with good air ventilation. 5. Most important of all, do everything possible to keep the seedlings in healthy active growth. If they once become stunted recovery will be very slow, if at all.

Among palms one group which includes *Borassus*, *Corypha*, *Hyphaene*, *Latania*, and *Orania*, needs more than general care. These genera develop a long extended hypocotyl or root structure before the first leaves sprout. If sprouting seedlings are kept in a crowded seed pan until the secondary roots begin to develop it is almost impossible

to separate them for potting without damaging most of them badly. The long brittle root-like growth that first develops can stand crowding if need be, but if it is damaged or broken the young seedling will be severely stunted. In years past, seeds of palms such as *Borassus* were planted singly at the top of a box three feet long set on end. As the seed sprouted the hypocotyl pushed down several feet before the primary leaves were put out at its base and the roots developed just below that point. This made it difficult to handle and plant the young palm. In recent years we have learned to sprout the seeds in small pots just large enough to hold the seed until it begins to germinate. Then the seed is shifted to a six-inch or seven-inch pan, and the long root-like structure is allowed to wind about the lower sides of the pan until it stops and the leaves and true roots begin to develop. When leaves appear, the seedling is shifted into an eight-inch pot or a large tin can for growing. This method has proved successful with a number of palms that germinate in this way. It is absolutely necessary, however, to keep the developing plants under close observation so that they do not become stunted.

Some sun-loving palms, such as *Coccothrinax* and *Copernicia* will grow much faster and stronger if they are moved into slightly larger than usual containers and put in almost full sun as soon as possible. Under shaded conditions growth is very slow.

*Chamaedorea*, *Geonoma*, and other similar small, shade-loving palms have a particular dislike for growing in pots in a compact, heavy soil. These normally grow in moist loose leaf mold on the forest floor so they do much better in containers if the soil is loose and the drainage good, or if they can be planted out in a shaded protected location.

## Fertilization Requirements

DOUGLAS KNAPP

The subject of palm culture is a most difficult one to discuss in a brief article for several reasons. Most important, the palms constitute a family of less than three thousand species growing in all parts of the tropical world, under many situations so far as soils, climate, and other environmental factors are concerned. The Saw Palmetto in Florida grows on highly infertile soil with poor drainage. In Mexico, species of *Brahea* grow on dry limestone hillsides in competition with cactus and other xerophytes. Such palms survive under conditions that are unfavorable for the majority of ornamental plants. Many palms, however, seem to grow poorly except when provided with fertile soils of good physical structure and containing abundant quantities of nutrient elements. For the most part, palms seem to grow more rapidly under conditions favorable to the growth of plants generally. However, there appears to be wide variation in the need for both primary and secondary elements among palms.

The object of this paper is to bring together available information on fertilization and culture of palms in Florida and similar areas. The information has been secured in three ways: 1. A search through literature relating to palm culture and to research on palm nutrition in various parts of the world. 2. A survey of nurserymen, park superintendents, and others engaged in the business of growing palms to determine the methods developed by these individuals, and to learn of any observations they have made on

problems concerning palms in Florida. 3. An attempt to learn the history of specific palm specimens in Florida which exhibit particularly good or particularly poor growth in order to arrive at some understanding of environmental factors affecting palms.

There are several obvious drawbacks to these methods of gathering information. Most research is limited to that on species grown commercially for their products, particularly those of the Coconut, Date, and Oil Palms. Our interest is generally in the ornamental value of palms so research conclusions concerned with the yield of commercial products may not necessarily apply. Information from the second and third sources does

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not represent controlled or carefully observed experiments, but is based only on the opinions and memories of the persons consulted. The information received, however, suggests a number of ways to provide palms with optimum cultural conditions, especially in Florida, and it shows the need for research under our conditions to furnish a sounder basis for cultural practices.

H. Mowry offers a very complete discussion of soil preparation and planting, but his statements are based almost entirely on observation rather than on research. When transplanting, he recommends the digging of large holes where palms are to be set. "The holes are then filled with a mixture of compost, decayed leaves and grass or other litter, well rotted manures in fairly large quantities, and some muck and clay if the soil is quite sandy." This preparation "should be made two or three months prior to time of planting so that the whole mixture will have become well settled and more or less thoroughly decayed."

He further states that palms can be planted at any time of year but that the warm, rainy, sunny months are to be given preference. Palm roots do not form new root caps when severed so a ball of earth extending a foot from the base of the trunk should be moved with the tree. In this way, the small roots emerging from the base are preserved intact and their power to function is undisturbed. The pruning of leaves is recommended to reduce loss of moisture by transpiration, fan-leaved palms seeming to require removal of a larger proportion of leaves than the feather-leaved types. "With the Cabbage Palmetto it is best when transplanting to remove all of the leaves other than the central one that is just unfolding . . . Extreme caution must be exercised when undermining large trees to prevent them from falling heavily. Frequently such falls so injure trees that, regardless of other attention, they do not survive. The underground portion with its roots should not be exposed to the sun and wind in moving." Regular watering is required to insure success in transplanting and large trees must be well braced either with planks or wires for some months.

Dent Smith wrote of his experience with soil preparation in answer to our

survey "From my own experience in growing palms here [Daytona Beach, Florida], I have long since concluded that ninety per cent of the battle consists in planting the palms properly in the first place, that is, in huge holes filled with the best organic matter obtainable, mixed, preferably not with sand, but with good soil . . . In nature many palms grow in heavy soils but here we have no clay, and marl is not a good substitute except for lime-loving palms. Palms . . . hardly require additional fertilization if painstakingly (and sometimes expensively) planted to begin with.

"An example of good and bad cultivation was observed here in the case of two African Oil Palms (*Elaeis guineensis*), each of the same age and size when planted. One was indifferently planted in sandy soil, moderately enriched with leaf mold and some manure; the other was planted in a huge hole, back-filled with a ton of manure (cow) and moisture-retaining 'black soil'—a treatment entirely disproportionate to its size. The former plant grew skimpily, but the latter one grew mightily, and when only six years old had leaves eighteen feet long—longer than any I have seen on a plant of its age."

The *Third Annual Report of the West African Institute for Oil Palm Research* contains a report that fifty tons of the bunch refuse per acre worked in before planting had a very marked beneficial effect on oil palms and mulching also produced response. Several transplanting trials there showed the superiority of ball-of-earth planting over bare-root planting. Dipping the bare roots in clay slurry before planting also gave fair establishment. Root pruning a month before lifting gave better development in the ball-planting system and resulted in markedly improved development over the bare-rooted system. These trials also showed that applying fertilizer in the planting hole was beneficial.

Mowry states, and most local nurserymen and growers seem to agree, that organic sources of nitrogen are more satisfactory than inorganic fertilizers. Mowry says "Cottonseed meal, ground steamed bone meal, tankage, blood, guano, fish scrap, and manures are satisfactory. Tankage, steamed bone meal, and manures in combination will tend to keep the palms in a thrifty growing

condition. Such fertilizers may be applied during the early spring and summer months. Ten to twenty-five pounds of such fertilizer scattered under the spread of the leaves is not too much for large specimens. Manures should be applied as a mulch.

"The nutritional requirements of palms can be met also by the use of commercial fertilizers. For this purpose fertilizers containing from four to eight per cent nitrogen, six to eight per cent phosphoric acid and four to eight per cent potash should be satisfactory. The amount to apply will vary with age and size of the plants, fertility of the soil and quantity of organic matter supplied but may range from approximately one to two ounces for very small recently planted palms to fifteen pounds for large, mature palms per application. In the northern half of Florida, two applications per year should be given, the first in late winter or early spring, the second in mid-summer. In the southern half of the peninsula, where growth may continue practically the year round, a third application in late summer or early fall may be advantageous."

The Florida Agricultural Extension Service recommends an all purpose mixture such as 6-6-6 or 9-6-6 for palms, but E. W. McElwee, Extension Ornamental Horticulturist, from whose office this recommendation originates, frankly admits that we have no research for palm fertilizer requirements in Florida. The recommendation is based on practice and experience only.

John T. Poulos of the Miami Beach Parks Department, contributed the following information concerning practices at Miami Beach worked out over a period of years for their special conditions: *Cocos nucifera* needs no fertilizer except sulphate of potash on ailing trees, one pint per thirty-two gallons; *Ptychosperma macarthurii*, a heavy feeder, needs one-half pound to two and one-half pounds of 6-6-6 fertilizer four times yearly depending on size and requires nutritional spraying; *Veitchia merrillii* can tolerate one to three pounds of 6-6-6 or 5-10-5 per tree approximately four times a year; *Chrysalidocarpus lutescens* is fertilized with two to four pounds of organic fertilizer (Milorganite or rotted manure) approximately six times a year

plus nutritional spray of manganese as needed; *Chamaedorea elegans* and *C. erumpens* receive one-half to one pound of 6-6-6 twice yearly; *Ptychosperma elegans* needs one and one-half to four pounds of 6-6-6 three times a year plus soluble spray every three weeks, it needs 20-0-20 after cold winters; *Coccothrinax* species are fertilized once yearly with one-fourth to one pound of 6-6-6; *Phoenix* species are given five to ten pounds of 6-6-6 per tree once yearly if needed.

H. H. Worssam of the Dade County Parks Department says that on coconut palms newly transplanted he makes three applications of 10-20-10 water soluble fertilizer applied at the roots at intervals of two weeks. Complete fertilizer is applied three or four times during the first year after transplanting.

Many growers are of the opinion that application of potash in the fall increases resistance to cold damage, but are without supporting evidence. Dent Smith reports results of experimenting with potash at Daytona Beach as follows: "The much-touted benefit of potash to increase the cold tolerance of palm is a plain fake in my experience. Here there has been no difference between the ability to withstand cold of the treated and untreated palms . . . Moreover, I can say that too much of it will cause the palm to decline in a hurry . . ."

Various workers, after extensive research, report that potassium in comparatively small dressings produced marked response in yield in coconuts one year after application. In widespread field tests in India, applications of a 1-1-2 resulted in a substantial increase in yield in coconuts from the third year onward. H. Sankarasubramoney found from soil analysis taken in high-versus low-producing areas in India that the high areas contained high concentrations of potash while the soils in areas of low production were low in potash. Most workers report that applications of phosphate gave no increase in yield over plots receiving no phosphate even after eighteen years. At one station in Ceylon, however, response to phosphate application was highly significant. Generally speaking, potash seems to be by far the most important element influencing yield in coconuts.

H. Broeshart found in Trinidad that young oil palms deprived of nitrogen had uniformly yellow leaves. Those lacking potash showed marginal yellowing. In Africa, however, potassium deficiency causes orange or yellow spotting on the fronds. Nitrogen and phosphate do not appear to affect yield there except that excess nitrogen reduced yield.

R. D. Dickey found that curly top or frizzle leaf of *Arecastrum* was completely corrected by applications of one-half to five pounds of eighty per cent manganese sulphate, depending on size of the tree. He suggested applying by plugging, particularly where palms are growing in lawns. The application gave control under conditions of high pH (8.2). A one per cent lime manganese spray gave equally good results. Although curly top is more common on *Arecastrum* in alkaline soils, according to Dickey, it is frequently found on acid soils.

Others are affected. Deficient leaves of *Phoenix canariensis*, particularly young ones unfolding from the bud, are a pale green to a greenish yellow. A number of *Phoenix* species exhibiting frizzled leaf appearance associated with chlorosis have been observed in the Miami area. *Roystonea regia*, *Caryota urens*, *Livistona chinensis*, and *Acrocomia totai* develop a serious disorder similar to that found in *Arecastrum* for which Dickey recommends manganese treatment. Manganese deficiency can become so serious in *Arecastrum* that the new leaves are unable to push out and the tree finally dies. Although chlorosis is usually associated with frizzle leaf, the writer has seen lush green palms showing the characteristic frizzle symptoms.

Species of *Caryota* frequently develop a pale coloration on the alkaline soils of southern Florida which has been corrected in some instances by application of chelated iron. Stanley Kiem, Superintendent of the Fairchild Tropical Garden, has cleared up this chlorosis by application of neutral iron. In some cases iron seems to be ineffective, however, and Dent Smith has never detected an improvement from use of chelated iron in Daytona Beach. After observing numerous unhealthy palms in Dade County over a period of time, the writer

strongly suspects that lack of secondary elements other than manganese and iron may occasionally create a problem.

A condition affecting the lower fronds of various *Phoenix* species resulting in their premature death is very similar to magnesium deficiency described by R. A. Bull in *Elaeis guineensis*. Various workers have established the high magnesium requirement of both oil palms and coconut palms. In the African Oil Palm, *Elaeis guineensis*, symptoms of magnesium deficiency are yellowing and dying of the lower and middle leaflets and vascular necrosis of the rachis. These symptoms disappeared within nine months, according to R. A. Bull, when magnesium was applied at five to ten pounds per palm. It was found that yield increased significantly in response to copper and manganese applications.

It has also been noted that boron and molybdenum deficiencies may also occur in the oil palm. H. Broeshart and others found that the disease known as little leaf was induced when boron was lacking. Lack of sulphur may result in yellowing of the young leaves and intravascular chlorosis.

Although most palms grow in Florida with minimum attention to nutritional and cultural requirements, deficiency diseases exist in many species. The application of nutritional sprays containing copper, zinc, manganese, and chelated iron applied once or twice a year generally keeps palms in vigorous condition. At the same time, research on nutritional requirements of ornamental palms grown in Florida is badly needed to complement that already done on economic palms. The leaf injection method for tracing deficiencies has proved highly effective in African work on the oil palms. Its use is suggested for ornamental species as well.

The importance of proper soil preparation before planting, however, cannot be overemphasized, particularly in sandy Florida soils. In Africa, sandy soils containing less than thirty per cent clay are not considered suitable for oil palms unless large amounts of organic matter are added to the soil thus improving physical structure and compensating for lack of clay in the soil. The same requirements probably hold for a majority of ornamental species in Florida.

## Pruning Palms

R. BRUCE LEDIN

Pruning deals mostly with removal of old and unsightly leaves and fruiting clusters. In clustering species it is often desirable to remove certain stems. The terminal growth is never pruned as in other plants. The terminal bud is dominant and axillary buds, if produced at all, are not capable of development. If the terminal bud is removed the stem dies, and in single trunked plants, the whole plant is lost.

In multiple stemmed palms new shoots are continually produced from under the surface. If some of the older stems are removed, younger ones are left to continue the life of the plant. There is little need for pruning cluster palms. Sometimes it may be desirable to remove some tall shoots growing at the edge of a house. Some examples are: *Caryota mitis*, *Chamaedorea erumpens*, *Chamaerops humilis*, *Chrysalidocarpus lutescens*, *Paurotis wrightii*, *Phoenix reclinata*, *Ptychosperma macarthurii*, and *Rhapis excelsa*. Stems should be cut off as close to the ground as possible. If specimens are vigorous, new and younger shoots will fill in and maintain the plant. Pruning stems of certain cluster palms may also be desirable to keep the plants from spreading—as in hedges, narrow borders, specimen plants—involving the removal of new shoots. Examples are: *Chamaedorea erumpens*, *Chrysalidocarpus lutescens*, *Paurotis wrightii*, *Phoenix reclinata*, and *Ptychosperma macarthurii*.

The leaves and stems of *Chamaedorea seifrizii* are often trimmed to maintain a formal hedge.

In some species of monocarpic clustering palms, especially those of *Arenga*, *Caryota*, and *Wallichia*, the old stems should be pruned out of the clump after the final fruiting as these stems will die shortly anyway after producing the last fruit cluster near the base. The new shoots that surround the old will maintain the clump.

A palm normally maintains only a certain number of leaves, the number varying according to the species and growing conditions. As new leaves appear at the top of the plant the lower and older leaves die. When these leaves turn brown they should be removed.

Many palms do not immediately shed their old leaves. Instead the leaves die

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and remain attached to the trunk until they eventually rot away or are removed by the wind or some other agency. In some cases the blade will fall or break off leaving the petiole base or boot persisting on the trunk for many years. In some species the trunk is self-cleaning, as in the Coconut Palm and the Queen Palm, but in others the petiole bases will remain indefinitely often covering the trunk to the ground, as in *Arenga*, *Arikuryroba*, *Butia*, *Chamaerops*, *Elaeis*, *Phoenix*, *Sabal*, *Trachycarpus*, and *Washingtonia*. Associated with the persistent dead leaves and boots on the trunk may be fibers of various types and even spines. These structures are a characteristic feature of many palms—the familiar “skirt” of dead leaves of *Washingtonia*, the black fibers of *Chamaerops* and *Trachycarpus*, the masses of black spines of *Arenga pinnata*, and the persistent leaf bases of *Phoenix*. Frequently such material accumulating on the trunk can harbor insects, rodents, and often is a fire hazard. It is a good practice, then, to prune off the old leaves as they die, or even before, by cutting or sawing them off as close to the trunk as possible. The boots and fibers will be, in many cases, very difficult to remove until they have rotted away.

There is one group of pinnate palms which sheds the old leaves all in one piece—blade, petiole, and sheath, and pruning of these leaves is not necessary for they fall away from the trunk of their own accord. Examples of these palms are *Archontophoenix*, *Chrysalidocarpus*, *Dictyosperma*, *Mascarena*, *Ptychosperma*, *Roystonea*, and *Veitchia*. When the leaf begins to turn brown it can be removed readily by pulling it away from the trunk. If the palms are small this is easily done, but in certain species, particularly in the royal palms, *Roystonea*, when the trunk becomes tall and the leaves are out of reach, their removal may be difficult. Nevertheless, when these palms are growing in public areas, these leaves should be removed.

Leaves injured by disease, insects, or frost should be removed. In *Sabal palmetto*, *Phoenix canariensis*, and many other species, the leaves may be invaded by the false smut fungus, or by leaf spots, or be attacked by insects. These leaves should be pruned from the plant and burned. In marginal areas palms may

be injured by freezing temperatures in some years. It is usually the lower leaves which are hurt the most and these should be removed as soon as possible. When palms are injured severely by low temperatures, all the leaves except the inner two or three can be pruned but the plant should not be destroyed until it has been definitely determined that it is dead. One should wait at least six months to determine whether or not the palm will survive. If the terminal bud is still alive, it will send out new leaves. If most of the leaf blades have been pruned off and the leaf bases have dried and hardened, the new growth trying to push up may become stunted. It may be necessary to loosen the dried leaf bases as the new growth begins to show to prevent this.

Pruning also involves the removal of old stalks after flowers and fruits have been produced. These should be cut off as close to the trunk as possible. It is also advisable to remove the fruiting clusters of palms which produce large fruits, as the dropping fruit may be a hazard. This is especially true of the coconuts planted in public areas—the falling nuts can injure a person and damage automobiles and even a roof of a house and can result in costly litigation.

