PRINCIPES

Journal of The Palm Society

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THE PALM SOCIETY

A non-profit corporation primarily engaged in the study of the palm family in all its aspects throughout the world. The Society relies on voluntary contribution for support, and membership is open to all persons interested in the family. Requests for information about membership or for general information about the Society should be addressed to the Executive Secretary.

PRINCIPES

JOURNAL OF THE PALM SOCIETY

An illustrated quarterly devoted to information about palms published in January, April, July, and October, and sent free to members of The Palm Society

EDITOR: Harold E. Moore, Jr.

EDITORIAL BOARD:

Paul H. Allen, David Barry, Jr., Duncan Clement, Walter H. Hodge, Eugene D. Kitzke, Harold F. Loomis, Nixon Smiley, Dent Smith.

Manuscript for PRINCIPES, including legends for figures and photographs, must be typed double-spaced on one side of 8½ x 11 bond paper and addressed to the Editor at Bailey Hortorium, Mann Library, Cornell University, Ithaca, New York, for receipt not later than 45 days before date of publication. Authors of one page or more of print will receive six copies of the issue in which their article appears. Additional copies or reprints can be furnished only at cost and by advance arrangement.

Contents for January

Cover Picture

Typical interior view of a "palm brake" in the Luquillo Mountains of Puerto Rico with specimens of *Euterpe globosa* in all stages of growth (one fruiting at right top). Photograph by W. H. Hodge. See also page 19.

NEWS OF THE SOCIETY

As you will see by the sheet enclosed separately with this issue of PRINCIPES, members continue to join the Society in gratifying numbers. We have added Argentina, the Belgian Congo, Ceylon, New Guinea and Portuguese East Africa to the list of countries in which we have members. Two members have changed their addresses to new areas: Bermuda and Ghana. One new state—Alabama—has been added. May we once again thank each of you who has sent in names of prospective members, or helped to increase our numbers in other ways. Slowly but surely, we are reaching for 600, the goal at which we hope the Society will become self-sustaining.

Slide Collection

Several members have sent in slides, some of them excellent, all interesting. As soon as we can build up a good collection, we shall make them available to members, for use in programs, or for study. Going over them slowly many times, one is able to notice details and become familiar with the different characters of the various genera and species. Copies of existing slides are seldom very satisfactory; as a rule they lose color and detail as compared with the original. We urge you to take two shots of palms you think of interest, and donate one of them to the Society.

Meetings

Thirty members in the Fort Lauderdale area met together on the evening of Nov. 11th, 1958, for informal talk and to look at the Society's slides. The Garden Center at Birch State Park was engaged for the meeting; we are indebted to a generous member for the rental fee. Mrs. Gertrude Cole made the arrangements and greeted arrivals. Mr. H. L. Nies and Mr. James E. Smith furnished handsome door prizes and refreshments. Mr. Smith also brought a large number of his choicest palms and told about their origins and characteristics most interestingly.

* * *

About a dozen members and their guests gathered at noon on Saturday, Nov. 22nd, at the entrance to the United States Plant Introduction Station, (Chapman Field), Miami, and, led by Mr. Nat J. De Leon, spent two and a half hours looking at a few of the palms in the Station's plantings. This proved to be such an educational and pleasant tour, that it is hoped to repeat it at a time when more members can come. Any number of visits to the Station could be made before one would become really familiar with this large collection. Later on perhaps other collections can be visited.

* * *

On the evening of December 3rd, 1958, forty members in the Greater Miami area met at Simpson Garden Center. Short talks were made by Mr. H. F. Loomis on the genus *Coccothrinax*, by Nat J. De Leon on latanias, and by Mr. Louis W. Snyder on palms in garden design. Many questions from the audience showed their interest in these subjects.

Mrs. Gunter F. Herman of Los Angeles, California, had kindly lent the Society her slides of palms taken in Hawaii, Tahiti and Fiji. Members were delighted at the opportunity to see palms growing in these areas.

It was decided to hold either a meeting or a visit to an outstanding palm collection every other month. Those wishing to attend are requested to self-

address five postcards and send them to the Executive Secretary so they may be notified of future meetings and walks.

Palm Society Stickers

Several good suggestions have been received from interested members, regarding ways in which the Society's name can be brought to the attention of the public. Plans are being made to put some of these projects into effect. Attractive stickers or labels are in the works, which can be used on stationery or on the backs of envelopes, bearing the legend: "Member of The Palm Society". One of the directors, Mr. David Barry, has suggested mailing labels, which can be used by shippers on the outside of packages. Another idea is for an emblem to be attached to a plate-glass window or other prominent location where it will be seen by many persons who may not know of the Society's existence. Your comments, favorable or otherwise, and any other thoughts on this subject, are earnestly requested by the Executive Secretary.

Nat De Leon Awarded Medal

Nat J. De Leon, formerly Treasurer and now a Director of The Palm Society, was recently awarded a bronze medal issued by the Botanical Garden of Rio de Janeiro to commemorate the 150th anniversary of its founding. Nat was one of thirteen individuals and institutions so honored in the United States. His efforts in the introduction of palms are appropriately rewarded.

The Palm Handbook

The Palm Society is preparing a Handbook of Palms to be issued by the National Horticultural Magazine. The Editorial Committee is as follows: R. Bruce Ledin, Florida, Chairman; David R. Barry, Jr., California; Nat. J. De Leon, Florida; Walter H. Hodge, Pennsylvania; Mildred E. Mathias, California; Nixon Smiley, Florida; and Lucita H. Wait, Florida. The Handbook will deal primarily with horticultural information on such topics as seed viability, planting and care of seeds, growth of seedlings, palm culture and fertilization, moving large palms, palm nurseries, insects and fungus diseases, uses of palms in landscaping home grounds, parks and other public areas, uses of palms as house plants and decorative arrangements, and using palms in restricted places. Other subjects will deal with the cold hardy palms, books on palms, keys to and descriptions of the more common species, and botany of palms. There will be a section on famous botanical gardens throughout the world with large palm collections. Another section will deal with palms in different parts of the world—Florida, California, Hawaii, Japan, as well as articles on the native palms of the United States, Cuba, Central America, Panama, South America, Africa, Malaya, Australia, and the Philippines.

The National Horticultural Society, continuing its custom of producing special handbooks, will print our Palm Handbook as one of the special numbers of its quarterly journal, *The National Horticultural Magazine*. This is the first time that such a wealth of information on palms will be gathered together in one book, and we have many authorities on palms—botanists, horticulturists, and other specialists, from Florida, California and many places throughout the world contributing the articles.

We know that the members of The Palm Society will be interested in this book. At the present time we do not know when the book will be issued, but we hope it will be some time in late 1959 or early 1960.

Diseases of the Coconut Palm*

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The diseases of the coconut palm (*Cocos nucifera* L.), including some that have not been reported to occur in the United States, will be discussed in a series of papers to appear in this journal. It is anticipated that each issue will contain information useful to the palm fancier in the way of disease description, names of causal organisms, and recommended control measures. The information to be presented here and in future issues was obtained in part through cooperation with the State Plant Board of Florida, who made possible trips to the Caribbean area to obtain information and illustrations of the various diseases of the coconut palm.

The diseases to be discussed in this series of articles have been classified into two groups—major and minor—based upon relative importance only. Thus any disease, after further research has been accomplished, may be reclassified. The diseases considered to be of major importance drastically affect the yield and/or kill the trees. These are the diseases of lethal yellowing (unknown disease), bronze leaf wilt, red ring, bud rot, yellow mottle decline (cadang-cadang), and frond drop. The minor diseases include wilt (root) disease, root diseases, bitten leaf, St. Mary disease, leaf spots, smut disease, *Exosporium* leaf spot, sooty mold, coconut thread blight, yellowing, drought wilt, pencil point, stem bleeding, and the phenomenon of lightning strike.

*Elaborated from a paper presented at the Palm Conference, Fairchild Tropical Garden, April 18, 1958. Florida Agricultural Experiment Station Journal Series, No. 844.

The etiology or causal organism is definitely known for only two of the major diseases, red ring and bud rot. The red ring disease is caused by the nematode *Aphelenchoides cocophilus* Cobb, and bud rot is caused by the fungus *Phytophthora palmivora* Butl. Yellow mottle decline and lethal yellowing are suspected to be caused by viruses. The bronze leaf wilt disease in Trinidad has been attributed to physiological drought. Since diseases similar to bronze leaf wilt have been reported from other countries, it now appears that factors other than physiological drought are needed to explain its cause or etiology. Frond drop was originally thought to be caused by a genetical controlled structural weakness of the fronds, but lately this disease and the wilt (root) disease of coconut palms in Travancore-Cochin are also suspected of being virus in origin.

When consideration is given to the difficulty in conducting research with the coconut palm, it immediately becomes apparent why so little is known about the causal agents (etiology) of its many important diseases. The lack of basic information and research on the anatomy, histology, physiology, and nutritional requirements of the coconut palm has greatly hindered any research program on the etiology of the diseases that affect it.

For further information the reader is requested to consult the literature cited at the end of each article and Briton-Jones' book *Diseases of the Coconut Palm* which reviews the literature on coconut diseases prior to 1940.

