PRINCIPES

Journal of the Palm Society

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July, 1958

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.

PRESIDENT: Walter H. Hodge, Longwood Gardens, Kennett Square, Pennsylvania.

VICE PRESIDENT: R. Bruce Ledin, Sub-Tropical Experiment Station, Route 1, Box 560, Homestead, Florida.

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PRINCIPES

JOURNAL OF THE PALM SOCIETY

An illustrated quarterly devoted to information about palms published on the first day of 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.

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Contents for July

Cover Picture

Three plants of *Pelagodoxa Henryana* growing at Summit, Panama Canal Zone. Photograph courtesy of Walter R. Lindsay. See also page 95.

Mailed July 10, 1958

Society News

Biennial Meeting of the Society and the Palm Conference

Your two-year-old Society passed an important milestone on April 17-18, 1958. A large group of members and their friends gathered at the Fairchild Tropical Garden, Miami, Florida, to get acquainted, look at palms, photograph palms and talk palms. Members began arriving at 10:00 a.m. on Thursday, the 17th. They registered, then went out in small groups with guides to see the large collection of palms in the Garden. Besides seeing fine specimens, one of the chief advantages of visiting the Garden is learning how to plant palms for landscape effects, as the Fairchild Garden is noted for its unusually fine landscaping. At noon members returned to the Garden House where picnic lunch was served on the loggia.

The biennial business meeting was called to order at 1:30 p.m. The President, Executive Secretary, and Treasurer gave their reports which are reproduced in this issue. The following officers and directors were nominated and elected for the period 1958-1960: President, Dr. Walter H. Hodge; Vice-President, Dr. R. Bruce Ledin; Secretary, Mrs. David Fairchild; Treasurer, Mr. Frank R. May; Directors to fill existing vacancies, Mr. Nat J. De Leon, Mr. Frank R. May, and Mr. Nixon Smiley. A short talk on proposed standards of quality for container-grown palms by Mr. T. E. Whitmore of the State Plant Board of Florida concluded formal business.

At 3 p.m. the meeting adjourned to enjoy the hospitality of Mrs. Alvin R. Jennings at her nearby estate. In the absence of Mrs. Jennings, we were greeted at the house by several hostesses, and were entranced by the large number of flowering orchids, the exotic flower and fruit arrangements, and the magnificent sweep of lawn bordered with palms seen through the picture windows. Cool punch, cookies, and frozen lychee fruit refreshed us; then we were ready to follow our guides through the grounds. The late Colonel Robert H. Montgomery spent twenty years energetically searching for and acquiring palms from every part of the world where they grow and developed one of the greatest private palm collections in the world. The remainder of the afternoon was spent among splendid specimens of palms including such rarities as *Bismarckia* (*Medemia*) *nobilis*, *Veitchia Montgomeryana*, and perhaps the only two specimens of the double coconut, *Lodoicea maldivica*, in the United States.

At 7 p.m. one hundred and seventeen of us met again at Miami Springs Villas for dinner, more palm conversation, and an informal, beautifully illustrated talk "Palms through a Botanist's Eye" by our president, Dr. Walter Hodge. It was indeed a thrill to look at the color slides of palms in many of their varied forms, and to increase our understanding of their parts and the function of each in the life of the plant.

On Friday, April 18th, the Society was privileged to join with the Fairchild Tropical Garden in perhaps the first palm conference of general nature. Brief talks were given on palm insects, diseases, history of palm introduction into Florida, propagation, germination, seed viability, culture and names. Some of these papers will appear in this and in succeeding issues of PRINCIPES.

L.H.W.

Report of the President

Until today, most contacts with our members have been through correspondence. It is, therefore, a very great pleasure to be able to attend this second biennial meeting of the Society and to meet a representative group of our membership. How fortunate we are to have been offered this attractive auditorium set in such lovely garden surroundings. As many of us already know and others will soon see, this is the outstanding palm collection in this country. Our thanks to the Fairchild Tropical Garden and to its Director, Nixon Smiley, for their generous hospitality in making all this possible. The planning for the Palm Conference, scheduled for tomorrow, is also largely due to Nixon Smiley, even though the full cooperation of others has been given to this program.

This is also the proper time, I feel, to extend the full thanks of the Society to the committee on local arrangements. For some time this committee has been active in making plans. Our Executive Secretary, Lucita Wait, has headed this group. To her and to her fellow committeemen is due a great deal of credit for making what should prove to be a very successful meeting.

Following this business session, we will be privileged to visit the Alvin R. Jennings estate to see the palm collection of the late Colonel Robert H. Montgomery whom many of us know as the founder of the Fairchild Tropical Garden. Mrs. Jennings, one of our Directors, is presently out of town so unfortunately cannot be with us today. Her hospitality is none the less appreciated and I am sure that all of you would wish me to pass on your thanks.

Our business reports promise to be brief, mine included. I would like, however, to say a few words about the Society's past, its present status, and its future aims.

First a bit about the past. As most of you are aware, the Palm Society was organized informally by a handful of palm lovers in November of 1955. The enthusiasm behind this first beginning was that of Dent Smith who carried the officer-less Society completely on his shoulders for five months until April 17, 1956, which was the date of the first formal meeting of members, held here in Miami, a short two years ago. From that meeting came a constitution and a set of by-laws as well as officers and directors whose term of office was set at two years. As was fitting and proper, Dent Smith became our first president and in addition ably served as the first editor of a new journal, PRINCIPES, a quarterly devoted to information about palms. Other officers elected at the time included Bruce Ledin, Vice President, Mrs. Claire Hargert, Secretary, and Miss Margueriete Martin, Treasurer.

Upon his election Dent Smith had indicated that it would be impossible to continue in office for the first full two-year period, and it was on account of this that the Society changed its officers a year ago, resulting in the present incumbents. A year ago an added position, that of Executive Secretary, was created. I would like again to thank personally that first team of officers who had the onus of planting a seed, watching it in its critical year of germination, and seeing it off to a flourishing start.

A year ago, as retiring president, Dent Smith wrote, "Our past as an organization is short and inconsequential, but its future is long and full of promise." Although these words are still largely true, we must admit of certain achievements. The successful birth of a new society is certainly something to record as well as the unusually rapid growth which re-

sults in the present membership of over 400. The past year has seen the Society incorporated and also, as a non-profit organization devoted to scientific and educational purposes, declared exempt from federal income taxes. It is hoped that our new tax exempt status will stimulate future contributions to our treasury.

I am sure that we all recognize our journal PRINCIPES to be our most solid achievement to date. It is the Society's principal means of communication to all members and its sole method of supporting, in the words of our original masthead, "the study of the palm family in all its aspects throughout the world." Dent Smith, first editor, launched it with enthusiasm and outstanding stewardship. We are indeed privileged in having as its present editor Dr. Harold E. Moore, Jr., outstanding botanist and this country's foremost student of the palms. With the cooperation of all of us the future of PRINCIPES should indeed be a rosy one. Besides coming to each and all of you four times a year, it is also in demand by the libraries of scientific establishments both here and abroad.

All young and growing organizations need money and the Palm Society is no exception. As a matter of fact, and our treasurer's report will undoubtedly bear me out, ours is still very much a hand-to-mouth existence. With no fixed dues our receipts are the sum of our voluntary contributions from members. These just about cover the cost of printing and distributing PRINCIPES, but do not include the entire operation of the office of Executive Secretary which has been subsidized through the generosity of one of our members. However worthy such a subsidy may be, I personally feel that every one of us should work fully to make our organization completely self-sufficient. Our per-member costs remain at an approximate $10 per annum level, which is excessive. You have been contacted during the year to help in getting new members. This is an important appeal, for if we can reach the 600-member goal and hold it, we will be close to self-sufficiency. Since financial solvency is absolutely necessary to a society's progress, I am recommending the appointment of a financial committee with the hope that competent members can suggest ways of solving this important problem.

What about our future? I have already mentioned the basic aim of financial self-sufficiency. I hope, also, that there can be an increased participation by our members in Society affairs at all levels. This will, I am sure, help increase the contribution of important information about palms. Naturally, PRINCIPES will continue to be our chief mouthpiece, but from time to time we may find additional ways of implementing the primary task of increasing the fund of knowledge about palms. As an example, you will be interested to learn that your officers and directors are presently considering the preparation of a "Handbook of Palms." This will stress primarily the horticultural aspects of these plants. Under the direction of a special committee, it will be prepared by competent writers and will be published, we anticipate, as a special issue of the *National Horticultural Magazine* which is the journal of the American Horticultural Society. The recent "Holly Handbook," familiar to some of you, is an example of the type of volume we hope can be prepared.

From the foregoing you will realize that your officers are trying to do all they can on behalf of the Society. May I request in closing that each member in his own way try to do likewise.

WALTER H. HODGE, *President*

Treasurer's Annual Report

The Society again operated this fiscal year on a contribution basis, realizing that the membership is not yet large enough to establish fixed dues and still be able to meet its bills. A statement of income is shown below.

Other receipts consisted of money derived from classified advertising, the seed bank, and from purchase of back issues of PRINCIPES and mimeographed bulletins. The printing covers cost of PRINCIPES, engravings used, and various stationery and forms needed to conduct the Society's business. The miscellaneous item consists mostly of the cost involved in incorporating the Society. This year we are happy to report that the Society has been granted a tax exempt status.

I cannot step down without thanking the membership at large for their wonderful support and generous contributions. Special thanks should be given to S. C. Johnson and Son, Inc., for their gift to the Society of $250.00. Real financial security has not been achieved yet, but such security can be gained through increased membership. It is hoped that the members, realizing this, will continue in their efforts to obtain new members.

