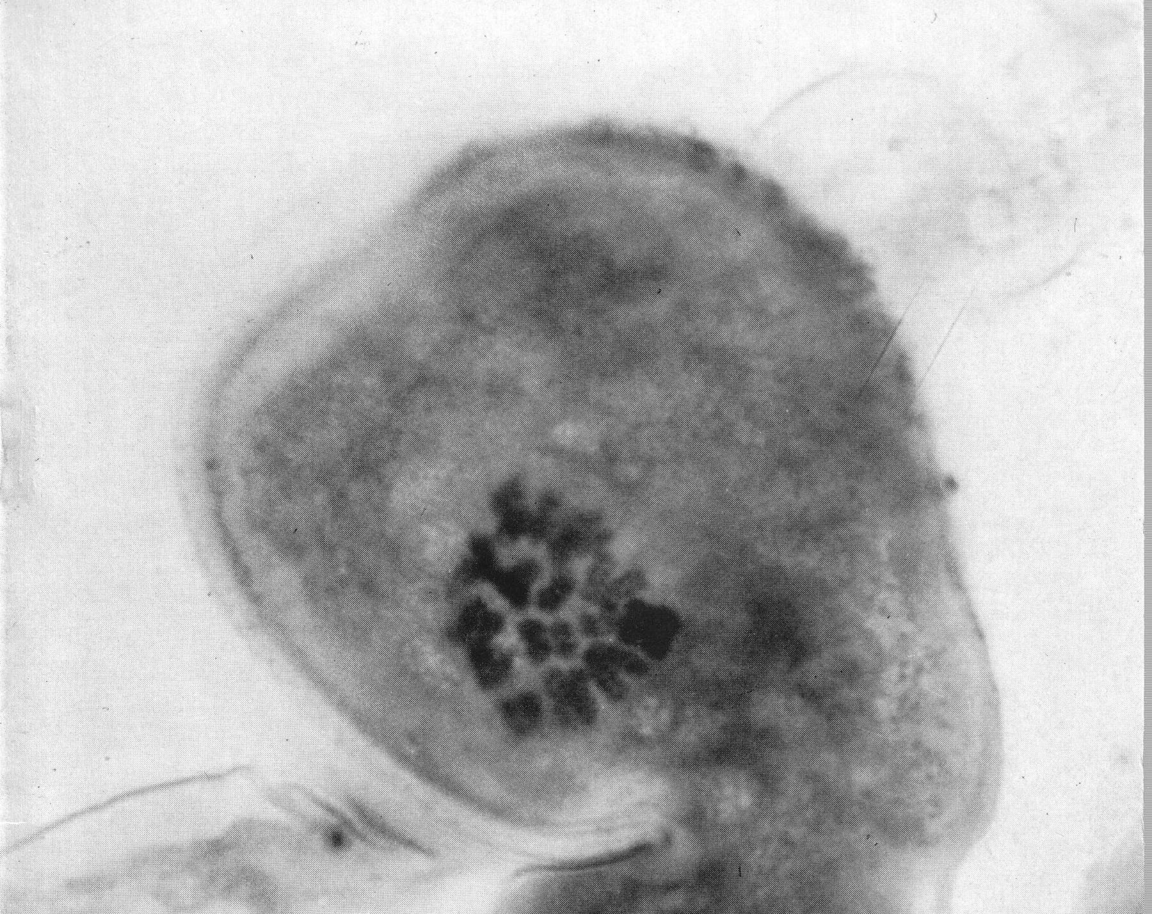

PRINCIPES

Journal of The Palm Society

July, 1963
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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.

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Contents for July

Cover Picture

Chromosomes of *Thrinax floridana,* enlarged approximately 7,000 times, appear in this photomicrograph of a germinating pollen grain. All 18 chromosomes are not clearly visible since the pollen grain is three-dimensional and the two-dimensional photograph shows only those apparent at one focus. For other photographs and an informal account of work on chromosomes now being done see page 85. Photographs by R. W. Read.

Mailed at Miami, Florida, July 23, 1963

NEWS OF THE SOCIETY

The Society was honored recently by a visit from two of our Japanese members. Mr. Zenkichi Ishiwatari, manager of the Kikko-En Nursery Company of Tokyo, and Mr. Kentaro Yamaoka, head of the O. E. K. Trading Company, another large firm dealing in ornamental plants, located at Osaka, were on a trip around the world, including a visit to the International Horticultural Exhibition at Hamburg, Germany. Although they had only three days in New York, they took one of them for a quick trip to Florida, to look at our palms and become acquainted with some members of the Society and the personnel at Fairchild Tropical Garden. Flying down from New York with them was Mr. Toyotake Abe, noted teacher of flower arranging, a very pretty young lady, Miss Okamoto, and two other gentlemen, Mr. Torii and Mr. Adachi. We tried, in the short time they were here, to show them as much as possible, and they took advantage of every minute to see something of southern Florida. They brought greetings from other Society members in Japan, including Mr. Toshihiko Satake and Mr. Takao Endo, with news of the recently-formed Japan Subtropical Horticultural Society. This society plans to translate PRINCIPES and other horticultural publications into Japanese for its members.

Another recent visitor was Mr. R. L. Mackintosh, who spends nine months of each year on the island of Grenada, B. W. I., and the other three months in New England. As a landscape architect, he is interested in obtaining new plant materials for Grenada, particularly drought-resistant species, since the island is semi-arid. He promised to try to collect seeds of the two native palm species of the island, one of which has not yet been named and described botanically.

Russell Lawrence, one of our teen-age members, has been conducting some experiments under the direction of Robert W. Read, botanist at Fairchild Tropical Garden, which may well prove to have great value.

He has acquired seeds of every genus of palms growing in Florida and the Bahamas that he could get, has carefully recorded their average size, weight and shape, then has planted them in controlled heat (about 95°), and charted the time elapsed between planting and germination, comparing the results with seeds under normal temperatures planted in the greenhouse, and with published reports.

As the seeds sprouted he has noted the seedling type, according to Tomlinson's classification in "Essays on the Morphology of Palms III," *Principes*, 5:8-12. Types of seedling leaves, number of bladeless sheaths and any other peculiarities of the young seedling, are recorded. Then herbarium specimens are made, which will greatly aid in the identification of palm seedlings in the future.

Russell prepared an exhibit of his work for the Science Fair in which all secondary schools in Dade County participated, and received a Superior Award. Congratulations, Russ!

* * *

Robert W. Read, botanist at Fairchild Tropical Garden, spent two very rewarding weeks in Jamaica recently. While there he visited the type locations of every species of *Thrinax* native to the island, obtained herbarium material and collected live plants of each. This was rugged work, requiring much travel and climbing rough mountainsides. He says it would have been impossible to accomplish what he did except for the extraordinary knowledge and help of Mr. George Proctor of the Institute of Jamaica, who is well acquainted with the flora of the island and knew just where the desired species were to be found. Bob also spent some time in Haiti, getting material needed to complete his thesis on *Pseudophoenix.* He promises an article for PRINCIPES as soon as he has had time to study the material collected.

LUCITA H. WAIT

International Palm Year

Response to Dr. P. B. Tomlinson's proposal concerning an international cooperative effort to measure and record the growth rate of palms has been encouraging. To date, sixty-five persons have indicated willingness to undertake this project. Now that Dr. Tomlinson's instructions have been conveyed via PRINCIPES, April, 1963, it is hoped that all of them will begin to keep records, and that at the end of one or more years some valuable data will have been compiled.