1.—LETHAL YELLOWING OR UNKNOWN DISEASE

Lethal yellowing or unknown disease is not of recent origin and has been reported from several of the Caribbean islands. Probably the first account of it, according to Johnson (5), is that given by Fawcett, who reported its occurrence in Montego Bay, Jamaica, in 1891 and in the Island of Grand Cayman in 1889. The disease has since been reported from Jamaica, Haiti, Bahamas, and Cuba (2, 3, 6, 7, 9). The disease was originally known as bud rot until Ashby (1) termed it west-end bud rot to distinguish it from the common bud rot caused by the fungus *Phytophthora palmivora*. The term west-end bud rot was used to indicate its restriction to the west end of the Island of Jamaica. Leach (6), while making a comparison of a similar disease in Trinidad with the bud rot disease in Jamaica, suggested the name unknown

1. Young coconut palm in Key West, Florida, exhibiting symptoms similar to those attributed to the lethal yellowing or unknown disease.

disease for the latter. This name has been quite widely used and accepted. Although the name does not necessarily define the symptoms of the disease, it certainly has described its etiology or cause. Recently Nutman and Roberts (10) working with the disease in Jamaica suggested the name lethal yellowing. In Cuba the disease is referred to as *pudricion del cogollo* (rot of the heart or young leaves).

A disease of coconut palms heretofore unreported in the United States occurs in Key West, Florida. At present only a comparison of the symptomatology between this and the other diseases of the coconut palm has been made. It appears that the disease is similar to or identical with the lethal yellowing disease of coconut palms in Cuba and Jamaica.

The difficulties and misinformation that may arise from such a comparison are immediately realized when consideration is given to the fact that diseases with similar symptoms may be caused by different organisms and diseases with different symptoms may be caused by the same organism.

The disease was first noticed in a small area of Key West, Florida, in 1955. Since then more than 800 diseased trees have been removed and destroyed. One of the first symptoms is a premature dropping or shedding of the nuts or fruit. The young inflorescence while still in the spathe may be a deep brown (necrotic) instead of the normal creamy yellow. The inflorescence when opened soon dries up and becomes blackened. The lower fronds become yellow and the upper ones progressively yellow until the entire crown consists of yellowish-bronze fronds. Figure 1, photograph taken in Key West, Florida, shows a coconut palm in an early stage of the disease. The lower fronds are yellowish-bronze. The tree was devoid of fruit and the inflorescences were dry and black. The tree was eventually removed by the owner. Hydrotic or water-soaked spots occur at the base of the still folded leaves and may eventually result in a soft rotting of the heart or bud. The heart or bud of the palm dies and secondary organisms enter and cause decay.

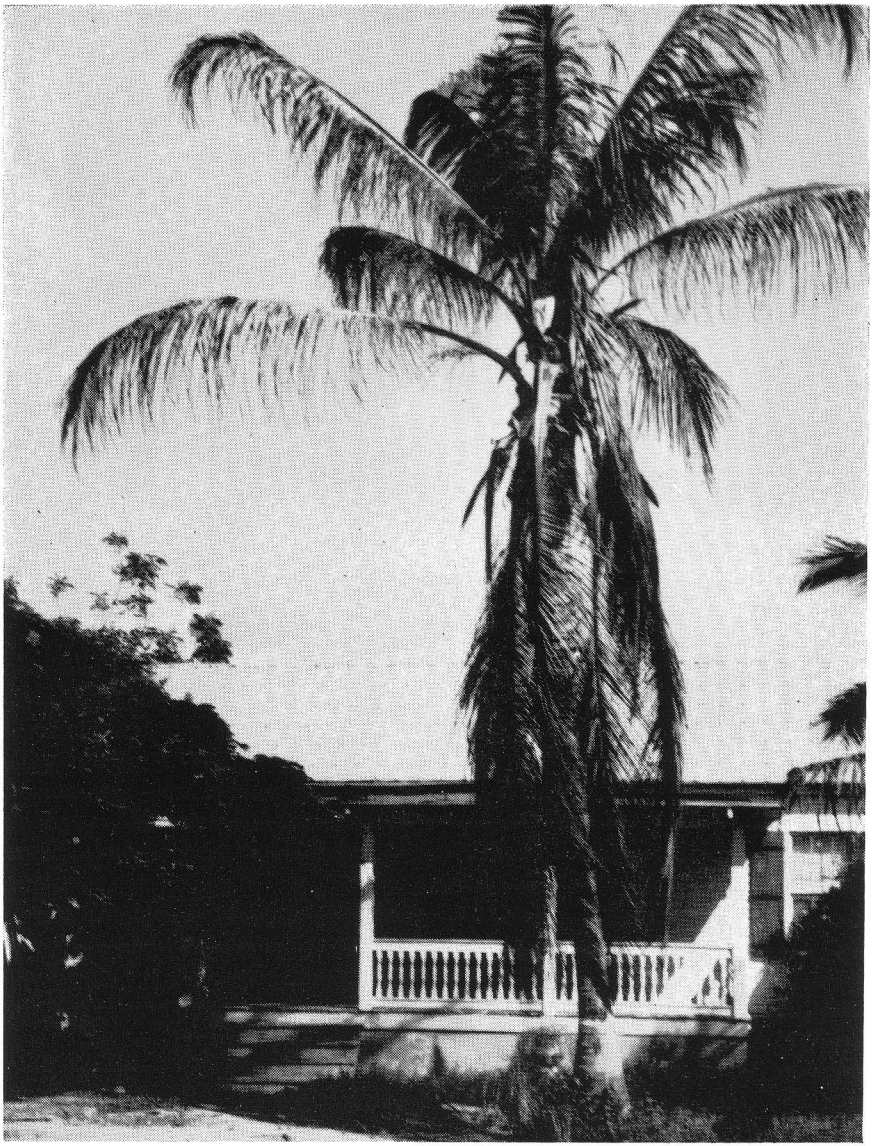
Figure 2, photograph of a palm in Key West, illustrates the more advanced stages of the disease. The remaining upright fronds are almost completely yellow. The fronds that are hanging down by the trunk have dried up and are brown in color. The fronds are easily removed from the tree and the heart gives off a very offensive odor.

Figure 3 illustrates the advanced stages of the disease in Jamaica. The heart fronds have collapsed and the remaining fronds are yellowish bronze. The inflorescences are blackened and dried and the tree is devoid of fruit. The yellowing of the fronds continues over a period of two to four months, at which time the entire crown is yellow and the heart dies. The coconut palm has but one growing point; thus the tree is doomed when the heart or bud dies. There are no reported cases of recovery from the disease (10).

The fronds continue to fall until all that remains is the naked trunk. Figure 4 illustrates the devastating nature of the disease in a coconut plantation in Jamaica, which is worthless for coconut production although a few have escaped infection.

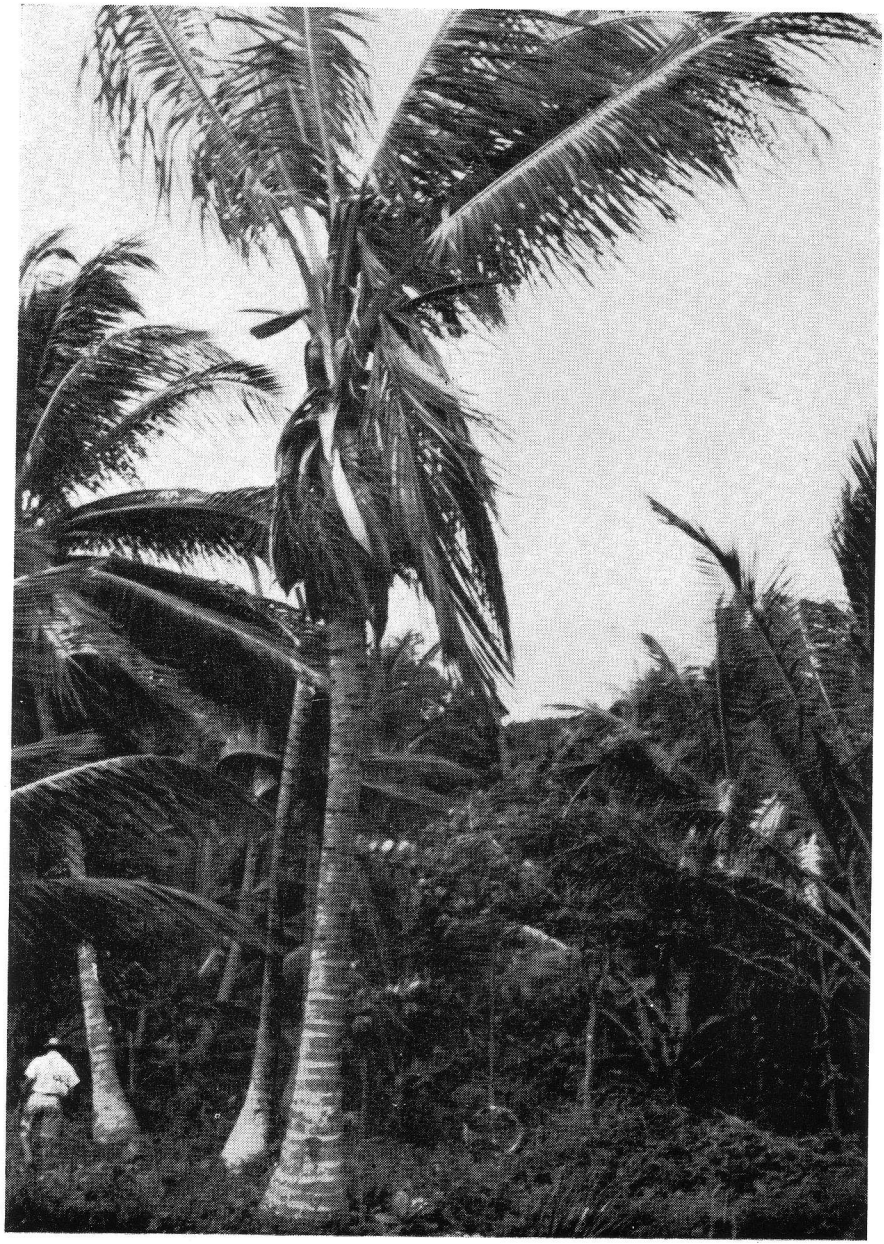
This disease has been attributed to several different agents. Deficiencies and toxicities of the soil (4) or bacterial and fungal infections have been implicated as the causal agents. Pres-

ent information indicates that the disease probably is not caused by soil conditions because palms become infected on many different soil types (6, 8, 10). The failure by many workers to detect a bacterial or fungal pathogen seems to eliminate these strongly suspected causal agents. The pattern of field spread, infectious nature of the disease, and lack of a visible pathogen strongly support the hypothesis that the disease is caused by a virus. Nutman and Roberts (10)