Pruning may also be desirable to remove spines on the trunks of certain palms, such as *Acrocomia*, or the lower leaflets of *Phoenix*, especially if these palms are planted in a public area.

In pruning palms a pair of sharp pruning shears or clippers or a sharp saw should be used. For tall palms, it will be necessary to use a pole saw or pole clippers in order to reach up into the crown to cut the leaves and old fruiting clusters. It is a good practice on large leaves to undercut, that is, to cut from beneath. One should not prune carelessly by making bad cuts, nor should one attempt to pull off old leaves or flower spikes before their normal shedding time. If this is done, it is very easy to tear the tender top of the trunk and to cause permanent damage to the palm. Also, one should not remove too many green leaves or old leaf bases at one time for this will expose the tender part of the trunk and as a result it will dry and shrivel and develop vertical cracks which will never heal over and provide an entrance for rot.

## Palm Insects

Many insects and mites are known to infest palms. They kill some, injure others. They make many palms unsightly. In general, all parts of the plant are susceptible to attack. Unusual vigilance is required to detect pests and to control infestations before extensive damages.

The Coconut and Date Palms produce important articles of world commerce; more studies have been conducted on their problems and solutions than on palms of ornamental value. Part of this research is adaptable to palms used as ornamentals. Other investigations have been made on other palm insects and some results are quoted in this paper. Continued research is urgently needed, however, on many palms used in ornamental plantings.

D. O. WOLFENBARGER

Some insects present on palms are harmless to the plant; some are even beneficial. Most species damaging to the plant are kept in check by their enemies which include other insects—some microscopic, others larger. Lady beetle larvae, pupae, and adults were blamed for the scale insect epidemic of the Coconut Palm in southeastern Florida in 1956. The scale populations infesting the fronds reached their peak before most people realized it. Hordes of lady beetles feeding on the scale insects, appearing about the time the palms were most unsightly, were blamed for the premature yellowing and death of the fronds. The onset of this epidemic began in May, reached its peak about August. Chemical control measures should have been applied in early June.

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Injurious epidemic populations of insect pests develop occasionally on palms as on other kinds of plants. These epidemics occur on palms of a single species rather than on palms as a general group. Losses and injuries from insects occur, however, without an epidemic. Isolated plants are frequently attacked as are those within groups.

Scale insects regularly infest palm trees and are probably the most prevalent insects. Commonly observed species include the coconut scale, *Aspidiotus destructor*; Florida red scale, *Chrysomphalus aonidium*; dictyospermum scale, *C. dictyospermi*; the latania scale, *Aspidiotus lataniae* and thread scale, *Ischnaspis longirostris*.

Severely infested palm fronds lose the green color, become yellowish, then brown and die prematurely. An entire plant, however, has not been observed to die from scale insect attacks.

Homeowners who wish to treat palms for scale insect control will get most effective results from spray applications. An oil emulsion spray containing one and one-quarter to one and one-third per cent actual oil in water is effective. Palms can be injured by oil emulsions. Parathion at 0.15 to 0.30 pound active ingredient per hundred gallons of water is more effective and less likely to injure plants than oil emulsion. Parathion is very toxic to man and other animals. It should be used with caution and only on trees where man or his pets are not likely to be injured. Malathion is safer to man and his pets and is effective for control of many scale insects but is less effective than parathion or oil emulsion for control of the armoured scales such as the Florida red and dictyospermum scales. Malathion at one pound technical ingredient per hundred gallons of water is the suggested rate of application. Three quarts of emulsifiable oil combined with one pound of actual malathion per hundred gallons of water may be substituted as an equal for the parathion in scale control.

Careful consideration should be given to many factors before embarking on a program using chemical treatments for control of scale insects on trees along streets, in parks, and on other public property. Size of trees makes coverage difficult and lessens chances of getting effective control since the toxicant must contact each insect. Drift of spray mixtures to nearby objects and adjoining properties may be undesirable or even injurious. Cost of effective and thorough applications for preservation of some greenness of fronds may not make treatments worthwhile since trees are not actually killed by scale insects.

The coconut mealybug, *Pseudococcus nipae*, infests many species of palms. The coconut mealybug along with *P. citri* and *P. virgatus*, may be found on the Coconut Palm in Puerto Rico, but are not important pests. *P. adonidum* (previously termed *P. longispinus*) was listed as an "important minor pest" feeding on coconut leaves in South Malabar. Petioles and leaf bases of the Date Palm

in Libya are always infested with small numbers of *Pseudaspidopectus hyphaeniacus*, but this species is of little importance. Other species may be taken from various palm species. Mealybugs are not sufficiently important palm pests to make chemical control necessary except on potted plants or on trees in scattered locations.

A number of methods may be used by owners of small or potted plants to control mealybug and scale insects. The particular method used depends on the plants and the materials at hand. Hand picking with tweezers or fingers may be used. A small camel hair brush may be used to touch each insect with some toxicant. Oil of almost any kind that may be available may be applied to each insect but care must be taken that no oil reaches the plant. Small piston-type hand sprayers may be used to spray the plant. Oil emulsion materials designed especially for indoor and garden plants applied according to recommendations should be effective.

Populations of *Cerataphis lataniae* are usually so low as to be of no importance. This aphid appears from the records in the West Indies, Colorado, the Philippines, and Mauritius, to have wide, perhaps world-wide distribution. It is unlike many aphids in that it secretes white waxy strands which surround each individual. Its sedentary habit, black color, waxy secretions and flattened appearance are suggestive of scale insects or white flies for which it may be mistaken. Although this was termed the coconut aphid several or many species of palms may be infested. Potted or indoor plants or those growing out of doors may be infested.

Aphids were recently so numerous on Alexandra King Palm, *Archontophoenix alexandrae*, that a request was made for information on recommended control measures. Although a parathion spray was recommended (1-1/2 pounds, fifteen per cent wettable powder per hundred gallons of water) for this case other aphicides, such as nicotine sulphate at the rate of one teaspoon of forty per cent material per one gallon of water, would give control.

Fronds and flowers appear more susceptible to attacks by larvae of moths and butterflies than other parts of palm plants. Leaf eating by caterpillars may

go unnoticed until there is much injury. Most of the larvae are parasitized and perish without having been observed or having been of importance.

Palms of several species are attacked by the palm leaf skeletonizer, *Homaledra sabalell*. It was a major pest in the decade 1930-1940 in Florida, and is common today but the populations are sparse. Larvae of this insect are small, less than a half inch in length, and feed in groups on the leaflets.

One of the common skipper moths, *Asbolis capucinus*, feeds on Coconut Palm fronds so extensively that only the vein of a leaf segment remains. This larva has a large dark colored head connected with the body by a strongly constricted neck. It has not been abundant in Florida or Cuba.

Three species of *Batrachedra* moths injure three or more palm species. A small, whitish to light tan colored larva, *B. mathesoni*, feeds on coconut bloom in Florida and Puerto Rico. Sufficient webbing is produced by the larvae to contain bloom husks and other debris which makes an unsightly mass. Nut production is apparently reduced by larval feeding. Such reduction in parks and on street trees, however, may be of benefit since liability for injuries from falling nuts necessitates removal of fruits before they fall. Coconut flowers were damaged by *B. arenosella* in India.

Caterpillars on palms may be controlled by treatments with many of the older and newer insecticides. Lead arsenate sprays, three pounds per hundred gallons of water, is suggested. Thorough wetting of the infested parts is recommended.

Bagworms are encased and seen frequently as grayish green colored, cylindrical objects projecting perpendicularly from the trunks of the Royal Palm. These cases project a quarter to three-eighths inch from the trunk and are about an eighth of an inch in diameter at the base but taper somewhat, especially the outer sixteenth of an inch. This bagworm was identified as *Prochalia pygmaea*. The larvae, within the bags, feed on lichens which grow on the tree trunks and do not harm the palm.

Very small ambrosia beetles attack and frequently kill palms. One species was tentative identified as *Xyleborus affinis*. Burrows of these beetles are usual-

ly constructed in logs or stumps of recently cut or killed trees or in trees of low vitality. Trees having low vitality are more susceptible to attacks. Ambrosia beetles are contaminated with fungi which they introduce into the burrows. Larvae hatch from the eggs deposited in the galleries and develop by feeding on the mycelia of the fungus. The fungi extend into the tree trunk tissues and often cause the palm to perish. It is frequently impractical or impossible, however, to determine whether the beetle infestation, fungal invasions or the low tree vitality was the most important factor in the death of an individual palm. Sometimes a nearby log pile or dump of removed trees may be the source of an unusually dense population of beetles.

Control of ambrosia beetles is generally achieved by keeping the palms in vigorous condition and by destroying or removing infested logs or plants. It is recommended that those who wish to spray for control of the beetles use two pounds of ten per cent gamma-isomer of benzene hexachloride or one pound of twenty-five per cent gamma-isomer of lindane per five gallons of water, wetting each plant thoroughly.

Infestations of the palmetto weevil, *Rhynchophorus cruentatus* occasionally kill trees. This beetle infests *Sabal palmetto*, *S. umbraculifera*, and *Phoenix canariensis*. Early indications of infestations are drooping and falling fronds. Such fronds are often loose enough to be pulled from the trunk. Larvae of a related species, *R. palmarum*, is the most destructive pest of the Coconut Palm in the West Indies, but the larvae occur in other palms and also in stalks and root-stalks of sugar cane. These larvae are termed "gru-gru" in Puerto Rico and are used for food. Fermenting sap in a wound attracts beetles which deposit eggs in or on tissues from which sap is exuding.

Three methods of control of the beetle are available: 1. Prevent injury to trees. 2. Destroy infested trees and logs. 3. Apply chemical treatments. Infested trees and logs should be destroyed before adult weevils emerge. Infested trees may be saved, however, if the infestation is found in the early stages and is treated before the growing point in the palm is attacked. Thorough drenching with lindane, benzene hexachloride, dieldrin



or DDT sprays is recommended. Amounts to use are: lindane, twenty-five per cent wettable powder, one pound; benzene hexachloride, ten per cent wettable powder, two pounds; dieldrin, twenty-five per cent wettable powder, one pound; or DDT, fifty per cent wettable powder, two pounds; all per hundred gallons of water. These may be applied by a spray operator riding a lift platform so the sprays are directed from near and slightly above the terminal bud.

Infestations of the royal palm bug, *Xylostodoris luteolus*, on the Royal Palm have caused more concern among those interested in palms than have other true bugs. Only five species of Heteroptera were listed as important pests of the Coconut Palm. These were listed as injurious to inflorescence or as sucking juice from tender leaves. Rare infestations of the cotton lace bug, *Corythuca gossypii*, were reported on the Cuban Royal Palm. A lace bug, *Stephanitis typicus*, was the only member of the order Hemiptera attacking Coconut Palm.

The royal palm bug was controlled by sprays of chlordane and dieldrin. Emulsion and wettable powder formulations were equally effective at one pound technical chlordane or one-quarter pound technical dieldrin per hundred gallons of water. A lift is an important mechanical aid for use in wetting the growing point. Airplane applications were not satisfactory in reducing bug populations. Either of these spray treatments should control other bugs on other palms.

Termites frequently invade trunks of palm trees. These infestations occur apparently in trees of low vitality where the tissues have become nearly lifeless. Unsightly trunk scars may occur. The smooth-headed powder post termite, *Cryptotermes cavifrons* has been taken from Royal Palm trunks.

The best control is achieved by keeping trees healthy. Applications of aldrin, chlordane, dieldrin or heptochlor should reduce the infestations.

Infestations of the greenhouse thrips, *Heliothrips haemorrhoidalis*, were observed in great abundance on Royal Palm fronds. These insects remove or destroy the green color in leaves by rasping leaf tissue and sucking plant juices. Infestations begin on young fronds where the insects feed and cause the frond to become yellowed, then brown in color. The leaves die prematurely and give an unsightly appearance. Three species of flower thrips, *Frankliniella difficles*, *F. williamsi*, and *Haplothrips gowdeyi*, were reported as infesting coconut flowers.

Dieldrin, four ounces of the technical material per hundred gallons of water, is suggested for use as a chemical control measure. Wettable powder and emulsion formulations are satisfactory. Thorough wetting of the growing point and young fronds is recommended.

Infestations of mites occur on fronds and give rise to unsightly yellowed and premature death of the foliage. Leaves appear dry and the leaf surfaces have a powdery appearance in early stages.

The tumid mite, *Septanychus tumidus*, infestation was severe on Royal Palms in a nursery in the Everglades National Park, Florida. *Brevipalpus* sp. has been taken from Coconut Palm fronds where it was damaging to leaves. These mites have been more injurious to nursery and young palms in Florida than to mature trees. Date Palms in inland oases are heavily attacked by *Oligonychus afrasiaticus*. Webs of the mite hold nymphal exuviae, dust, and sand particles, making a grayish colored coating on the dates.

General unhealthy appearing leaves and general weakening of young palms were reported to result from feeding by *Raoiella indica*.

Sulfur dust or wettable sulfur (ten pounds per hundred gallons of water) is recommended for use if chemical control is needed. If sulfur is ineffective one of the newer miticides, Kelthane, Tedion, or Chlorobenzilate, may be tried, applied according to the manufacturers' recommendations.

## Palm Diseases

LORNE A. MCFADDEN

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Once established, palms are usually easy to maintain disease free. A wide variety of parasitic or saprophytic organisms, however, do occur on palms.

Butt rot disease, believed caused by the fungus *Ganoderma lucidum* (*G. sulcatum*), has been reported in Florida and elsewhere. Palms attacked are: *Arecastrum romanzoffianum*, *Cocos nucifera*, *Phoenix sylvestris*, *Serenoa repens*, *Phoenix canariensis*, *Sabal palmetto*, *Arikuryroba schizophylla*, *Areca catechu*, and probably others. The disease spreads rapidly in neglected plantings, particularly if diseased palms are not removed promptly. This disease is important since it attacks palms ten years and upward in age; such palms are of great value in ornamental and economical plantings. First evidence of the disease is poor growth and vigor. Lower leaves turn yellow and die, hang down, giving a general drooping effect; new leaves become progressively smaller until only a few dead leaves remain. It may be months or possibly years before a palm finally dies. The yield of coconuts is reduced; exudation of a sticky reddish-brown juice occurs near the base. When cut open, the interior trunk is brown for several feet above the ground. Advanced margin of decay is yellowish and the rotted tissue emits a musty odor.

The fungus spreads through the soil and air-borne spores. Spores are borne in a mushroom-like structure growing from the trunk and root of the diseased palm, at first grayish and spongy, later becoming hard with brownish, lacquered upper surfaces. Mature spores fall from the under surface and are wind disseminated.

Control of the disease is difficult since the fungus is well established before visible symptoms appear. Root and trunk injury to palms should be avoided, as the fungus probably enters through such wounds. Susceptible palms should not be planted in damp locations or where shrubbery causes excessive shading. Infected trees including sporophores should be removed and burned. The application of fine sulfur to the soil around the trees was found helpful in Mysore.

Phytophthora trunk rot was reported occurring in California on plantings of

*Washingtonia filifera*. Leaves rapidly die due to the rot that develops at or near the base of the trunk. Within two to three months the rot becomes soft and spongy. Young seedlings, when inoculated, were noted to die within ten days. The roots of diseased palms are apparently not rotted. The causative organism is thought to be a water mold, *Phytophthora parasitica*, and infections are believed to occur through wounds under wet conditions.

A trunk canker of *Arecastrum roman-zoffianum* caused by *Penicillium vermoseni* occurs in California. A leaf base rot of *Phoenix canariensis* and a bud rot of *Washingtonia filifera* are caused by the same fungus.

In Arizona, a root rot of *Washingtonia filifera* was observed in the Salt River Valley in early 1935. The leaves of affected palms die from below upward to the crown and finally the terminal bud dies. Diseased roots turn brown and become water-soaked. The cause of this disease is not known.

Red ring is a disease of *Cocos nucifera* occurring in Brazil, Venezuela, Colombia, Panama, and elsewhere, caused by a nematode, *Aphelenchoides cocophilus*. The nematodes feed in the periphery of the cortex of young palms, releasing a toxic substance which kills affected trees. The region in which large numbers of nematodes are actively feeding turns red-brown in color. Mature palms are not attacked by the nematodes. Infected trees should be removed and burned.

Wilt and trunk rot occurs on *Cocos nucifera* and *Roystonea regia*, at Ft. Lauderdale and Key West, Florida; it was briefly described in 1957. Symptoms of the disease include wilting and graying of lower leaves, accompanied with a gum-like exudate along the trunk. When the trunk of an infected palm is split open the vascular tissues adjacent to the point of leaf attachment may be orange-red in color and brown longitudinal streaks are often evident on diseased fronds. The lower leaves wilt and die prematurely. Disease development is rapid, resulting in a complete breakdown of the interior trunk prior to death of the bud. Cause of the disease is not known.

Coconut Palm bud rot caused by *Phytophthora palmivora* is one of the most destructive palm diseases occurring

wherever palms of any age are grown.

During seasons of normal rainfall, bud rot is usually not serious; however, during wet seasons or after hurricanes this disease is frequently troublesome. This is probably due to mechanical damage which makes conditions favorable for the fungus to enter the bud; the fungus also is highly dependent upon water and wind for its dissemination. Small coconut seedlings under crowded, wet conditions in the nursery are at times killed by this fungus.

Symptoms of the bud rot disease include wilting, yellowing of the leaves, and finally death of the terminal bud. Once the bud is killed the life of the palm is terminated. Infected bud tissues are quickly reduced to an odoriferous, gelatinous mass from which many saprophytic organisms may be isolated. *Phytophthora* bud rot is also said to occur on *Borassus flabellifer* and *Areca catechu*.

Bacterial bud rot was first observed in the West Indies and Mauritius in 1913 on *Roystonea* and *Areca catechu*. It is caused by a bacterial parasite, *Xanthomonas vasculorum*. A bud rot of *Dictyosperma album* has also been traced to the same cause. On royal palms the disease is characterized by wilting, yellowing and browning of the leaves which later become dry and brittle. Upon cutting open the cabbage leaves, the core area is found to be reduced to a vile-smelling soft rot. A yellow gum-like substance exudes from the vascular vessels when the fronds are cut. As the rot progresses, infected trees become top heavy and the crown falls over. On *Areca catechu* the disease is characterized by small brown areas in affected tissues.

The cause of "unknown" disease of the northern Caribbean and bronze leaf wilt of the southern Caribbean and West Africa has not been directly associated with any recognized parasites. Likewise, the cause of *cadang-cadang* in the Philippines and a root disease of coconut palms in Southern India is not known.