The following persons and institutions have returned the pledge cards:

Australia: Mr. Ernest Todd. *Germany:* Städtischer Palmengarten, Frankfurt. *Ghana:* Raymond A. White, Jr.; University of Ghana (Mr. E. R. Vaughan). *India:* National Botanic Gardens, Lucknow (Prof. K. N. Kaul). *Jamaica:* Research Dept., Coconut Industry Board (D. H. Romney). *Japan:* Sadao Sawai, Takao Endo. *Malaya:* Botany Department, University of Malaya (E. A. Turnau). *Mexico:* Finca Experimental La Novia, Tapachula (G. Ross). *Southern Rhodesia:* Botany Department, University College of Rhodesia & Nyasaland (Prof. A. S. Boughey). *United States: Arizona:* H. G. Yocum; Richard Mayer; A. E. Johnson. *California:* Jack Corbet; County Horticultural Dept., Santa Barbara (H. E. Bauernschmidt); W. J. Dolby; Ernest Eveland; Mr. & Mrs. G. F. Herman; Huntington Botanical Gardens, San Marino (Myron Kimnach); Los Angeles State & County Arboretum, Arcadia (C. A. Hallberg); W. J. McBride; Otto Martens; L. H. Miller; R. W. Palmer; H. E. Roller; Joe Sullivan; L. F. White. *Florida:* Mrs. G. F. Adams; W. L. Bildingmayer; D. V. Bremerman; K. E. Brown; Mrs. T. C. Buhler; Caribbean Gardens, Naples (J. Kuperberg); A. B. Clemons; Mr. & Mrs. O. W. Doherty; C. F. Dowling, Jr.; Joseph DuMond; G. A. Ellis; R. H. Fackelman; Mr & Mrs. F. C. Flint; R. H. Fuller; F. H. Gick, Jr.; C. R. Grant; Joseph Kellett; H. F. Loomis; J. C. McCurrach; H. J. Mitchell; R. G. Riggle; W. F. Rogers, Jr.; G. B. Scholl; Dent Smith; C. H. Stedman; G. B. Stevenson; E. F. Thayer; University of Florida Sub-Tropical Experiment Station (C. W. Campbell); J. E. Turner; U. A. Young. *Georgia:* G. R. Phillips. *Hawaii:* H. E. Crawford; Mrs. M. Hirose. *Louisiana:* Louisiana Research Foundation (L. A. Simmons). *Texas:* H. T. Hilliard; E. R. Cantwell, Jr. *U. S. Virgin Islands:* Mrs. R. B. Queneau.

Latania lontaroides—the Correct Name for the Red Latan Palm

The period of 1788-1792 was a very active one in botany. Many important books were published, sometimes in several parts, within days or months of each other and exact dates of publication for the parts therefore become important in determining the priority of names. Dr. Frans Stafleu of Utrecht, Netherlands, has recently published a detailed analysis of publications and dates during this period (*Taxon* 12: 43-87. 1963), an analysis which dates more precisely works in which the red latan palm was named independently three times. It is apparent from this new evidence that *Latania borbonica* does not have real priority even though the title-page of the volume in which it appears is dated 1789, since the particular part in which the name appears was not published until 1792. An older epithet, *lontaroides*, must now be taken up and the correct name for the red latan becomes *Latania lontaroides*.

The genus *Latania* was described by Commerson in Jussieu's *Genera Plantarum*, a book published on August 4, 1789. No species was named however. Later, within a period of two years, *Latania borbonica*, *Latania Commersonii* and *Cleophora lontaroides* were proposed for the one species then known. *Cleophora* is a direct nomenclatural synonym of *Latania* and the epithet *lontaroides* now clearly has priority. In the following synonymy, the more precise dates for pages and parts are followed in parentheses by dates which appear on the title-pages of the volume when these differ.

Latania lontaroides (J. Gaertner) H. E. Moore, **tr. nov.**

Cleophora lontaroides J. Gaertner, De Fructibus et Seminibus Plantarum 2 (2) : 185. April-May 1791.

Latania borbonica Lamarck, Encyclopédie Méthodique, Botanique 3 (2): 427. 13 February 1792 ('1789').

Latania Commersonii Gmelin in Linnaeus, Systema Naturae, ed. 13, 2 (2): 1035. April-Oct. 1792 ('1791').

Latania rubra N. J. Jacquin, Fragmenta Botanica 13. 1801 ('1800-1809').

H. E. Moore, Jr.

Palm Chromosomes*

Robert W. Read
Botanist, Fairchild Tropical Garden, Miami, Florida

Each and every cell of palms, as in all except the lowest organisms, contains chromosomes, which appear as microscopic rod-shaped structures at the time of cell division. These tiny rod-shaped bodies are the bearers of the genes, which control hereditary characteristics. That is to say, the units of heredity, which control the ultimate size, shape and color of palms, are borne within the body of the chromosomes. The number of chromosomes is usually constant for any given species and in the palm family it is usually constant for each genus. In cells which are not undergoing division, the chromosomes are enclosed within a spherical structure known as the cell nucleus. Chromosomes are often studied during the process of cell division when an individual cell divides into two new daughter cells. During cell division the membrane surrounding the nucleus disappears and the chromosomes round up into their characteristic shapes. Each chromosome has already reproduced itself and the new chromosome halves separate, one half to each of the two daughter nuclei. A wall then forms separating the two new nuclei into two new cells both having identical complements of chromosomes. This process continues in the growing portions of plants as long as they are alive and growing.

There are also places other than the growing points where chromosomes may be observed. One of these is in the pollen

*An informal report based on a study of the cytology of palms, which is presently being supported by the National Science Foundation as part of Grant G-18770. The cytological research is being carried out at the Fairchild Tropical Garden by R. W. Read under the direction of Dr. H. E. Moore, Jr. of the L. H. Bailey Hortorium and Dr. C. Uhl, Department of Botany, Cornell University, Ithaca, N. Y.

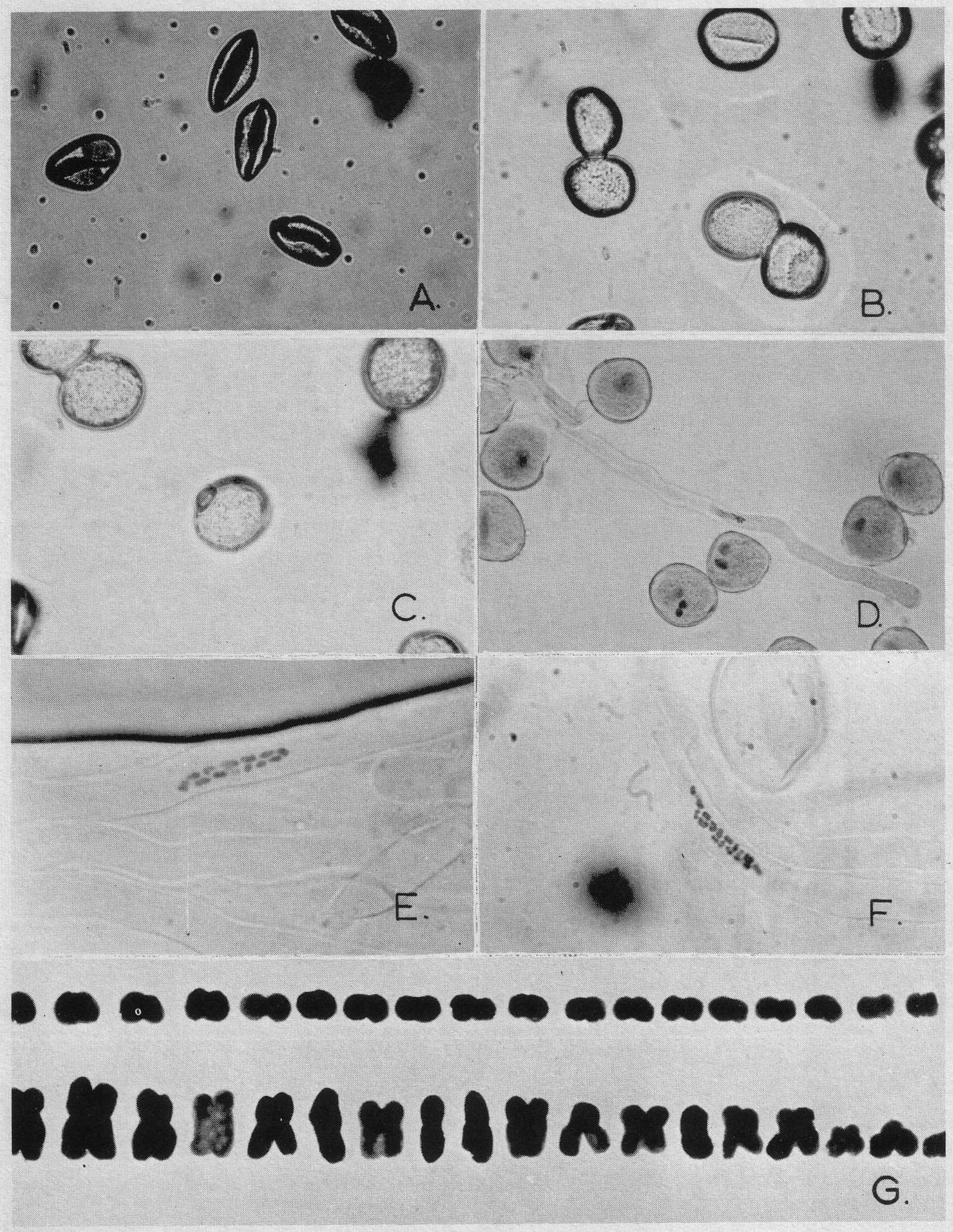
tube after the pollen grains germinate. In order for normal fertilization to be effected and for seed to be produced, it is necessary for pollen from male flower parts (anthers) to germinate on a receptive female flower part (the stigma). When a pollen grain germinates on the stigma of a palm flower, a pollen tube is produced which grows down through the style and into the ovary bearing the sperm from the pollen grain to the ovule and fertilizing the egg therein. Within the pollen grain of palms there are normally two nuclei, one of which (the generative nucleus) undergoes a division into two smaller nuclei which are called sperm nuclei. At this stage, referred to as mitosis of the generative nucleus, or pollen tube mitosis, the chromosomes are readily stained and may be observed with a high power microscope.