Any member of the Society may inspect the books if he so desires. They are now in the possession of my successor as Treasurer, Mr. Frank R. May, at Miami.

Respectfully submitted,
Signed NAT J. DE LEON, *Treasurer*

April 17, 1957 to April 16, 1958

Receipts:		
Contributions and Subscriptions	$4,306.45	
Other receipts	175.55	
		$4,482.00
Disbursements:		
Supplies and Stationery	$ 66.56	
Postage	255.00	
Printing	2,227.21	
Mimeographing	86.72	
Miscellaneous	236.86	
Secretary's Salary	1116.87	
Withholding and Social Security	161.26	
		$4,150.48
Balance		$ 331.52

Report of the Executive Secretary

It is a real pleasure for me to stand here at this meeting of our Society and greet old friends; also, to welcome those whom I have known through correspondence but now have the opportunity to meet. May I, first of all, thank all of you for your support of the Society, your success in obtaining new members, your wonderful aid in preparing for this meeting, and your help in many other ways. This applies not only to those present here today, but to those who could not come.

It was my hope that before this meeting we would enroll our four-hundredth

member. *We have done so,* thanks to your response to the membership campaign, and to the lists of prospects which you have sent on the blanks provided, or by letter and postcard. You are given credit in our card file for each new member who joins through your efforts.

We have lost three members by death, and two have resigned. Unfortunately, thirty-seven members have never shown any interest in the Society by contributing, or even by writing a letter. This, of course, does not include those members who are honorary by reason of their eminence in the world of palms, nor those who would willingly contribute except for a lack of dollar exchange in their countries. This leaves 358 active, interested members; our goal is 600. We must find 242 more persons who are interested in palms and who would like to join the Society. This should not be too hard, for inquiries are constantly being received. Our main responsibility is to let people know about the Society and its aims.

Our members are scattered over a very large area of the world. Florida has the largest number of members: 219. California is next with 68. Texas is third with 14. Thirty-seven of our members are located in Arizona, Arkansas, Illinois, Iowa, Louisiana, Massachusetts, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Wisconsin, the District of Columbia, Canal Zone, Guam, Hawaii and Puerto Rico.

Members in foreign countries number 49. They live in Africa, Australia, the Bahamas, Belgium, Brazil, Canada, Colombia, Costa Rica, Cuba, Dominica, El Salvador, England, France, Germany, Guatemala, Honduras, Indonesia, Italy, Jamaica, Japan, Malaya, Mexico, New Zealand, Paraguay, the Philippines and Samoa. You will note that there are no members in India or Ceylon. Lately inquiries have been received from India, so we hope soon to remedy this lack. We also need more members in Brazil, the greatest palm land of all.

Educational and botanical institutions which may have rules against membership in organizations are eligible to subscribe to PRINCIPES, without the privileges of membership. We now have subscribers in Africa, Australia, Europe, Indonesia, New Zealand, South America, as well as the United States and its possessions. I shall be very grateful to anyone who knows of institutions which should be subscribing to PRINCIPES and will send names and addresses, so I may query them.

It is a delight to me to hear from you, wherever you may live. We want to know what you are doing and thinking about palms. Please send bits of news, photographs, or questions, which we shall try to answer. Since members are so scattered, we must communicate through the mail and through our Journal.

Lately our youngest member, Arthur Scarpa, 15, of East Boston, Mass., won first prize in his school for a science exhibit demonstrating the uses of palms. His exhibit has gone on to the Boston Science Fair, where we hope he will acquaint more people with the palms. Mr. Toshihiko Satake, of Saijo, Japan, has sent many fine photographs of palms taken by his representatives while they were in Indonesia, Hawaii, British Guiana, Trinidad, Ceylon, Egypt, California and in Japan itself. Interesting pictures show his own specimens of *Sabal minor* and *Butia capitata,* covered with snow. Mr. J. C. McCurrach, of Palm Beach, is busy compiling an illustrated volume on palms. A number of members have written about their planting projects, special problems in their area, etc. Only short-

age of time prevents me from quoting them at length.

Also, please do not fail to notify me if you do not receive your copy of PRINCIPES, or if you know of ways in which we can be more efficient, or serve you better. If we all work together enthusiastically and mutually, the Society will continue to grow and improve.

LUCITA HARDIE WAIT,
Executive Secretary

Society Members Awarded Medals

Two members of the Society were awarded medals by the Fairchild Tropical Garden at its annual meeting on March 25, 1958. The Founder's Medal, awarded for "distinguished achievement in the world of palms and cycads" was presented to Professor Dr. Max Burret of Berlin in absentia and to Dent Smith, founder of the Palm Society. The citations that follow were read by Harold E. Moore, Jr., for Professor Burret and by Harold F. Loomis for Dent Smith.

MAX BURRET

Professor Burret has studied palms for over thirty years. Working with specimens sent to Berlin from the tropics of both hemispheres by various plant collectors, and with his own material gathered during trips to Brazil and Indomalaya, he has published over 100 technical articles concerned with the taxonomy and nomenclature of palms. Over 550 species have been described as new to science in these articles, and outlines of monographic studies in many critical genera have appeared in the period 1927-1956.

The manuscript for a monograph of the family Palmae to have been published in *Die natürlichen Pflanzenfamilien*, and most palm collections at Berlin, were burned when the Botanical Museum was bombed on the night of March 1, 1943. Undaunted by this tragic loss of his most important work, Professor Burret, first alone and then aided by Dr. Eva Potztal, has since published an outline of the Palmae in the form of keys to the genera.

Professor Burret's contribution to our knowledge of the palms has indeed been significant. His name will rest with those of illustrious predecessors as an outstanding student of this most fascinating and noble family of plants. It is appropriate that the award of the Founder's Medal of the Fairchild Tropical Garden recognizing his distinguished achievement in the world of palms is made this year as Dr. Burret celebrates his seventy-fifth birthday.

DENT SMITH

Dent Smith, after wide experience in many fields in Mexico and in the United States, including service in the Regular Army, entered Wall Street where he attained such success that in less than fifteen years he was able to retire and to devote his energies to less mundane matters. Fortunately, these included an interest in palms, initiated by the establishment of his home in Florida at Daytona Beach. The difficulty of growing many palms so far from the subtropical regions of the state presented a challenge which was met by starting a collection of all available species for testing. The relatively few nurseries where palms were offered and the seemingly limited number of people interested in them astonished him, as did the fact that nowhere had any effort been made to form clubs or associations of palm enthusiasts. His decision to form an international palm society was followed by purposeful activity in establishing it at great sacrifice of time and money, and has resulted in a growing organization now

numbering nearly 400 members in 26 countries. As the Palm Society's first president, and through the pages of its quarterly journal which he founded, his enthusiasm stimulated world-wide interest in the study, introduction, commercializing, and planting of palms. He has brought together, from many parts of the world, the lovers of these magnificent plants, and has formed them into a working group which will greatly benefit all.

Now, after the disastrous winter just passed, when he saw many of his cherished species frozen to the ground, he is taking his losses philosophically and using his surviving species as indicators in a search for new palms that will withstand low temperatures. Thus will his efforts further extend our knowledge of hardy palms, open new areas where they may be grown, and increase the number of people who may plant and enjoy them.

In recognition of these outstanding contributions in relation to palms, the Fairchild Tropical Garden is honored to present the Founder's Medal to you, Dent Smith.

* * *

Frank R. May — New Treasurer

The Society's new treasurer, elected at the biennial meeting in April, is Mr. Frank R. May, a successful businessman, owner and operator of the Miami Transfer Company.

Although he has lived in Florida since early childhood, he did not discover his enthusiasm for palms until about six years ago, when he and his family moved into a new home. In order to mitigate the bareness of the newly bulldozed lot, he brought over some large coconut trees from the old home. They were such an instantaneous success that Frank became interested in other palms.

For about two years he gave up fishing, and concentrated on studying palms and combing the nurseries of the area for new species. He had a large sinkhole dug at the back of his lot, for the shade- and moisture-loving kinds. He is now one of the leading amateur palm collectors in southern Florida. In six years his bare lot has been transformed, by much work and plenty of fertilizer, into a mecca for palm enthusiasts.

Slide Collection

The Society is interested in building up a collection of palm slides with the ultimate goal of selecting the best to form a traveling set which can be made available to members on a rental or loan basis.

Will members donate duplicates or copies of their best slides to the Society for this purpose? Let's get behind this project and see how fast we can build up a good collection to help in our study and for the use of competent speakers.

If any member wishes to add to his own collection and will pay for the film, we will try to get a good photographer to take the pictures on a 50-50 basis, one for the member and one for the Society.

Please send your slides and/or comments to the Executive Secretary.

L. H. W.

EDITOR'S CORNER

The error regarding *Pelagodoxa Henryana* made in October and confessed in January (*Principes* 1: 174; 2: 16) is rectified in part on the cover of this issue and on page 95. Mr. Walter R. Lindsay and Mr. Toshihiko Satake have been most kind in providing photographs of the true *Pelagodoxa* for publication. A further note comes from Mr.

Lindsay who writes "We received our *Pelagodoxa* trees as seedlings in 1938 from Mr. Harrison Smith (ex Mathematics Professor from Harvard University), Papeete, Tahiti. They are a shade-loving species and we lost several plants by planting them in the sun. Strong winds raise havoc with their beautiful leaves . . . None of the . . . seeds from our trees have germinated."