Palms infected with unknown disease and bronze leaf wilt usually die within four to six months after the first symptoms appear. Yellowing of the outer fronds accompanied with nut fall occurs prior to death of the bud. Bronze leaf wilt causes an earlier leaf wilt and often the older nuts are not shed, whereas in

the unknown disease the yellowing foliage remains turgid until the bud dies and all the nuts are shed. Bronze leaf wilt usually attacks older trees. When healthy palms are replanted in areas where the unknown disease occurred, they also become infected within two or three years.

Symptoms of *cadang-cadang* disease of the Philippines include yellowing of the crown and a gradual reduction in size of leaves and a tapering of the stem. Decline of infected palms is gradual prior to actual death.

An unknown disease of the Coconut Palm occurring at Key West, Florida, resembles in many respects the so-called lethal yellowing disease of coconut in Jamaica. Symptoms include dropping of fruit and a progressive yellowing and withering of the leaves. Affected trees should be removed and burned, since no other known treatment will arrest the disease. The disease has not been observed on the Florida mainland, although danger of spread from the Keys area still exists.

Several palm leaf and twig spots have been reportedly caused by the anthracnose fungi (*Colletotrichum*, *Gleosporium*, *Glomerella*). Leaves and stems of Fish-tail palms and others become blighted due to numerous spots which coalesce, causing entire leaflets and fronds to die. Elongated grayish spots with brown borders characterize the anthracnose diseases. Upon close observation, tiny black spore-producing structures are visible in the center of the spots. Under moist conditions rose-colored spores ooze out in mass and are splashed by rain to adjacent leaves. Nurserymen have experienced good control using frequent applications of either maneb or ferbam fungicides and by avoiding overhead watering.

Many species of palms, particularly *Phoenix dactylifera* and *P. canariensis*, are susceptible to attack by the false smut fungus, *Graphiola phoenicis*. Infected leaves contain numerous dark, scablike spots or warts with powdery brown or yellow centers. Under magnification, long flexuous sterile hyphae or threads may be seen. Destroy infected leaves and spray plants with a fungicide. Avoid overhead watering.

The fungus *Pestalotia palmarum* is reported to occur on leaves of *Cocos nu-*

*cifera*, *Arecastrum romanzoffianum*, *Howeia forsteriana*, *H. belmoreana*, and *Phoenix dactylifera*. It is not an aggressive parasite. It causes leaf spots on old or weakened palms; young palms exposed to long periods of cold weather frequently develop leaf spots in large numbers.

Leaf spots characterized by oval to irregular sunken spots having tan centers with a definite margin are caused by the fungus *Helminthosporium*. Seedlings of *Roystonea regia*, *Arecastrum romanzoffianum*, *Howeia*, *Cocos nucifera*, *Phoenix*, *Sabal*, and *Thrinax* may be attacked. Under moist humid conditions and high temperatures the spots coalesce, forming large necrotic areas which may involve the entire leaf, killing the young palms. Regular spray applications of either maneb or ferbam have given control.

A leaf spot fungus, *Cylindrocladium macrosporum*, was first described in Florida, occurring on seedlings of *Washingtonia robusta*. The spots are numerous, round to oblong, small, dark in color with translucent borders. The surface of the spots is smooth except in moist or damp weather when they become covered with a thin whitish growth. Spread and development occur when moisture is present and where poor air ventilation exists. Control is largely a matter of providing good ventilation and keeping the leaves dry.

A leaf spot common on many palms is caused by the fungus *Exosporium palmivorum*. The disease is usually found on plants grown under greenhouse or lath where insufficient light is provided. The spots are small, round, yellowish and transparent. These areas coalesce to form large irregular gray-brown blotches which may result in death of entire leaves. Severity may be reduced by removing infected leaves and spraying the foliage with a fungicide.

Diamond leaf spot or diamond scale has been reported to occur in California. The causal fungus, *Sphaerodothis neowashingtoniae*, produces elongated diamond-shaped black shiny pustules on the surface of leaves and leafstalks of *Washingtonia*. Affected leaves may live for several years but heavily infected trees eventually die. Diseased leaves should be removed and the plants sprayed with a good fungicide.

## Cold Tolerance of Cultivated Palms

DENT SMITH

During the past seven years the writer has maintained at Daytona Beach, Florida, a collection of several hundred planted palms ultimately containing upwards of a hundred and thirty-five species belonging to sixty-four genera. The purpose of this planting has been twofold: 1. to make a more northern palm garden of as many different palms as might be grown; 2. to determine what species could endure the colder winters of a region nearly two hundred miles north of the Florida latitudes considered warm enough for success in growing any really large number of species.

The second consideration was an experiment full of risks, for the weather records revealed that the Daytona Beach area had been subjected, occasionally, to invasions of deep cold even though the outbreaks usually had occurred many years apart. However improbable, a heavy freeze may descend upon the area in any winter, and several such freezes actually did occur in the winter of 1957-1958, with the inevitable dire results to most tropical plants. The latest outbreak of comparable cold had been eighteen years earlier, in late January, 1940, when a temperature of eighteen degrees Fahrenheit established an absolute minimum in the records of the Weather Bureau station. During the interval of eighteen years between the two outbreaks only a negligible number of the myriad tropical plants had been winter-killed in the warmer parts of the area. Perhaps no planted palms at all had been killed during the period, but only the hardier kinds had ever been generally planted.

The main object of this article is to record as accurately as possible the effect of the 1957-1958 winter's multiple freezes upon each of the planted palm specimens in the writer's collection. In order for such a report to be of much value to subtropical gardeners it becomes necessary to go into some detail about the location, the climate, and other factors affecting the palms, so that the gardener may relate the facts (temperatures, etc.) to his own situation and perhaps draw practical conclusions.

Daytona Beach is on the east coast of Florida, at latitude twenty-nine degrees eleven minutes North about four hun-

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dred and twenty-five miles north of Havana and about three hundred and sixty miles north of the Tropic of Cancer. The distance north from Miami is two hundred and sixty-three road miles or two hundred and forty-two miles in a straight line. The climate is classified as "humid subtropical" and according to a climatological summary of the U. S. Weather Bureau ". . . is characterized by mostly sunny days, gentle breezes, and pleasant year-round temperatures, suitable for bathing and sunning at the beach every month of the year. . . . Average annual temperature is seventy-one degrees." But there are, in fact, two separate winter climates in Daytona Beach, that of the mainland and that of the peninsula, a narrow strip of land confined between the salt-water Halifax River and the open Atlantic. The palm collection dealt with here is located on the peninsula, which is more subject to marine influences and hence distinctly warmer in winter.

This usually benign climate was reversed by three months of record cold weather, suddenly beginning with a light frost on December 2, 1957, followed by hard freezes on December 12 and 13, when minima of twenty-five and twenty-seven degrees were recorded. These two freezes destroyed all the foliage of about half the writer's palms and damaged that of certain others. Although the recorded twenty-five-degree temperature was the absolute minimum for the three winter months, much worse was yet to come, in January and February, 1958, in the form of continuous cold weather punctuated by eight additional freezes—a total of eleven during the three months. For severe and protracted cold this was by all odds the coldest winter in the history of the local Weather Bureau and in the memory of the oldest lifetime residents. At last here was something an experimenter with palms could sink his teeth into: a trial by cold of historically unheard-of duration, for it eclipsed anything experienced here in over fifty years.

Obviously the result to the palms was calamitous, but by no means was it a total catastrophe. Had it been total, there would be no point in writing this report. Besides the palms already known to be remarkably cold-hardy, a few hitherto believed tender, by surviving unscathed, were proved equally hardy or

nearly so. Many others that were defoliated or otherwise injured fully recovered, or were definitely recovering, eight months after the first freezes. Much of the greater number of the so-called tender palms, however, were killed and conclusively proved not even slightly tolerant of hard freezes.

Without wanting to appear in the least didactic, the writer must make it clear that only a close study of the factors involved—and there were many—could avoid certain misleading conclusions. For example it would be wrong to conclude, from the summary appearing near the end of this article, that the royal palms, just because three specimens here unquestionably recovered, can take anything produced by the whims of subtropical weather; on the contrary, only large, older specimens can survive repeated freezes and young ones will surely perish if not protected. The reverse of this is to conclude, and again wrongly, that a planted specimen of *Drymophloeus beguinii*, say, will succumb to one short freeze of twenty-five degrees simply because one specimen was finally killed here by the later freezes of the past winter, in February. Actually dozens of palms were not visibly affected by the first few freezes here, but were eventually killed by much later ones.

The whole matter of plant injury and survival here is complicated, and not only by the fact that there were eleven freezes during the winter instead of just one. Though the thermometers were housed in the prescribed standard shelter for such instruments, the recorded temperatures do not allow for the differences bound to exist at various locations on the premises. Temperatures may vary by several degrees within only one hundred feet (much more vertically), depending usually on a change in ground level, on proximity to foliage or solid objects, and on air circulation. But there were other factors, of which the principal was insect attack upon freeze-weakened plants. Which one of the eleven freezes finally killed a palm? Which palms finally succumbed to insect attack instead of primarily to cold destruction? These questions are not easily answered, but in the summary towards the end of this report the writer attempts to answer them in every ascertainable case. No attempt, however, is made here to account for numerous other consider-

ations, as, for instance, the moisture content of the plants or the soil, the vigor of the specimens, nor in all cases the size and age of the palms. These are but a few of the factors that directly bear on the subject, and indeed to deal with every one would require more than the available space.

About a quarter of the palms killed owed this outcome directly to bud infestation by insect larvae and only indirectly to cold injury. In many cases an apparently healthy bud appeared only to sicken and die, whereupon it was pulled out and found heavily infested in its soft basal parts with larvae resembling maggots. Unfortunately the insect responsible for these larvae was not discovered, but without presuming to name the culprit, a fly was suspected. The larvae infested the buds of not only the freeze-injured palms but also of thirty or more uninjured palms in perfect vigor. In the latter case the insect showed a preference for the species of *Arecastrum*, seven of which were attacked and their buds destroyed by larvae; but all of these palms fully recovered, for they and some of the other cocoids are able to thrust up a new leaf bud when one is destroyed—an ability notably shared with the *Phoenix* and certain other palms not allied with *Arecastrum*.

Presumably the freeze losses could have been reduced by the use of several hundred grove heaters or some other kind of artificial heating. The temperature could have been raised several degrees by such methods, but this would have defeated the purpose of learning the true cold-tolerance of the palms. For this reason no artificial heat was used at any time, and the palms were strictly on their own. On the morning of each of the heaviest freezes it might have been legitimate to sprinkle the frosted palm foliage to prevent the rising sun from thawing it too fast, but this could not be done because the irrigation system was frozen solid.

Defining a freeze as each time the temperature dropped to thirty-two degrees or lower, there were during this historic winter of eleven freezes a total of approximately sixty-three hours of freezing weather. The first one, which was also the shortest, occurred on December 2 and lasted but twenty minutes. The longest one occurred on January 9 and lasted thirteen hours. (Actually the

latter freeze began at 8:30 p.m. on the 8th and ended at 9:30 a.m. on the 9th, but the weather reports at the writer's station have been made once daily covering the twenty-four hours from 5 p.m. of the previous day to 5 p.m. of the day newly reported, for the reason that the thermometers are read but once each twenty-four hours.) December had three freezes with twenty hours of freezing weather, January had one with thirteen hours, and in February there were four freezes on consecutive days with thirty hours. No temperatures below freezing were recorded during daylight after ten in the morning. The most damaging weather occurred in mid-February, when the minimum temperatures were in either the twenties or thirties on nine consecutive mornings. A good many of the tropical palms that had survived all seven preceding freezes—some of them virtually unaffected—at last were killed by the sustained cold of February, which was the winter's parting shot. No frost recurred after February 20th.

Including the palms in containers there were represented in this collection, before the freezes, over two hundred and fifty species in more than a hundred genera. About half of the potted palms were casualties, but this account is concerned only with planted specimens, of which there were four hundred and forty-five. More than half of these were still very small juveniles, and hence less resistant to cold.

In the alphabetical summary below, an account is made for each palm. Brevity occasionally has been sacrificed in favor of detail that may be essential. Because the size of a palm has a great deal to do with its cold resistance, the overall height of each specimen is shown in either feet (') or inches ("). Figures in parentheses signify the total number of individuals of each species.

*Acanthophoenix rubra* (1), 20", killed Dec.

*Acrocomia aculeata* (2), 11' and 17', both severe foliage damage Dec., total loss remaining foliage Feb., recovery slow but complete July 1960. *A. fusiformis* (1), 20", unaffected. *A. totai* (1), 10', unaffected at any time. *A. mexicana* (1), 2', slight damage Dec., seemingly dead Feb., began recovery late Mar., fully recovered Aug. *A. sp.* (1), 3', quickly recovered from very slight damage.

*Aiphanes acanthophylla* (2), 5' and 8', both killed outright Dec. *A. caryotaefolia* (1), 11', killed Dec. *A. erosa* (1), 3', killed Dec. *A. lindeniana* (3), all 2', two killed Jan., the third apparently dead also but began recovery July 3, recovery complete in 1959.

*Archontophoenix alexandrae* (4), one of 9', two of 15', one of 25'. Slowly died from effects Dec. and Jan. freezes. Woody stems as well as foliage destroyed. *A. cunninghamiana* (2), 11' and 16', foliage of both gradually made unsightly but none of it destroyed, buds of both killed by larvae early June despite drenchings of malathion solution, smaller died early July, larger slowly recovering after July 15.

*Areca catechu* (1), 4', killed Dec. *Areca triandra* (2), 4' and 8', slight damage to the smaller Jan., severe Feb., died May from insect attack. Minor damage to foliage of the larger Dec., more in Jan. and Feb., 3 stems killed by insects Mar., 1 stem alive and rapidly growing. *A. sp.* (2), 3' and 5', killed Jan.

*Arecastrum romanzoffianum* (8), 8' to 24', unaffected.

*Arenga engleri* (3), 4' to 9', unaffected. *A. pinnata* (1), 7', foliage destroyed Dec., pruned back to bare 2' stub. A stunted leaf appeared in late June. Recovery extremely slow but complete Aug. 1960.

*Arikuryroba schizophylla* (1), 8', only minor damage early freezes, severe in Feb., lingered till mid-Mar. and died.

*Bactris gasipaes* (1), 6', killed Dec., new suckers have since risen from roots.

*Bismarckia nobilis* (1), 1', unaffected.

*Butia capitata* (4) 1', 5', 7', and 13', all unaffected. *B. eriospatha* (1), 6', unaffected.

*Caryota mitis* (6), 6' 8', 9', 12', 20', most or all foliage destroyed Dec. except of shaded suckers. The three smaller specimens killed Dec., the three larger alive only through the three to six suckers in each clump. *C. urens* (3), two of 8' and one of 16', the two smaller killed Dec. but the largest, also apparently dead, began recovery late Apr., full recovery in 1959. *C. sp.*, rec'd as *C. cumingii* (1), 2', killed Dec. *C. sp.*, rec'd as *C. "plumosa"* (1), killed Feb.

*Chamaedorea brachypoda* (1), eleven stems to 2', six stems killed Jan., five uninjured. *C. cataractarum* (1), 2', unaf-

ected. *C. costaricana* (1), 2', one stem killed Dec. and one Feb., recovered fully with many new stems in 1959. *C. elegans* (3), 1' to 4', all unaffected. *C. erumpens* (12), two weak plants killed Feb., ten alive suffered very slight to moderate injury. *C. fragrans* (1), 3', killed to ground Jan., new stem of this single-stem plant rose from roots late June. *C. ernesti-augusti* (1), 1', foliage shabby from repeated freezes, larvae destroyed bud, but recovered in 1959. *C. klotzschiana* (1), 5', unaffected. *C. oblongata* (1), 3', severe injury Jan., killed Feb. *C. radicalis* (2), 10" and 16", smaller killed Feb., larger unaffected. *C. seifrizii* (1), 3', unaffected. *C. tepejilote* (2), each 18", both killed Dec. *C. sp.* (11), 1' to 3', four of these several undet. species killed Dec., remaining seven uninjured.

*Chamaerops humilis* (2), 1' and 6', both unaffected.

*Chrysalidocarpus lutescens* (5), 7', 9', two of 10', 12', severe injury to foliage and stems Dec. except shaded suckers, one killed outright Feb., remainder alive only through new suckers and shorter stems. *C. sp.* "Soledad" (2), 2' and 3', minor injury to both Dec., larger killed Feb., smaller no further injury till May when killed by insect larvae.

*Coccothrinax argentata* (1), 2', injured Jan., killed Feb. *C. crinita* (2), 1' and 2', very minor damage to foliage of smaller, larger totally uninjured, obviously suitable for the climate. *C. dusiana* ? (1), 3)', unaffected. *C. sp.* (1), 2', killed Dec.

*Cocos nucifera* (9), 3' to 13', five killed Dec. incl. one dwarf Malay, two killed Jan., two killed Feb., all severely injured unless killed by the first hard freeze.

*Corypha umbraculifera* (1), 10", damage quite minor, killed by insect larvae late Mar.

*Cryosophila warszewiczii* (1), 2', seemingly killed Dec. when stem pruned back to 3" stub, first new leaf mid-June, full recovery in 1959. *C. sp.* (1), 3', killed Dec.—or, one might well ask, would it not have recovered if it had not been grubbed out and discarded?

*Dictyosperma album* (4), 2' to 9', all except smallest severely injured Dec., no recovery, but smallest persisted with only minor damage till May when killed by insect larvae. *D. album* var. *rubrum* (1), 8', killed Dec.



*Drymophloeus beguinii* (1), 4', unaffected by first seven freezes, killed Feb.

*Elaeis guineensis* (3), 2', 8', 11', total destruction foliage of all Dec. and all presumed dead till late June when the bare stub of the former 8' palm erected a first leaf only to be killed by insect attack.

*Euterpe edulis* (1), 4', killed Dec.

*Gaussia attenuata* (4), 2' to 3', all killed Dec.

*Geonoma* sp. (1), 3', stem killed Dec., suckers killed Jan.

*Hedyscepe canterburyana* (1), 10'', killed Dec.

*Heterospatha elata* (1), 4', severe injury Dec., killed Jan.

*Howea belmoreana* (1), 3', killed Dec. *H. forsteriana* (5), 2' to 7', all but one of only 2' killed Dec., but inexplicably the two-footer was uninjured at any time.

*Latania borbonica* (5), 1' to 5', all minor to moderate leaf damage Dec., more extensive Jan., all killed Feb. except for one small specimen that lingered on till killed by larvae late July.

*Licuala grandis* (2), 10'' and 16'', only minor damage to foliage of either through first seven freezes, smaller killed Feb., larger never did lose quite all its foliage and recovered in 1959. *L. peltata* (1), 14'', unaffected Dec. and Jan., killed Feb. *L. spinosa* (1), 1', weak plant, killed Feb.