Rather than attempt to isolate and study pollen which has germinated and produced tubes in the female flower parts (the stigma and style), it has been found simpler to sow pollen grains, as one would sow orchid seed, on a nutrient material in a moist environment and to study the pollen tubes as they germinate. Conditions of heat, moisture and nutrients must be exactly right or the pollen will not germinate properly. After the pollen is sown and germination occurs, a pollen tube is developed within which the chromosomes of the generative nucleus become distinct, each one having become doubled. In the present work, colchicine is being used to prevent the chromosome pairs from separating. (Colchicine is also commonly used to induce polyploidy, but it is used here only to slow down the division of the generative nucleus.) Without the use of colchicine the chromosome pairs would separate and rapidly form into the two new (sperm) nuclei. Colchicine arrests the chromosomes at the stage most favorable for study.

The cover is a photomicrograph of *Thrinax floridana* (n=18) chromosomes enlarged approximately 7,000 times. The chromosomes are shown within the germinating pollen grain.

Their actual sizes range from about 1 micron to 2.9 microns in length. In this cell all chromosomes could not be photographed clearly at the same plane of focus. To see more clearly the range in size and shape of palm chromosomes, and for comparative studies, an enlargement of a photomicrograph is made, the individual chromosome figures are cut out, and the figures of the chromosomes are then glued in line according to size and shape (Fig. 61G).

Thus far in the study of palm chromosomes it has been found that certain palm genera (*Sabal, Nannorrhops, Serenoa, Copernicia, Paurotis,* etc.) have very tiny chromosomes (0.5 microns to 1 micron in length) whereas other genera, e.g., *Rhapidophyllum, Trithrinax, Cryosophila* and *Chamaerops,* have chromosomes which are conspicuously larger (1 micron to 3.5 microns long). By studying such characteristics as size and shape of the chromosomes in different species and genera of palms, in much the same manner as leaves, flowers, and fruits are studied, we may be able to understand something more concerning the relationships of palm genera or groups of genera to one another. For example, the size range of the chromosomes in *Paurotis, Copernicia* and *Erythea* may serve, along with floral and fruit characters, to suggest that these genera are more closely related to each other than to other genera possessing larger chromosomes. On the other hand, *Trithrinax* and *Cryosophila* have the largest chromosomes observed dur-



61. Palm chromosomes. A, B, C, D, Polaroid photomicrographs illustrating the process of pollen grain germination of *Coccothrinax argentata* upon a nutrient medium, enlarged approximately 1,000 times. A, freshly sown pollen; B, ten minutes later, as moisture is imbibed; C, one hour later as germination proceeds; D, fully mature pollen tube containing group of chromosomes. E, F, photomicrographs of chromosomes within pollen tubes, enlarged approximately 1,500 times. *E, Chamaedorea Ernesti-Augusti*, 13 chromosomes; F, *Thrinax microcarpa*, 18 chromosomes, one not clearly in focus. G, photographs of chromosomes cut out and arranged according to size for comparative studies. *Thrinax excelsa* above, *Trithrinax brasiliensis* below.

ing the present study. The large size and general similarity of these chromosomes suggest a close relationship. However, differences in shapes of individual chromosomes suggest that the genera are nonetheless distinct.

Introduction of Palms in the U.S.S.R.

S. G. Saakov

Botanical Institute of the Academy of Sciences of the USSR, Leningrad

The main regions of cultivation of subtropical plants (including palms) in the Soviet Union are the Black Sea coast of the Caucasus from Sochi to Batumi and the south coast of Crimea, where the first attempt to cultivate palms in the open in Russia was made near Yalta in 1814 at the Nikitsky Botanic Garden.

According to the 1818 records of H. Steven, the first director of the garden, *Chamaerops humilis* grew well in the open, and since 1824 it has spread along the south coast of Crimea at Gurzuf, Alupka, Sudak and some other places. Other early introductions at Yalta were *Phoenix* sp. (1824) and *Trachycarpus Fortunei* (1860) which began to ripen fruits in the open in 1881 (though thousands of young plants had been obtained earlier by cutting infloresences and ripening them indoors). *Erythea armata* was introduced in 1910 and *Washingtonia filifera* in 1913, both from Sukhumi. *Phoenix canariensis* and *Butia capitata (Cocos australis)* have also also been grown in the Crimea.

A very cold winter in 1910-1911 had 33 days of uninterrupted frost and minimum temperatures down to —12.5° C. (9.5° F.) (air) and —13.6° C. (7.7° F.) (soil). During this winter, *Chamaerops humilis, Trachycarpus Fortunei, Butia capitata, Jubaea chilensis, Latania lontaroides (L. Commersonii)*, and *Phoenix canariensis* endured frost of —7° C. (19.4° F.) without injury. At —11° C. (12.2° F.), *Trachycarpus* leaves were damaged; at —13° C. (8.6° F.) all species suffered leaf damage and *Butia, Jubaea,* and *Latania* were killed. In another cold winter (1928-1929), *Chamaerops* was severely damaged by —14° C. (6.8° F.) temperatures and did not flower again in four subsequent years though by 1934 most plants again flowered. The winter of 1949-1950 was exceptionally cold at the Nikitsky Botanic Garden with 35 frosty days and temperatures to —17° C. (1.4° F.). The palms were severely damaged though some plants of *Chamaerops, Sabal minor, Trachycarpus Fortunei, T. Martianus, T. Takil* and *Phoenix canariensis* managed to survive. The cultivation of the above species in the open in Crimea is only the beginning. Results suggest that more and more new species should be tested.