* * *

Several new names appear among contributors to the July number. Drs. Dahlgren and Glassman are currently working together on a monograph of *Copernicia*. Dr. Dahlgren, now retired from the staff of the Chicago Natural History Museum where he was formerly Curator of Botany, is known to palm students for his *Index of American Palms* published in 1936. Dr. Glassman obtained his Ph.D. at the University of Oklahoma and is now Curator of the Herbarium at the University of Illinois, Division of Biological Sciences, Navy Pier, Chicago. He is the author of *The Flora of Ponape* published as the *Bernice P. Bishop Museum Bulletin* 209 in 1952.

Mr. T. R. N. Lothian was born in Melbourne, Australia, where he commenced professional training at Burnley Horticultural College. Added experience was obtained at the Christchurch Botanic Garden, New Zealand, the Royal Botanic Gardens, Kew, England, and the Munich Botanical Garden in Germany. After army experience he was Senior Lecturer in Horticulture, Lincoln Agricultural College, New Zealand before assuming duties as Director of the Botanic Garden in Adelaide in 1948.

Born and raised in San Antonio, Texas, Mr. A. P. Martinez settled in Florida in 1947. A graduate of the University of Florida in 1955, he is now working part-time on his master's degree in plant pathology while working with the State Plant Board of Florida as Assistant Plant Pathologist.

Dr. Eva Potztal is a native of Berlin, Germany, who has studied at the Friedrich Wilhelm University and the Free University in Berlin. She obtained her doctor's degree under Professor Robert Pilger with a study on grasses, her field of special interest. Now Custodian of the Botanical Museum at Berlin, Dr. Potztal has worked with Professor Burret, about whom she writes, since the summer of 1954.

Dr. D. O. Wolfenbarger is Entomologist at the Sub-Tropical Experiment Station of the University of Florida in Homestead, thus well acquainted with the insects about which he writes. A graduate of Colorado Agricultural College, he earned his doctor's degree in economic entomology at Cornell University. Before moving to Florida in 1945, Dr. Wolfenbarger was associated for several years with the United States Department of Agriculture and was Assistant Entomologist at the Delaware Agricultural Experiment Station from 1943-1945.

Mrs. Roy A. Hunt of Pittsburgh, Pennsylvania, shares the following lines, the exact source of which has not been traced.

"The man who has been among palms is never the same again. How can he be when he has seen the loneliness of the desert with its palms and the glory of sunset breaking over it in purple and red; when he has walked at midnight beneath a golden moon and a hyacinthine blue sky, or felt nature alive in the velvet darkness of a moonless tropic night."—Goethe

Professor Dr. Max Burret

Eva Potztal

Karl Ewald Maximilian Burret was born on June 6, 1883, in Saffig bei Andernach, Germany, the son of a landowner. He reached maturity at Koblenz and, at the wish of his father, first studied law at Lausanne, Switzerland Then —his own inclination speaking—he changed to the study of natural history at Berlin. In 1909 he took his doctor's degree under Adolph Engler, then the Director of the Botanical Garden and Museum at Berlin-Dahlem, with his study entitled "The Comparative Relationship and Distribution of the African species of *Grewia* (Tiliaceae)" [Verwandtschaftsverhaltnisse und Verbreitung der afrikanischen *Grewia*-Arten].

Since there were no openings at the Museum at the time, he was able to remain only for a year as an assistant. From 1911 to 1921 he served as assistant at the Botanical Institute of the Agricultural High School in Berlin. In spite of these quite different duties, he remained true to taxonomy and published during this time a number of taxonomic works dealing with the Tiliaceae and Moraceae. The year 1922 brought him the opportunity to return to Berlin-Dahlem as curator of the Botanical Museum.

Toward 1925, Professor Burret was induced by the second director of the Museum, Ludwig Diels, to occupy himself with the palms. The palms, though not selected from special preference, were the principal part of his scholarly occupation for over thirty years. His researches on the palms have become fundamental for our knowledge of this family today. On the basis of the rich collections of the Botanical Museum

Fig. 51. Professor Max Burret, a recent photograph taken in the Museum at Berlin.

and the flow of incoming collections from the tropics, Dr. Burret was able to publish over 100 palm studies; monographic accounts of a number of genera, new genera, and many new species.

Besides general botanical field trips in the Mediterranean region, to Bosnia and Herzogovina, he was able to study palms on the spot in their native habitats on two extensive trips in the tropics. At the invitation of the Brazilian government, he traveled for research purposes in Brazil from October, 1937 until February, 1938 and, at an English invitation, through Ceylon, the Malay Peninsula, Java and Sumatra, from December, 1938 until July, 1939. Unfortunately the war prevented his undertaking a

third long journey of botanical investigation in the South Seas jointly with some American scientists on a special ship. From all his trips, Professor Burret brought back large collections of palms for study at Berlin.

The war struck still a further blow. In a bomb attack of March, 1943, a part of the extensive palm collection was burned as well as the major part of a manuscript for *Die natürlichen Pflanzenfamilién*. Despite his attempts, he was unable to put the manuscript together again, chiefly because the great library of the Museum was also destroyed. Thus, after the war, he published only a review of the palms in the form of keys to the genera.

In recognition of his special distinction in the investigation of the palms, the Fairchild Tropical Garden presented him with its Founder's Medal in this year of his 75th birthday. All those who know him well admire his vigor and freshness and wish that his health, which has been poor recently, may be restored so that he may be permitted to spend his next years pleasantly.

PALM PUBLICATIONS BY DR. MAX BURRET

1. Eine neue Palmengattung von den Molukken [A new palm genus from the Moluccas]. *Notizblatt** 10:198-201. 1927.
2. Über *Ptychosperma elegans* (R. Br.) Bl. *op. cit.* 202-206.
3. Eine neue Art der Palmengattung *Pelagodoxa* Becc. aus der Südsee [A new species of *Pelagodoxa* from the South Seas]. *op. cit.* 286-288. 1928.
4. Die Palmengattungen *Oenocarpus* Mart. und *Jessenia* Karst., nebst Bemerkungen zu *Archontophoenix* H. Wendl. et Drude (einschl. *Loroma* O. F. Cook) [The genera *Oenocarpus* and *Jessenia* with remarks on *Archontophoenix* (including *Loroma*)]. *op. cit.* 291-312.
5. Beitrage zur Kenntnis der Palmen von Malesia, Papua und der Südsee [Contributions to knowledge of the palms of Malesia, Papua, and the South Seas]. *Rep. Spec. Nov.* 24: 253-296. 1928.
6. Die Palmengattung *Manicaria* Gaertn. *Notizblatt* 10: 389-394. 1928.
7. Die Palmengattungen *Chelyocarpus* Dammer und *Tessmanniophoenix* Burret nov. gen. *op. cit.* 394-401.
8. Eine neue *Copernicia*-Art aus Paraguay [A new species of *Copernicia* from Paraguay]. *op. cit.* 402-404.
9. Die Palmengattungen *Orbignya, Attalea, Scheelea* und *Maximiliana. op. cit.* 493-543, 651-701. 1929.
10. Neue und kritische Arten der Palmengattung *Mauritia* [New and critical species of *Mauritia*]. *op. cit.* 565-574.
11. Palmae Cubenses et Domingenses a cl. E. L. Ekman 1914-1928 lectae [Palms of Cuba and the Dominican Republic collected by E. L. Ekman 1914-1928]. *Kungliga Svenska Vetenskapsakademiens Handlingar*, ser. 3, 6(7): 3-28. 1929.
12. *Lepidocaryum Tessmannii* Burret nov. spec. *Notizblatt* 10: 771. 1929.
13. Die Gattung *Euterpe* Gaertn. *Botanische Jahrbücher* 63: 49-76. 1929.
14. Die Heimat von *Astrocaryum rostratum* Hook. f. [The native country of *Astrocaryum rostratum*]. *Notizblatt* 10: 837-838, 1929.
15. Zur Gattung *Jessenia* Karst. *op. cit.* 839-84.
16. Die Gattung *Ceroxylon* Humb. et Bonpl. *op. cit.* 841-854.
17. Die Gattung *Hyospathe* Mart *op. cit.* 854-859.

**Notizblatt=Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem*, changed in 1953 to *Willdenowia; Rep. Spec. Nov.= Repertorium Specierum Novarum Regni Vegetabilis*. [Ed. note: titles have been translated except when they are repeated, when they concern a single species, or when they are of generic studies (*Palmengattung* = palm genus)].

18. Geonomeae americanae [American Geonomeae]. *Botanische Jahrbücher* 63: 123-270. 1930.
19. *Calamus rhabdocladus* n. sp.; *Rhapis gracilis* n. sp.; *Pinanga Sinii* n. sp. in Diels, Miscellanea sinensia III. *Notizblatt* 10: 882-884. 1930.
20. Iriarteae. *op. cit.* 918-942.
21. Palmae novae Luetzelburgianae [New palms collected by Luetzelburg]. *op. cit.* 1013-1026. 1930.
22. Über *Leopoldinia piassaba* Wallace, die Stammpflanze der Pará-Piassave [On *Leopoldinia piassaba*, the source of Pará piassava]. *op. cit.* 1027-1028.
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The Livistonas of Australia. With Particular Reference to The Central Australian Cabbage Palm

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The genus *Livistona*, so far as palms are concerned, is a comparatively small one. In addition to perhaps up to half a dozen species in Australia, there are about another dozen or so outside that continent, where members of the genus are found through Java and Celebes, to the Malay Archipelago and then extending up through Burma and into South China. Palms are one of the principal inhabitants of rain forest and demand such conditions, or their equivalent, to thrive.