*Livistona australis* (1), 3', unaffected. *L. chinensis* (5), 3' to 5', none affected. *L. cochinchinensis* (6), 2' to 4', none affected. *L. rotundifolia* (2), 1' and 3', the smaller killed Jan., the larger lost half the foliage but fully recovered by late midsummer.

*Mascarena verschaffeltii* (7), 2' to 8', foliage of all seven destroyed Dec., no recovery of six; seventh recovered partially June only to lose bud to larvae.

*Mauritia setigera* (1), 2', killed Dec.

*Metroxylon amicarum* (1), 3', killed Dec.

*Nephrosperma vanhoutteanum* (1), 1', killed Dec.

*Opsiandra maya* (11), 2' to 6', all killed Dec.

*Orbignya cohune* (1), 2', unaffected. *O. speciosa* (4), 1' to 2', injury none to inconsequential, apparently hardy here.

*Parajubaea cocoides* (1), 20'', unaffected.

*Paurotis wrightii* (2), 3' and 7', unaffected.

*Phoenix*. Plants of the following species were in no way affected: *P. "abys-sinica"* (1), 6'; *P. canariensis* (4), 2' to 12'; *P. dactylifera* (3), 2' to 7'; *P. humilis* (1), 5'; *P. roebelenii* (5), 3' to 8'; *P. reclinata* (20) 4' to 11'; *P. rupicola* (1), 5'; *P. sylvestris* (2), 6' and 9'. A few of each of the following hybrids, of which only the female parent is known, lost their buds but not any of the opened leaves and subsequently grew new buds: *P. pusilla* × ? (6), 2' to 5'; *P. rupicola* × ? (5), 2' to 3'; *P. zeylanica* × ? (6), 1' to 2'.

*Phytelephas macrocarpa* (1), 2', killed Dec.

*Pinanga kuhlii* (1), 3', minor damage Dec., extended Jan., killed Feb.

*Pritchardia beccariana* (1), 2', minor injury Dec. and Jan., seemingly killed Feb., revived Apr., killed by larvae May. *P. pacifica* (2), 2', killed Dec. *P. thurstonii* (8), all 2', all killed Dec. save one specimen which retained one green leaf and is now gradually recovering.

*Pseudophoenix vinifera* (1), 5', killed Dec. *P. sargentii* (1), 2', inexplicably not injured. *P. saonae* (2), 18'', killed Dec.

*Ptychosperma elegans* (9), 5' to 12', foliage and also woody trunks destroyed Dec., trunks exuding a pinkish paste where cells were ruptured, fatal damage obvious to every specimen from the first hard freeze (these palms had survived, without the slightest injury, five light freezes in past years). *P. macarthurii* (2), 3' and 4', killed Dec. *P. sp. "Ragey"* (2), 5' and 7', killed Dec. Also killed Dec., five specimens of two undetermined species.

*Raphia ruffia* (1), 2', foliage destroyed Dec. and plant seemingly dead, recovery started early June but killed by larvae in Sept.

*Reinhardtia gracilis* var. *gracilior* (1), 1', three fruiting stems killed, two suckers remained alive, plant dug up and placed indoors on eve of Jan. freeze, not replanted.

*Rhapidophyllum hystrix* (1), 3', unaffected.

*Rhapis excelsa* (2), 3' and 6', unaffected.

*Rhopalostylis baueri* (1), 1', apparently killed Dec., revived late Mar., killed by larvae Apr.

*Rhyticocos amara* (1), 4', half foliage destroyed by successive freezes, recovery complete in Aug.

*Roystonea elata* (8), all 4' and two years old, planted Nov. 1957, all killed the following month. *R. oleracea* (2), 3' and 5', both killed Dec. *R. regia* (17), 5' to 24', nine of which were 2½ years old averaging 5' in overall height, all killed Dec.; five six-year olds averaging 12' killed Dec. except for one survivor growing under oak foliage, this survivor now healthy again; one 14' specimen eight years old killed Jan.; one 16' specimen ten years old lost all foliage Dec., grew two new leaves late in the month, new foliage destroyed Jan., began recovery late Mar., again flourishing by late fall; one 24' specimen about twenty years old lost all foliage Dec., made no recovery till Apr., but again flourishing by late fall.

*Sabal causiarum* (1), 3', unaffected. *S. etonia* (14), 3' to 5', native, unaffected. *S. glaucescens* (1), 3', unsightly damage to foliage, no deep injury. *S. mauritiaeformis* (1), 20'', ugly but inconsequential damage to foliage. *S. mayarum* (1), 5', unaffected. *S. nematoclada* (1), 3', foliage mostly burned, otherwise uninjured. *S. palmetto* (42), 8' to 26', native, unaffected. *S. parviflora* (1), 2', totally uninjured though its "saucer" was covered with a thick cake of ice for seven hours. *S. texana* (1), 3', unaffected. *S. umbraculifera* (2), 1' and 3', unaffected. *S. yapa* (1), 2', unaffected.

*Salacca edulis* (1), 3', killed Dec.

*Scheelea* sp. (1), 8', third of foliage lost Dec., more in Jan., severe injury Feb., appeared moribund Mar., recovery complete by Oct. 1959.

*Serenoa repens* (3), 1' to 6', native, unaffected.

*Syagrus coronata* (4), all 2', all seemingly killed by cumulative effect of freezes, three dug up and discarded, mere stub of the fourth invisible after being mashed by wheel of tree-crane truck, began revival early May, by Aug. fully recovered, wherefore it may be suspected that the three other plants might have survived if not discarded. *S. quinquefaria* (1), 3', seemingly dead from December 12 till late May, this palm has fully recovered. *S. sancona* (1), severe damage Dec., seemingly dead early Jan. till early July, full recovery in 1960. *S. weddelliana* (2), each 2',

minor damage to one which was later killed, Mar., by larvae in bud, the other one unaffected.

*Synechanthus* sp. (1), 3', its only stem killed Dec., suckers killed Feb.

*Thrinax parviflora* (8), 1' to 4', three killed Dec., three others killed Jan., two largest both survived the winter but were killed May by larvae in lower buds. (This palm much more cold-resistant when adult).

*Trachycarpus fortunei* (3), 18'' to 3', unaffected. *T. martianus* (1), 18'', unaffected.

*Trithrinax brasiliensis* (1), 2', unaffected.

*Veitchia merrillii* (19), 3' to 9', all killed Dec. *V. sp.* (probably *V. montgomeryana*) (2), 5' and 6', both killed Dec.

*Washingtonia robusta* (3), 6' to 14', unaffected.

*Zombia antillarum* (1), 1', slowly declined for 8 months and died.

The maximum and minimum temperatures below were recorded at 2514-2518 South Peninsula Drive, Daytona Beach, Florida, in degrees Fahrenheit. Each recording was made at 5 p.m. for the 24-hour period then ending. Temperatures of 32° or less are shown in *Italic* type.

Day	Dec. 1957	Jan. 1958	Feb. 1958
1	64-35	70-56	65-41
2	62-32	56-45	59-35
3	69-40	58-54	49-32
4	66-40	52-50	56-30
5	62-39	61-50	63-35
6	69-44	65-54	76-44
7	76-57	53-47	75-57
8	80-59	42-35	57-39
9	66-50	43-27	57-36
10	55-38	52-33	53-57
11	65-43	61-35	55-45
12	44-25	63-38	54-45
13	55-27	65-58	47-35
14	63-35	68-53	55-31
15	62-42	63-44	68-36
16	63-50	53-45	61-35
17	70-45	59-39	48-29
18	69-55	55-39	48-26
19	67-55	55-45	54-26
20	78-58	68-46	53-29
21	64-52	66-47	58-35
22	72-61	57-48	63-42
23	76-64	59-45	65-47
24	77-63	71-57	67-47
25	76-62	62-41	66-59
26	70-63	68-44	67-40
27	71-58	61-45	83-60
28	73-61	61-40	75-55
29	67-58	57-44	
30	69-56	59-39	
31	68-54	69-56	

**List of the Hardier (†) and Half-hardy (‡) Cultivated Palms**

<i>Acrocomia aculeata</i> †*	— <i>cerifera</i> †	— <i>sapida</i> [older specimens only]‡
— <i>armentalis</i> ‡	<i>Corypha umbraculifera</i> †*	<i>Rhyticocos amara</i> †*
— <i>fusiformis</i> †*	<i>Cryosophila warszewiczii</i> †*	<i>Roystonea elata</i> [older specimens only]‡*
— <i>hospes</i> ‡*	<i>Diplothemium campestre</i> †	— <i>regia</i> [older specimens only]‡*
— <i>mexicana</i> †*	— <i>maritimum</i> ‡	<i>Sabal allenii</i> ‡
— <i>sclerocarpa</i> ‡	<i>Erythea armata</i> †	— <i>causiarum</i> †*
— <i>totai</i> †*	— <i>brandegeei</i> †	— <i>etonia</i> †*
<i>Aiphanes lindeniana</i> †*	— <i>edulis</i> †	— <i>glaucescens</i> ‡*
<i>Archontophoenix</i> <i>cunninghamiana</i> †*	<i>Hyphaene thebaica</i> ‡	— <i>mauritiaeformis</i> ‡*
<i>Arecastrum romanoffianum</i> †*	<i>Jubaea chilensis</i> †	— <i>mayarum</i> †*
<i>Arenga engleri</i> †*	<i>Jubaeopsis caffra</i> †	— <i>mexicana</i> †
<i>Bismarckia nobilis</i> †*	<i>Licuala grandis</i> †*	— <i>minor</i> †
<i>Borassus flabellifer</i> †	<i>Livingstonia australis</i> †*	— <i>morrisiana</i> ‡
<i>Brahea dulcis</i> †	— <i>chinensis</i> †*	— <i>nematoclada</i> ‡*
<i>Butia capitata</i> †*	— <i>cochinchinensis</i> †*	— <i>palmetto</i> †*
— <i>eriospatha</i> †*	— <i>decipiens</i> †	— <i>parviflora</i> †*
— all other species†	— <i>mariae</i> †	— <i>texana</i> †*
<i>Caryota mitis</i> [suckers, shorter stems only]‡*	— <i>rotundifolia</i> ‡*	— <i>umbraculifera</i> †*
— <i>ochlandra</i> ‡	<i>Nannorrhops ritchieana</i> †	— <i>yapa</i> †*
— <i>urens</i> [older specimens only]‡*	<i>Orbignya cohune</i> †*	— <i>yucatanica</i> ‡
<i>Ceroxylon</i> species†	— <i>speciosa</i> †*	<i>Scheelca</i> species‡*
<i>Chamaedorea brachypoda</i> †*	<i>Parajubaea cocoides</i> †*	[probably other species]‡
— <i>catractarum</i> †*	<i>Paurotis wrightii</i> †*	<i>Serenoa repens</i> †*
— <i>costaricana</i> ‡*	<i>Phoenix "abyssinica"</i> †*	<i>Syagrus coronata</i> ‡*
— <i>elegans</i> †*	— <i>canariensis</i> †*	— <i>insignis</i> ‡
— <i>ernesti-augusti</i> ‡*	— <i>dactylifera</i> †*	— <i>quinquefaria</i> ‡*
— <i>erumpens</i> †*	— <i>humilis</i> †*	— <i>sancona</i> ‡*
— <i>graminifolia</i> ‡	— <i>paludosa</i> †	— <i>weddelliana</i> ‡*
— <i>klotzschiana</i> †*	— <i>reclinata</i> †*	<i>Thrinax microcarpa</i> †
— <i>radicalis</i> †*	— <i>roebelenii</i> †*	<i>Trachycarpus fortunei</i> †*
— <i>seifrizii</i> †*	— <i>rupicola</i> †*	— <i>martianus</i> †*
— several undet. spp.‡*	— <i>sylvestris</i> †*	— <i>takil</i> †
<i>Chamaerops humilis</i> †*	— <i>zeylanica</i> †	<i>Trithrinax acanthocoma</i> †
<i>Coccothrinax crinita</i> †*	<i>Pseudophoenix sargentii</i> ‡*	— <i>brasiliensis</i> †*
<i>Copernicia alba</i> †	<i>Rhapidophyllum hystrix</i> †*	<i>Washingtonia filifera</i> †
	<i>Rhapis excelsa</i> †*	— <i>robusta</i> †*
	— <i>humilis</i> †	<i>Zombia antillarum</i> ‡*
	<i>Rhopalostylis baueri</i> [older specimens only]‡	

†Because the term "hardy" cannot be universally applied with accuracy to suit all subtropical climates, the adjective "hardier" has been availed of to avoid any possible misinterpretation. Obviously the climates of the cooler palm-growing regions are not identical, and on the contrary are sometimes drastically different even within the borders of each state or country where palms are cultivated. It follows, then, that the word "hardy" referring to cold tolerance is only relative and cannot always be used interchangeably for the cultivated palms of northern Florida, southern California, southern Texas, southern Japan, etc.

The check list above is not represented to be complete, for no records exist for all the palms cultivated at one time or another in all the subtropical climates throughout the world. Moreover, the list might be extended by the inclusion of borderline cases. Longer experience with more palm species and larger specimens should lead to an expansion of a check list. There is more than just a suspicion that many palms having tough or waxy foliage may possess cold-resistant properties, as untried species of *Copernicia*, *Coccothrinax*, *Corypha*, several other genera; and there is little question that several dozen species of *Chamaedorea*, not yet tested for cold endurance, would prove markedly hardy in cultivation.

‡The term "half-hardy" as used here is restricted to the palms which suffered relatively minor damage during the coldest winter of record on the peninsula at Daytona Beach, or else, though severely damaged, have shown a consistent ability fully to recover; plus certain other palms for which good grounds exist to consider them equally cold-resistant.

The above list might be extended almost indefinitely, depending on the degree of conservatism brought to bear. None of the palms surviving in the compiler's collection solely by some odd streak of luck have been included in it, though of these there are a surprisingly fair number. Something less than half-hardy, as defined above, but well able to tolerate a few light freezes not followed by continuous cold weather are some of the palm species of the following genera: *Areca* (*A. triandra*), *Arenga* (*A. pinnata*, *A. ambong*), *Arikuryroba*, *Chrysalidocarpus*, *Drymophloeus*, *Hedysepe*, *Howea*, *Latania*, *Licuala*, *Mascarena*, *Pinanga*, *Pritchardia* (*P. beccariana* and certain other Hawaiian spp.), *Pseudophoenix*, *Rhaphia*, *Thrinax* and still other genera not much represented in cultivation as yet if at all.

\*An asterisk denotes species has proved its cold tolerance in the Hardier (†) or in the Half-hardy (‡) category for the peninsula at Daytona Beach, Florida.

# USES OF THE PALMS

## Use of Palms in the Home Garden

NIXON SMILEY

*Nixon Smiley is the well-known farm and garden editor of the Miami Herald. Since 1956 he has also served as the director of the Fairchild Tropical Garden, noted for its outstanding collections of palms. Mr. Smiley is also a director of The Palm Society and a member of the editorial board of its journal, Principes.*

Although the palm is widely planted as an ornamental in the tropics and subtropics, little has been written that suggests how to use it in landscape design, especially as related to the small place. What has been recorded, merely states that the palm is an interesting plant useful to create the lush atmosphere associated with the common idea of the tropics.

Since no particular style of gardening has been developed in the tropics that has attracted special distinction, "as such," the beginner in this country has no precedents on which to lean or from which to borrow.

The problem that usually comes first to mind is the selection of which palms for planting. Should one use small palms for the small garden and large palms only in the large garden? What does one prefer in leaf forms with their resulting textures in mass? May one plant a fan palm next to a feather palm? Are there palms that combine well in settings of broad leaved trees and shrubs, and if so, how should they be used? Should one also consider color of leaves? Are there palms to be avoided? Or is one interested in palms for purely sentimental reasons, as are so many persons born and bred in the "North"?

The most commonly met idea in the use of palms, is the creation of an avenue or line of a single kind or to plant a pair one on either side of an entrance. These ideas by no means exhaust the possibilities and if not well considered have in them elements of danger.

Since this paper is concerned with the home grounds rather than with estates, the first decisions must be made as to whether or not palms are to be the dominant feature of the planting or if they are to serve only as accents, or be concentrated in some specially restricted area, such as a patio.

Whether one has considered it or not, a palm, any palm by its very nature, is an object to which the eye turns instinctively.

The basic reasons are two. First, in spite of the occurrence of some species native to this country, under widely differing ecological conditions, the palm is not a common element in our general scene. To turn to the savannahs with

their isolated or grouped specimens of palmettos, to waterways with clumps of *Paurotis*, dry pine lands with expanding colonies of *Serenoa*, or dry canyons with specimens of *Washingtonia*, gives only indirect inspiration for the home garden with its limited dimensions. Second, the structure of the palm plants in itself, is so distinct from our common accustomed plant forms, that the eye and mind are immediately involved with it.

Like other woody plants, there is first the central axis from which the leaves extend, in masses that are strongly marked by the relatively flat plane surfaces of the fan palm leaf, or the soaring arcs of the rachis of the feather palms. The blades of the fan palm relate to one another again, in spiralling circles, and overlap in degrees as in fish scale patterns. The blades of the feather palms give no such patterns but are more like the soaring arcs of an explosion! The trunk that carries all this may be smooth as any architectural column with the leaf mass like an expanded capital, or it may be patterned with the bases of old leaves as removed, some like bosses in architecture, some like basket work as in the species of *Sabal*. The relation between this trunk and the leaf mass is also of great importance since the height of the bare trunk will determine the effectiveness of the total silhouette.

In the leaves themselves other design elements are to be reckoned with. Color? There are innumerable degrees of greenness, from dark to light, from yellow toned to grays; from dull matt surfaces to glistening shine, all of which relate to the effects of sunlight and shade falling on them, whether sparkingly reflected or absorbed.

There are also to be noted the actual width of the individual sections, pinnae, as extremely narrow segments give a grace not found in the broader ones. This variation also relates to the way in which the wind may move the leaves, gently as in grass or with a clatter that astonishes.

All of these things and more are to be found in palms and should make clear that one must find the perfect position for any palm before introducing it into a garden scheme, particularly a small garden property, which as a whole is an artificial, man-made, man-dominated unit, in an even more artificial human creation, the city or town.

If one is determined to have palms, the ideal practice is to visit as large a botanic garden collection as one can find and study the plants to determine which pleases most and which suggest a reasonable size for the home property, remembering keenly that a fine specimen or group of specimens in ample acreage is no criterion for successful use on a town lot. If one is not convinced of this point, he need travel no great distance to find small properties in his home town on which palms planted many years ago as "charming graceful things" are now monsters that overshadow the garden, dwarf the house and require particular planting underneath their canopies. In many parts of the country, magnificent pairs of the Canary Island Date Palm now present a sorry spectacle for the same reason, though in themselves they are superb.