2. Coconut palm in Key West exhibiting symptoms of advanced stages of the disease. The crown fronds are yellowish-bronze and the fronds that are hanging down are dry and brown. The tree is devoid of fruit.

have demonstrated the presence of binucleate cells in infected plants. This abnormality does not occur in healthy palms. Since the binucleate condition has been reported by other workers to occur in other hosts as an internal symptom of virus infection, Nutman and Roberts have used this information, sup-



3. Advanced stages of lethal yellowing in Jamaica. Note collapse of heart fronds and blackened necrotic inflorescences.

ported by serological results and pattern of field spread, to support the virus hypothesis.

At present no known control measures are available. No chemical cures are known, and once a tree becomes infected it eventually dies. In Jamaica the disease apparently is limited in its spread by the removal and destruction of diseased trees (10).

The Malayan dwarf coconut palm appears to be highly resistant to or immune from infection (3, 10). Although inoculation experiments have not been conducted, palms of the Malayan dwarf variety that have been growing in the

4. Dead coconut palms resulting from the devastating effects of the unknown disease in Jamaica.

5. Malayan dwarf coconut, green variety, growing in the area affected by lethal yellowing in Jamaica. Note height of palm and yield of fruit.

diseased areas of Jamaica and Cuba for more than ten years have exhibited no symptoms of the lethal yellowing disease (3, 10). This coconut variety, because of its apparent natural resistance, is being used for replanting purposes in the disease affected areas of Jamaica and Cuba (3, 10).

The dwarf coconut, contrary to the implications of the terms, grows to considerable heights (Figure 5). The palms are dwarfed only in the sense that they start to produce fruit approximately three to four feet above ground level (Figure 6). The Malayan coconut occurs in several varieties based upon the color of the fruit. The three most commonly occurring varieties are the green, yellow, and golden.

Seed nuts of the Malayan dwarf coconut for replanting purposes should be obtained from parent trees in pure stands. The dwarf variety will hybridize with the tall susceptible variety and the offspring or progeny from such a cross may not possess the high degree of resistance or immunity exhibited by the parent.

At present the following control practices are recommended for the area affected by the disease in Key West, Florida: 1) Remove and destroy by burning all diseased trees; 2) if possible, spray the diseased and healthy surrounding palms with a mixture of insecticides before removal of the diseased trees; 3) replant seedlings of the Malayan dwarf coconut.

Acknowledgments

Grateful acknowledgments are made to the State Plant Board of Florida for making this study possible; to Miss Jean Smith for assistance with illustrations; and to the citizens of Key West who have shown interest in this problem and in the fate of the coconut palm. The

6. Malayan dwarf coconut, yellow variety, growing in Cuba. Note height of fruit production.

author is sincerely grateful for the assistance received in Cuba and Jamaica, especially that of the late Dr. Arthur Reid, Plant Protection Service, Kingston, Jamaica.

Literature Cited

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Palm Culture with Special Reference to Fertilization*

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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 more than 2,500 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, braheas 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 study 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 coconuts, dates, 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 not represent controlled or carefully observed experiments, but is based only on the opinions and memories of the persons consulted. However, the information received 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.

Soil Preparation and Planting

Mowry (20) offers a very complete discussion of soil preparation and planting, but his statements are based almost

*Presented at the Palm Conference, Fairchild Tropical Garden, April 18, 1958.

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 90 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 50 tons of 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.

NPK (Nitrogen-Phosphoric Acid-Potassium) Requirements

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 25 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 4 to 8 percent nitrogen, 6 to 8 percent phosphoric acid and 4 to 8 percent 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 1 to 2 ounces for very small recently planted palms to 15 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 (6 parts Nitrogen, 6 parts Phosphoric Acid, 6 parts Potassium) or 9-6-6 for palms, but Dr. E. W. McElwee, Extension Ornamental Horticulturist, from whose office this recommendation originates, frankly admits that we have no research on palm fertilization in Florida. The recommendation is based on practice and experience only.

Mr. 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 32 gallons; *Ptychosperma Macarthuri,* 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 preventive 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 three times every three weeks, 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 palms 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 . . . Morever, 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 one year after application. In widespread field tests in India, applications of NPK in a 1-1-2 ratio resulted in a substantial increase in yield from the third year onward. Sankarasubramoney (22) 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. However, at one station in Ceylon, response to phosphate application was highly significant. Generally speaking, potash seems to be by far the most important element influencing yield in coconuts.

Broeshart (4) 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.

Secondary Element Deficiencies

Although the majority of palms grow successfully in Florida under various maintenance programs without showing obvious effects of minor element deficiencies, many of the most important species are subject to deficiency diseases.

Dickey (10) found that curly top or frizzle leaf of *Arecastrum* was completely corrected by applications of one-half to five pounds of 80 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 in central Florida.

Other palms are also affected. Leaves of *Phoenix canariensis*, particularly young ones unfolding from the bud, are pale green to greenish yellow. Dickey states that the characteristic frizzled condition is lacking in this species but 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 growth is so reduced in the final stages that new leaves are unable to push out and the tree finally dies. Both Dickey and Mowry state that chlorosis is always associated with frizzle leaf but the writer has seen lush green palms showing the characteristic frizzle leaf 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 Bull (6) in *Elaeis guineensis*. Various workers have established the high magnesium requirement of both oil palms and coconut palms. In the 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 Bull (6, 7), 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. Broeshart and others (5) 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 intra-veinal chlorosis.

Conclusions

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 per 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 palm. Its use is suggested for ornamental species as well.

The importance of proper soil preparation before planting, however, cannot be overemphasized, particularly in our sandy Florida soils. In Africa, sandy soils containing less than 30 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.

Acknowledgements

The writer wishes to express his gratitude to Mr. Dent Smith, former President of The Palm Society, to Mr. Stanley Kiem, Superintendent of the Fairchild Tropical Garden, to Mr. John Poulos of the Miami Beach Parks Department, and to Mr. H. H. Worssam of the Dade

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7. *Euterpe globosa* forming "palm brake" between elevations of 2000-3000 feet on the sheltered slopes of Mount Britton, Luquillo Mountains, Puerto Rico.

The Mountain Cabbage Palm of the Antilles

W. H. Hodge

Few West Indian palms are as gregarious or wide-ranging as *Euterpe globosa*, the mountain cabbage palm, which inhabits moist montane sites throughout the Antilles from eastern Cuba (Oriente Province) to Grenada. On certain islands, such as Puerto Rico, square miles of the higher mountain slopes are dominated by this species forming a plant community known to the tropical ecologist as "palm brake". A curious thing is that the mountain cabbage palm, so abundant and widely dispersed in nature in a tropical area so relatively accessible and well-known, has not to my knowledge been brought into cultivation as an ornamental, at least not outside its native Antillean range. Its horticultural potentialities should be tested, for the species is certainly an attractive one.

A medium-sized palm, *Euterpe globosa* sports a rather slender (to 6 inches in diameter) erect stem which may rise anywhere from 15 to 70 feet tall depending in part on whether the growing conditions are sheltered or windswept. There is no definite crownshaft and the pale green pinnate leaves, 6 to 8 feet long, with their attractive arching pinnae form crowns which, to the person below, make attractive silhouettes against the sky. The slender, branched infrafoliar flower clusters (spadices) average about half the length of the leaves and at maturity produce an abundance of black globular (hence the specific name *globosa*) fruits averaging about half an inch in diameter.

Euterpe globosa is of special interest to the plant taxonomist. It represents the first or type species described in the neotropical palm genus *Euterpe*. Joseph Gaertner, the botanist who wrote the first account of this palm (1788) in his classical work on fruits and seeds of the world, knew only the globose fruit, which formed the basis of his original description. Moreover he did not know the origin of his plant material. We now realize that Gaertner's specimens must have come from somewhere in the West Indies for this species is now known to range for 1500 miles throughout all the mountainous Antilles (with the apparent exception of Jamaica) including Cuba, Hispaniola, Puerto Rico, St. Kitts, Nevis, Montserrat, Guadeloupe, Dominica, Martinique, St. Lucia, St. Vincent, and Grenada. As might be expected, *Euterpe globosa* is known by a variety of vernacular names in the islands—*palma azul, palma boba, palma justa and yagua justa* in eastern Cuba; *macoutouca* and *palmiste a chapelet* in Haiti; *manacla* or *palma de manacla* in the Dominican Republic; *palma de la sierra* in Puerto Rico; *palmiste montagne* in the French Antilles; and mountain cabbage palm in the British Lesser Antilles. Most euterpes, with palatable buds tasting like raw cabbage, are known as cabbage palms, hence the origin of the common English name of this species.