Of the species within Australia, two are of considerable interest, namely *Livistona australis*, cabbage palm, and *L. Mariae* Central Australian cabbage palm. In the distribution of these two species we find that while the former is limited to the east coast of Australia and then in rain forest country only, *L. Mariae* is limited entirely in its distribution to a few square miles of favourable territory (actually a sunken river bed) surrounded by very arid and inhospitable country in Central Australia.

The cabbage palm is a somewhat stocky but slender growing species with a massive head of foliage. After 10 or even up to 15 years, the plant elongates into a ringed robust but slender-stemmed palm usually reaching between 40 and 60 feet, but specimens exceeding that have been measured. The leaves form a dense crown. The leaf stalk is somewhat spreading and pendulous or decurved. The fan-shaped leaves are from 6 to 8 feet in diameter, and the stalk is heavily armed along its two edges. The foliage has never been greatly used by the aborigines nor manufactured into articles of clothing, but sometimes crude shelters are constructed from the leaves.

Flowering is usually annual. The spathes vary from 6 to 12 inches long, while the spadix is often up to 4 feet long. The flowers are produced in tremendous numbers, but individually are small, greenish in colour and when the plant is in full flower often giving a yellow appearance. Fruit, under favourable conditions, is produced in quantity, globose in shape, and between ½ inch and ¾ inch in diameter. The seed is slightly larger than that of the ordinary garden pea, brownish black in colour, and under artificial conditions it germinates readily when sown in bottom heat of between 75 and 80°F.

The Central Australian cabbage palm, *L. Mariae*, is undoubtedly a remnant of a probable long ago distribution through parts of Australia which then were moist and humid but are now arid. The Finke River which forms "Palm Valley" (Glen

Fig. 52. Palm Valley, Central Australia, looking along the floor of the Finke River bed, with pool in foreground. Aquatic and bog plants on the left, with Central Australian river red gum (*Eucalyptus camaldulensis*) and Central Australian cabbage palm (*Livistona Mariae*) growing together.

of Palms), the principal locality of this palm, commences away outside the MacDonald Ranges and flows through the Krischauff Ranges, finally to lose itself in the arid regions of Central Australia. In Palm Valley, richly coloured sandstone cliffs have been formed as the river has slowly etched its way through this one-time plateau. The cliffs in places are nearly 300 feet in height, and while basically of a rich brownish-orange in colour, a variety of shades and tones can be seen during the various periods of the day.

Compared with *L. australis*, the Central Australian species is more slender, apparently very much longer lived, and reaches a very much greater height. The leaves are slightly smaller, and an interesting characteristic is the reddish colour which all the young leaves show. For this reason many have assumed that this is a distinct variety; I have seen it referred to in American catalogues as such. This red colouring of the young leaves never, to the best of my knowledge, occurs in *L. australis*. It is particularly noticeable on young plants, but as soon as the stem commences to elongate the red colouring in the leaves diminishes and in old palms it is very rare to find leaves tinged or coloured at all. The plant ultimately will reach 70 or 80 feet, and there have been notable examples in Palm Valley which have been estimated to reach almost 100 feet in height.

The Valley itself is comparatively short and narrow. Permanent rock pools are found, and following good rains,

fish very quickly breed in these pools. In addition to *Livistona Mariae*, other plants found in the area include the river red gum (*Eucalyptus camaldulensis*), the ghost gum (*E. papuana*), bullrushes (*Typha*), and other aquatic and semi-aquatic plants.

Another "palm" is found in this region, namely the Central Australian cycad, *Macrozamia Macdonnellii*. It is because of the presence of this cycad and the *Livistona* that the valley has received its name.

The cycad is a short stocky plant, extremely slow growing, with pinnate fronds 6 to 8 feet in length. Seed is copiously produced, and these, on an average, are the size of a hen's egg. Unfortunately it is one of the principal items "souvenired" by tourists visiting the Valley, and concern is now felt regarding the continuity of the species because of the lack of young plants.

Like all cycads, the Central Australian cycad is extremely slow growing. However the development of the young plant including the germination of the large seed, is somewhat spectacular, and it is for this reason that they are frequently cultivated as a curio. At one stage the seeds were known as "desert eggs." Following germination, growth is comparatively slow, and it is several years before the "fronds" are more than 2 feet in length. The seeds germinate freely in a warm site or under glass, with a minimum temperature of 70°F.

Following germination they can be potted singly into 5 or 6 inch pots, the compost being comparatively open and of a sandy nature. The young seedlings can remain in these pots for a great number of years, and they form useful tub plants in a 15 or 18 inch tub.

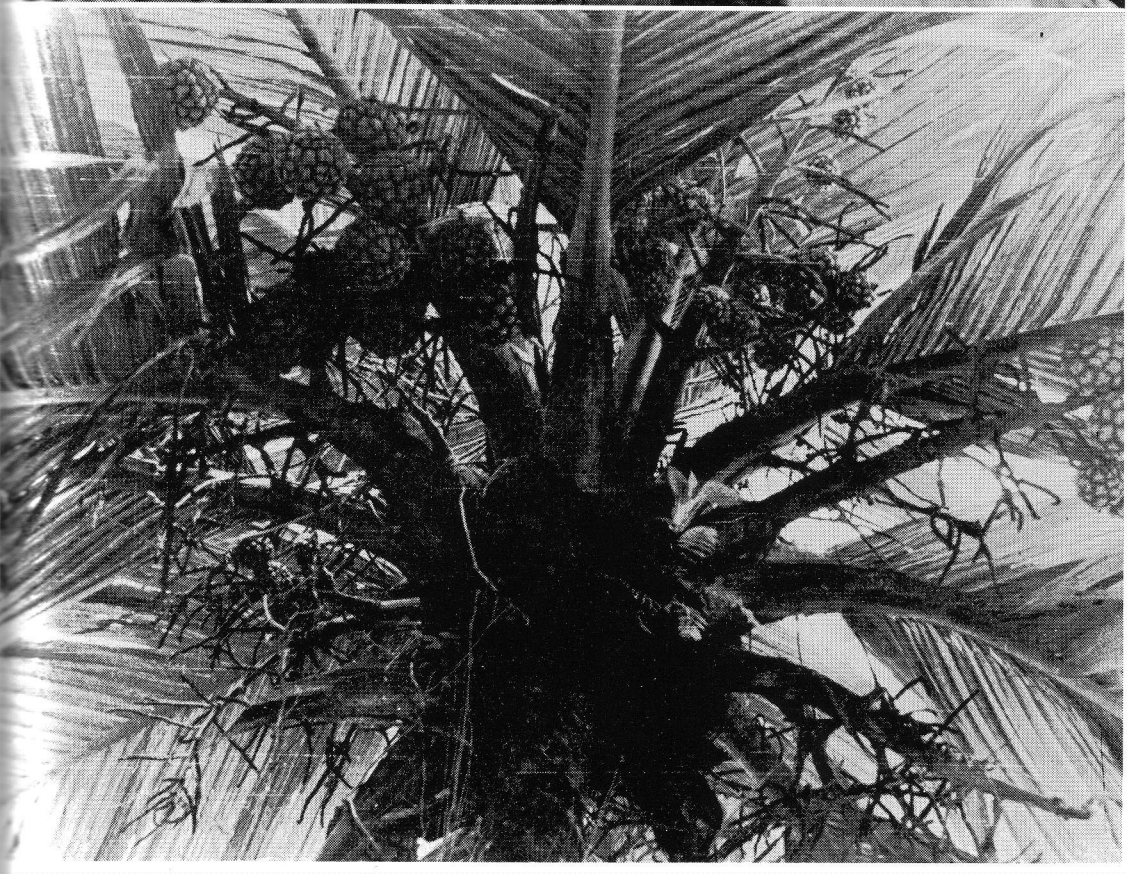
However, outside they grow quite freely in the open ground, preferring a site (Adelaide and similar sub-tropical localities) which gives partial shade especially during the hottest part of the day.

Under cultivation (in Adelaide), *Livistona australis* grows rapidly, but must be kept away from limestone marl areas. As is to be expected, it does not have the same luxuriant appearance, nor does it produce the lush growth found with this species under natural conditions. Here rainfall is high and soils congenial to optimum development.

Very few plants of *L. Mariae* are under cultivation. Because it prefers slightly acid conditions and overall slightly higher temperatures than related species, cultivation in Adelaide is somewhat more difficult. In fact, because of hard water in addition to alkaline soils, it has not been easy to establish. Seed must be fresh if a high percentage of germination is expected, but with viable seed sown in temperatures between 70 and 80°F., germination occurs in a month or so. Seedlings must be potted on and held under glass for at least a year or 18 months to permit a solid crown to form.

It is not known when plants of *L. Mariae* commence to produce an elongated trunk. Under natural conditions, and because of considerable variation in annual rainfall, this activity may not take place for at least 10 or 15 years. However, records are being kept, and it is hoped that some idea will ultimately be gained from plants at present in cultivation.

Fig. 53. *Pelagodoxa Henryana* in flower (above) at Summit, Panama Canal Zone, photograph courtesy of Walter R. Lindsay; and in fruit (below), photograph courtesy of Toshihiko Satake.