The next step toward planning is a visit to the best nurseries to discover whether or not the palms you prefer are available. Many are not. This too becomes increasingly a "reducing exercise" for the gardener who lives far from the frost free areas and again for him who lives in a basically dry area of minimum or seasonal rainfall.

Except for the specialist who means to become a collector of palms, the design problem is that of introducing this "prima donna" type of plant into a general scheme, of developing its full potentials without missing the total effect of all the other plants one cares to grow.

As a practical reminder on the matter of growth rates remember that species of *Veitchia*, *Cocos*, *Ptychosperma*, *Livistona*, *Washingtonia*, *Arecastrum*, and *Roystonea* are fairly rapid; *Copernicia*, *Coccothrinax*, *Pseudophoenix*, and *Sabal* are slow. Buy as large a plant as one can afford, and plant the fast growing sorts where you want height and mass in a hurry, and the slow ones for immediate effect, leaving all problems of ultimate heights to your descendants.

No mention has been made till now of the species that produce clumps, many stems in clusters. For them, one must use the design practices such as one uses for shrubs with strong vertical elements of trunk and stems, as in clump bamboos, the spectacular *Viburnum japonicum*, or on a smaller scale, *Nandina*. Like all such plants, these palms must be studied for the ultimate widths of the

clumps, which in the case of *Phoenix reclinata* differ from those of *Paurotis wrightii*, *Chrysalidocarpus lutescens* or *Rhapis excelsa*. They can give a problem as difficult as that of any ill chosen hedge plant.

Undoubtedly a visit to the Fairchild Tropical Garden near Miami will give inspiration. Designed by William Lyman Phillips who had a huge acreage on which to work, abundant funds, a relatively flat terrain, water for pond and lake, and plant material either bought as specimens or specially grown, the garden presented an almost ideal opportunity to his creative powers. The results speak for themselves. Using the basic principles of mass versus void, height versus flatness, matt surfaces (lawn) versus reflecting surfaces (water), the result is outstanding. The essential element of its success, however, lies in his acute and accurate "sense of scale."

It is the lack of the last element that frequently either destroys or mars the home development. One should study such effects as Mr. Phillips created and translate them either in degree or by section into his own setting, always realizing the smaller degree in each detail.

If one's property is relatively flat or the areas to be planted are so, a degree of formality in the design of the planting areas will usually preserve a sense of space, as visual perspective will add apparent distance. Curving outlines, our design inheritance from other types of terrain, are useful chiefly in larger areas, but remember that every curve must have a reason, not a whim, for being.

If one decides one wants palms in quantity and determines to keep them near the property lines, remember that the man next door may not like palms at all. As hedges they offer no more community problem than any other hedge plant, but palms that develop huge crowns, the shade of which may fall on the adjoining property, should be placed with care. The same thing is true for palms planted near the home paths, drives, and public sidewalks. Some are spiny, some are dirty, with falling leaves, fruits and flowers. Be careful! Some species are shade loving and if you now have fine evergreen trees, these should be one's choice. A short period of study will also make clear the fact that grouped palms may well start with

plants of various heights to bring out full contrast of the height levels of the several crowns. It will also make clear which species, among those possible for the location, will make good companions. And a little wit and imagination will suggest what companion plants shall be used, remembering always that the companion plant should either be one of no strongly marked character, thereby offering no competition, or one with strong character in a minor degree, as for example the many aroids available for some areas or some of the amaryllids that repeat the fountain or explosion form in their foliage.

In planting against a wall or building two design elements should be recalled. Is the palm chosen one that makes a mass or one that gives a silhouette pattern, i.e., trunk and top? The latter are more difficult to place as the specimen bought and planted so that the crown today is shown against a wall, will grow taller and the crown rise above the roof line. Will that be equally effective?

Remember also that palms are sometimes noisy in the wind, that they brush against home or wall and that they do not normally make some litter.

This last idea leads naturally to a reminder that palms do need a certain amount of grooming, discussed elsewhere in this issue, but grooming is time consuming, arduous work and costly. As a home owner do you want much or little?

Not all lovers of palms live in southern Florida or in California, but design problems are the same everywhere. The chief difference as one moves out of the favorable areas is the reduction in the number of species that may be used with safety. The present data are not final or arbitrary, for palm lovers will make the necessary experiments and prove what species may be added to those already known to be safe. The only cautionary remark must be that species that are on the borderline of hardiness, if they persist, often show little of the beauty they present in the proper locations.

If one needs professional advice, by all means get it. Remember that the professionals are somewhat new to all this too, and perhaps can offer better help in planning the areas to be developed than in choosing the species to be planted.

## Small Palms For Special Locations

H. F. LOOMIS

Expanding interest in palms engendered by the formation of an international group of palm lovers, The Palm Society, has resulted in the exchange of untried species between tropical and subtropical countries and induced much wider use of those already there. Also, new and enthusiastic palm growers have shown that many species may be established in areas beyond those previously known to be suitable.

A few years ago the palm growers of one country had little contact with those in other lands and seed exchanges or purchases were difficult, if not impossible, to arrange but the roster of The Palm Society now provides the membership and others with names of residents in most palm growing countries who may be solicited for seeds or information of their species. The recent development of several nurseries specializing in palms of all degrees of rarity also reflects the increasing interest in these plants and for the first time makes available many species never before commercially obtainable. Many people, also, have found it highly entertaining and productive to visit other countries and collect seeds of species unavailable at home. Thus today many more species may be had with reasonable effort than a half dozen years ago, and the acquisition of uncommon kinds has added greatly to the pleasure of having these decorative plants in one's garden or patio.

As contrasted with most trees, advantages in the use of single-trunked palms, and some of the cespitose ones also, are that the size of their crowns is predictable and remains quite uniform throughout their life, increasing but little once the normal top has formed although held higher and higher as the trunk grows; their root systems are less spreading and do not thrive from reasonably removed plantings nor do they disrupt paving and water systems or clog home sewage drain fields. Since no palms are truly deciduous their tops are always green and the few old leaves that fall or are removed do not present the litter problem of most trees at certain times of the year. They are of easy culture and attacked by comparatively few insect pests or diseases. The relative ease with which many species may be transplanted, regardless of their size or age, also is in their favor.

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Recognizing the adaptability of palms to many unusual places and conditions makes them desirable subjects not only for home owners but for nurseries, florists, gardeners, and especially landscape architects wishing to combine beauty and permanence with reasonable maintenance in plantings that give or enhance a tropical atmosphere.

While palms range in size from tiny species that never exceed several feet in height to giants two hundred feet tall—a few even becoming enormously long vines—the greatest use is found for those of dwarf to small or intermediate size. The habits and names of some of these palms and the locations and manners in which they may be used to advantage are of importance. Generally, the well-known and already established species are herein discussed but countries contain a great number of other species that, from experience with related ones here, can be introduced with confidence of their suitability to our conditions.

The majority of palms are sun lovers and do best under considerable or full exposure. Particularly adapted to growth in the open are the beautiful fan-leaved *Coccothrinax* species of which *C. argentea* is best known but *C. dussiana*, *C. fragrans*, *C. martii*, and *C. miraguama* are among those also seen. *C. crinita*, with its trunk hidden in three-foot long, streaming fibres, is rare but much admired. The Florida Silver Palm, *C. argentata*, is almost a dwarf, requiring many years before a trunk begins to form and seldom exceeds a dozen feet in height at maximum size. A true trunkless member of the genus recently introduced from Cuba, which contains the most native species, is *C. pseudorigida* var. *acaulis*, with small leaves composed of stiff radiating pinnae. No member of the genus has a large crown of leaves and, where height is not an objection to planting, any of the 35 presently recognized species will be found charming.

The genus *Thrinax* contains three cultivated species: *T. microcarpa* and *T. parviflora*, of medium height, and *T. morrisii*, which eventually develops a trunk only a few feet tall.

Most palmettos attain large size, but several of them are intermediate or small although few of these have been brought into cultivation. Adapted to full sun are the trunkless *Sabal etonia*,

and the widely seen *S. palmetto*, which requires many years to reach intermediate size but in exceptional locations eventually attains great stature. Another trunkless species, *S. minor*, appears to do well in all situations from fairly deep shade to full sun and has been reported to withstand winter temperatures as far north as Pennsylvania.

Hardy, stout-trunked palms with gracefully curving, gray-green feather leaves are *Butia capitata*, its many varieties, and *B. eriospatha*, which are seen more frequently in the northern portions of the palm belt than in the subtropics but do well in many parts of the latter.

Among the many species of *Copernicia* in Cuba are some of small size but the interesting *C. torreana*, with its dense mass of leaves almost without petioles, is the only one of these attractive but generally slow-growing palms at all common in cultivation.

Two species of *Pritchardia*; *P. pacifica* and *P. thurstonii*, are handsome palms but easily harmed by frost so that they may be grown only in the warmer parts of southern Florida. Hawaii is the home of additional species worthy of trial in the hope that hardier ones, adapted to the subtropics, may be found.

In this group also may be included the medium-sized and pinnate-leaved *Mascarena lagenicaulis* and *M. verschaffeltii*, interesting but hardly handsome palms.

Single representatives of miscellaneous genera widely planted with success in full sun are the feather-leaved *Arikuryroba schizophylla*; the European Fan Palm, *Chamaerops humilis*, that suckers when young but is easily kept to a single trunk; *Erythea armata*, from rocky canyons of Lower California, has a crown of arching lead-green leaves and has grown surprisingly well on a brackish-water canal bank in South Florida; *Phoenix roebelenii*, the Dwarf Date Palm; *Pseudophoenix sargentii*, with gray-green pinnate leaves, is adapted to sandy limestone areas, is tolerant of sea spray and of having its roots in what must be nearly undiluted sea water; *Ptychosperma elegans*, the Solitaire Palm, has arching pinnate leaves borne on a slender trunk with large clusters of small bright red fruits; *Syagrus coronata* has gray-green feather leaves on a trunk en-



cased in persistent leaf-bases rising in slightly whorled arrangement; *Trachycarpus fortunei*, the very hardy Chinese Windmill Palm, whose fan leaves and fibres from the trunk are put to many uses in its Chinese home.

Another excellent sun palm is *Trithrinax brasiliensis*, with fan leaves and projecting spine-like leaf-base fibres. Last but far from least in importance is the widely planted *Veitchia merrillii*, for many years included in the genus *Adonidia*.

For those wishing the group effect to be obtained with multiple-stemmed palms there are numbers of suitable kinds from which selection may be made. Much used is *Chrysalidocarpus lutescens* of intermediate size, spreading its feather leaves widely from curving trunks tightly clustered at base. The Mazari Palm, *Nannorrhops ritchiana*, has its somewhat branching trunks hidden by the projecting, silvery, fan leaves, which make a mound not exceeding a dozen feet in height. It is worthy of trial by growers along the northern border of the palm belt but is known to do well in much warmer regions. The Florida native *Paurotis wrightii* is slow growing and usually of medium size but under the best conditions is capable of making a tremendous, dense clump. Somewhat more columnar in shape than any of the preceding is *Ptychosperma macarthurii*, attaining heights of fifteen to twenty feet or possibly a little more. Seldom used as yet but tolerant of exposure to both sun and dry conditions is the Saw Palmetto, *Serenoa repens*, which spreads by subterranean trunks that, in a very old specimen, may rise six to ten feet above ground and, when pruned of their basal leaves, make a distinctive group. Offering distinct possibilities in a very unusual situation is the Nypa Palm, *Nypa fruticans*, of southeastern Asia and the Philippines, a truly aquatic, pinnate leaved species, suited to brackish water shores or tidal swamps in southern Florida, where freezing temperatures are infrequent.

Outstanding among the palms that do best in full shade are those of the great genus *Chamaedorea*, made up of species ranging from the tiny *C. elegans*, probably the most widely grown palm in the United States today and well known by its synonymous name as *Neanthe bella*,

through single and multiple-trunked species of increasing size to vine-like ones climbing for many feet. Most species have bright green canes or stems with prominent nodes resembling bamboo, the feathery leaves contributing further to the similarity. Among the cultivated species are *C. concolor*, *C. costaricana*, *C. erumpens*, *C. geonomaeformis*, *C. pacaya*, *C. seifrizii* and *C. tepeljilote*, to name a few. *Chamaedorea ernesti-augusti*, formerly known as *Eleutheropetalum ernesti-augusti* is a beautiful palm with leaves of completely united pinnae.

Among other fine shade species the magnificent *Licuala grandis* rarely exceeds a six-foot trunk supporting bright green leaves that are almost circular. The new, bronzed, pinnate leaves of *Pinanga kuhlii* give added attractiveness to this small Indonesian Cluster Palm. Suitable for all degrees of shade in moist locations is the Needle Palm, *Rhaphidophyllum hystrix*, which forms a low, hemispherical mound with its numerous stiffly radiating palmate leaves rising from a very short but slender trunk. Much taller, single-trunked, fan-leaved palms are in the genus *Cryosophila*, of which *C. warscewiczii* is most seen. The basal portion of its trunk and frequently the upper parts as well have curious simple or branching spines that are modifications of roots developing only after the leaves have fallen from that part of the trunk.

Three single-trunked palms of moderate size, with pinnate leaves, rather recently established in South Florida, which will be more widely planted outdoors as they become better known, are *Drymophloeus beguinii*, *D. olivaeformis* and *Siphokentia beguinii* from Indonesia.

The largest genus of American palms is *Geonoma*, predominantly made up of handsome small to medium-sized shade-species of which many are worthy of introduction and trial but none is currently in wide cultivation here.

A great number of palms are woodland species accustomed to shade in their early stages but eventually pushing their crowns of leaves above the forest canopy into full light. In the forest understory are many smaller kinds that spend their lives in the shade but among them are species capable of adjusting to

considerable or full sunlight as they grow older. In cultivation most of these palms do best if started in shade but in later life exposure to varying degrees of sun is possible.

In the above category are *Howeia belmoreana* and *H. forsteriana*, single-trunked feather palms, from Lord Howe Island, that are among the longest cultivated of palms in ornamental use. In moderate shade, young specimens of the Maya Palm, *Opsiandra maya*, are very graceful but when they reach sunlight at their full height of twenty or more feet the relatively small crown of leaves gives the palms a spindly appearance that may, however, recommend them to certain locations. The dramatically pinnate-leaved, spiny, single-trunked *Aiphanes* species, of which *A. caryotaefolia* is most often grown, are shade lovers that become accustomed to the sun as they age. *Zombia antillarum*, a palm found in light shade in Haiti, will grow in full sun in South Florida. It is an attractive, cespitose, fan-species bearing clusters of large, round, snowy-white fruits and the trunks are encased in coarsely fibred leaf-sheaths having the apical fibres of each sheath in a coronet of spines. The slow-growing Lady Palm, *Rhapis excelsa*, thrives in partial shade and if not restricted in time will spread into a broad, dense clump seldom exceeding ten feet in height. The clustering *Licuala peltata*, *L. elegans* and *L. spinosa* are adapted from part shade to full sun. All are striking with palmate leaves divided at the base into radiating sections of several segments each. An ideal shade species in its youth is the thick Cluster Fish-tail Palm, *Caryota mitis*, that later can be moved into full sunlight.

Large palms such as the species of *Washingtonia*, *Roystonea* and some of the dates (*Phoenix*), and several others have been used for a great many years in many countries along city streets, in parks, and around public buildings. In recent years some of the smaller growing species have come into their own in such places and their use is expanding. Species like *Phoenix roebelenii*, *Ptychosperma elegans*, *Thrinax microcarpa*, *T. parviflora*, *Veitchia merrillii*, and several cluster palms are being used to beautify city business areas, where limitations of space, for both roots and tops, would preclude planting trees or shrubs. Many

other small palms are suitable for similar planting, and mixtures of species can function to relieve the monotony of repeating single kinds. Safe cluster effects may be obtained by planting several single-trunked palms of the same kind very close together without danger of the clump spreading unduly, as might happen with a cespitose species.

In parkways between city streets or country highways, around public buildings, and in parks and gardens, low plantings that will not obstruct the view may be made with dwarf palms typified by *Sabal etonia*, *S. minor*, the trunkless form of *Coccothrinax pseudorigida*, and *Serenoa repens*, the latter possibly needing some pruning to prevent the trunks from becoming erect. Except for the last species, these palms are ideal for foundation planting of walls, homes or other structures, and need little care.

Several kinds of palms planted together in groups occasionally are seen in parks or large gardens and can be exceedingly effective when properly placed. Judicious selection and combination of dwarf, small, and intermediate species in a restricted group can be arranged to produce a beautiful, striking and long lasting unit for hotel entrance, courtyard or garden.

The home dooryard affords many opportunities for growing small palms effectively, in short rows, in groups of one or more kinds, or singly. All those previously mentioned are suitable subjects for such locations provided their requirements for temperature, shade, and moisture are met. Even many of the larger palms are of sufficiently slow growth when young to justify planting and enjoying them for many years in spots they may outgrow eventually, necessitating removal. When this occurs, some compensation for the loss may be derived if the palm is an attractive specimen, capable of being transplanted, for such palms often command excellent prices. In more northern parts of the country, species grown in pots or tubs that must be given winter protection may be moved out during the summer and incorporated in garden plantings to add an unusual touch to what might be an otherwise commonplace scene.

Among the shade and semi-shade-loving species that do well in properly selected parts of a dooryard or garden are many that adjust to growth indoors or

in patios for all or part of their lives. While some of these palms have been mentioned in foregoing pages, a more complete discussion of them and their use in such locations will be found in another part of this handbook.

Among the members of the palm family are kinds, growing in special habitats, that have adapted themselves to unusual conditions of low temperatures, moisture, drought, alkalinity, and root restriction, singly or in various combinations.

Outstandingly hardy species of different sizes, capable of withstanding considerable freezing, are *Arecastrum romanzoffianum*, *Butia capitata*, *Chamaerops humilis*, *Nannorrhops ritchiana*, *Phoenix canariensis*, *P. dactylifera*, *Sabal etonia*, *S. minor*, *S. palmetto*, *Serenoa repens*, *Trachycarpus fortunei*, *Washingtonia filifera* and *W. robusta*. During the severe winter of 1957-1958 in Florida, *Chamaedorea seifrizii*, surprisingly, proved very cold tolerant in several locations, one as far north as Daytona Beach.

Florida palms adapted to permanently moist locations are *Rhapidophyllum hystrix* and *Paurotis wrightii*, the latter also being able to grow in brackish water, as is *Pseudophoenix sargentii*. The oriental *Nypa fruticans* is wholly aquatic and will grow only where its underground trunks are covered by brackish water, at least at high tide. Actually, many palms normally accustomed to existing on fresh water only, may be acclimatized to brackish water if, when

young, they are planted in spots where their roots gradually reach into it as they grow. This fact opens the opportunity to experimenters for trying many palms in locations that might seem unlikely because of high salinity of the water.