The wide Antillean distribution of the mountain cabbage palm is of much interest to students of palms. As has been shown above, the species, though a variable one, occurs on many of the West Indian islands. Each insular population of this palm has been well isolated for

8, top left. Mountain cabbage palm and *Cecropia* on a high ridge near the Freshwater Lake, Dominica. The windward Atlantic coast is to be seen in the haze in the background.

9, bottom left. *Euterpe globosa* seen from below in "elfin forest" near summit of Morne Trois Pitons, Dominica.

10, above. *Euterpe globosa* approaching higher ridges of Mount Britton, Luquillo Mountains, Puerto Rico. Note how the palms tend to occupy more sheltered slopes (left background) and ravines (right foreground).

centuries by water from even the nearest adjacent island population. In time, with such geographic isolation, one would expect evolutionary changes to have resulted in the origin of a number of distinct endemic races from the original mountain cabbage palm. Such evolution has taken place in a number of other Antillean genera having a similar dispersal. The royal palms (*Roystonea*) and the gru-gru palms (*Acrocomia*) are good examples of palm genera with closely related yet obviously distinct species or varieties described for the major islands or areas in the Antilles. *Euterpe globosa*, on the other hand, although definitely recognized as a variable species, apparently has not evolved recognizable geographical variations within its range—or perhaps it hasn't received intensive enough botanical study as yet.

Wherever it occurs the mountain cabbage palm occupies an altitudinal niche which is affected very much by precipitation brought on by the constant northeast trade winds. These winds, deflected upwards on the mountain slopes, are cooled as they rise bringing at elevations above 1500 to 2000 feet rather constant and well distributed precipitation throughout the year. The kinds of plants found at the higher levels of the islands are thus quite distinct from those which occupy the drier lowlands or slopes below. In this montane climate rainfall may run anywhere from 100 inches to probably as much as 400 inches a year, especially on the heights of islands as notably wet as Dominica. Vegetation is lush with tall rainforests at the more sheltered mid elevations (1500-2500 feet). These forests diminish in height on the upper mountain slopes until they are replaced by a dwarf, often impenetrable form of vegetation generally known by the descriptive terms elfin woodland or mossy forest (*fangales* is a Spanish name used locally for similar vegetation in the Sierra Maestra range of eastern Cuba). It is in these wet tropical forest formations—rainforest and elfin forest, that one finds the mountain cabbage palm at home.

In the lofty rainforest where the dominant trees may attain heights of 100 feet or more, *Euterpe globosa* is an "understory" species growing almost completely beneath the dominating canopy of giant trees. Even then this palm is recorded as attaining a maximum height of from 60-70 feet. Although a secondary species under such conditions, it is often so abundant on certain of the islands (especially St. Kitts and Nevis) as to represent as much as 50 per cent of all trees in the rainforest stand. On the other hand this palm is almost completely absent in the rainforest belt of such islands as Dominica, though the species is relatively common at higher elevations.

Above the belt of rainforests, on the more steeply pitching mountain slopes, *Euterpe globosa* really comes into its own and on a number of the Antilles forms extensive dense pure groves of palm forest generally called "palm brake". The line of demarcation between rainforest and palm brake is often sudden and indicative of the ecological reasons for the existence of palm forests: they seem to occupy the unstable soils of steeper slopes which either because of their physical properties or the constant saturation from rain are prone to landslides. These forests are examples of what ecologists call a disturbance climax (disclimax).

At elevations above 2000 feet in the Luquillo Mountains of eastern Puerto Rico palm brakes (here called "sierra palm forest") are especially imposing,

forming as they do more or less continuous bands around the slopes and extending up to the elfin forest-clad ridges near the summits of the highest peaks (3500 feet). These impressive forests of palms tend to occupy more sheltered sites and *Euterpe globosa* noticeably falls off in numbers as the upper windy ridges are reached or on the windward slopes. Here temperatures may average 10° or more cooler than at sea level, the soil is perennially soaked, and atmospheric humidity is high. These should all be clues to the successful culture of this palm species when it is attempted.

These Puerto Rican forests of mountain cabbage palms are about the only ones readily accessible to the casual traveler. Elsewhere, particularly in the Lesser Antilles, stands of *Euterpe globosa* can usually be reached only by strenuous climbing on slick mountain slopes or often through the well-nigh impenetrable thickets of the elfin forest. In Puerto Rico, on the other hand, one can drive by car from San Juan on good roads right up into the belt of palm brake in the Caribbean National Forest. The visitor to this area will be surprised to find how relatively open this forest is under foot with a rather poor representation of shrubs. The abundant moisture and humidity precipitated from rain clouds make mosses abound and these cover many of the palm trunks thereby serving as a fine medium for a wealth of epiphytic plants—chiefly ferns, orchids, and bromeliads. It will probably be from these accessible palm forests of Puerto Rico that propagation material can ultimately be gathered to establish *Euterpe globosa* as a new ornamental.

Pseudophoenix in Florida

R. Bruce Ledin[1], Stanley C. Kiem[2], and Robert W. Read[3]

I. THE NATIVE PSEUDOPHOENIX SARGENTII

Pseudophoenix Sargentii[4] is the rarest palm native to Florida. It has also been found on certain islands of the Bahamas, and is possibly the species found in northern Cuba, and Hispaniola, but in Florida it has been accurately recorded for only three stations, all of which are on the Florida Keys.

Its discovery, "rediscovery", taxonomy, and relationship have been given by Sargent (13), Cook (4), Small (17), and Bailey (1). Additional information recently come to light concerning this palm in Florida is herein recorded along with notes on the palm's discovery and history.

Early History

Charles S. Sargent, the authority on American trees who for fifty years was director of the Arnold Arboretum of Harvard University, was the botanist who announced the occurrence of the palm in Florida. On one of his few trips

1. University of Florida Sub-Tropical Experiment Station, Homestead.
2. Fairchild Tropical Garden, Miami.
3. Cornell University, Ithaca, New York.
4. The following common names have been given to this palm: hog palm, hog cabbage palm, hog palmetto, buccaneer palm, wine palm, false date palm, false royal palm, dwarf royal palm, ram's horn palm, lost palm, Sargent's palm, feather leaf Florida cherry palm, but perhaps the best common name is Sargent cherry palm, a name which seems to have been originated by L. H. Bailey.

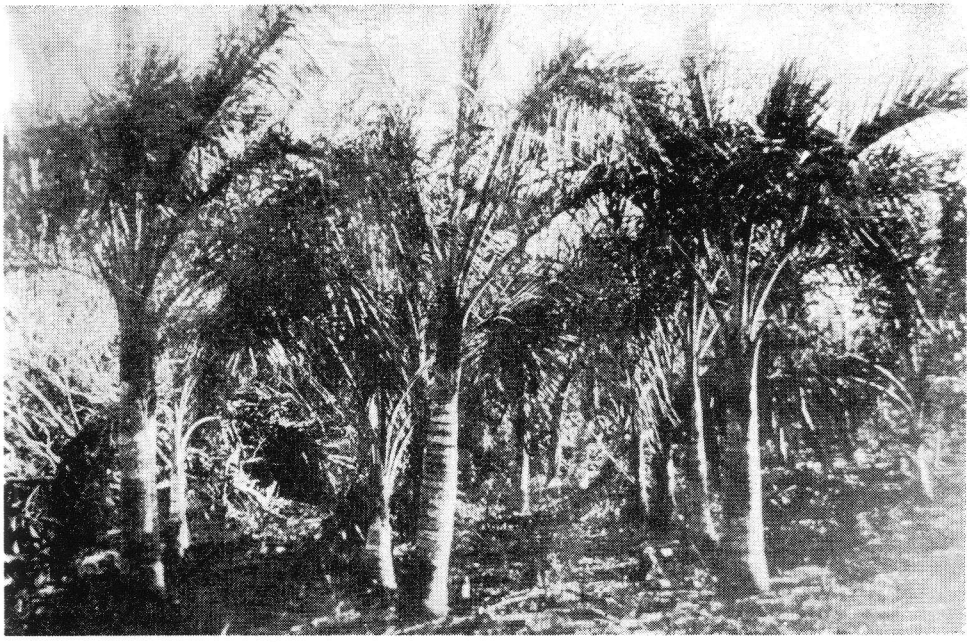
to Florida to collect and to study the tropical trees of this area, he was accompanied by A. H. Curtiss of Jacksonville and C. E. Faxon, the artist who made many of Sargent's plates for his *Silva of North America.* On April 19, 1886, these men, together with Lieutenant Hubbard of the U. S. Navy, on the lighthouse tender "Laurel", visited Elliott Key as guests of Mr. Henry Filer, who had a pineapple plantation on the upper or eastern end of the Key. Here Sargent came upon a solitary palm left standing in a clearing. Sargent thought at first it was a royal palm, but on closer examination he found it to be an entirely different plant, the bright orange-red globular or two- to three-lobed fruits and the conspicuous leaf scars on the otherwise smooth trunk proved to be an "interesting addition to the North American sylva". He found only six individuals in two localities two or three miles apart. "A few individuals were discovered scattered throughout the woods in the neighborhood of Mr. Filer's plantation" and growing on the border of a field recently cleared. The palms were 20 to 25 feet tall and the trunks were 10 to 12 inches in diameter.