Viability of Palm Seeds*

NAT J. DE LEON

In any discussion of palms, the subject of viability of seeds is an important one. To be able to grow and appreciate palms, we must in most instances start from seed. Many failures of germination have been attributed to poor practices, but if we could trace the circumstances under which the seeds were collected and sent, we would find that the seeds had passed their period of viability in transit so could not have germinated anyway. An understanding of the viability of seeds, therefore, will greatly improve chances of obtaining germination.

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.

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 sub-tropical 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, Hyphaene, Jubaea, Mascarena, Nannorhops, Opsiandra, Orbignya, Paurotis, Phoenix, Pseudophoenix, Rhapis, Sabal, Scheelea, Serenoa, Syagrus, Thrinax, Trachycarpus,* and *Trithrinax.* It should be expected that 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, Calyptrocalyx, Calyptronoma, Chambeyronia, Clinostigma, Cyrtostachys, Didymosperma, Drymophloeus, Eugeissona, Euterpe, Gronophyllum, Iguanura, Iriartea, Jessenia, Linospadix* (*Bacularia*), *Loxococcus, Mauritia, Metroxylon, Nenga, Normanbya, Nypa, Oenocarpus, Oncosperma, Orania, Pinanga, Podococcus, Ptychoraphis, Raphia, Rhopaloblaste, Roscheria, Salacca, Socratea, Stevensonia, 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, Arenga, Astrocaryum, Bactris, Caryota, Chamaedorea, Chrysalidocarpus, Cory-*

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

pha, Cryosophila, Diplothemium, Geonoma, Heterospathe, 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 we may expect exceptions to the rules. Thus we find that *Pinanga Kuhlii* seeds remain viable longer than those of most species. We also find that seed of *Chamaedorea erumpens* remains viable longer than its intermediate range would suggest.

There are several palm genera that have never been introduced into cultivation in the United States, but we can safely predict the viability of their seeds by the areas from which they come and by their relationship to other genera. Thus seeds of *Prestoea,* which have not been introduced, should be short-lived since the genus is closely allied to *Euterpe, Jessenia,* and *Oenocarpus.*

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 many 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 seed from the drying effects of air. The material most frequently used for protection is dry peat-moss. The practice at the Botanic Gardens, Singapore, 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 Dr. 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 seed 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 seed, the longer it takes to germinate, providing it is 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. Last year, the Fairchild Tropical Garden received a shipment of *Arenga pinnata* seeds collected in Cuba. The seeds were quite fresh and germinated within two months. At the same time, I 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 sub-tropical 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.

It is hoped that the information given here will be of some use to anyone attempting to grow palms from seed. The importance of the short period of viability should be impressed on the collector and shipper by those persons who seek foreign sources of seed.

The Preparation and Germination Of Palm Seeds*

H. F. Loomis

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 seed for planting is that from fully ripe fruits, planted within several days of harvesting under conditions that will induce rapid germination. However, these conditions are not always attainable, 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 shrunken 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.

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

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 seed should be placed in tightly closed plastic bags mixed with half to an equal mass of peat-moss or sphagnum moistened enough that the seed 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 but 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. Detailing several such methods and the results obtained may guide others in planting seeds and point the way for making improvements.

At the United States Plant Introduction Station, Coconut Grove, Florida, newly received palm seeds are cleaned, if this has not already been done, and planted within 24 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 40°F, but no heat is provided to keep it above this level. Summer temperatures on sunny days may go 10 to 12° above the outdoor maximum. Seed containers are watched closely and never allowed to dry out, nor are they allowed to become soggy through overwatering. Germination 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 last 12 years and are summarized in Table 1 which shows the species planted and the number of days until germination was recorded.

It will be noted that the most rapid germination was obtained from seed of *Copernicia vespertilionum* which occurred in 14 days, while the longest period was 316 days for *Syagrus comosa*, although a different introduction of this species required but 99 days. Of equal interest were two plantings of locally harvested, fresh seed of *Coccothrinax fragrans*, one germinating in 45 days, the other requiring an unexplainable 237 days.

TABLE 1

Species name	Germination period in days
Acanthophoenix rubra	71
Areca Cathecu	79
*Astrocaryum mexicanum (Hexopetion mexicanum)**	38
Bentinckia nicobarica	75
Butia capitata	142
Chamaedorea erumpens	222
Chrysalidocarpus lutescens	31
Coccothrinax crinita	37
C. fragrans (2)**	45-237
C. Miraguama	104
C. pseudorigida	48
Cocos nucifera	119
Colpothrinax Wrightii	55
Copernicia Burretiana	37
C. Cowellii	37
C. gigas	73
C. hospita	37
C. Torreana	22
C. vespertilionum	14
Corypha umbraculifera (2)	52-108
Dictyosperma album (D. furfuraceum)	84
D. aureum	75
Drymophloeus Beguinii	26
Elaeis guineensis (3)	64-147
Erythea Pimo (Acoelorraphe Pimo)	193
Euterpe longibracteata	24
Gaussia attenuata	43
Geonoma longipetiolata	74
Hyophorbe indica	75
Jubaea chilensis (J. spectabilis)	113
Licuala amplifrons	70
L. grandis	122
Livistona cochinchinensis (L. Hoogendorpii)	31
Mauritia flexuosa	56
Maximiliana elegans	147
Metroxylon amicarum	94
Orbignya Cohune (Attalea Cohune)	67
O. phalerata	71
Phoenix reclinata	42
P. Roebelenii	39
Pritchardia Lowreyana	45
Pseudophoenix vinifera	23
Ptychoraphis augusta (2)	29-68
Raphia pedunculata	81
Rhopalostylis sapida	73
Rhyticocos amara	62
Syagrus campicola	293
S. comosa (2)	99-316
Thrinax Ekmanii	99
Veitchia Joannis	82
Wallichia caryotoides	89
Zombia antillarum	48

*Names in parentheses are synonyms under which seed was received. **Figures in parentheses indicate two or three 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.

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 120° F. 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 150 to 160°F, for two or three weeks hastened germination when the seeds were removed and planted in the germination house. By above practices he has sprouted up to 95 percent 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.

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 as high as the daily maximums reached in his germination house.

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 83°F. 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 10 seeds of *Corozo oleifera*, generally considered difficult to sprout. With samples of the same seed, 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 for a number of species are shown in Table 2.

While there is little duplication of species involved in the data shown in Tables 1 and 2, several related species may be compared. No material advantage appears evident for either one of the methods from which these data were drawn.

In PRINCIPES 2: 5, 1958, E. D. Kitzke has described in detail a method of germinating seeds of a number of species of *Copernicia* in water, soaking them for as much as nine months in water alone or for lesser periods after the seeds were scarified near the embryos or were treated with dilute sulphuric acid for 15 minutes. Some fresh *Copernicia* seeds germinated after only two days of soaking in water alone, that is, their em-

TABLE 2

Species name	Germination period in days	Species name	Germination period in days
Areca concinna	43	*Geonoma longipetiolata*	119
A. latiloba	27	*Latania Verschaffeltii*	32
Astrocaryum Standleyanum	148	*Licuala spinosa (L. horrida)*	31
Bactris Ottostapfeana	57	*Loxococcus rupicola*	49
Bentinckia Coddapanna	30	*Mauritia flexuosa*	126
Bismarckia nobilis	39	*Oncosperma fasciculatum*	46
Caryota Cumingii	317	*O. tigillaria*	44
Chamaedorea glaucifolia	89	*Pseudophoenix vinifera*	33
C. Schiedeana	44	*Ptychosperma angustifolium*	43
C. sp. *(C. corallina)*	95	*P. Hosinoi*	39
Chrysalidocarpus lucubensis	150	*P. Ledermannianum*	60
C. madagascariensis	145	*Raphia gracilis*	115
Clinostigma ponapensis	48	*Sabal glaucescens*	59
Copernicia glabrescens	18	*Salacca edulis*	24
Didymosperma caudatum	65	*Salacca Wallichiana*	24
Diplothemium maritimum	73	*Socratea durissima*	55
Erythea Brandegeei	44		

bryos pushed loose the seed coat covering them and began to emerge. In all his experiments as soon as this evidence of germination was seen in any immersed seeds they were removed and planted in individual pots of soil above the surface of which the first leaf sprout usually appeared within 35 days.

Kitzke suggested the application of this method to seeds of other genera of palms and De Leon has reported in PRINCIPES 2: 75 its successful use with six species of as many genera.

A paper by R. Galt, "Methods of Germinating Oil Palm Seeds," in *Journal of the West African Institute for Oil Palm Research*, 1: 76-87, 1953, describes and reviews early commercial methods of germinating seeds and describes several improved methods. These recent methods are based on maintaining a relatively high and uniform temperature (approximately 100°F.) throughout the germination period and rely on actual fire or fire-heated water pipes to do so.

Since so little factual knowledge on palm seed germination has appeared in print the foregoing brief descriptions and reviews may be of aid in helping palm growers decide on a suitable method for sprouting their seeds. The need for carefully controlled experiments on the various phases of palm seed germination is very great and publication of the results will benefit all palm growers, commercial and amateur alike.

A New Species of Copernicia from Cuba

B. E. Dahlgren and S. F. Glassman

During the past two years we have undertaken a revision of *Copernicia*. This project is an outgrowth of the senior author's field work in Brazil and Cuba of the past 25 years. The following new species is being published to clarify one of the many problems now being studied in this genus.

Copernicia Leoniana Dahlgren & Glassman, sp. nov.