Many palms are capable of having their roots restricted considerably without seriously affecting their health although possibly slowing their rate of growth. Among these are the species suitable for indoor or patio use in pots, tubs or planting bins. In some countries, however, a few palms seem to seek rocky locations where root systems are limited to a cubic foot or two of soil or humus and where they must endure varying periods of drought. Several of the species of *Coccothrinax*, like *C. argentea*, thrive in such places, but preeminent in prospering under hardship is the related *Haitiella ekmanii*, generally found growing in tiny pockets in solid limestone in exposed locations on the south coast of Haiti and nearby Beata Island. Other members of this austere group are certain species of *Thrinax* and *Gaussia princeps*, which lives only on the precipitous sides and tops of the curious rocky hills of Cuba that are known as "mogotes."

While little has been done to test these palms in cultivation under as adverse conditions as they face in nature, they appear to be fit subjects for trial in situations where root restriction, drought, low fertility, and exposure might prevent growing other palms or leafy plants.

## Palms for Home and Greenhouse

DAVID BARRY, JR.

Palms do well as container plants because they put up with crowding and have no tap roots. They can be grown thriftily in containers that are small in relation to the size of the plant. When planting palms, however, or especially when re-potting them into a larger container, be sure to compact the soil with great firmness; otherwise the roots will not penetrate into the fresh soil. They will grow instead round and round in the old ball and the plant will eventually die.

When palms are grown in planters, leave them in pots so that they can be revolved from time to time to prevent their leaning in the direction of the strongest light. Thus the natural erectness and symmetry of the plants can be maintained. If the plants are in pots, furthermore, they can be taken outside for spraying with insecticides without first having to be dug out of the planter. To give such plants in pots the appearance of growing naturally in the planter, place moss or peat between the containers and level it off at rim level to the trunks of the plants.

The most difficult problem facing the grower of palms and other indoor plants is how much, and how often, to water them. When a potted plant is given insufficient water, the small feeding roots dry up and die. Then the plant cannot feed itself until water is provided and new feeding roots are formed. This process takes time, and the plant suffers meanwhile. In order to avoid this drying out of the feeding roots, which will likely be located at the bottom of the pot, give water two or three times a week in sufficient quantity so that all of the soil in the container becomes moist. A test is to be sure that water emerges from the drain hole. Two or three fillings of the pot to the rim may be necessary. A little experimenting with each potted plant will help the grower develop a watering routine. Bear in mind also that the water requirement may change with the seasons. Frequency of watering can be reduced if containers of wood or tin are used in place of porous clay.

Palms will grow well in a variety of soils. Nevertheless, even though a palm

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may grow naturally in a heavy soil, the rule to follow in container culture is to use a soil mixture through which water will pass readily. To a light, porous, or sandy soil, add humus, peat, or leaf mould. In general, good drainage is essential to permit aeration between waterings, letting in the oxygen that is essential to root development. In particular, in some areas, such as Southern California where the water is alkaline, lack of good drainage in a potted plant will trap the alkaline salts and the plant will become unhealthy. A usual sign is the brown-tipping of the leaves. Salt accumulation may be visible on the surface of the soil, and may form a crust which should be replaced with fresh soil.

With potted palms there are no problems in fertilization that are peculiar to the palm family. Simply follow the directions of the manufacturer of any fertilizer that is fairly balanced between the essential elements. If possible, alternate between the organic and inorganic kinds. If growing palms in a temperate zone, stop feeding with the advent of cold weather, and resume in the spring with the beginning of warmer weather.

Among the few pests that may afflict household palms are mites, known also as red spiders, mealy bugs, and scale. When a leaf area begins to lose its green color and to turn brownish, examine the underside for minute crawling "insects." You may expect to find mites, especially when the air is dry. An infestation may attack the leaves of a palm severely enough to change markedly its appearance within two or three days. Lose no time in spraying the entire plant, with thorough attention to the underside of the leaves. Repeat twice at four-day intervals to extinguish completely the infestation. Use miticide, a specific for mites. Malathion and other insecticides may have no effect on mites. Pests other than mites may be controlled without haste as they are slow to disfigure a palm. Use any of the spray insecticides on the market for the purpose. Malathion is excellent. A word of caution: an oil-base spray suitable for woody plants outside should be used half-strength on palms, whether interior or exterior plants, to avoid the chance of burning the leaves. If mealy bugs get down between the trunk and the dry leaf sheaths, loosen the sheaths so that

the spray can reach all of the insects.

An easy way to kill mealy bugs on a palm or two is to touch the insects with rubbing alcohol, applied either with a small cotton swab or brush.

When palm leaves become old, a natural process, they become dry, begin to lose their green color, sag, or may break at the stem. Cut off any old unsightly leaves. In doing so, do not remove the leaf sheaths prematurely. Wait until they are dry and easy to loosen, for if pulled away forcibly while still green, strips of trunk below the ring of attachment will be torn off with the sheaths, forming permanent scars. The immaculately clean and smooth trunk of a palm is an element in its beauty.

Over the years the premier indoor palm, especially in public places, has been the so-called kentia: *Howeia forsteriana*. The popularity of the plant justly rests on a combination of beauty and durability. The dark green, arching leaves are thick and hard-finished. They resist cold, lack of light, and neglect. The *Howeia* is not tropical, but semi-tropical. It comes from Lord Howe Island off the coast of New South Wales where the mean temperature is too low for the Coconut Palm. It will withstand several degrees below freezing, a resistance that is important when the plant is used in buildings where heating is not maintained throughout the night. *Howeia* is usually planted three or four to the pot to create a many-leaved, full-foliage effect, and thus the palm appears to be a clustered type.

When the climate is warm and tropical, the commonest plant is *Chrysalidocarpus lutescens*, a native of Madagascar. It is a tropical plant and will not stand frost. It makes a very fine pot plant, and is a common house plant in many parts of the world. In large containers the smooth trunks reach a diameter of two to three inches, arching out at soil level to form beautiful, multiple-trunk, candelabra forms. In small containers, the trunks are much more narrow. Sometimes the plant is grown in a profusion of narrow trunks, as many as twenty to a five-inch pot. This style is common in Hong Kong where the plant is everywhere—inside, outside, low in gardens, and high on balconies.

Among single-trunk palms that do provide a desirable thickness of foliage

are the many-leaved date palms of the genus *Phoenix*, and *Syagrus weddelliana*. Most of the date palms are too large for tub plants. Sometimes young plants of *Phoenix canariensis* are used around public buildings, at the bottom of light courts for example, to provide greenery. The commonest *Phoenix* for interiors is *P. roebelenii*, the Dwarf Date Palm. It makes a splendid house plant. The crown of a well-grown plant will comprise thirty to forty leaves with a diameter of from four to six feet, and the slender trunk a diameter of around four inches. The plant will withstand at least eighteen degrees Fahrenheit in the open. In Japan, especially, this species is grown to robust and pleasing proportions for interior use.

*Syagrus weddelliana* provides somewhat the same appearance as *Phoenix roebelenii*, but with more open and delicate foliage. It is likewise slow in growth. *Syagrus* is more difficult to grow and is more susceptible to attack by mites. Formerly in large production in the United States, its popularity should be restored by increased production.

The palm that in a few recent years has gone to the head of the list in American house palms is *Chamaedorea elegans*. For all practical purposes, it is a *Chamaedorea*, still being sold and grown as *Neanthe bella*. It is not to be confused with the palm which was discovered around the turn of the century by O. F. Cook, the palm specialist with the United States Department of Agriculture. Dr. Cook found a diminutive palm in Alta Vera Paz, Guatemala, which he called *Neanthe bella*. Dr. Cook's palm is perhaps a different species from the Mexican plant. It is not in commercial production and consequently is not known as a house plant.

*Chamaedorea elegans* has become a chain store item and is raised by the hundreds of thousands, principally in Florida. It is used as a solitary pot plant, and when very small, as a dish garden plant. Sometimes it is assembled in groups. The species is fast-growing, and is easy to grow. The popularity of the plant is richly deserved as it is truly a horticultural gem. When young it provides the charm of a miniature. When in a three-inch pot, with a width and height of only a foot, and a trunk diameter of half an inch, the plant will go

through its reproductive cycle, forming floral branches and flowers that extend up among the green, feathery leaves. Such precociousness in a palm so small! Ordinarily years must pass before a palm is old enough to flower.

Very popular house and conservatory palms are *Rhapis humilis* and *Rhapis excelsa*, clump palms with fan-shaped leaves. These species give a bushy, bamboo effect and will luxuriate in shade or semi-shade in the semi-tropics. They are slow-growing, and hardy, taking at least eighteen degrees Fahrenheit.

Palms of the American genus *Chamaedorea* are deservedly growing in popularity as house plants. In Europe they have been used as such for many years. The virtues of *Chamaedorea* palms for interior use are many. The most important is their ability to grow thriftily where the amount of light is deficient. They will also stand considerable neglect in watering, as many species come from regions of prolonged dry seasons. The dozens of species present a great variety of appearances. The most popular kinds are the clump-forming types. The reed-like stems and feathery leaves remind one of bamboo which, as a decorative motif, is much sought after. Such a resemblance is a valuable characteristic of these palms, as bamboo is not suitable for the interior as it sheds brown leaflets profusely and requires bright light. Many *Chamaedorea* species will withstand several degrees below freezing. They should not be grown in full sun. Single-trunked species can be planted together in one container to make thicker foliage.

At the present time multiple stemmed species of *Chamaedorea erumpens* and *C. seifrizii* are commonly used in Florida, and in California *C. erumpens* and *C. costaricana*. The last is the best palm of the three in growth habit, leaf pattern, and depth of color. Single-trunked *Chamaedorea* species now in commercial production are *C. geonomaeformis*, *C. klotzschiana*, and *C. cataractarum*. Each species has its own distinctive foliage characteristics, and is to be highly recommended as a house plant.

In addition to the naturally lower growing palms, many tall tree palms will make attractive container specimens for interior use as juvenile plants. Examples are palms of the genera *Archon-*

*tophoenix*, *Dictyosperma*, and *Ptychosperma*. Among other clump-forming palms that are justifiably popular for similar use are the fish-tail palms, *Caryota*, and several species of *Ptychosperma*, of which the most common is *P. macarthurii*, the Macarthur Palm.

One of the most delightful palms for interior use is *Livistona rotundifolia*. It is a tropical, tall tree palm. When young, and in small containers, it will remain small. The numerous fan leaves look like fringed dinner plates. The effect is charming. This species is not as commonly grown today as some years ago, but it deserves a return of popularity. Its more hardy relative, *L. chinensis*, a fairly common plant in Florida, is not as suitable for interiors as *L. rotundifolia*.

The kinds of palms currently used in interiors are few compared to the great many species that could be used. Palms that are being newly introduced to horticulture will find their way into homes and conservatories. Many of them are of exceptional beauty and interest. Among the future house palms will be such dainties as the reinhardtias with numerous slender trunks and "windows" in their leaves. Many other *Chamaedorea* species and small palms from Madagascar will find their way to interior use. The same prospect holds for new *Rhapis* palms, such as the variegated, and a very diminutive one. Also there are several species of *Licuala* which may do well as potted plants.

For the present, there are available among nurseries and florists in the United States a sufficient variety of palms to fulfill with their beauty, exotic quality, and dependability any interior requirement.

### List of Palms Suitable as House and Conservatory Plants

List 1. Species which are dwarf or semi-dwarf for pots or tubs.

*Balaka seemannii*  
*Calamus ciliaris*  
*Chamaedorea cataractarum*

*Chamaedorea concolor*  
*Chamaedorea costaricana*  
*Chamaedorea elegans*  
*Chamaedorea ernesti-augusti*  
*Chamaedorea erumpens*  
*Chamaedorea geonomaeformis*  
*Chamaedorea klotzschiana*  
*Chamaedorea seifrizii*  
*Chamaedorea tepejilote*  
*Chamaerops humilis*  
*Chrysalidocarpus lutescens*  
*Coccothrinax argentinii*  
*Drymophloeus beguinii*  
*Hedyscepe canterburyana*  
*Howeia belmoreana*  
*Howeia forsteriana*  
*Licuala grandis*  
*Licuala spinosa*  
*Phoenix roebelenii*  
*Pinanga kuhlii*  
*Reinhardtia gracilis*  
*Rhapis excelsa*  
*Rhapis humilis*  
*Syagrus weddelliana*

List 2. Species when young making good pot or tub plants but with age need to be given larger containers or planted in the ground.

*Aiphanes caryotaefolia*  
*Archontophoenix alexandrae*  
*Archontophoenix cunninghamiana*  
*Areca triandra*  
*Arecastrum romanzoffianum*  
*Butia capitata*  
*Caryota mitis*  
*Caryota "plumosa"*  
*Caryota urens*  
*Cocos nucifera*  
*Dictyosperma album*  
*Heterospathe elata*  
*Livistona chinensis*  
*Livistona rotundifolia*  
*Pawotia wrightii*  
*Phoenix canariensis*  
*Phoenix reclinata*  
*Phoenix rupicola*  
*Ptychosperma elegans*  
*Ptychosperma macarthurii*  
*Thrinax parviflora*  
*Trachycarpus fortunei*  
*Veitchia merrillii*  
*Washingtonia robusta*

## Palms in Decorative Arrangements

LUCITA H. WAIT

The inventive arranger with a fresh approach to his or her material can find many uses for various parts of the palm—be it spathe, leaf, fruit, or flower. "There is hardly a palm that does not offer something which can be used in arrangements," observes the superintendent of one of the world's largest private palm collections. Leaves, either feather- or fan-shaped, in their varied tints of green, gray or silver; many-branched inflorescences; fruits which may be scarlet, yellow, brown, or blue can be gathered for use in fresh arrangements. Dried materials with odd form or shapely curve can be carefully stored and brought out when needed.

The qualities which make palm materials valuable are: their sculptural form, durability (especially when dried), their relative rarity and, in some cases, their color values. Fresh materials can be freely used where palms grow abundantly; they can be used alone or in combination with other plant material. One more often sees them in their dried forms, however, for then they can be kept indefinitely and shipped any distance. An example of the virtues of palm materials is a fine cluster of *Raphia ruffia* fruits. The seeds of this Madagascar palm are encased in hard, shiny shells, beautifully incised in a diamond design. A cluster of several fruits has weight, which makes it excellent as a center of interest or base for a composition. When fresh, the color range is in dull greens, orange and brown, which changes with time to a rich glossy brown. If some dried twigs of the inflorescence are left attached, they add line to the mass.

In creating a dried arrangement using palm materials it is worth while to take time and to give considerable thought in making the arrangement. For if well done an outstanding composition will last indefinitely—it can be displayed for a while, put away, then brought out again and again. A well-known arranger in southern Florida has several of these handsome creations which she not only uses repeatedly herself but has lent to others for demonstration purposes.

Spathes are valuable because of their durability, form and sculptural qualities. The spathe is the protective outer covering of the flower cluster. While imma-

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ture it is generally green in color and may be shaped like a sword, a horn, a flat pocket, or a long switch. When the flowers are ready to appear, the spathe splits lengthwise. Many palms have thin, papery spathes, of no value to the arranger; others, however, are strong and hard. They are thick or thin, long and narrow, boat-shaped or spreading, according to the species of palm from which they come. Usually they are smooth inside, with a good natural finish, while outer surfaces may be thorny, woolly, or have fissures running lengthwise. Occasionally there is a difference in color between the inner and outer surfaces.

The "cohune" palms: *Attalea*, *Scheelea* and *Orbignya*, almost impossible for the layman to tell apart, all bear enormous spathes which open to reveal great ostrich plumes of flowers in orange-yellow or lavender, followed by huge bunches of fruits. The spathes are from three to six feet long, deeply grooved on the outside, with a projection four or five inches long at the tip. When they open it can be seen that the shell is quite thick, a half inch or more. They usually remain upright after the inflorescence has been released; occasionally, however, they become twisted into odd and ornamental forms. These spathes have a somewhat open, porous texture. After a time they may be attacked by borers, and a fine sawdust begins to sift out of them. This calamity can be avoided or delayed by saturating the spathe with a colorless insecticide.

Coconut Palm spathes have been cheapened in some localities, the writer believes, by being painted rather garishly and sold as souvenirs, made into hors d'oeuvres trays, or, with the inflorescence left in and painted to resemble flowers, used as table centerpieces. In their natural form, however, they remain useful to the arranger. Trees which receive ample fertilizer and water produce larger, thicker spathes.

The Queen Palm (*Arecastrum roman-zoffianum*) has spathes which vary in size and thickness. There is a tree in Orlando, Florida, which produces spathes of such good quality that they are in demand for making handsome trays, dishes, etc. Spathes of *Syagrus* are particularly good. The wood is thin but hard, and of an attractive rich brown color. The spathes dry wide open with

a graceful twist and are adaptable for use as bases for fruit arrangements and in many other ways. *Arikuryroba schizophylla* has very slender narrow spathes, in demand for adding height without heaviness.

Palm leaves are more often used in the fresh state, as they tend to curl up when dried. Some, though, are thicker and have a larger silica content; these can be placed between sheets of newspaper, shaped as desired, weighted down until dry, then trimmed to size. When carefully done good effects are achieved.

Leaf sheaths or bases, the part of the petiole which encircles the palm trunk, are sometimes used. The Areca Palm, *Chrysalidocarpus lutescens* has a long rather papery leaf-sheath which, when it drops off, curls into very good lines. The petiole is cut to the desired length and used as the "stem," while the sheath, turned upside down, becomes the top.

The inflorescence consists of the spathe, the rachis or stem (usually branched), and the flowers, either pollen-bearing (male) or pistillate (female), or both. Most palms have both kinds of flowers on the same inflorescence, with the female flowers at the base of the branch and the pollen-bearing or male flowers at the tip. The latter drop off after opening and shedding their pollen, leaving the pistillate flowers to form fruits. Thus, we often see the branched panicle with fruit maturing on the lower part of the branches and the upper part bare. Coconut "roses" are persistent sepals from which the immature coconuts have dropped. The excess twigs can be trimmed off and the "roses" used in arrangements.

Other palms, such as the *Copernicia*, have dainty inflorescences which dry in intricate and lovely curlicues. *C. glabrescens* is one of the favorites in this respect. If handled gently, the dried flower branches are remarkably durable in spite of their fragile appearance.

The species of *Latania* bear male and female flowers on separate trees; the dried stems of both are sought after by arrangers.

The inflorescence of a *Geonoma* species, probably *binervia*, has been dried, lacquered bright red and used as a Christmas tree in a home in Panama.