Black Sea Region

Among the localities of the Black Sea coast of the Caucasus, Sukhumi holds the first place in the diversity of palms, followed by Batumi, Sochi, Gagra and Poti. The time of the appearance of the first palms in the southeastern part of the Black Sea coast can be established but approximately. The first work on the introduction of subtropical plants was started at Sukhumi in the thirties of the Nineteenth Century and was intensified with the foundation of the Sukhumi Botanic Garden in 1840. Many plants were destroyed during the Russo-Turkish war of 1877-1878 so that new plants in the parks were planted after 1878.

Vvedensky reported that in 1899, the

following species were growing in the open and successfully overwintered without any protective cover: *Arecastrum Romanzoffianum, Butia Bonnetii, Chamaerops* (probably also including *Trachycarpus*), *Jubaea chilensis, Livistona australis,* and *L. chinensis.* The following species were affected by frost to some extent: *Phoenix canariensis, Sabal Palmetto, Washingtonia robusta* and *W. filifera.* An acclimatization garden was founded at Sukhumi in 1885 by P. E. Tatarinov. Most palms were planted there in 1892 and in 1899 there were over 30 palm species in the garden.

The park owned by N. N. Smetzky at Sukhumi was distinguished for the greatest diversity of palms. In April, 1904, Smetzky listed 37 species growing in his park (obsolete synonyms have been replaced by the author) as follows: *Arecastrum Romanzoffianum, Butia Bonnetii, B. capitata, B. eriospatha, B. Yatay, Brahea calcarea, B. dulcis, Chamaerops humilis* and var. *arborescens, Corypha elata, Erythea armata, Jubaea chilensis, Livistona australis, L. chinensis, L. cochinchinensis, L. olivaeformis, L. rotundifolia, Nannorrhops Ritchiana, Phoenix canariensis, P. dactylifera, P. humilis, P. paludosa, P. reclinata, Rhapis excelsa, R. humilis, Rhapidophyllum hystrix, Rhopalostylis sapida, Sabal minor, S. princeps, S. umbraculifera, Syagrus flexuosa, Trachycarpus Fortunei, Trithrinax brasiliensis, Washingtonia filifera, W. robusta, W. sonorae.* These palms had been introduced between 1893 and 1903, and by 1904 *Butia Bonnetii, B. capitata, Chamaerops humilis, Phoenix canariensis,* and *Trachycarpus Fortunei* had fruited. Most plants were set into open soil on sites protected from wind on the slopes facing south, the overwhelming majority in the 1890's.

Today, this park, now the park of the state villa no. 6, is one of the most outstanding on the Black Sea coast despite the fact that many palms perished during the inclement winters of 1910-1911, 1924-1925, 1928-1929, and 1949-1950. Many of those that survived, especially in the most severe winter of 1910-1911, had been given protection (bast mats and lath panels) or were buried under the snow—a thick layer 54-100 cm. (22-40 in.) thick which persisted for forty days contributed much to survival.

All the palms of the Sochi Botanic Garden except *Trachycarpus Fortunei* and *Chamaerops humilis* were sheltered with some protective cover during the winter of 1928-1929 which, like the earlier bad years, caused a great deal of injury to subtropical plants. Plywood cabins were made for the largest specimens of date palm while small dates, *Washingtonia* sp. and others were covered with bast mats. These precautions lessened the damage.

The Botanic Garden at Batumi has has also had a variety of palms. S. G. Ginkul mentions the following as growing there by January 1, 1939: *Butia capitata, B. Yatay, Chamaerops humilis* and var. *duplicifolia, Erythea armata, E. edulis, Livistona australis, L. chinensis, Phoenix canariensis, Phoenix sylvestris, Rhapidophyllum hystrix, Sabal minor, S. Palmetto, Trachycarpus Fortunei, T. Martianus, T. Takil, Trithrinax brasiliensis. Washingtonia robusta.*

Most introduced palms fruit at Sukhumi; *Trachycarpus Fortunei* is even capable of mass natural reproduction by seed. An overwhelming majority of palms are more vigorous at Sukhumi than the same species are at Batumi, where the precipitation is excessive (about 2500 mm. [100 in.] per year) while at Sukhumi it is nearer to optimal for most species (about 1250 mm. [50 in.]) per year. At Sochi, the limit-

62. *Sabal Palmetto* at Sukhumi, Nov., 1953. Photograph by Prof. A. Kolakowski.

ing factor for profuse growth of palms is the lower air temperature.

Again, the winter of 1949-1950 was particularly inclement all over the Black Sea coast as it was on the south coast of Crimea. Many palms were killed and many more were severely damaged. All the diseased and weak plants perished irrespective of the species. The specimens growing in moist sites, near water bodies, as a rule failed to survive. As an example, a specimen of *Phoenix canariensis* in the Arboretum of Sochi planted close to the ornamental pool where the moisture content of the soil was excessive, perished while the specimens of the same age growing at some distance from this pool survived.

Transcaucasia and Middle Asia

The introduction and acclimatization of palms was being accomplished not only in the south coast of Crimea and in the southeastern part of the Black Sea coast of the Caucasus (from Sochi to Batumi) but also in eastern Transcaucasia (Tbilisi, Baku, Lenkoran) and in Middle Asia (Kizyl-Atrek, Krasnovodsk Region, Turkmenian S.S.R.). *Trachycarpus Fortunei*, *Chamaerops humilis* and *Sabal umbraculifera* were grown at the Tbilisi Botanic Garden without any protective cover in winter in the 1890's. Similar cold winters with attendant damage were experienced at Tbilisi.

Palms are also cultivated on the Apsheron peninsula (southeastern part of Azerbaijan S.S.R.) only at Baku, Mardakiany and a few other localities. *Trachycarpus* fruits and seeds itself there where the soil is sufficiently moist.

Work on the introduction of the date palm was started in 1935 at Kizyl-Atrek in Middle Asia. The winter extreme at Kizyl-Atrek (–12° C., 10.4° F.) affects especially the plants under three years of age. The date palm begins to fruit at this locality at an age of four or five years. Cold winters several times de-

63. *Trachycarpus Fortunei* at Sochi, February, 1959.

stroyed the leaves but the foliage returned during the spring and summer. At present, fruits are harvested before they are quite ripe owing to the onset of night frosts. The unripe fruits are placed in special chambers where they complete their ripening at temperatures of 55°-65° C. (131°-149° F.). Other palms cultivated at Kizyl-Atrek are *Phoenix canariensis, Trachycarpus Fortunei, Chamaerops humilis, Washingtonia robusta* and *W. filifera.*

On the basis of the 80 years' experience of acclimatization and naturalization of palms (1878-1958) and the evidence accumulated, the following conclusions may be made. The possibility of successful open air culture of palms as ornamental plants both in the south coast of Crimea and in the southeastern part of the Black Sea coast of the Caucasus is beyond all doubt. Several species fruit at Sukhumi and Batumi (*Jubaea chilensis, Trachycarpus Fortunei, Butia Bonnetii, B. capitata, B. eriospatha, B. Yatay, Chamaerops humilis, Erythea armata, E. edulis, Phoenix sylvestris, Sabal minor* and some others); some of these are capable of natural reproduction by seed. All these and other species mentioned elsewhere as successfully enduring the conditions of these regions can be planted as separate trees, in clusters, and in avenues in gardens, parks and along streets. The success of overwintering palms depends largely on microclimatic conditions that hitherto have been paid too little attention. This factor must be taken into consideration in further work as well as the requirements of palms to the methods of culture.

During the period of cultivation in the subtropical regions of the U.S.S.R., many biological characteristics of the introduced species have undergone certain changes, which had the effect first of all on the developmental stages and on the winterhardiness of palms.

Striking examples of these changes of biological characteristics of evergreen plants are afforded by *Trachycarpus Fortunei* and *Chamaerops humilis* in the south coast of Crimea. The generations of these palms grown from local seeds proved to be far more frost-resistant than those grown from imported seeds. The same holds true with respect to *Trachycarpus Fortunei* at Sukhumi where it propagates by natural seed reproduction.