Tree 4-5 m. tall. Trunk about 15 cm. in diameter. Petiole 20-30 cm. long, apex 4-5 cm. wide, margins armed with robust spines; ligule 1-12 cm. long. Leaf blade cuneiform at base, margins armed with spreading spines; blade segments 60-65 in number, central one 110-120 cm. long, green on both surfaces, with conspicuous red stegmata. Spadices up to 2.80 m. long; lower spathes glabrous, upper ones more or less pilose. Flowering branches 1-1.5 cm. long, 0.4-1 cm. wide, all of the spathelets more or less pilose. Flowers 4-5.5 mm. long, densely clustered, bracteoles ovate, densely pilose, 2-4 mm. long; calyx pilose on the outside, corolla tomentose on the outside, lobes triangular-elongate; stamen ring 3-lobed; ovary sculptured above, glabrous. Fruit subglobose, 16 x 14 mm. in diameter, seed 10 x 9 mm.

Palma 4-5 m. (fide León) alta. Caudex circa 15 cm. (fide León) in diameter Petiolus 20-30 cm. longus, apice 4-5 cm. latus, margine spinis robustis armatus; ligula 1-12 cm. longa. Lamina cuneata, margine spinulis dispersis armata; segmenta laminae 60-65, centralia 110-120 cm. longa, utrinque viridia, glabra, cum punctis conspicuis rubris notata. Spadices usque ad 2.80 m. longa; spathae inferiores glabrae, superiores plus minusve pilosae. Ramuli floriferi 1-1.5 cm. longi, 0.4-1 cm. lati, omnibus spathellis plus minusve pilosis. Flores 4-5.5 mm. longi, dense glomerati, bracteolis ovatis, copiose pilosis, 2-4 mm. longis; calyx extus pilosus, corolla extus tomentosa, lobis elongato-triangularibus; staminium annulus 3-lobatus; ovarium supra exsculptum, glabrum. Fructus (fide León) subglobosus, 16 x 14 mm. in diam., semen 10 x 9 mm.

Specimens examined: SANTA CLARA: Potrero Manatí, Trinidad, March 19, 1856-1860, *Wright 3969a* (TYPE, A—2 sheets, inflorescence in flower and young fruit, and leaf; isotypes, A, F, GH, NY); near Macio Bay, near Casilda, Trinidad, June 27, 1931, *León 14922* (A, MT, NY) February 2, 1949, *Dahlgren & Cutler 49/069* (F); Finca Molina, Trinidad, March 1, 1951, *Dahlgren & Macbride 51/052* (F); Florecita, railroad stop north of Anton Recio, January 23, 1949. *Dahlgren & Cutler 49/017* (F); CAMAGUEY: savanna north of Cromo, Camaguey, February 8, 1949, *Dahlgren & Cutler 49/041* (F); Finca Santa Rosa, April 1, 1950, *Dahlgren 50/016* (F); Sabana de Juan Grande, Finca Buena Vista de Eduardo Saldibar, February 7, 1952, *Dahlgren & G. Moore 52/028* (F); La Carbonera, January 24, 1953, *Dahlgren 53/003, 53/004, 53/005* (F); west of Caobillas, Finca de Luiz Gomez, *Dahlgren & G. Moore 54/010* (F).

This species has long spiny petioles, inflorescence branches 0.4-1 cm. in diameter, flowers 4-5.5 mm. long, and floral bracts 2-4 mm. long; whereas *C. macroglossa* Wendl. ex. Becc. has no petiole or only a very short one, inflorescence branches 0.8-2 cm. in diameter, flowers

5-8 mm. long, and floral bracts 5-7 mm. long.

León apparently intended to publish this species as new; instead he published both *C. Burretiana* León and *C. Torreana* León as synonyms of *C. macroglossa*

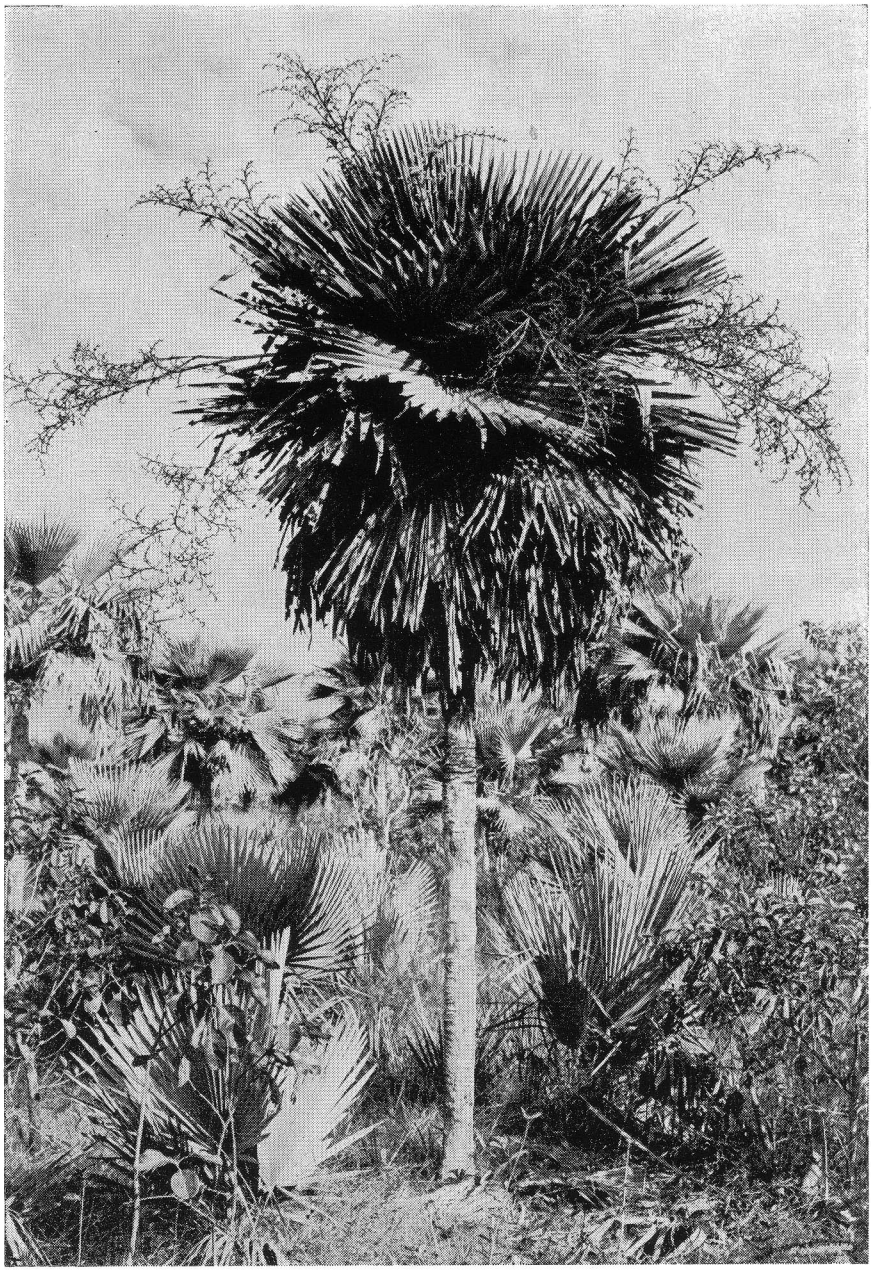


Fig. 54. *Copernicia Leoniana.* A mature tree at La Carbonera, Province of Camaguey, Cuba. (Dahlgren 53/004).

(*Rev. Soc. Geogr. Cuba* IV, 2: 10-12. 1931; *Mem. Soc. Cubana Hist. Nat.* 10, 4; 208-209. 1936). We are describing this species in honor of Brother León, late Director of the Colegio de la Salle in Havana.

The writers are most grateful to Dr. Francis Drouet of the Chicago Natural History Museum without whose help this paper could not have been written. We would also like to thank the curators of the various herbaria (indicated here by the abbreviations proposed by Lanjouw and Stafleu, *Index Herbariorum*, Part I, Ed. 3, 1956) for the privilege of studying the specimens cited here.

Helminthosporium Leafspot of Palms*

A. P. MARTINEZ

State Plant Board, Gainesville, Florida

The royal palm grower has become alarmed at the destruction that is being wrought by a fungus on palms of all ages. The most critical period is from the seedling stage to five years of age. The primary symptoms of infection are oval to irregular slightly sunken spots with tan centers and definite light green to yellowish-green margins. The fungus, under ideal conditions, sporulates readily on these spots and the spores are disseminated by wind and water to form new infections. These spots may coalesce to form large necrotic areas. At this stage secondary fungi invade the affected plant parts and hasten breakdown of the tissue. The condition prevails until all the foliage is killed and only the stem and leaf rachis remain.

The fungus, *Helminthosporium*, has been recovered consistently in culture. Experimental inoculations have revealed that it is capable of causing primary infection on healthy foliage of seedling palms. The cardinal temperatures for fungus growth are: maximum—96.8°F.; optimum—82.4°F.; minimum—46.4°F.

This malady on palms is not new to Florida. The University of Florida

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

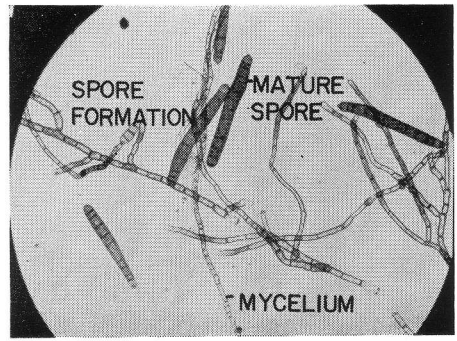


Fig. 55. *Helminthosporium* sp. enlarged 330 times.