Palm fruits lend themselves well to decorative purposes. *Raphia ruffia*, one of the choicest, has been mentioned

above. There are few mature *Raphia* palms in the United States, however, so fruits are at a premium. Anyone owning a good cluster is fortunate and knows enough to take good care of it.

The species of *Hyphaene* produce fruits with smooth skin, resembling small chocolate or gingerbread cup-cakes. They grow singly or in groups along dark brown velvety branches. Carefully treated, they are long-lasting. The sweetish tasting meat around the seed is dry, so there is little danger of shrinkage and wrinkling.

*Nypa*, the famous swamp palm of Indonesian and Philippine areas, has unusual inflorescences and seed heads, the latter reminiscent of a primitive war club. There is some difficulty in keeping the large nuts from falling away from the stalk; harvesting at the proper point of maturity may control this.

When using fresh palm materials in any quantity, we are more or less restricted to areas in which many palms are grown out of doors so that cutting can be done as needed. More is constantly being learned about palm survival, and in time growing locations may be extended by judicious use of the proper species.

Those who have access to fresh palm materials already know how sensational a good palm exhibit can be. The scarlet fruits of the Christmas Palm, the Solitaire Palm, the Macarthur Palm, the Cherry Palm, or the newly described species of *Veitchia montgomeryana*, have been used with much success in southern Florida shows. Unfortunately, they hold their color and shape for only a few days and cannot be dried successfully. *Thrinax parviflora* (the Key Thatch Palm) has long sprays of white fruits like porcelain beads, while species of *Livistona* bear blue or olive-green fruits. Harder to find, but very handsome, are compact bunches of large red or yellow fruits of the Peach Palm (*Bactris gasipaes*).

Most palm flowers are cream or white and very fleeting. An immature Coconut Palm spathe, for example, can be cut from the tree, slit carefully down one side, and the flowerstalk gently removed. When held upright and twisted from side to side, the branches of the inflorescence will fall outward, forming an ivory fountain which will last for about twenty-four hours, then begin to turn dark

and drop. Churches sometimes use the flowers of Queen Palm (*Arecastrum romanzoffianum*), prepared in the same way, as decorations on Palm Sunday.

There are brightly colored palm flowers also. Mention has already been made of the gorgeous yellow and lavender plumes of the "cohunes." *Phoenix reclinata* has orange bracts surrounding white flowers; some jelly palms (*Butia capitata* var.) have lavender flowers. Male blooms of an *Arenga* species, erroneously called in southern Florida *Wallichia caryotoides*, are rich golden yellow and extremely fragrant—a two-inch piece will perfume a large room. The Spindle Palm flower (*Mascarena lagenicaulis*) is not at all showy unless seen under a magnifying glass, but its mignonette fragrance is delightful. A few strands might be introduced into a large arrangement for the sake of the scent.

Leaves of palms, used fresh, offer many opportunities for creative work. Mrs. Yoneo Arai, of Greenwich, Connecticut, has used the leaves of the dwarf palmetto, carefully trimmed and the petioles bent into curves, to make an outstanding arrangement in the Japanese manner. This arrangement has been pictured in numerous books and articles. *Thrinax microcarpa* leaves, fan-shaped, are blue-green on the reverse, and make a charming background for other greens and bright colors. *Livistona rotundifolia* has handsome shiny green leaves; those on mature plants may be too large for most uses, but young specimens, particularly if raised indoors, will furnish beautiful smaller leaves, unmarred by the hazards of outdoor conditions.

Few of us own or have access to large numbers of palm trees which may be plundered for artistic purposes. Therefore, we must have a keen eye for an interesting piece wherever it can be found and not be timid about going after it.

The Palm Spathe, at the Fairchild Tropical Garden stocks a few items in their natural state.

Uses of palm parts in arrangements are only in their beginning, and an alert person can find beautiful, interesting, and previously untried elements even in some of our most common palms, that will contribute to unique and pleasing arrangements.

## Palms as Hedge Plants

R. BRUCE LEDIN

There are some species of cluster palms which when planted close together will make growth dense enough that they may be used as a hedge or for screening purposes along a border. Several of these palms are discussed below.

*Chrysalidocarpus lutescens*, the Areca Palm, is one of the best for this purpose. It can make a fine informal border or screen hedge. It grows rapidly, is easily propagated from seed, and it sends up new shoots for many years. Its gracefully arching pinnate leaves, usually with an orange tinge, make it a fine specimen for mass planting along the border of a property. This palm can also be used to line driveways and walks, as is frequently done in Cuba, Hawaii, and other countries. When planted along both sides of the driveway the arching leaves of the older shoots meet overhead and form an attractive tunnel. A low hedge may also be maintained by cutting out the taller canes and allowing the other canes to grow only to three or four feet high.

*Phoenix reclinata*, the Senegal Date Palm, is fast growing and suckers freely. If plants are set close together and the old stems removed, this species will make a good barrier hedge particularly since the lower leaflets are transformed into spines. The trunks in age may become twenty feet or more tall and may tend to lean away from each other; these can be removed if desired as there will be an abundance of younger shoots present to maintain the hedge effect. Propagation is usually by seed.

*Ptychosperma macarthurii*, the Macarthur Palm, has relatively short pinnate leaves and stems up to twelve or fifteen feet in height and forms dense clumps. This palm, readily propagated from seed, grows better in partial shade as it tends to suffer in the full hot tropical sun during the summer months. It is generally fast growing and should form dense clumps in a short time.

*Caryota mitis*, the Cluster Fish-tail Palm, is very attractive with its bipinnate leaves and thick growth formed by the numerous shoots. This species can make an effective tall screen or border hedge up to twenty five or thirty feet high when

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planted close together. Propagation is by seed.

*Chamaedorea erumpens*, the Bamboo Palm, has rather short pinnate leaves and reed or bamboo-like stems which may reach ten or twelve feet in height. It suckers freely and grows best in shade or partial shade. It is useful as a screen planting in an inclosed patio. Propagation is by seed or by division of the clump.

*Chamaedorea seifrizii* is a clumping species which forms a thick, compact growth. It can be used to make a low hedge divider maintained at four or five feet. This palm usually does best in shade but it has been grown successfully in full sun. In some Central American and West Indian countries it has been planted as a hedge in full sun with the tops trimmed with regular pruning shears. This trimming prevents further growth of the stems but the stems and leaves remain alive for quite some time. Propagation is by seeds or by division of the clumps.

*Chamaerops humilis*, the hardy European Fan Palm, can be used to make an informal barrier hedge. The plants normally form dense clumps and if many plants are set out in a row, in time a thick, dense, impenetrable hedge can be produced which will become ten feet high. It is often believed to be a slow

growing palm, but if well planted and fertilized frequently, the plants will make fairly rapid growth. The main leaders may grow quite tall and tend to lean in age. If a uniform hedge is to be maintained, the older leaning stems should be removed to allow the small sucker shoots to develop. This palm will grow well in full sun or in partial shade. Propagation is by seed or by separation of the offshoots.

*Rhapis excelsa*, the Lady Palm, can be used as a low growing hedge along a walk or for border planting. The slender canes grow four to eight feet tall and sucker freely. It is somewhat slow growing. It often does better in partial shade but can be grown in full sun. Propagation is generally by division of the clumps.

Palms used as hedges should be allowed to grow informally; they should not be clipped or pruned in the same manner as other hedge plants. The only trimming that should be done is to keep the new sucker shoots from spreading out beyond the confines of the hedge row and to remove the older shoots when they get too tall. Planting in good soil, frequent fertilizing and watering when needed, will encourage fast growth to obtain the desired hedge effect.

## Palms for Northern and Central Florida

R. D. DICKEY

The most tropical portions of the continental United States are found within the confines of the State of Florida. This situation makes possible the successful culture of numerous species of palms under outdoor conditions, where suitable soils, heavy rainfall, and relative freedom from severe frosts tend to form an ideal combination for the growing of palms and other tropical plants. One of the great charms of the tropics is its palm flora and, since conditions within the state are so favorable for their growth and culture, palms are extensively used in Florida's ornamental plantings.

From the large number of species now growing in the state palms suitable for almost any location may be selected, the choice varying from very dwarf shrubby sorts to magnificent trees reaching a height of nearly a hundred feet.

Susceptibility to injury by cold, more than any other factor, determines the range of adaptability of a species within the state. The number of palms that are sufficiently hardy to withstand the colder temperatures experienced in the northern half of the peninsula and northwestern Florida is comparatively limited as compared to the much larger numbers that can be grown in the southern half of the state.

No attempt will be made to list all of the species grown in this area, rather those of outstanding merit will be discussed. In this number are included both native and introduced species. The number of kinds that can be recommended without reserve for this area is limited since they must be able to withstand several degrees below freezing.

### North and Northwestern Florida

The native *Sabal palmetto*, the official state tree of Florida, adapted to a wide range of growing conditions, is found in wet places and in dry, inland, or on the seashore exposed to whipping winds and salt spray. The Cabbage Palmetto is an erect tree reaching a maximum height of about eighty feet, although fifty feet is average, with a trunk diameter of one to two feet. The fan-shaped, shiny, deep green leaves are five to six feet long. Other native palmettos, *Sabal etonia* and *Sabal minor*, are hardy and can be grown

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in the central and northern sections. They are shrub-like and very similar in general appearance.

*Chamaerops humilis*, has a small trunk which is seldom over two to three feet tall though occasional specimens may be fifteen feet high. The stiff fan-shaped leaves are rarely over two feet in width. They sucker from the base which results in most specimens having several trunks. *Trachycarpus fortunei* is a slow growing, very hardy fan-leaved palm with an erect trunk usually covered with old leaf sheaths. *Serenoa repens* covers large areas of pine "flat woods" and other lands in the state. They are shrubs with horizontal stems which run just beneath or at ground level, though occasional specimens have erect or inclined stems. This palm tolerates salt spray and is excellent for planting on coastal areas. *Rhapidophyllum hystrix* is a dwarf, hardy, low-growing shrubby species which rarely attains a height of over a few feet. The slender trunk is usually reclining and the fan-shaped leaves are a dark glossy green and grayish beneath.

*Phoenix canariensis* is at home throughout Florida. It has a spread of about thirty feet and is tall-growing with graceful pinnate leaves and massive trunk. *Butia capitata* grows well over all Florida. It may reach a height of twenty-five to thirty feet in its native Brazil, but seldom attains this height here. The pinnate leaves, which have a distinctive bluish cast, are recurving giving a graceful arching effect to the foliage.

*Washingtonia robusta* is commonly grown in Florida. The leaves are injured some winters in the colder locations of north and northwestern Florida. The tall trunk is swollen at the base and topped with a crown of brilliant green fan-shaped leaves. *Washingtonia filifera* is similar in general appearance but the massive trunk is not so tall and is about the same size throughout.

### Northern Half of Peninsular Florida

All of the palms adapted to the colder portions of the state may be grown in

this area and, in addition, there are several species that will stand enough cold that they may be recommended for the central and warmer locations of northern peninsular Florida.

*Arecastrum romanzoffianum* is a tall-growing medium sized palm with graceful pinnate leaves and a smooth trunk. It is one of the most widely planted palms in the state and may be used in the colder areas as a substitute for the royal palms where the later species are not adapted. *Acrocomia totai*, a medium sized pinnate leaved species, attracts attention because of its spiny trunk. It is adapted to only the warmest central Florida locations.

*Phoenix reclinata* suckers from the base and it is at its best when allowed to produce a tree with many trunks. *Phoenix sylvestris*, which is grown to a limited extent in this area, has a taller less massive trunk than the Canary Island Date Palm and shorter leaves. *Phoenix dactylifera* is occasionally seen but is less ornamental than other species of this group. *Phoenix roebelenii* is one of the most attractive of the small, slow-growing, pinnate leaved plants. It is adapted to only the warmest central Florida locations.

*Sabal causiarum* is occasionally seen in this area. It is one of the most massive of the palmettoes grown in Florida. *Sabal umbraculifera* deserves wider use than it now enjoys in the central Florida area. The imposing cement-like trunk is comparable to that of the royal palms. *Livistona chinensis* is a slow-growing, medium sized, fan-leaved palm that is well adapted to all but the coldest locations of peninsular Florida.

The two species of *Rhapis* (*Rhapis excelsa* and *R. humilis*) commonly grown in Florida do not differ much from a horticultural viewpoint. *R. excelsa* is the one usually grown and it is adapted to the central and warmer parts of northern peninsular Florida. The small fan-shaped leaves are borne on slender trunks which may reach a height of eight to ten feet. It usually forms dense many stemmed clumps.

## Palms for California

NOLAN W. KINER

Palms are an important part of the California landscape. They have been used for ornamental plantings since the days of the Spanish missions and older boulevards are lined with magnificent specimens. The tender species are common in the mild coastal areas while hardier varieties are planted throughout the state. During the past ten years there has been a steadily increasing interest in palms for beautification of large public and private buildings and for home use. So important are palms for a wide range of use that several nurseries in California have found it profitable to make palms and palm-like plants their specialty, if not their sole crop.

Some concern has recently been voiced that palms may be merely a fad and will wane from their present popularity to a status of much less importance. This seems unlikely since several species have been grown in California for over half a century and are still popular.

Furthermore, palms in general are durable, long-lived and relatively free of pest and disease problems. They require a minimum amount of maintenance. They are versatile and possess a high degree of adaptability culturally and in the landscape. Many species are tough and persistent in the face of winds, drought, poor soil, and general neglect. The public, encouraged by nurserymen, is becoming increasingly aware of the possibilities of a wider variety of palms and has a corresponding desire to use them. Thus, in areas of "mushroom" growth where nursery stock is in great demand, many kinds and sizes of palms are popular and should continue so for some time to come.

The climatic conditions of central and southern California approach the ideal for a number of palms. Others must be protected and some of the tropical species require a glasshouse. California is noted for marked variations and extremes of temperature. The heat of the summer sun pushes temperatures to well over a hundred degrees in some desert regions. This condition is not uncommon in some of the lower elevation portions of Imperial, Riverside, San Bernardino, and several other inland counties. The winter temperatures in these counties may drop to twenty degrees or less

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in extreme periods. Fortunately for the citrus, palms, and other ornamental plants these "lows" are not the rule, nor do they normally persist for long periods. Some frost is common in lower parts of the interior valleys and unprotected places each year.

The annual rainfall where some palms are grown may be four to six inches or less, but many parts of the state receive ten to fifteen inches, and some of the coastal and northern portions receive twenty to forty inches or more. The rainfall occurs almost entirely in the cool winter season, however. This is a limiting factor in the culture of certain palms. Prevailing cool or hot winds are definitely detrimental factors to optimum success with palms in California.

The mild and relatively moist coastal climates occurring at such cities as San Diego, Santa Monica, Ventura, and Santa Barbara allow probably the widest representation of genera and species of palms to be found in the state (with the possible exception of the outstanding palm garden at the Huntington Botanical Gardens at San Marino.

Air pollution, vulgarly referred to as "smog," has proved adverse to some species, particularly those chosen for tub and indoor decoration, such as *Howeia*. The extent of damage from this source even on apparently rugged outdoor species has not been determined.

A relatively wide representation of this stately family, however, is found in California. Several species generally surviving the greatest extremes of environment are listed below in approximate order of decreasing hardiness: *Trachycarpus fortunei*, *Chamaerops humilis*, *Butia capitata*, *Phoenix canariensis*, *Washingtonia robusta*, *W. filifera*, *Erythea edulis* and *Arecastrum romanzoffianum* (probably variety *botryophorum*). A few species closely following the above in hardiness are *Phoenix dactylifera*, *P. reclinata* (and some natural hybrids among *Phoenix*), *Erythea armata*, and *Jubaea chilensis*. In essentially all cases hardiness to cold parallels maturity.

About twenty different genera of palms can be found in California. Over forty species are cultivated out-of-doors, some very common and some rare. Other species than those listed are grown in California, but in very limited numbers or in special private collections.

The following alphabetical list of spe-

cies includes both the botanical and common names, brief pertinent observations, and the approximate cold hardiness. (*H* indicates *hardy* to 16-20°F; *h* indicates *half hardy*, tolerating about 28°F, *T* indicates *tender*, including species preferring little or no frost and needing some sun protection.)

*Archontophoenix cunninghamiana*, (*h*), the King Palm is one of the most striking species when restricted to the milder sections. Noteworthy for both its pendulous amethyst flowers and stately habit. Easy and rapid to germinate, and in favorable sites the seedlings may form an attractive, temporary ground cover. Another species, *A. alexandrae*, Alexandra King Palm, is much less frequent.

*Arecastrum romanzoffianum*, (*H-h*), the Queen Palm, possesses much grace when well grown and free of disease. The best substitute for the royal palms for California. Slow to start but becoming more rapid in age. Relatively short-lived in southern California with about thirty-five to forty years of optimum growth.

*Butia capitata*, (*H*) the South American Jelly Palm, is slow here. It possesses distinctive grace with its gray arching foliage and golden fruit clusters; Occurring with either a full compact, or a sparse open crown.

*Butia eriospatha*, (*H*), the Woolly Butia Palm is not common here. Characteristics similar to the above.

*Butia yatay*, (*H*) the Yatay Palm is a somewhat taller species than either of the above and with larger fruit which are also edible.

*Chamaedorea costaricana*, (*h-T*), the Costa Rican Parlor Palm is typically a single, greenish, bamboo-like stalk with only a few leaves displayed at one time. An interesting small accent plant but not found in general cultivation.

*Chamaedorea elegans*, (*h-T*), (*Colinia elegans*, *Neanthe bella*), the Parlor Palm is widely used while very small for dish gardens and planters, but makes an attractive foliage mass in the garden. Prefers ample protection from sun, wind, and cold. Probably second only to *Howeia forsteriana* in popularity as a container plant.

*Chamaedorea sp.*, (*h*) (Probably *Chamaedorea tepejilote*, the pacaya palm has leaflets sloping or drooping laterally from the rachis somewhat resembling a stiff thatch. A handsome



small specimen in protected places or in containers.

*Chamaedorea seifrizii*, (H-T), the Grass-leaf Parlor Palm, is of very delicate proportions, giving a bamboo-like effect. Usually under four feet tall. May be grown as a single or multiple stem plant.

*Chamaerops humilis*, (H), the European Fan Palm, is slow to start but striking in specimen clumps as it matures. Most frequently seen here in multiple, arcing trunks resulting from its habit of sprouting basal offshoots from the main stem. Noted for variability of color and habit from seed. Nurserymen often seek glaucous, compact forms. This is the only palm native to Europe and is widely known for its hardiness.

*Chrysalidocarpus lutescens*, (*Areca lutescens*), (T), the Areca Palm, is a showy, usually multiple-stemmed feather palm which gives a tropical effect. The arching, yellowish-green leaves are a refreshing color variation from the usual green. This handsome species is too little seen in California doubtless due to its intolerance of cold.