The growth and development of palms in the Soviet subtropics depends largely on the soil humidity, which can be illustrated by the examples of palm growth at Batumi, Sukhumi and Yalta (Crimea); thus, *Trachycarpus Fortunei* grows best at Batumi where the precipitation is the most abundant, it grows somewhat worse at Sukhumi and still much worse at Yalta, where the precipitation is the most scanty among these localities, being particularly deficient during the hot summer months when the young leaves are developing. The result is that in Crimea only six or seven leaves develop in this palm (as compared to twelve on the average at Sukhumi) that do not complete their growth before the onset of frosts. Consequently up to 50 per cent of the leaves are killed almost every year by frost and wind. This is one of the main reasons for the much slower growth of this palm in Crimea as compared to the Black Sea coast of the Caucasus. In Crimea this palm is on the average only three meters (ten feet) high at the age of forty and only six meters (20 feet) at eighty years, while at Sukhumi it attains the height of eight and a half meters (24 feet) at the age of forty. The hygrophilous *Sabal minor* grows better at Batumi than at Sukhumi, while the relatively less hygrophilous *Washingtonia filifera* grows better at Sukhumi; at Batumi it is more readily impaired by frost due to superfluous moisture. *Rhapidophyllum hystrix*, growing under the canopy of other trees both at Batumi and Sukhumi, thrives and successfully overwinters, while on dry soils in well illuminated sites the blanching of leaves is observed and the plant declines.

Some palms thrive and exhibit quite good longevity on the Black Sea coast of the Caucasus but do not fruit owing to excessive humidity of the climate *(Phoenix dactylifera, Brahea dulcis, Rhapidophyllus hystrix)*; at the same time the date palm at Kizyl-Atrek begins to fruit at the age of four and five years.

The palms *Erythea armata, Jubaea chilensis, Washingtonia* and the others (except *Livistona chinensis* and *Trachycarpus Fortunei)* grow better at Sukhumi, than at Batumi, the climate in the latter locality being too moist for them.

The mere fact of fruiting of a given species at a given locality does not imply that the conditions of that locality are optimum for the species. The important element of the work on the introduction of plants is the finding out of the environmental conditions required during each developmental stage and providing as far as possible these conditions in the course of rearing of plants. The environmental conditions afford the very possibility of the existence of plants and at the same time they are the factors affecting the plants in some way. The task is, therefore, by no means restricted to attaining a higher frost resistance in the palms; it is necessary also to take into consideration the entire complex of the natural environmental conditions and to provide the complex of the required cultural conditions.

The prospect of acclimatization of new species of palms in the U.S.S.R., in particular, on the Black Sea coasts of the Caucasus and Crimea, in the vicinity of Lencoran and in southwestern Turkmenistan is very promising and the list of species potentially capable of being cultivated in the open ground is by no means exhausted, considering that in the past the planting material was procured mainly from the horticulturists of southern France and Italy without sufficient attention being paid to the biological characteristics of plants and to the ecological and geographical conditions.

Despite a number of failures that are inevitable in any work on the acclimatization of palms, the results of the 80 years' efforts in this field can be regarded as inspiring; there are all reasons to expect that many difficulties will be overcome in the course of persistent work with the use of proper methods.

The general results of the work on the introduction of palms in the U.S.S.R. can be summarized as follows: from fifteen to eighteen species of palms are growing in the southeastern (Georgian) part of the Black Sea coast of the Caucasus (Sukhumi, Batumi), somewhat less in Sochi; several species are also cultivated in the south coast of Crimea and a few species grow in the eastern Transcaucasia (the region of Tbilisi and the Apsheron peninsula) and in the Middle Asia (Kizyl-Atrek).

Species Introduced

The description of the species introduced and their characteristics under the conditions of the subtropical regions of the U.S.S.R. follow.

BUTIA

Four species, *B. Bonnetii, B. capitata, B. eriospatha, B. Yatay,* are cultivated on the Black Sea coast of the Caucasus. The individual trees have densely leafy crowns with 40-50 leaves. Usually five or six new leaves develop in each growing season (April to September or October) and leaves last from four to eight years depending on the species. [Editor's note: for obtaining approximate dimensions in feet in the following descriptions, one meter equals about 3 ft., 4 in., 1 cm. about 3/8 in.]

Butia capitata is represented by specimens of different age, but not over 55 years old. The adult plants (at the age of 40-50 years) have a height of 4.5-5.0 m. and a trunk diameter of 50 cm. Leaves are 3.4 meters long. Flowers appear in June in quantity. The length of inflorescences varies from 1.2 to 1.4 meters. The fruits have a fine sweet and sharp flavour, ripening in September-October (in Sukhumi) and in October-November (Sochi). This species is widespread in the parks of Sukhumi, Batumi and Sochi. It is the most frost-resistant of all the species of *Butia* cultivated on the Black Sea coast of the Caucasus; it is also drought-resistant.

Butia eriospatha. Adult specimens (25-35 years old) have trunks 3.0-3.5 m. high and 60-80 cm. in diameter. Leaves are about 3 meters long. Flowers are produced in July. The fruits, ripe in December, have a delicious sweet and sharp flavor. *B. eriospatha* is grown in small numbers in the gardens and parks of Sukhumi. It is similar to *B. capitata* in resistance to frost.

Butia Yatay. Adult plants (at the age of 30-35) have trunks 2.5-3 m. high and 45-50 cm. in diameter. Leaves are about 3 meters long. Flowers in profusion appear in May. Fruits ripen in November. Many specimens were killed by frost during the extremely cold winter of 1949-1950. A few specimens remain at Sukhumi (Gulripshi).

Butia Bonnetii. The specimens at Sukhumi had attained adult age and quite a good size, but only a few survived through the winter of 1949-1950. The adult specimens (at the age of 35-40) have trunks 2.5-3 m. high and 40-45 cm. in diameter. Leaves are about 1.7-2 meters long. This species flowers abundantly in July. The inflorescences are short (only 60 cm. long). The fruits ripen in November-December.

CHAMAEROPS

Chamaerops humilis is represented by specimens of different ages but not over 50 years old. The adult plants have trunks from 2-3 m. high and 20-24 cm. in diameter. The crown consists of 30-40 leaves; the diameter of the leaf blade is 40-60 cm. (more seldom 70-80 cm.). Five or six new leaves are formed during the vegetative period (from April till October). The longevity of leaves is from five to six years. Plants flower profusely each May. The length of inflorescences is up to 40 cm. The fruits ripen in November. This drought-resistant species is widespread in the gardens and parks all over the southeastern part of the Black Sea coast of the Caucasus (S. E. of Sochi), in some regions of western Georgia (in Samtredia and in some other localities), on the south coast of Crimea and it grows also at Kizyl-Atrek. During cold winters a somewhat higher percentage of mortality was observed in this species as compared to *Trachycarpus*. In our gardens and parks this species is represented by three forms differing in the colour and structure of leaves.

ERYTHEA

Erythea armata and *E. edulis* are cultivated on the Black Sea coast of the Caucasus.

Erythea armata is represented by adult specimens of up to 50 years of age at Sukhumi; their trunks are 7.5-8 m. high and 80-90 cm. in diameter, but at Sochi the height and diameter of the palms of the same age are 6 m. and 50-60 cm. respectively. The crown is densely leafy, the number of leaves being from 70 to 80, and the leaf lamina is from 1.2-1.5 m. in diameter. From eight to twelve new leaves develop during each vegetative period. The longevity of the leaves is from five to seven years. Flowers are borne profusely and annually in August. The inflorescences are from 2.5-3.5 m. long; at Sochi the number of inflorescences formed per plant varies from 1 to 17. At Sukhumi and Batumi the fruits ripen in November; at Sochi the ripening is completed in December or even still later in winter. For this reason the the fruits freeze and are not harvested in years when the winter is frosty. *Erythea armata* is grown in the gardens and parks of Sochi, Sukhumi and Batumi where it is drought-resistant.