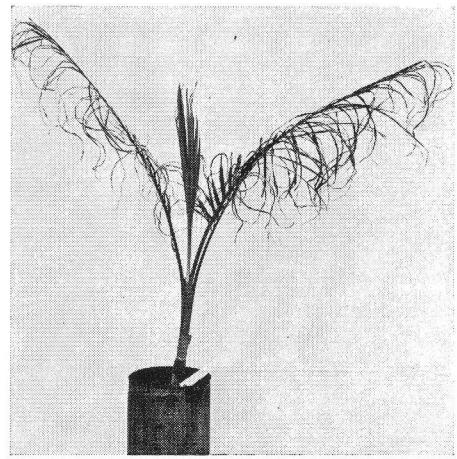


Fig. 56. Typical curling or shredding of the leaflets is shown on this seedling royal palm. The new leaf is normal.

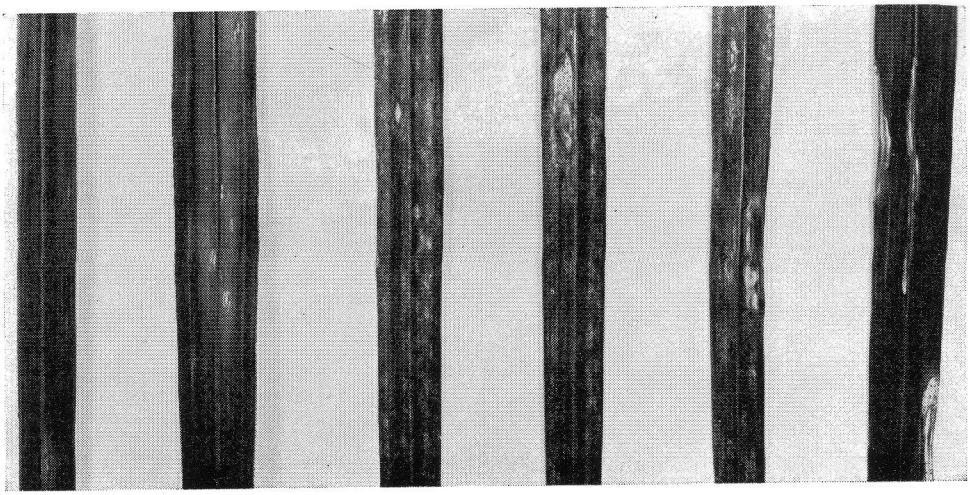


Fig. 57. Progression of fungus infection may be observed from left to right.

Herbarium recorded its occurrence as early as 1925 on *Cocos nucifera*. There are additional records of its occurrence on *Arecastrum Romanzoffianum* (Cocos *plumosa*), *Howeia* (*Kentia* of the trade), *Phoenix* and *Roystonea regia*. Other workers have identified species of this fungus on *Phoenix, Sabal* and *Thrinax*.

The following fungicidal materials were recommended to nurserymen, as experimental sprays last September: a, Zineb; b, Maneb; c, Fermate. All materials listed should be applied at the rate of one and one-half pounds per 100 gallons. Since the palm leaves have a waxy surface, a spreader-sticker should be added to assure adhesion of spray material.

The following program is recommended for best results in the control of this fungus:

a. Employ a regular spray schedule at intervals of 7 to 10 days. Use Maneb or Fermate, since these two materials have given the best results, and thoroughly spray the entire plant.

b. Keep plants growing normally. Make use of such nutritional sprays as Ortho-gro and Hy-gro, to maintain healthy growing plants.

c. Provide sufficient growing space when lining out palms in cans. The free circulation of air will help reduce infestation. Closely packed cans provide a natural moist chamber for fungus sporulation. Also, a more thorough spraying is possible when ample space is provided between the rows of cans.

d. Finally, sanitation is an important part of any control program. Removal and burning of plant debris will appreciably reduce the source of fungus inoculum.

Palm Insects and Their Control*

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Sub-Tropical Experiment Station, Homestead, Florida

Well-kept palm trees enhance the beauty, and lend interest to the Florida landscape and make real estate more valuable. Many insects inhabit palm trees, however. It requires vigilance to detect and control them before extensive damage occurs. A brief discussion is presented of some of the most important insect pests, with consideration of some factors affecting their abundance and management.

A few general comments are given concerning insect pest infestations. All parts of the trees are susceptible to attack by one to many species. Many insects present on palms are harmless to the plants and to man; some are beneficial. Most of the species which are damaging to the plants are held in check by their enemies. Occasionally conditions become favorable for the rapid multiplication of a species. Then many trees may be injured and some killed. Scale insects, *Aspidiotus destructor* Sign and *Chrysomphalus aonidium* (L.) on coconut leaves in 1956 and the royal palm bug, *Xylastodoris luteolus* (Barb.), in 1957 are examples of insects that recently reached and passed epidemic abundance. Epidemic populations of insects develop and occur periodically. Apparently there is great irregularity in the appearance of these epidemics which appear to be non-cyclic, dependent on conditions favoring reproduction of a species. Epidemic populations of harmful insects are not now predictable, nor can the degree of harmfulness be foretold.

Palms are comparatively slow in reacting to severe insect infestations. As a result great damage or even death may occur before there is any manifestation of injury by the plant. The scale insect infestation of the coconut palms in 1956 is an example. In this instance the scale populations infesting the fronds reached their peak before most people realized that the palms were heavily infested. Hordes of ladybeetles feeding on the scale insects were observed by many and occasionally were blamed for the premature yellowing and death of the fronds. The author observed the onset of this epidemic about May, 1956, its peak about August, and the decline through September and October. Time for chemical control measures would have been early June.

Many species of insects infest palms. A total of 59 coconut palm pests was listed by Capco (1950) in the Philippines. Two endemic and 30 non-endemic species were listed by Simmerman (1948) as inhabitants of the genus *Pritchardia* in the Hawaiian Islands. Bruner, *et al.* (1945) listed 23 insect species as those which attack the coconut palm in Cuba, while 13 insects were named as pests of the royal palm. No compilation of palm infesting insect pests, other than that of scale insects by Riddick (1955), has been made for Florida.

Scale Insects

Most palms in Florida are infested by the coconut scale, *Aspidiotus destructor* Sign.; Florida red scale, *Chrysomphalus*

*Florida Agricultural Experiment Station Journal Series, No. 748. Presented at the Palm Conference, Fairchild Tropical Garden, April 18, 1958.

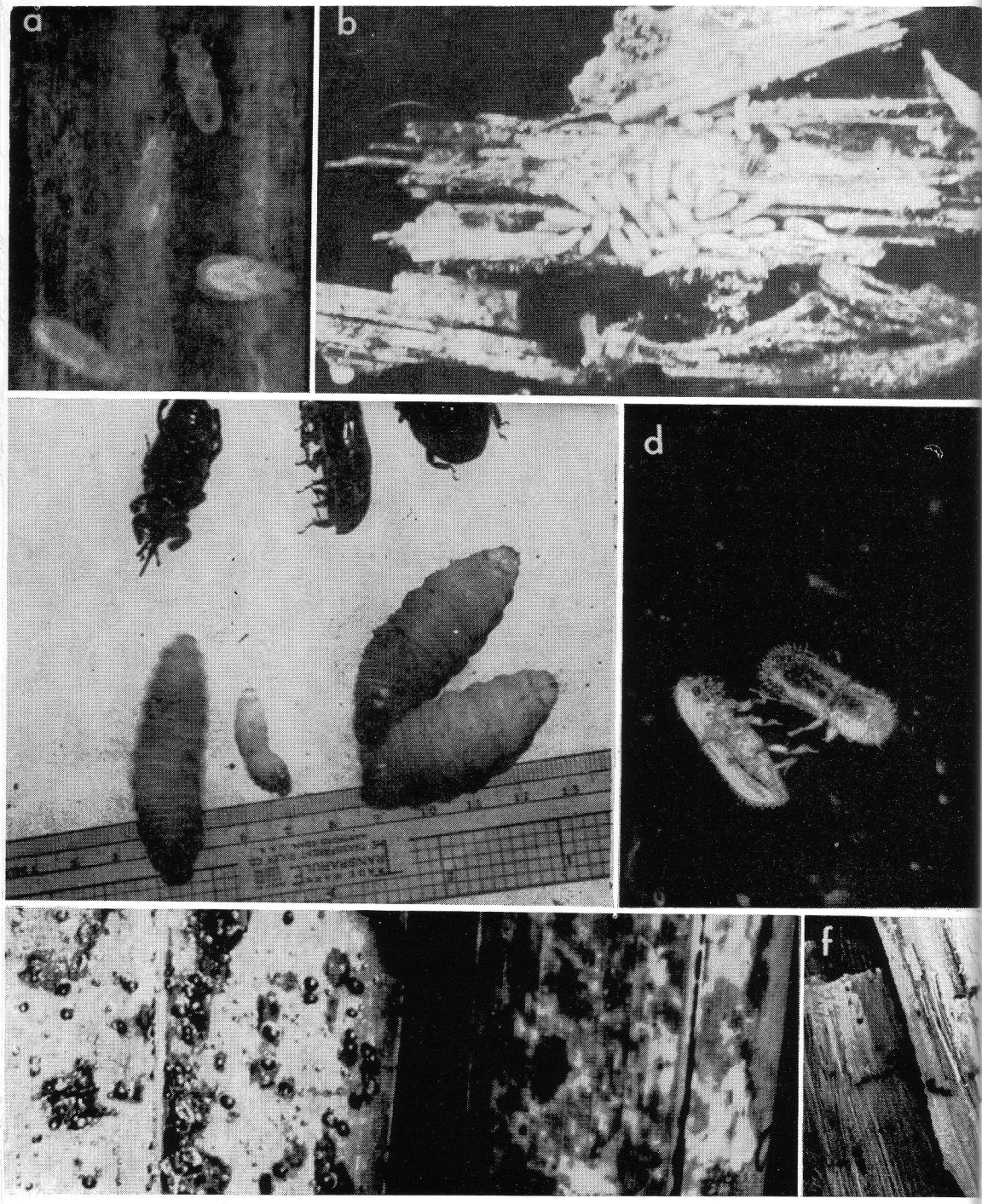

Fig. 58. Insects that attack palms: a, royal palm bug, much enlarged; b, termites in royal palm trunk, enlarged; c, palmetto weevil from *Phoenix* with adults at top and larvae at bottom, all slightly reduced; d, ambrosia beetles, much enlarged; e, Florida red scale on coconut palm, top of leaflet at left, bottom at right, all much enlarged; f, ambrosia beetle burrows, about natural size.