Sargent sent unripe fruit, photographs, and a description of the palm to Dr. Herman Wendland of Hanover, Germany, who was growing palms in the palm garden at Herrenhausen. He at once not only recognized it as a new species, but considered it a new genus as well. He sent Sargent a letter in which he suggested the name *Pseudophoenix Sargentii.* Sargent published a brief note in 1886 (11) giving Wendland's proposed name.

The discovery of the palm on another island is given in Ralph Middleton Munroe's book *The Commodore's Story* (7). In Chapter 14, "Botany and Fishing" (page 148) Munroe says: "While visiting the Hines this winter [1886] on Long Key we discovered on its east end great numbers of what appeared to be small royal palms; we afterward learned that Professor Sargent had found isolated specimens on other Keys, and that it was a new variety named by him [*sic*] *Pseudo-phoenix Sargenti* [*sic*]". Munroe at this time took a photograph of the grove of Long Key palms; this photograph was used by J. K. Small in his article on the bucaneer [*sic*] palm (17) and is reproduced in this paper (Figure 11).

Further on in Chapter 14 Munroe states: "During the same visit to Long Key we had a northern which brought the mercury down to 36°". This "northern" was the devastating "big freeze" of January 9, 1886. Munroe sent a letter to Dr. Isaac Holden of the American Museum of Natural History who published a little article in the *Evening Post* about the cold spell in south Florida. This article is dated February 8, 1886. From this evidence, then, we conclude that Munroe found and photographed the "royal palm" on Long Key in early January of 1886. Later that year, on April 19, Sargent discovered the palm on Elliott Key. Sargent must have heard about the palm on Long Key; in writing about his discovery of the palm on Elliott Key he states, ". . . late [*sic*] in the same year a grove of them was discovered near the east end of Long Key by a gentleman from Bay Biscayne whose name I can not recall." (12).

A year later, in the spring of 1887, Sargent, Curtiss, and Codman again visited southern Florida, this time to see for themselves the grove of palms on Long Key. In writing about these palms, Sargent (12) states: "There are about



11. Photograph taken by Commodore Munroe in January, 1886, of the native grove of *Pseudophoenix Sargentii* on Long Key. This photograph was used by Small in his article on the buccaneer palm (1922). Notice that the trees appear to be arranged in rows, but this is probably a result of the seeds germinating very close together. The palms at this stage showed no bulges; it is possible that they are 20 to 25 years old. The scrubby vegetation which surrounds the palms had been removed so they could be photographed.

200 plants, large and small, in this grove, which is represented in the illustration upon page 353, from a photograph made by Mr. James M. Codman at the time of our visit to Long Key in the spring of 1887."

Following Sargent's original description of the palm, Curtiss published an account on the new species, giving a report of its discovery and a picture made from a drawing. This appeared as a front page article in the *Florida Farmer and Fruit Grower* for February 23, 1887, published in Jacksonville by A. H. Curtiss (5). Through an error, the name appeared as *Chamoephoenix* instead of *Pseudophoenix*.

Another note by Curtiss in the *Florida Farmer and Fruit Grower* appeared on page 89 of the March 23 issue (5). And in June 15, 1887, on page 185 of this magazine, E. N. Reasoner published an article describing a visit that his brother, Pliny Reasoner, made to Long Key in the spring of 1887 (10). Reasoner states: "In response to your request for some notes on the *Pseudophoenix* palm on Long Key, recently visited by my brother, I write the following from his description. The palms are growing on the east end of Long Key, in a little grove by themselves, on a high, dry ridge surrounded on all sides by almost impenetrable swamps. The ridge is not more than ten rods in length and five in breadth, and is situated on the southern-most of the two points which extend out into the straights of Florida, and

about eighty rods back from the beach. The surrounding swamps are dense jungles of red mangrove, and the ridge itself is covered with a growth of black mangrove, button-wood, stoppers of various kinds and the great scrambling "nicker-bean" vine (*Guilandina Bonduc*), in addition to the palms.

"The palms are about 150 in number, and the largest specimen of all, the 'great grandfather', is not more than eleven feet in height. Most of the others seem to have reached a 'responsible age', in spite of their small size, and showed old blossom spikes, though not a perfect seed was found. The almost total absence of small plants seemed to show that perfect seeds are very rarely produced, or else that the conditions of moisture are seldom favorable enough for them to germinate. There were many small and imperfect seeds under some of the trees, but no perfect ones. The non-germination of the perfect seeds may also, perhaps, be accounted for on account of the extreme dryness of the soil, which is finely powdered shell covered with a thin stratum of dry leaf mold.

"The most of the island, including the palms, is the property of a New York gentleman, who has extensive cocoanut groves along the beach, and who has already taken commendable steps to protect the trees from the vandal's axe. It is worthy of note that the eastern extremity of Long Key is not more than eight miles distance from the old home of Dr. Perrine, on Lower Matecumbe, and must undoubtedly have been often visited by him on his seed planting excursions."

Another article by Curtiss was published in 1888 in the first edition of *Garden and Forest* magazine (6). He mentions the discovery of *Pseudophoenix* on Elliott and Long Keys, which are over fifty miles distant from each other. "They might have disappeared wholly from the world but for their timely discovery by Professor Sargent and the enterprise of Messrs. Reasoner Brothers, of Manatee, in obtaining plants and seeds for cultivation."

Sargent, in this same issue of *Garden and Forest* (12), gives a more detailed account and description of the species along with a Latin diagnosis, a drawing and a photograph of the palm on Long Key. Wendland wrote the Latin description of the species after he had received ripe fruit collected by Curtiss in 1887.

Sargent in his *Silva of North America* (13) describes the palm in some detail and gives an account of its discovery, and Faxon has an excellent plate showing the structure of the fruit, etc. It is in this work that Sargent inadvertently gives Key Largo as a location for the palm instead of Long Key; this mistake is repeated in his *Manual of the Trees of North America* in 1905, and in the second edition of 1922.

"Rediscovery" by J. K. Small and Others

John K. Small of the New York Botanical Garden began his explorations in southern Florida in 1901. From then until the late 1920's Small made many trips to Florida and several of them were described in the *Journal of the New York Botanical Garden.* In five of these articles he mentions *Pseudophoenix.*

In the fall of 1901 with G. V. Nash, Small spent three weeks in the Miami region with two days devoted to the Keys. His trip was reported in 1902 (14). While visiting Elliott Key, Small "rediscovered" *Pseudophoenix Sargentii* —this was fifteen years after Sargent had first seen it there. Small found only three plants—one in the center of a

pineapple field and the other two preserved near a building. Nash secured one plant that had been previously transplanted to Miami and sent it to the New York Botanical Garden. There it remained for two years in a more or less dormant condition in the greenhouse. At the end of the second year it put out new leaves and flowers. This was reported by Nash in 1903 (8). The following year, Nash described the "rarest of all the palms of Florida" in *The Palms of Florida* (9).

N. L. Britton, in his explorations of the Bahamas, visited southern Florida and the Keys in 1904. He collected on Soldier Key, Sands Key, and Elliott Key. He reports (3) finding a few old specimens of the palm on Elliott Key and presents a photograph of one of them.

Another fifteen years went by before the palm was again mentioned as being "rediscovered" on Elliott Key. Charles T. Simpson in a letter to J. K. Small tells of a visit in 1919 with Mr. Somers of Coconut Grove to Elliott Key (17). They found a young plant and three other plants on the upper end of the island a short distance through the thick scrub near the bay side. They also found a large specimen some distance up the Key.

This letter apparently inspired Small to search again for the palm on the Keys. In December 1919 (15), he visited Upper Matecumbe Key to investigate a reported occurrence of royal palm growing on this Key. It turned out that the palms were *Pseudophoenix* collected and transported from Long Key and planted as royal palms. In April, 1920 (16) he reports his find of the palm on Elliott Key in 1901 and states that probably by now (1920) "the palm apparently is nearly extinct on this island" — as a result of the extensive pineapple cultivation in the early 1900's and the transplanting of the palm to Miami. He visited Long Key in 1920 and, inexplicably in view of later reports, was unable to find a single plant of *Pseudophoenix*. He believed that all of the 200 plants that were there in 1886 had completely disappeared as a result of transporting and selling them as royal palms. He refers again to the specimens on Upper Matecumbe Key, and mentions that a boatload of *Pseudophoenix* plants were brought over to Miami from the Bahamas and sold here as royal palms.

Small was back in south Florida in December, 1921, and January, 1922, (18) and this time investigated a report of the palm growing on the islands north of Elliott Key. On investigating Ragged Key No. 6, he found that the palm in question was *Thrinax parviflora*. Then he visited Sands Key, a small island just north of Elliott Key, with Wirth Munroe of Coconut Grove, who had found the palm on Sands Key in 1921. They saw one specimen of the palm completely surrounded by hammock growth. The trunk was 25 feet tall and was bent over above the middle as a result of crowding by a large pigeon plum tree. They were unable to find any young plants. Later in the same year, in April and May, Small made another trip to Long Key (19). This time he was successful in finding the palm forming a grove situated on a small plateau of sand protected from the ocean by a barrier ridge and a swamp. There were only about two dozen plants; some were old trees, others had just sprouted, and a few were twin palms.