Erythea edulis is represented by adult trees 45-50 years old; their trunks are 6.7 m. high, 60-65 cm. in diameter. The crown consists of 50 leaves; the diameter of the lamina is 0.8-1.8 m.; each leaf persists for 6-7 years. Abundant flowers are borne annually in August on inflorescences 2.0-2.5 m. long. The fruits ripen in December but if the winter is frosty they are killed by frost before ripening. A number of specimens of this species are grown in the gardens and parks of Sukhumi and Batumi.

JUBAEA

Jubaea chilensis (J. spectabilis) is represented by adult trees aged 50-55 years; the height is 10-12 m., the trunk diameter is 1.25-1.5 m. The crown is densely leafy, consisting of 60-70 (sometimes up to 80) leaves 4-5 meters long. The 5-7 new leaves formed each year persist for 5-6 years. The inflorescences are 1.2-1.4 m. long and bear flowers in September. *J. chilensis* is widespread at

64. *Trachycarpus Fortunei* at Sochi, 1962.

Sochi, Sukhumi and Batumi. It is being tested for the second time at the Nikitsky Botanic Garden (Crimea). During the cold winter of 1949-1950 these palms lost all their leaves, but new leaves developed during the summer of 1950.

PHOENIX

Three species of *Phoenix* are cultivated in the open ground in the subtropical regions of the U.S.S.R., viz. *Phoenix canariensis*, *P. sylvestris*, and *P. dactylifera*.

Phoenix canariensis is represented by the trees of different age, but not over 50 years. The large specimens attain the height of 10-12 m. and trunk diameter up to 1.0 m. The crown is densely leafy; at the age of 30-35 years it consists of 100-150 large leaves; in sites well sheltered and favourable in other respects the number of leaves per tree is increased (150-180). The length of leaves is 3.0-3.5 m.; 10-20 new leaves are formed during the vegetative period and their longevity is 2-3 years. The inflorescences are densely branched, up to 2m. long. The fruits ripen in November. This species is widespread in the gardens and parks of Sochi, Gagra, Sukhumi and Batumi. It grows also at the Nikitsky Botanic Garden, but there it is sorely damaged by frost during cold winters; it is also cultivated in the Apsheron peninsula and at Kizyl-Atrek, but at the latter locality these palms are frequently impaired by frost in winter.

Phoenix sylvestris. On the Black Sea coast of the Caucasus this species is represented mostly by the adult trees at the age of 40-50 years. These palms attain the height of 9 m. and a trunk diameter of 130 cm. The crown is densely leafy, consisting (at the age of 40) on the average of 120-130 large (3-4 m. long) leaves; 10-12 new leaves, each lasting 3-4 years, develop during the vegetative period. The inflorescences are densely branched, 1.5-1.8 m. long. The fruits ripen in October. This species is cultivated in small numbers in the gardens and parks of Sukhumi and Akhali-Afoni.

Phoenix dactylifera. In the Soviet Union the open air culture of the date palm for fruit production has been achieved at Kizyl-Atrek. The first seeding was made at this locality in 1935 and the first fruits harvested in 1939. At Kizyl-Atrek the trunks of 14- and 15-year-old specimens have a height of 7-8 m. and the crowns consist of 25-35 leaves. This species is winter hardy, enduring low temperatures up to 14° C. Although all the leaves are destroyed at such temperatures, the apical bud survives and a new crown of young leaves develops during the next summer. It is certain that in the course of 15 years' period of the open air culture of the date palm at Kizyl-Atrek the biological characteristics of this species have somewhat changed, which had an effect on the developmental stages. Apparently these changes are similar to those which *Trachycarpus* has undergone in Crimea. These palms flowered and fruited even in the years of the Great Patriotic War (1941-1945), when practically all the work on their maintenance was suspended.

RHAPIDOPHYLLUM

Rhapidophyllum hystrix is represented by adult trees not older than 35-40 years. They are 1.5-2 m. high, with a trunk diameter of 25-28 cm.; the crown consists of 16-20 leaves 60-70 cm. long, 3-5 new leaves developing each year. The longevity of a leaf is 7-10 years. This species flowers seldom and up to the present time it has never fruited. *R. hystrix* is cultivated at Sukhumi and Batumi where it is winter hardy and moderately

65. *Phoenix canariensis* at Sukhumi, 1962.

shade tolerant. It does not grow in open sites with dry soil.

SABAL

Two species are cultivated in the gardens and parks of the subtropical regions of the Soviet Union, viz *Sabal minor* and *Sabal Palmetto.*

Sabal minor is represented by adult plants at the age of 15-20 years. As no trunk is formed in this palm, all the leaves are radical. There are 12-15 (in some specimens up to 20) large flabelliform leaves, each with a blade 0.9-1.0 m. long. Only three or four new leaves develop each year. The longevity of a leaf is 2-3 years. The inflorescences are 2 m. long, appearing in the gardens and parks of Sukhumi and Batumi. It is also grown at the Nikitsky Botanic Garden but there it is sorely impaired by frost during cold winters. The species may be regarded as well acclimatized on the Black Sea coast of the Caucasus, despite the fact that during the exceptionally cold winter of 1949-1950 from 50 to 75 per cent of leaves (up to 100 per cent in some plants) were destroyed by frost. Fruiting begins at the age of eight years. At Sukhumi there are some plants propagating by natural seed reproduction.

Sabal Palmetto is represented by adult specimens 30-40 years of age. Their height is 5-6 m., the stem diameter 60 cm. The crown consists of 30-35 leaves 1.5-2 m. long. During the vegetative period 4-6 new leaves are formed which have a longevity of 4-5 years. Flowers appear abundantly in July; the inflorescence length is 1.5-2.0 m. Fruits ripen in December-January (in the southeastern part of the Black Sea coast of the Caucasus from Sochi to Batumi). The requirements of this plant are very frugal. It may be regarded as being well acclimatized, although the leaves are sorely damaged by frost during cold winters. This species propagates by natural seed reproduction.

TRACHYCARPUS

There are three species of this genus in the gardens and parks of the subtropical regions of the U.S.S.R., viz. *Trachycarpus Fortunei, T. Martianus,* and *T. Takil.*

Trachycarpus Fortunei. The 50-55-year-old specimens are large trees, the trunks of which are 10-12 m. high and 25-28 cm. in diameter. The crown is densely leafy; at the age of 30-45 (up to 50) years it consists of 60-100 flabelliform leaves 60-75 cm. long, 8-12 of them developing during the spring and the summer and lasting 3-5 years. Inflorescences are up to 1 m. long. The fruits ripen in November-December. Natural reproduction by seed is abundant; the plants of the seed progeny thrive, flower and fruit. *T. Fortunei* is the most widespread species in gardens and parks; it is also extensively used for planting along streets at Sochi, Akhali-Afoni, Sukhumi and Batumi. This species is also cultivated in some districts of Western Georgia, at Tbilisi and in the Apsheron peninsula in the Azerbaijan S.S.R. It is remarkably frost resistant and frugal in its requirements for environmental and cultural conditions.

Trachycarpus Martianus was introduced at Batumi Botanic Garden during the period between 1934 and 1938 and at Yalta by the Nikitsky Botanic Garden in 1948 in the form of seeds from Batumi. The trees growing at the Batumi Botanic Garden have the height of 2.0-2.5 m., their crowns consisting of 20-30 leaves, and the palms flower and fruit. They are quite frost resistant. At Yalta the 7- and 8-year-old specimens also endure the frost very well.