aonidium (Linn.), (Fig. 58e); latania scale, *Aspidiotus lataniae* Sign. Scale insects are probably more injurious to Florida palms year after year than any other group of insects. A total of 22 scale insect species is listed, Riddick (1955), as infesting the coconut palm and the same number the royal palm. A total of 20 scale insects is listed, Capco (1956), as pests of the coconut palm in the Philippines. A list of eight scale insect pests was given by Bruner *et al.* (1945) as those which attack the coconut palm in Cuba, while six scale insects were named as those which attack the royal palm.

Many coconut, Florida red, and latania scale insects infested the fronds of trees in Florida in 1956. This epidemic was concurrent with the application of malathion-bait sprays for eradication measures against the Mediterranean fruit fly, *Ceratitis capitata* (Wied.). As a result the sprays were frequently blamed for the scale infestations. Observations of palm trees on New Providence Island, Bahamas, however, where no malathion-bait spray was applied, showed that deterioration of the fronds from insect infestations was about equal to that in Florida. Conditions were favorable in 1956 for the scale increase and are believed to account for the epidemic.

Homeowners who wish to treat palms for scale insect control will get most effective results from spray applications. An oil emulsion spray containing 1¼ to 1 1/3 per cent actual oil in water is effective. Parathion at 0.15 to 0.30 pounds active ingredient per 100 gallons of water is probably more effective than oil emulsion. Trees may be injured by applications of oil. Parathion is very toxic to man and other animals. It should be used with caution and extreme care and only on trees some distance from a residence or arterial highway. Malathion, which is safer than parathion, may be used for scale control but is less effective. A combination of one gallon of oil emulsion concentrate and four pounds of 25 per cent wettable powder of malathion may be used.

Above recommendations are for treating a few trees. Chemical control applications for trees on streets or other public property are considered impractical at this time for the following reasons: (1) size of trees which makes coverage difficult because toxicant must contact each insect, (2) drift of spray mixtures to nearby objects and adjoining properties, (3) cost of treatment would be rather high for preservation of some green fronds, since trees are not killed by infestations.

Palm Leaf Skeletonizer

Palm fronds of several species are attacked by the palm leaf skeletonizer, *Homaledra sabalella* (Chamb.), according to Creighton (1937). It was a major pest in the decade 1930-1940, and is very common today but the populations are sparse. Larvae feed on the leaflets and usually go unnoticed until there is much injury. Most of the larvae are parasitized and perish without having been observed or of importance.

Conditions may become favorable again for increase of the skeletonizer and make application of chemical control measures desirable. Three pounds of lead arsenate per 100 gallons of water may be used, but a visible residue may remain. Nicotine sulfate (one pint of 40 per cent nicotine sulphate per 100 gallons of water) was reported by Wolcott (1933) to control the insect in Puerto Rico. Emulsion formulation of some of the newer insecticides—chlordane, dieldrin, lindane and malathion—may be used, applied according to suggestions on the container.

Ambrosia Beetles

Very small beetles about 1/10 inch long frequently burrow into trunks of coconut palms. (One species was tentatively determined by Howard V. Weems as *Xyleborus affinis* Eich.). These burrows are usually constructed in logs of recently cut or killed trees and in trees of low vitality. (Fig. 58d, f). Trees having low vitality lack pressure of "sap flow" to repulse attacks. Ambrosia beetles are contaminated with fungi which grow in the burrows. Larvae which hatch from eggs deposited by the beetles grow and develop by feeding on mycelia of the fungus. The fungi also extend beyond the insect burrows into the tree trunk tissues and frequently cause the tree to perish. It is frequently impractical or impossible, however, to determine whether the beetle infestations, fungal invasions or the low tree vitality was the most important factor in the death of individual trees. Trees that appear vigorous are sometimes infested. Sometimes a nearby pile or dump of removed trees may be the source of an unusually dense population of beetles. Injured trees or those of low vitality which often cannot be detected are attacked by ambrosia beetles.

Control of the beetles generally is achieved by keeping trees in vigorous condition and destroying or removing infested logs or trees. Those who wish to spray for control of the beetles may use benzene hexachloride or lindane. Two pounds of 10 per cent gamma-isomer of benzene hexachloride or one pound of 25 per cent gamma-isomer of lindane per five gallons of water for each tree trunk is suggested.

Coconut Flower Moth

A small grayish colored moth larva, *Batrachedra mathesoni* Busck, feeds on coconut bloom and destroys much fruit production (correspondence Fransisco Sein, Jr.). The larvae feed among the flowers, spinning some webbing which produces unsightly masses. This insect, although present, has not been a problem in Florida. The moth may benefit man by preventing fruit production on trees in parks and on streets. Liability for injuries from falling fruits necessitates removal of fruits before they fall.

Royal Palm Bug

Infestations of the royal palm, *Roystonea*, had not been observed for years. In 1957, however, the royal palm bug, *Xylastodoris luteolus* Barb. (Fig. 58a), infested royal palm trees throughout Florida. Leaves of larger trees were affected more noticeably than those on smaller trees. Fronds became yellow, then brown colored, and died earlier than is usual, making the trees unsightly. No tree is known to have been killed by the insect. Some interesting life history studies on this bug are reported, Baranowski (1958).

Control was achieved 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. Successful sprays were those applied by power sprayers. Airplane applications were not satisfactory in reducing bug populations.

Termites

Infestations of the smooth-headed, powder-post termite, *Cryptotermes cavifrons* Banks (determination by F. Gray Butcher), (Fig. 58b) occur in tree trunks. These infestations occur apparently in trees of low vitality where the tissues have become lifeless. Unsightly trunk scars occur from termite infestations and decomposition of the fibers.

The best control is achieved by main-

taining healthy trees. Applications of aldrin, chlordane, dieldrin or heptachlor to the initially infested areas might reduce the cavities in the trees.

Palmetto Weevil

The palmetto weevil, *Rhynchophorus cruentatus* Fab. (Fig. 58c), occasionally kills trees of *Phoenix canariensis*. Early infestation indications are reclining and falling fronds (Fig. 59). Such fronds are often loose enough to be pulled from the tree trunk. At the bases of these loose fronds very large white grubs may be found. (The same or a closely related species is called "gru-gru" in Puerto Rico and is an item of food.) These larvae hatch from eggs, develop in the tree, pupate and give rise to adults in the tree. The coconut palm, *Cocos nucifera*, is also infested with the beetle.

The beetle has been controlled by applying DDT and lindane to the center of the palm where new fronds are emerging. Lindane or benzene hexachloride is preferred to DDT, since scale insects do not increase following their application. Liberal amounts of the aqueous suspension, mixed according to the maximum recommendations listed, are suggested.

Greenhouse Thrips

Greenhouse thrips, *Heliothrips haemmorrhoidalis* (Bouche), were found feeding on royal palm fronds. Other thrips species may be found. These insects remove or destroy the green color in leaves by rasping leaf tissue and sucking the plant juices. Infestations begin in the newly opened frond and soon the frond is yellow, then brown colored. Death of the leaf occurs earlier than usual. Thrips have not been numerous on palms in Florida.

Dieldrin, four ounces technical per 100 gallons of water from wettable powder or emulsion formulations, has given excellent thrips control on mangos and avocados and is suggested for use on palms.

Fig. 59. *Phoenix* with reclining fronds loosened by larvae of palmetto weevil feeding in area producing fronds.

Mites

The tumid mite, *Septanychus tumidus* (Banks), has been taken from royal palm fronds. They have been observed in low populations without having been serious. *Brevipalpus* sp. also has been found on the coconut palm and not been serious. Other species are probably present but have not been recognized. On mite infested fronds the leaves appear dry and powdery in early stages of infestations. In later stages of mite injury dead brown leaf tissues are evident.

Sulfur is suggested if control is needed. If sulfur is ineffective, one of the newer miticides, such as Kelthane or Chlorobenzilate, may be tried.

A number of destructive insects affecting palms are not known to be present in Florida. The coconut rhinocerus beetle, *Strategus quadrifoveatus* (Palisot de Beauvois), is very destructive in Puerto Rico, according to Plank (1948),

where larvae and adults feed principally in the trunk. It is significant to note that most infestations in Puerto Rico are observed about two years after hurricanes. Two other beetles, *Oryctes rhinocerus* Lind. and *Rhina oblita* Duval, harmful to coconut trees in other parts of the world, are not known to exist in Florida.

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