There are no records of Small's visits after 1922, but Bailey (1) states that he visited Long Key and Elliott Key with Small presumably in 1925. At this

time Bailey photographed two palms on Long Key. This, then, is the last time that the palm is mentioned as growing wild in South Florida. Bailey gives Upper Matecumbe Key as a station for the palm, but this is in error for the plants were planted there as described by Small in 1919 (15). Bomhard (2) repeats Bailey's error.

The Disappearing Palm

Thus we have only three locations for this palm in Florida — Elliott Key, Long Key, and Sands Key, the latter with only one specimen, and the last written record of the palm as occurring wild was in 1925. From the very beginning after its discovery plants have been removed, especially from Long Key, and it has been the general belief in recent years that the palm has been exterminated in Florida. J. K. Small in his *Manual* in 1933, states, "The colony of several hundred individuals on Long Key . . . has been destroyed by vandals who have removed the trees and sold them as royal palms."

Curtiss in his article on the "Flora of the Florida Keys" (6), states that *Pseudophoenix Sargentii* palms "might have disappeared wholly from the world but for their timely discovery by Professor Sargent and the enterprise of Messrs. Reasoner Brothers, of Manatee, in obtaining plants and seeds for cultivation." The Reasoner brothers — Pliny Ward and Egbert Norman — had contributed to our knowledge of the plants of south Florida. They established their Royal Palm Nursery in 1883 near Manatee, Florida, offering for sale many tropical plants, including many of the native ones. They explored and collected in south Florida, and Sargent gives them credit for discovering several palms and other tropical plants. For many years the Reasoner Brothers Royal Palm Nursery offered *Pseudophoenix* for sale.

In the Royal Palm Nursery Catalogue and Price List for the Season 1887-88, page 44, *Pseudophoenix Sargentii* is described as follows: "Florida's newly discovered palm. Discovered in the summer [*sic*] of '86 on Elliott Key, by Prof. Sargent, of England [*sic*], and named (as it was sufficiently distinct to constitute both a new species and a new genus) in honor of the latter, by Professor Wendlandt, of Germany. It is known nowhere else in the world, and in but two small groves on the Keys—containing in all not over two hundred specimens. It is a half-dwarf species, never exceeding 20 feet in height. The palm is pinnate-leaved, and somewhat resembles some species of *Phoenix*. The leaf-stalks drop off as soon as the leaves die, leaving a free, clean-looking trunk, the upper part marked with alternate rings of green and brown. Perhaps the rarest Palm in cultivation, and destined to be so for years—as the trees rarely perfect from seeds." The plants sold for $25, $50, and $100 each! On the back cover of the catalogue is a drawing made directly from a photograph of a lone tree on Long Key. The statement under the photograph reads: "From the owners of these unique and rare palms, recently found on Long Key (Messrs. T. A. and E. A. Hine, of New York), we have obtained control of the few plants small enough to be handled, the only procurable plants of this species known to be in existence, which have been potted and are now offered for sale."

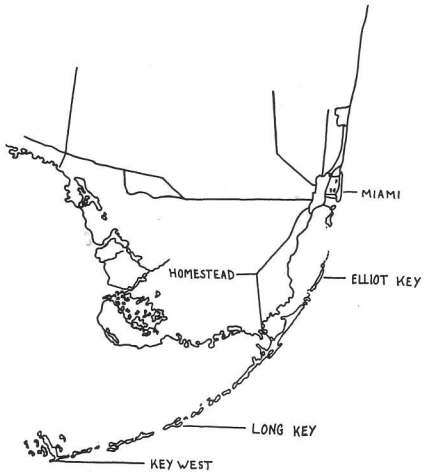
It is quite possible, then, that shortly after 1886 the palms began to disappear from Long Key. When Small and Nash were in Miami in 1901, they reported observing specimens of the palm growing on the grounds of the Royal Palm

Hotel. Small (15) states that "Ten tall specimens were removed from Elliott Key in 1897 to Miami and planted." By 1920, Small says that only two of the ten plants at the Royal Palm Hotel were left. Before 1920 a number of specimens had been transplanted to Upper Matecumbe Key.

In the 1920's *Pseudophoenix* was frequently seen as an ornamental palm in south Florida. The plants undoubtedly were ones transplanted from Elliott and Long Keys or purchased from the Reasoner's Nursery. According to Small (16) plants were also brought over from the Bahamas to Miami and sold as royal palms. Many of these plants have long since disappeared from cultivation — they died of old age, were attacked by a fungus, or were removed from parks and old homesteads to make way for new buildings and roads. So today *Pseudophoenix* is not commonly seen in south Florida except in botantical gardens and special collections.

Pseudophoenix on Elliott Key "Rediscovered"

Elliott Key, being about eight miles long and scarcely one mile wide, is the second largest of the Florida Keys; it runs somewhat NE-SW and it marks the outer edge of Biscayne Bay opposite Homestead (Figure 12). Before the turn of the century there were several pineapple plantations on the island; yet at this time, as well as today, the Key was relatively uninhabited. It is covered mostly with a dense hammock of West Indian trees and shrubs growing on coral rock. It is one of the few remaining "wild" regions of south Florida (outside of the Everglades) which has not yet been taken over for cultivation or residential areas. There are no roads to the island; it is accessible only by boat.



12. Map of southern Florida showing the location of Elliott Key and Long Key.

On December 10, 1950, the senior writer and members of the Gifford Society of Tropical Botany of the University of Miami made a trip to Elliott Key to collect plants and to investigate a report that royal palms were growing wild in a dense hammock. These royal palms were found to be well established *Pseudophoenix Sargentii.* There were about 20 plants growing in a dense hammock on the upper end of the Key bordering a road which runs the length of the island, and about 900 feet from the Bay side. Three sizes or ages of plants were found. The oldest and tallest specimen was a solitary tree some distance away from the others at the edge of a clearing. It was estimated to be about 20 to 25 feet tall and one foot in diameter above the base and was probably more than 50 years old. The other plants were all growing in one area approximately 300 feet square in the dense hammock of buttonwood, *Eugenia,* mahogany, prince wood, and other West Indian trees. Two sizes were noted here: 1) plants with trunks about 10 to 12 feet tall and 6 to 8 inches in

13. *Pseudophoenix Sargentii* on Elliott Key. Photograph taken by Mr. Charles Steffani, Jr., December 10, 1950. This plant was growing at the edge of the hammock in the clearing made when the Elliott Key road was being constructed. The edge of the road is visible in the foreground. Notice the conspicuously swollen base of the trunk and the prominent rings set far apart. The trunk of this palm is estimated to be ten feet tall and six to eight inches in diameter above the base and the plant is probably 25 to 30 years old. 14. The same palm as in 13 but photographed eight years later, April 25, 1958, by Stanley Kiem.

diameter above the base and probably about 25 to 30 years old (Figure 13); 2) young plants with hardly any trunk showing above the surface of the ground and probably about 10 to 12 years old. In all cases the trunks were straight except for the enlarged base next to the ground; the conspicuous bulges often found in this species, brought about either by age or climatic conditions, were absent.

No seedlings were found and no plants were under ten years old. Nevertheless, there were periods when seeds were capable of germinating as shown by the different age groups. We do not know if this is the same area where the palm was originally found in 1886, but it is believed that the plants found in 1950 were ones that came from seed since the original plants were discovered, as it is felt that none of the palms could have been over 60 or 70 years old. One factor in accounting for the lack of seedlings could be that raccoons, rats, and black squirrels prevalent on the island eat the fruits; in some years these animals may be scarce and the seeds then are able to germinate. It is also possible that in certain years non-viable seeds are produced.

That the palms were still present eight years later, was shown by the junior authors who, on April 26, 1958,

made a trip to Elliott Key and found by careful count 28 palms (Figure 14). The area was plotted on a map and was found to be the same as the one explored in 1950. They also noted the different age groups and reported that no seedlings were found and no specimen appeared to be less than 15 years old. They also found evidences of at least 17 very large specimens that were represented by stumps consisting only of a high mound of roots on top of the coral rock. The diameter of some of these stumps was 2 to 3 feet, indicating that these palms had been very old plants before they died.

Pseudophoenix on Long Key "Rediscovered"

One of the peculiar features of the "grove" of palms on Long Key, as shown in the photograph Commodore Munroe took in 1886 (Figure 11), is that these plants appear to be growing in rows as they would be if some one planted them in this manner. This has led several of us to speculate on the idea that perhaps the palms were actually planted on Long Key, having been brought over from the Bahamas by some early settler, perhaps in the 1860's. However, the photograph represents only a small portion of the "grove" and it is possible that the plants could have grown in this manner since the 150 or 200 palms were growing very close together in this small area. Moreover, the photograph Sargent took and used in his article in 1888 (12) does not show the palms in rows. It is also significant that not one writer who has observed the palms on Long Key mentions this peculiar feature. Therefore, even though it is difficult to explain why these palms appear to be in rows, the writers conclude that the palms on Long Key are a definite feature of our native flora.