WASHINGTONIA

Washingtonia filifera is represented

by specimens of different age, but not older than 50 years. The adult specimens are large tall trees attaining a height of 25-30 m. and a trunk diameter from 70-80 cm. (at Sukhumi). At the age of 35-40 years the palms have 40-50 large flabelliform leaves up to 4 m. long in a dense crown. The diameter of the leaf lamina is 1.3 m. and 8-12 new leaves are formed during the vegetative period, spring until autumn. The longevity of a leaf is 3-4 years but the dead leaves remain attached to the tree for a long time, hanging down loosely. Flowers are profuse, borne annually in August on large, drooping inflorescences 3.5-4.5 m. long. The fruits ripen in December-January. *W. filifera* is widespread in the gardens and parks of the Black Sea coast of the Caucasus (Sochi, Sukhumi, Batumi). During very cold winters all the leaves are destroyed by frost, but during the next summer new leaves develop. On the south coast of Crimea all the unsheltered and unprotected specimens failed to survive through the exceptionally cold winter of 1949-1950. The species is drought-resistant, growing on lime soils and preferring lowland sites.

Washingtonia robusta is represented by plants of different age but not over 45 years. The adult specimens are tall trees attaining the height of 20-22 m. (at Sukhumi); the trunk diameter is 60-70 cm. Thirty- to forty-year-old specimens have fifty large leaves 2.5-3.0 m. long, the diameter of the leaf blade being 1.5 m. The formation of new leaves is observed all the year round, but this process is most intense from April until October. 12-15 new leaves develop annually; the leaf longevity is 2-3 years. The inflorescences are large, 2.5-3.0 m. long, borne annually in June. The fruits ripen in November-December. This species is cultivated on the Black Sea coast of the Caucasus (Sochi, Batumi, Sukhumi) but is less frost resistant that *W. filifera*. In the sites sheltered from winds the frost damage is much less sore and in the impaired plants a bunch of new leaves is formed during the next summer.

Hunting for Palms in North Borneo

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North Borneo is the northeastern part of the Great Island, about the size of Ireland. The country is very sparsely populated. Only 450,000 people live here, and these for the greatest part are concentrated in coastal areas along the west coast. I have been travelling three years through this country in search of timber trees, meanwhile paying more casual attention to palms. This article is not intended to give an exhaustive survey of the palms of North Borneo, as my knowledge of them is still very limited and I feel yet at the beginning of my palm studies.

The genera represented in Borneo are generally the same as in Sumatra and Malaya. The richest in species are the rattans of which there is a considerable amount for export. Our collections of these spiny creatures (species of *Calamus, Daemonorops, Plectocomia, Korthalsia* and *Ceratolobus)* are still very incomplete. The most important from a commercial point of view is *Calamus caesia* called *rotan sega* which I saw rather frequently along the upper reaches of the Kinabatangan River. Along the coast, *Nypa* of course is quite abundant at the estuaries of rivers. Behind the *Nypa* and mangrove zone we often see, as in Sumatra, a sandy zone with a dominance of *Oncosperma tigillarium*, the *nibung* palm. Some people in

66. *Pholidocarpus Majadum*, Batu Sapi Rd., Sandakan, North Borneo. Photograph by W. Meijer.

67. *Pholidocarpus Majadum* inflorescence from trees in seasonal swamp forest, Serudong River, Tawan, North Borneo. Photograph by W. Meijer.

coastal towns use this palm for ornamental groups in their gardens. This same palm is very much used by the local fisher people for flooring. Inside the mangrove we often see our most common species of *Calamus*, *C. aquatilis*, called *rotan bakau* (*bakau* means mangrove).

Some palms are peculiar to swamp forests. *Cyrtostachys Lakka* with its attractive reddish sheaths is very common on the west coast in places where the railways go through sandy swampy areas, but it also occurs near Sandakan on the east coast. Swamp forests on more fertile soils are often characterized by a dominance of the large fan palms, *Pholidocarpus Majadum*. They look like species of *Livistona*, only with larger brownish fruits with broken brown corky skins. It is rather easy to grow them. The coastal swamps along the west coast are also very good localities for the attractive common species of *Licuala*, *L. spinosa*, and for some species of *Salacca*.

The most northern end of North Bor-

68. *Licuala spinosa* on the Malay Peninsula. Photograph by W. Meijer.

69. *Eugeissona* cf. *insignis* north of Tamparuli, Jesselton-Kota Belud Rd., North Borneo. Photograph by W. Meijer.

70. Details of *Eugeissona* cf. *insignis* north of Tampurli, Jesselton-Kota Belud Rd., North Borneo. Photograph by W. Meijer.

neo is the Kudat Peninsula near Marudu Bay. This bay is fringed with a great amount of *Corypha elata*. Unfortunately the Agricultural Department is trying to exterminate these populations because they harbour insects which cause damage in the near-by coconut plantations.

Sago palms *(Metroxylon)* are most common on the flat swampy Klias Peninsula where they must have been introduced. The related genus *Eugeissona* is locally represented by one or two species. Better collections and notes have to be made of these. They tend to be common in secondary forests on hills on the west coast but also on some steep river banks in the southeast corner of the country. At least one species, *E. utilis,* also produces sago. In the midst of the country I found lowland dipterocarp forests with a very rich undergrowth of a palm which has a habit similar to *Pholidocarpus*. It belongs, however, to a totally different genus. The leaf stalks are not spiny and the fruits have an edible endosperm. This is probably *Borassodendron Machadonis* which was not known from this part of Borneo.

Walking through the jungles we meet rather frequently dwarf palms belonging to the genera *Licuala* and *Pinanga*. Several of these might become very ornamental palms in other parts of the world. There are about 30 species of *Licuala* and 40 species of *Pinanga* with those of related or similar genera like *Iguanura, Gigliolia,* and even dwarf species of *Areca*. The first two mentioned have not yet been collected by me in North Borneo but of the latter I secured some herbarium specimens and living material from river banks and swampy forests.

71. *Calamus* cf. *scipionum,* the walking-stick rotang, Bukit Hampuan, Ranau, North Borneo. Photograph by W. Meijer.

72. *Arenga undulatifolia*, Sebatik Island, North Borneo. Photograph by W. Meijer.

Finally I want to call attention to some local species of *Arenga*. All over the place in our lowland forests we see on sandstone a species of *Arenga* with undulate leaf margins. The local people use it for their blowpipes and I have seen the fiber used with a piece of porcelain rubbed against a stem of the bamboo *Gigantochloa* sp. for making fire. This use is also mentioned by Beccari and by Elmer in the Philippines for a related or possibly identical species of *Arenga*. I have been puzzled a long time about a dwarf gregarious palm, possibly an *Arenga*, which is very common in swampy forests just behind the mangrove. This matter also needs more field study. After having seen the rather scanty collections of Bornean palms in some European and American herbaria, and when I have been able to collect much more information on the original descriptions and type localities of Bornean palms, I hope to engage myself with greater vigor in the exploration of the palms of North Borneo.

Two New Palms from Peru

Harold E. Moore, Jr.

From mid-April to the end of June, 1960, the palms of eastern Peru were the subject of a reconnaissance survey carried out by the writer in company with Ing. Adolfo Salazar C. of the Peruvian Forest Service and Dr. Earl E. Smith, Forestry Advisor, Agricultural Division, USOM/Peru.

The study of the palms collected is not yet complete but three have proved to be of unusual interest in that they represent undescribed species of apparently limited distribution. A new species of *Iriartella* is being described elsewhere in conjunction with a study of that genus (*Gentes Herbarum* 9 in press) Two others, one representing a new genus of cocoid palms, the other a new species of the arecoid genus *Socratea*, are described herein.

Chrysallidosperma

Ruminate endosperm is reasonably common in a number of genera of arecoid palms where it may be used to distinguish groups of species in subgeneric categories, but where it alone is seldom considered as a characteristic of generic importance. Among the cocoid palms, however, ruminate endosperm occurs only in a few monotypic genera—*Polyandrococos, Arikuryroba, Lytocaryum, Barbosa, Rhyticocos*—and appears to be of greater significance. The last four of these genera belong with a complex centered about *Syagrus* in which generic differences lie largely in the fruit and seed.