*Erythea armata*, (H), the Blue Hesper Palm, is sometimes called Gray Goddess, blue fan palm, Mexican blue palm, because of the bluish-gray leaves and extremely long inflorescence reaching almost to the ground in summer. This species is very slow growing, but otherwise it offers much for street, avenue, or garden planting.

*Erythea brandegeei*, (H), the San Jose Hesper Palm, has a rate of growth moderate here with proportions more suitable for landscape use than some of the commonly used larger species. Possesses good possibilities for increased use as a street and garden tree. May be seen in Balboa Park, San Diego and Huntington Botanical Gardens.

*Erythea edulis*, (H), the Guadalupe Palm has features of merit, which include the clean, erect bole, nearly unarmed, large, light green, undulate leaves, and conspicuous flower and fruit clusters. Comparatively slow to start but rugged and uniform for street or garden use. In spite of a slower growth rate, it might well receive some of the attention now given to *Washingtonia robusta*.

*Howeia belmoreana*, (*Kentia belmoreana*), (h-T), called the Belmore Sentry Palm is less frequently seen than the following species, but of equal grace and beauty. The distinctive arch formed by

the rachis set this species apart from other small green feather palms. Relative slowness of growth and tenderness are the main limitations to more extensive culture here.

*Howeia forsteriana*, (*Kentia forsteriana*), (h-T), Forster Sentry Palm, is limited to mild, coastal towns in Southern California. Resents prolonged sun, drying winds and cold. Average size in tubs (usually planted in multiples) is four to six feet, but protected outside, this plant may reach fifteen to eighteen feet here.

*Jubaea chilensis*, (*Jubaea spectabilis*), (H-h), the Chilean Honey Palm, is conspicuous for its massive, erect trunk as it matures. Feather type leaves are somewhat stiff and radiate from the crown in bristling, ungraceful manner. Limited here mostly to a few parks and private collections.

*Livistona australis*, (*Corypha australis*), (H-h), the Australian Fountain Palm, is a broad, flat-appearing crown with drooping leaflet ends. Most specimens seem to be naturally freed of the old petiole bases, revealing a rich, dark, gray-brown trunk. Worthy of more frequent use.

*Livistona chinensis*, (h), Chinese Fountain Palm, is recognizable by the pale, yellow-green leaves which are somewhat costapalmate and bend downward at the tips. Slower and less tolerant of heat than *L. australis*. Not widely used here but offering promising possibilities for gardens or streets in near frost-free locations.

*Livistona decipiens*, (h), the Graceful Fountain Palm, is not noted by the writer outside of the Huntington Botanical Gardens, although it may well be in other collections. Tall, slender, graceful.

*Phoenix canariensis*, (H), the Canary Island Date Palm, is one of the more massive species of the family, thus, out of proportion for small gardens or streets. Abundantly found in many parks and large estates here. As much a part of the skyline as the Washington Palm, Eucalyptus and Pepper trees. Natural hybrids are common in this genus, such as the one between *P. canariensis* and *P. dactylifera*, or between the former and *P. reclinata*. One promising intentional hybrid being tested in the Pierce Junior College Arboretum, west San Fernando Valley is between *P. canariensis*

and *P. roebelenii*. Most are naturally occurring crosses.

*Phoenix dactylifera*, (H), the true Date Palm, is planted on numerous acres of low elevation desert in the southeastern part of the state where its fruits are painstakingly nurtured to perfection. Many fine varieties are in cultivation. Left alone it tends to offshoot or sucker profusely, a habit of questionable ornamental value. A modest number are maintained as single-trunk specimens with attractive results. Rarely seen planted as a street tree here. Eventually becomes too large for averaged sized gardens.

*Phoenix humilis*, (H-h), is of smaller proportions than the above two species with leaf color somewhat intermediate. Noted for rather stiff appearance and abundant, persistent petiole bases. Not seen in general use here but has interesting possibilities for street and garden. Several varieties and hybrids are listed.

*Phoenix paludosa*, (h-H), the Siamese Date Palm, is very similar to *P. reclinata* but with lower sweeping trunks in maturity and a slightly paler green foliage. Seen here to a very limited extent. Needs much room as it matures for the sprawling, multiple trunk formation. Is extremely graceful and informal lending a real "tropical" feeling to the landscape.

*Phoenix reclinata*, (H), the Senegal Date Palm, is growing in popularity in California, the demand being mostly for large clumps. The stiff, basal petiole spines may be hazardous to children while it is low but the striking accent effect of large multiple-trunk examples is much sought after by landscape architects. Some thick trunk types found in southern California are probably hybrids of this species with *P. canariensis*. Readily grown from seed.

*Phoenix roebelenii*, (h), the Dwarf Date Palm, is possibly the most graceful of all the small palms. Prefers freedom from excessive sun, winds, and cold; a diminutive member of this genus that is rewarding in pot, tub, or garden culture. Even in the milder localities full sun seems to dwarf and discolor the foliage.

*Phoenix rupicola*, (h), the Drooping Date Palm, is deserving of much more attention for its very graceful form. An arresting lawn or street tree. This species has not been generally offered here in the trade.

*Phoenix sylvestris*, (H) the Indian

Date Palm, is a compromise in appearance between the true Date Palm and the Canary Island Date Palm, but with more arching grace to the leaves than either. The trunk is less massive than that of *P. canariensis*. Unfortunately, as with *P. rupicola*, it is not readily available here.

*Phoenix zeylanica*, (H), the Ceylon Date Palm, tends toward a bristling appearance but is of modest size and may well warrant more consideration for planting in California. Also not typically found in local nurseries.

*Ptychosperma elegans*, (*Seasforthia elegans*), (h-T), the Solitaire Palm, is confused frequently with *Archontophoenix* in the trade. This species is not found to any extent in gardens here.

*Rhapis excelsa*, (*R. flabelliformis*), (h), the Lady Palm, is often used in tubs or for background in tropical plantings. Bamboo-like stems from stoloniferous clumps, topped by small fan of eight to twelve leaflets. Handsome for vertical accent, but relatively expensive and uncommon in the trade.

*Rhapis humilis*, (h), the low ground-Lady Palm, is similar to the above but with more and narrower leaflets. Stems of usually less than one inch in diameter. Useful for background masses of handsome foliage; also fine in containers.

*Rhopalostylis sapida*, (h-T), Feather-duster Palm, is comparatively upright and stiff foliage of striking appearance. Globose, scarlet fruit clustered below the smooth, bulbous petiole sheaths draw attention to this species. Definitely prefers south coast mild winters and some protection from the sun. *R. baueri* is less frequently seen.

*Sabal causiarum*, (h), the Puerto Rican Hat Palm, is a handsome fan palm with a marked arching habit of the leaf blade center (costapalmate). Somewhat lighter green than most palms and with very large leaves. Not frequent here.

*Sabal minor*, (h), the Blue Palmetto, is noticeable for the folding or bending down of the older leaves at the junction of petiole and blade, giving the appearance of a partially open umbrella. The sparse, erect but rather persistent old inflorescence is an obvious feature on many specimens. Of small stature here and not widely seen.

*Sabal palmetto*, (H), the Cabbage Palmetto, is recommended by Mr. Hertrich of the Huntington Botanical Gar-

dens for Southern California because of its vigor and hardiness. The writer has not noted any number of this species here, but as the public is further informed, increased popularity should result.

*Sabal umbraculifera*, (H-h), the Hispaniolan Palmetto, is one of the best of this genus, showy in flower, fruits heavily, and has stately form. Not abundant as yet in California, however.

*Trachycarpus fortunei*, (H), the Chinese Windmill Palm, has as much to be said in its favor as any other palm cultivated here, although it is lacking in grace. A few of its attributes are exceptional cold tolerance (fifteen degrees or less), tolerance of neglect, lawn conditions, wind, and air pollution, its neat compact habit, and its freedom from pests and disease. Except for slowness of growth (slightly under one foot a year here) this species might well supplant some of the larger species such as *Washingtonia* for street and garden use.

*Trithrinax acanthocoma*, (h-H), closely resembling *Trachycarpus* in form but with larger leaves and a conspicuously armed trunk. Probably most useful as an interest or accent plant and not recommended for playgrounds or streets.

*Washingtonia filifera*, (H), the Washington Palm, is the single California native palm, and should logically rate

the most extensive discussion. Unfortunately, although it is well adapted and picturesque in its natural setting, it is far from a top rating landscape subject.

This species is frequently seen intermingled or alternated with *W. robusta* on streets and in parks. They are readily distinguishable (though not while very young) by the stouter trunk and duller color of the California native. Where the old leaves and petioles are entirely removed the form of this palm is unattractive chiefly due to the rather massive trunk. Certainly it is not a wise choice for a small property, and is best appreciated in the remarkable palm canyons of our southwestern deserts.

*Washingtonia robusta*, (H), the Mexican Washington Palm, is rapid growing and commonly planted in the southwest. Typically used for parks and streets or avenues with a noticeable trend for large specimens transplanted to large buildings.

Except for natural or intentional hybrids of the two species, the Mexican Washington Palm is more slender as it matures, supporting a more compact crown than *W. filifera*. The synonymous name, *W. gracilis*, suggesting slender grace, seems to this writer more fitting than *robusta* but the latter doubtless is in reference to the robust, thrifty rate of growth.

## Palms for Hawaii

L. W. BRYAN

The people who live in Hawaii have for many years shown a keen interest in the introduction of new plants to the new State. The original native flora was quite meager (it contained only a thousand, seven hundred and twenty-nine species of seed-producing plants and a hundred and sixty-eight species of ferns). As a result of these introductions, the number of exotic plants today exceeds the original number of native species. Naturally many different species of palms have been introduced from all parts of the world. A recent check list prepared indicates that there are now not less than a hundred and seventy species growing here in Hawaii (thirty species of these are native and so not introduced). For those interested in the palms of Hawaii this check list is given below. Some of those listed are quite common while others are exceedingly rare. The Foster Botanical Garden (seventy-seven different species) and the Harold L. Lyon Arboretum on the Island of Oahu contain numerous species including many that are not common. On the Island of Hawaii, there are several collections which contain some rather rare and unusual species. One collection in the Arboreta of the Territorial Division of Forestry in Hilo contains fifty-nine different species. There are a number of unidentified species growing in Hawaii which may, when properly identified, increase the total number of species by a considerable extent.

### Palms Known to Be Growing in Hawaii

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*Acrocomia* sp.  
*Aiphanes acanthophylla*  
*Aiphanes caryotaefolia*  
*Aiphanes lindeniana*  
*Aiphanes minima*  
*Archontophoenix alexandrae*  
*Archontophoenix cunninghamiana*  
*Areca catechu*  
*Arecastrum romanzoffianum*  
*Arenga obtusifolia*  
*Arenga pinnata*  
*Arenga tremula*  
*Arikuryroba schizophylla*  
*Astrocaryum standleyanum*  
*Bactris gasipaes*  
*Borassus flabellifer*  
*Butia capitata* var. *odorata*  
*Calamus muelleri*

- Calyptrocalyx spicatus*  
*Calyptronoma dulcis*  
*Caryota cumingii*  
*Caryota mitis*  
*Caryota rumphiana*  
*Caryota urens*  
*Chamaedorea elegans*  
*Chamaedorea erumpens*  
*Chamaedorea geonomaeformis*  
*Chamaedorea humilis*  
*Chamaedorea klotzschiana*  
*Chamaedorea stolonifera*  
*Chrysalidocarpus lucubensis*  
*Chrysalidocarpus lutescens*  
*Chrysalidocarpus madagascariensis*  
*Coccothrinax alta*  
*Coccothrinax argentea*  
*Coccothrinax crinita*  
*Coccothrinax dussiana*  
*Cocos nucifera*  
*Colpothrinax wrightii*  
*Copernicia cerifera*  
*Corozo oleifera*  
*Cryosophila argentea*  
*Cryosophila warszewiczii*  
*Cyrtostachys lakka*  
*Daemonorops mollis*  
*Desmoncus chinantlensis*  
*Desmoncus quasillarius*  
*Dictyosperma album*  
*Elaeis guineensis*  
*Erythea armata*  
*Erythea brandegeei*  
*Euterpe* sp.  
*Gaussia attenuata*  
*Heterospathe elata*  
*Howeia belmoreana*  
*Howeia forsteriana*  
*Hyphaene thebaica*  
*Latania borbonica*  
*Latania loddigesii*  
*Latania verschaffeltii*  
*Licuala aruensis*  
*Licuala grandis*  
*Licuala pumila*  
*Licuala spinosa*  
*Livistona australis*  
*Livistona chinensis*  
*Livistona cochinchinensis*  
*Livistona decipiens*  
*Livistona humilis*  
*Livistona robinsoniana*  
*Livistona rotundifolia*  
*Lodoicea maldivica*  
*Mascarena lagenicaulis*  
*Mascarena verschaffeltii*  
*Metroxylon amicarum*  
*Nypa fruticans*  
*Oncosperma tigillaria*  
*Opsiandra maya*  
*Orbignya cohune*  
*Paurotis wrightii*  
*Phoenix canariensis*  
*Phoenix dactylifera*  
*Phoenix farinifera*  
*Phoenix humilis*  
*Phoenix pusilla*  
*Phoenix reclinata*  
*Phoenix sylvestris*  
*Phoenix zeylanica*  
*Pinanga kuhlii*  
*Polyandrococos caudescens*  
*Pritchardia affinis*  
*Pritchardia affinis* var. *gracilis*  
*Pritchardia affinis* var. *halophila*  
*Pritchardia affinis* var. *rhopalocarpa*  
*Pritchardia arecina*  
*Pritchardia beccariana*  
*Pritchardia beccariana* var. *giffardiana*  
*Pritchardia brevicalyx*  
*Pritchardia donata*  
*Pritchardia elliptica*  
*Pritchardia eriophora*  
*Pritchardia eriostachya*  
*Pritchardia forbesiana*  
*Pritchardia gaudichaudii*  
*Pritchardia glabrata*  
*Pritchardia hardyi*  
*Pritchardia hillebrandii*  
*Pritchardia kaalae*  
*Pritchardia kaalae* var. *minima*  
*Pritchardia kahanae*  
*Pritchardia kahukuensis*  
*Pritchardia kamapuaana*  
*Pritchardia lanaiensis*  
*Pritchardia lanigera*  
*Pritchardia lowreyana*  
*Pritchardia lowreyana* var. *turbinata*  
*Pritchardia macdanielsii*  
*Pritchardia macrocarpa*  
*Pritchardia martii*  
*Pritchardia martioides*  
*Pritchardia minor*  
*Pritchardia munroi*  
*Pritchardia pacifica*  
*Pritchardia remota*  
*Pritchardia rockiana*  
*Pritchardia thurstonii*  
*Pritchardia viscosa*  
*Ptychovaphis augusta*  
*Ptychosperma angustifolium*  
*Ptychosperma elegans*  
*Ptychosperma macarthurii*  
*Ptychosperma nicolai*  
*Ptychosperma sanderianum*  
*Raphia ruffia*  
*Reinhardtia gracilis* var. *gracilior*  
*Rhapis excelsa*  
*Rhyticocos amara*  
*Roystonea elata*  
*Roystonea oleracea*  
*Sabal guatemalensis*  
*Sabal mauritiaeformis*  
*Sabal minor*  
*Sabal palmetto*  
*Sabal texana*  
*Sabal umbraculifera*  
*Scheelea excelsa*  
*Scheelea regia*  
*Syagrus campestris*  
*Syagrus insignis*  
*Syagrus weddelliana*  
*Thrinax excelsa*  
*Thrinax morrisii*  
*Thrinax parviflora*  
*Trachycarpus fortunei*  
*Trithrinax acanthocoma*  
*Veitchia joannis*  
*Veitchia merrillii*  
*Verschaffeltia splendida*  
*Washingtonia filifera*  
*Washingtonia robusta*

## Living Palm Collections

A living palm collection in which the plants are well cared for and especially if they are accurately labeled, is a valuable source of information for many people—the home owner, the garden club members, the nurseryman, the landscape architect, the researcher, the students of horticulture and botany. For here in a palm collection the individual—whatever his interests are—can study the different kinds of palms, learn how they are identified, observe their use in the landscape, see how they grow and what they look like when mature. They serve to increase the popularity of palms for home and public planting. Furthermore, the plants are source material for taxonomic and botanical studies which will aid to advance our knowledge of palms. Palm collections are also of interest to the visitor from temperate regions. Here he will be introduced to this fascinating group of plants and perhaps stimulated to learn more about the palms.

There are a number of palm collections throughout the world in tropical and subtropical areas. The following list of thirty such gardens is not intended to be complete. But it does include the major botanical gardens that are open to the public. There are many more collections maintained by private interests.

### Important Palm Collections

- Fairchild Tropical Garden, Miami, Florida
- Coconut Grove Palmetum, Miami, Florida
- United States Plant Introduction Station, Miami, Florida
- Sub-Tropical Experiment Station, Homestead, Florida
- Huntington Botanical Gardens, San Marino, California
- Los Angeles State and County Arboretum, Arcadia, California
- Zoological and Botanical Gardens, Balboa Park, San Diego, California
- Foster Botanical Garden, Honolulu, Hawaii
- Harold L. Lyon Arboretum, Oahu, Hawaii
- Arboreta, Territorial Division of Forestry, Hilo, Hawaii
- Federal Experiment Station, Mayaguez, Puerto Rico
- Atkins Garden of Harvard University, Cienfuegos, Cuba
- Hope Gardens, Kingston, Jamaica, B. W. I.
- Castleton Gardens, Ochos Rios, Jamaica, B. W. I.
- Royal Botanic Gardens, Port-of-Spain, Trinidad, B. W. I.
- Botanic Gardens, St. Vincent, B. W. I.
- Botanic Gardens, Roseau, Dominica, B. W. I.
- Georgetown Botanic Gardens, Georgetown, British Guiana
- Lancetilla Experiment Station, Tela, Honduras
- Summit Gardens, Balboa Heights, Panama Canal Zone
- Jardim Botanico, Rio de Janeiro, Brazil
- Jardin Botanique "Les Cedres," St.-Jean-Cap-Ferrat (AM), France
- Jardin Gillet, Kisantu, Belgian Congo, Africa
- Royal Botanic Gardens, Peradeniya, Ceylon
- Indian Botanic Garden, Calcutta, West Bengal, India
- Singapore Botanic Gardens, Singapore, Malaya
- Bogor Botanic Garden, Bogor, Indonesia
- Brisbane Botanic Garden, Brisbane, Queensland, Australia
- Royal Botanic Garden, Melbourne, Victoria, Australia
- Botanic Garden, Sydney, New South Wales, Australia

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*Phoenix dactylifera*