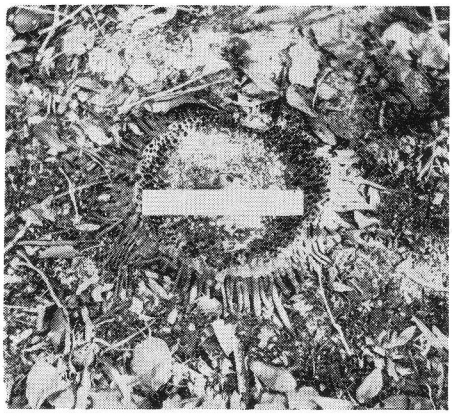
Long Key, about 50 miles southwest of Elliott Key, is shaped like a Y with the right branch forming a peninsula running east and west (see map). This area is uninhabited and no roads lead into it. It is covered with typical scrub-like vegetation with some coconuts and casuarina along the shore and considerable mangrove in low areas. The soil, unlike that of Elliott Key, is sandy and composed of minute broken shells. Toward the eastern or upper end the peninsula makes a decided turn, running more NE-SW. The writers visited this area on September 5, 1958, by boat and went in about one fourth mile from the point where the shore turns. In this area, which was the same location as described by Reasoner, Sargent, and Small, *Pseudophoenix* was found.

The plateau where the palms were growing was about 150 to 200 feet from the shore, separated from the sand ridge by a slough bordered by black mangrove. The vegetation is scrublike, consisting of *Eugenia, Pithecellobium, Pisonia, Rhacoma, Ximenia, Metopium,* and *Genipa.*

In an area about 40 feet wide and 60 to 80 feet long, we found three very old specimens of *Pseudophoenix* and evidences of many more. The three plants were 7, 8 and 12 feet tall, respectively, and consisted of 187, 199, and 248 leaf scars. Two plants were leaning and one was erect. The tallest one projected its crown above the vegetation of the surrounding plants. This palm had no swollen area except for being uniformly thick from the base to about five feet and from there to the crown the trunk was quite narrow. The other two palms had definite swollen areas above the base and from there to the crown the trunk was narrow. (Figure 15) The lower thicker portion of the trunks had

leaf scars 3 to 4 inches apart, indicating good growth for 20 to 25 years; the remaining growth with numerous leaf scars set very close together indicates slow growth for many years. In all probability these three plants were part of the original grove discovered in 1886 as we estimate them to be 80 to 100 years old.

15. *Pseudophoenix Sargentii* on Long Key, one of the three remaining specimens with R. W. Read at the side. Photograph by Stanley Kiem, September 5, 1958.



16. Stump of a *Pseudophoenix* on Long Key. A six-inch rule suggests the size. Photograph by Stanley Kiem, September 5, 1958.

No seedlings were seen and there was no evidence that any had been produced recently. However, these palms have reproduced themselves in the past as Small records in 1922 that he found seedlings, young plants, and even twin plants. It is quite likely that since that time the younger plants have been removed or were killed off by various causes.

Here also many stumps were found (Figure 16) ; 24 were counted in a small area and there could have been three to four times that many in the entire area. It is significant that none of the stumps appeared to be in rows. These palms had been dead for many years as only a flat mound of black, hollow tubelike roots was left. Hurricanes, salt, old age, diseases, etc., have taken their toll. But the interesting fact here is that not all of the palms had been removed by nurserymen and vandals—many have disappeared by natural causes.

It should be pointed out that any palm collector desiring specimens of *Pseudophoenix* would do well to find one already in cultivation. The three

specimens on Long Key are suffering from old age; the trunks are covered with lichens and blackened by sap which has oozed out from the numerous holes made by birds, probably woodpeckers. They are not handsome specimens and transplanting would probably kill them. The palms on Elliott Key would prove very difficult to transplant as these plants are growing in solid rock. There are palms in cultivation resulting from the United States Department of Agriculture distribution of seedlings in the 1930's and Fairchild Tropical Garden has also distributed plants. There are still a number of mature specimens in cultivation, especially in Miami, Key Largo, and Key West, which produce seed regularly. In some cases, as in Key West, small seedlings are found under the palms. Many seedlings are being grown in order to preserve the palm as an ornamental and it is being offered by several nurseries.

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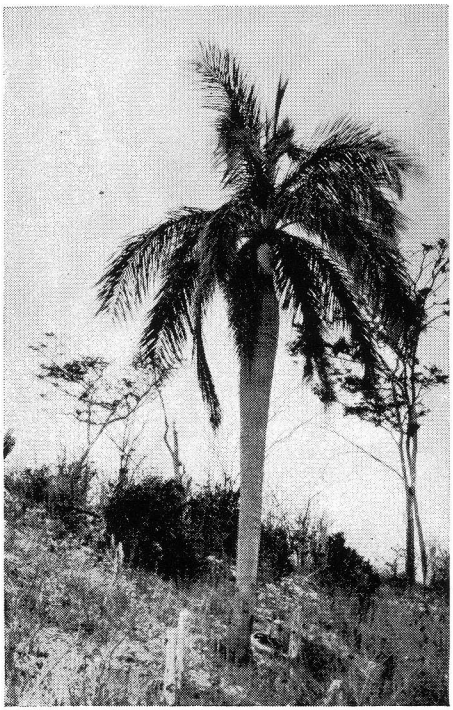
II. PSEUDOPHOENIX SPECIES IN CULTIVATION

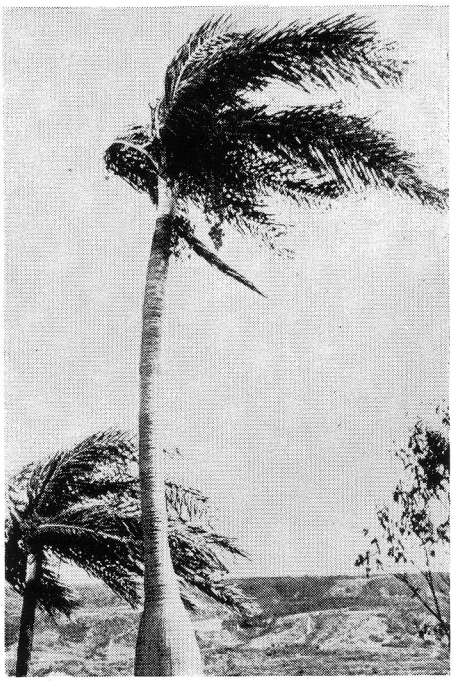
Three species of Pseudophoenix can be found in cultivation in Florida in botanical gardens, private collections and occasionally as single specimens in yards and public places. They are *P. Sargentii, P. vinifera,* and *P. saonae.*

Pseudophoenix Sargentii Wendland, is native to the Florida Keys, Bahamas, and is also recorded for Cuba and Hispaniola. It is possible that some of the original plants from Elliott and Long Keys are in cultivation, but it is more likely that most plants seen today represent second and third generations. The U.S.D.A. Plant Introduction Garden in Miami distributed plants from two accessions: P. I. 97823, the seed collected by G. G. Albury, at the request of Dr. David Fairchild, on Cat Island, Bahamas, March 21, 1932, and offered for distribution in 1933; P. I. 96488, the seed collected from a tree in the yard of Mrs. Edward George, Nassau, Bahamas, by David Fairchild, January 10, 1932, and the seedlings distributed in 1935. A group of plants at Fairchild Tropical Garden in Miami are from seeds sent by Brother Leon in 1939 from Cuba. Some specimens in cultivation were also obtained from the Royal Palm Nursery in Oneco, Florida; as late as 1938 this nursery was offering the palm for sale under the name of *P. vinifera.*

Pseudophoenix vinifera, Beccari (*P. insignis,* Cook, *P. linearis,* Cook), is



17. A fruiting tree of *Pseudophoenix vinifera* at Poteau, Haiti. Photograph by L. H. Bailey courtesy of the L. H. Bailey Hortorium.



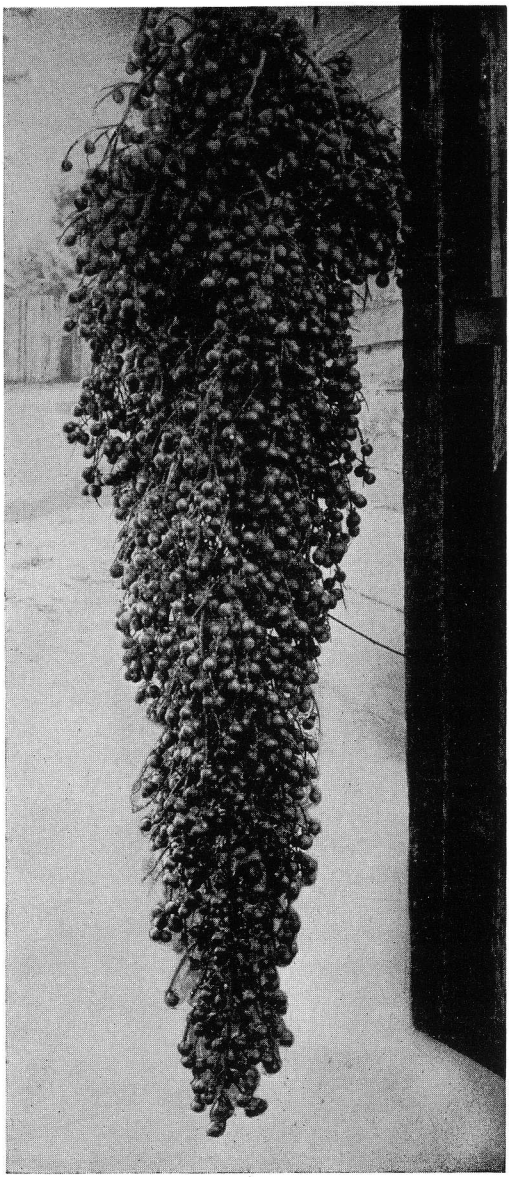
18. Old trees of *Pseudophoenix vinifera* on the dry hills at Los Quemados, Dominican Republic. A constant wind beats the leaves and bends the slender trunk. From a color transparency by R. W. Read.

native to Haiti and Santo Domingo. O. F. Cook collected seeds of this species in Haiti in 1923, as *P. insignis*. Some of the seeds were sent to the Plant Introduction Garden in Miami the same year and plants were set in the field in 1929. Cook, in July, 1931, sent three seedlings to the Plant Introduction Garden, the plants having been grown in Washington, D. C. Other plants were set in the field at the Plant Introduction Garden in 1930 and 1932. In December, 1951, all these *P. vinifera* plants from Cook's original seed were given the P. I. number 198875, and in the spring of 1952 seedlings from these original plants growing at Chapman Field Introduction Garden in Miami were offered for distribution. The best collection of mature plants of *P. vinifera* is at the Plant Introduction Station in Miami. There are also a few large plants in South Florida which were offered by Cook and others in the late 1920's and early 1930's to cooperators, but these plants were distributed without a P. I. number.

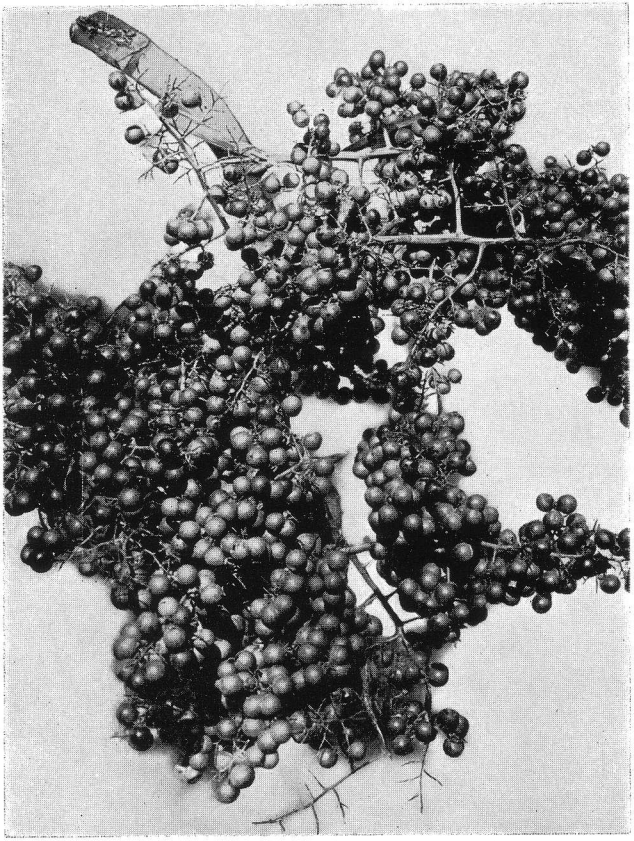
Pseudophoenix saonae, Cook. Plants were distributed by the U.S.D.A. in 1935 and 1937, as P. I. 96487. The seeds were collected by Mr. Harold F. Loomis, January 20, 1932, on the island of Saona, Dominican Republic, the only known locality for this species.

The identification of *P. Sargentii* and *P. vinifera* is not difficult. The distinguishing characteristics of the two species are summarized in the table. *P. vinifera* is by far a much more attractive palm (Figures 17, 18, 19) ; it is faster growing, the trunk is taller and thicker, the leaves are larger and much longer, the leaflets are less stiff and tend to droop like a royal palm; the inflorescence is much longer and drooping, and the fruit is much larger.

Plants of both species when grown in the shade produce quite a different aspect from those grown in the sun. *P. Sargentii* in the shade will be faster growing, become taller, the leaves larger



19. Fruit cluster of *Pseudophoenix vinifera,* hung in a gateway for photographing; about 6½ feet long. Barahona, Dominican Republic. Photograph by L. H. Bailey, reproduced from *Gentes Herbarum* 4: 278, fig. 179. 1939.



20. The broad divaricate fruit cluster of *Pseudophoenix Sargentii*. Photography by L. H Bailey, reproduced from *Gentes Herbarum* 4: 282, fig. 183 1939.

and the leaflets less stiff and more flexible, and the bulges in the trunk will usually be absent, except that in some individuals the base of the trunk may be swollen. Specimens in the sun will have a much shorter and thicker trunk and often appear dwarfed, and the bulges may or may not be present; if present, they generally are at the middle or below and result from transplanting or ecological conditions. In old age the specimens will often display a bottle-like neck. *P. vinifera* grown in the shade will produce a thick, straight trunk. In old age, the upper part of the trunk will often have a bottle-like neck as in *P. Sargentii*. Plants in full sun, and especially if growing in poor soil, will be somewhat dwarfed and quite often show bulges at the middle or above.

P. saonae is very similar to *P. Sargentii* and the two species are almost impossible to separate in the younger stages; they both show the same habit and slow growth. According to Mr. H. F. Loomis, mature plants of *P. saonae* usually have the older leaves less arched, being more erect or horizontal but not arching downward, and the flowering cluster is longer and drooping and projects below the leaves. In *P. Sargentii* on the other hand, the older leaves eventually are arching outward and downward, and the flower cluster (Figure 20) is held more or less among the leaves until sometimes the heavy fruiting cluster will cause it to droop downward.

The Main Distinguishing Characteristics of Pseudophoenix Sargentii and P. vinifera

P. SARGENTII	P. VINIFERA
Slow growing.	Much faster growing.
Trunk thinner, becoming 10-12 inches in diameter, rarely larger, usually smaller; plants in shade with taller slender trunk; plants in sun flowering when only 3 feet high, giving the aspect of a dwarf palm.	Trunk becoming over 12 inches in diameter, sometimes if bulged becoming almost 2 feet through; plants in shade taller growing.
Leaves generally stiff, spreading or arching, but hardly drooping; becoming 6-8 feet long, often only 3 feet long; plants in shade with longer leaves and less stiff pinnae.	Leaves 9-12 feet long or longer, gracefully arching and drooping.
Pinnae straight, sometimes more or less erect, rarely slightly drooping.	Pinnae longer and more drooping.
Petioles just below leaflets only 2-3 inches in diameter.	Petioles thicker and wider, 3½-6 inches in diameter.
Inflorescences short, usually as long as broad, sometimes longer, but much shorter than the leaves, to 3 feet long (Figure 20).	Inflorescence longer, 2-3 times longer than broad, to 6 feet long. (Figure 19).
Branches of the inflorescence standing at right angles to the main axis.	Branches of the inflorescence all pointing downward.
Fruit 1.5 cm. (½ inch) long and wide, in two- and three-lobed fruit to 2.5 cm. (1 inch) wide.	Fruit 2.5 cm. (one inch) long and wide; in two- and three-lobed fruit to 4 cm. (1½ inches) wide.

PALM CULTURE

Continued from page 17

County Parks Department who, together, contributed much of the information contained in this paper.

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DISEASES

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EDITOR'S CORNER

Volume 3 commences a new palm year with articles by some authors already familiar as former contributors. New names are those of Douglas Knapp, a native Floridian and graduate of the University of Florida, who is Assistant County Agricultural Agent of Dade County, Florida; of Robert W. Read, a New Jerseyite recently graduated from the University of Miami, who has worked at the Fairchild Tropical Garden and who is continuing his studies in the graduate school at Cornell University; of Dr. M. K. Corbett, a native of Nova Scotia, graduate of McGill University with a Ph.D. in plant pathology from Cornell University in 1954, and now on the staff of the University of Florida. Dr. Corbett's article is the first of seven which will appear in PRINCIPES.

Mrs. Wait has forwarded several interesting letters which lack of space prevents printing in this issue. They will appear in succeeding issues. If you have notes or comments which may be of interest to other members of the Society they will be welcomed in this or other columns.

Pseudophoenix Seeds

Mrs. Nis Juhl, 541 N. W. 47th Terrace, Miami, Florida, has clusters of ripe seeds on her *Pseudophoenix Sargentii*. She invites anyone who wants to come and get them to help themselves.

NOTES ON CULTURE

Mr. Ray Vernon, superintendent of the Montgomery palm collection in Coconut Grove, Florida, suggests the following:

Do not keep young palms in containers too long. Palm roots normally are stiff and straight. It harms them to encounter a hard unyielding surface which forces them to curl and deviate from their natural habit of growth. Set young palms out as soon as feasible so the root system will have an opportunity to develop properly.

Palm Slides

Dr. Walter Hodge, the Society's president, has contributed to its slide collection a set of 39 color slides on economically important palms. These transparencies are sold as a set by Ward's Natural Science Establishment, Inc., P.O. Box 1749, Monterey, Calif. They are listed in Ward's Natural Science Catalog 578 which can be ordered from the above address.

A commentary written by Dr. Hodge comes with the slides, giving the common name, botanical name and a brief resumé of the economic uses of each. Among the palms represented are: the betelnut, cohune, coconut, ivorynut, oil palm, raffia, rattan, peach palm, toddy palm and wax palm.

This set will be incorporated into the Society's loan collection. Anyone wishing to have his own set may obtain one by ordering from the company.

Classified Section