To these genera must be added another which seems to have a close affinity with them, but which differs from them in some rather striking characteristics of the fruit and seed. Because the form of the last suggests an odd chrysalis, I propose for this genus the name *Chrysallidosperma* from the Greek *chrysallis* (chrysalis) and *sperma* (seed). The epithet honors Dr. Earl E. Smith who initiated, arranged details for, and participated in the survey of palms as part of the program of the Agriculture Division, United States Operation Mission to Peru, International Cooperation Administration, and of the Servicio Forestal of Peru.

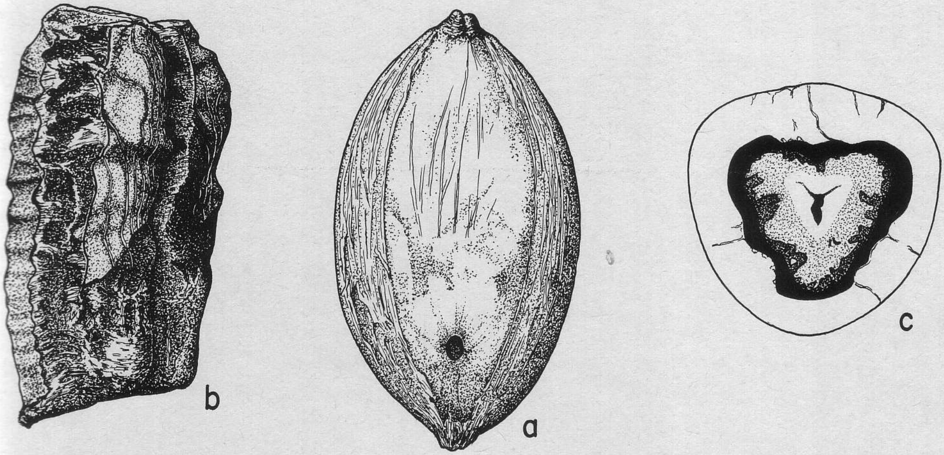
Juvenile plants of *Chrysallidosperma* were seen before mature individuals and were thought to represent an overgrown *Geonoma Spixiana* because of the large elongate-cuneate leaves which are undivided except for the bifid apex. These juvenile leaves may reach a length of three meters and may persist until the trunk is more than a foot or two high, only then beginning to divide. At maturity, however, the leaves are always pinnate with slender delicate pinnae.

Chrysallidosperma finds its closest relationship with *Barbosa* and *Rhyticocos* from which it differs in the irregularly three-angled seed that is truncate apically and obliquely truncate basally to the acute base of the outer margin wherein lies the embryo. The endocarp is very thick and hard with broad intruded bands between the shining vittae above the pores inside. Pending completion of studies on cocoid genera for a proposed "genera palmarum," the following brief synopsis and provisional key to genera of the "*Syagrus* alliance" may help to relate *Chrysallidosperma* within the alliance.

The *Syagrus* alliance consists of unarmed palms, except sometimes the sharply toothed margins of the petiole, with pistillate flowers not or only slightly sunken in the inflorescence axes. Leaves are mostly moderate in size and the pinnae frequently are arranged in groups and borne in several planes. Two bracts, the inner longer and deeply plicate-sulcate, subtend the inflorescence which is normally of one kind only (not like the dimorphic inflorescences of *Attalea* and its allies) bearing pistillate flowers on the axis of the spike or at the base of, in the lower portion of, or nearly throughout the rachillae. The pistillate flowers are ovate or ovate-conic, the sepals acute or more or less cucullate, the petals with conspicuously valvate apices. Staminate flowers have mostly acute, distinct or basally connate sepals much shorter than the flat petals, and 6 stamens. Fruit may be small or large with fibrous mesocarp and very thin to very thick endocarp, the pores near the base or at least below the middle. Included genera are *Arecastrum, Arikuryroba, Barbosa, Chrysallidosperma, Lytocaryum, Microcoelum, Rhyticocos* and *Syagrus.*

PROVISIONAL KEY TO THE GENERA

1. Petiole spinose-dentate along the margin; pinnae more or less oblique or toothed apically at maturity; seed with ruminate endosperm. Brazil. *Arikuryroba*
1. Petiole unarmed; pinnae acute to acuminate; seed various.
  2. Exocarp and mesocarp splitting regularly and longitudinally into three sections from the apex toward the base at maturity; endocarp thin.
     (the three species which fall here are maintained in one genus, *Lytocaryum,* by Toledo, in *Lytocaryum* & *Microcoelum* by Burret and Potztal)
     3. Endosperm homogeneous. Brazil. *Microcoelum*
     3. Endosperm ruminate. Brazil. *Lytocaryum*
  2. Exocarp and mesocarp not splitting at maturity or only irregularly so; endocarp mostly woody or bony and thickish to very thick.
     4. Seeds with homogeneous endosperm.
        5. Cavity of the endocarp irregular; seed irregular, gibbous-uncinate. Brazil to northern Argentina. *Arecastrum*
        5. Cavity of the endocarp regular, trivittate within; seed not irregular, terete in cross section. Colombia, Ecuador and Peru, to Brazil, northern Argentina. *Syagrus*
     4. Seeds with ruminate endosperm.
        6. Seed solid or with a very narrow central cavity, irregularly angled in cross section with rounded edges and impressed sides, truncate apically, obliquely truncate basally to the acute base of the outer margin and included basal embryo; endocarp ellipsoid, very thick and bony, readily separating from the thin fibrous mesocarp when dry, acute at both ends, marked with 3 pitted bands externally between the pores and with corresponding internal intrusions, the wall thinnest along the vittae above the pores. Peru. *Chrysallidosperma*
        6. Seed hollow, terete in cross section and globose or obovoid, the embryo sub-basal on one side near the uniformly rounded or tapered base; endocarp of uniform thickness.
           7. Endocarp ovoid, thin, woody, with a conic-rostrate apex; endosperm oily, broadly hollowed in the center. Brazil. *Barbosa*
           7. Endocarp ellipsoid-obovoid, thick, bony, acute at both ends but not rostrate; endosperm dry, narrowly hollowed in the center. Lesser Antilles. *Rhyticocos*



73. *Chrysallidosperma Smithii.* a, endocarp × 1; b, seed × 1½; c, endocarp and seed in cross section × 1 (from *Moore et al 8516).*

Chrysallidosperma H. E. Moore, **gen. nov.** (Palmae—Cocoideae).

Barbosae et *Rhyticoco* similis sed semine solido vel in medio anguste cavo, irregulariter triangulari, ad apicem truncato ad basin oblique truncato, endocarpio duro crasso intus trivittato intervallibus crassioribus differt.

Solitary unarmed monoecious palms of moderate size. Leaves pinnate; sheath short, fibrous; petiole elongate; pinnae arranged in groups along the rachis and borne in several planes, acute to acuminate at the apex, narrowly reduplicate at the base, with prominent keeled midnerve above. Infloresences interfoliar, subtended by 2 unequal basally inserted bracts, the outer short, ancipitous, opening obliquely at the apex, the inner deeply plicate-sulcate, with an elongate manubrium, the cymba woody, rostrate, splitting abaxially; peduncle and rachis elongate; rachillae spirally arranged and more or less flexuous, numerous, enlarged basally, at least the lower ones with a prominent naked base, bearing flowers in triads of a sessile central bracteolate pistillate and 2 lateral pedicellate staminate in the lower half or less of the rachillae, paired or solitary and sessile staminate above. Staminate flowers with 3 small distinct acute sepals, 3 large somewhat asymmetric acutish valvate petals grooved within, 6 stamens, the short filaments basally connate then distinct, the shortly sagittate linear anthers straight and basifixed, pistillode of 3 minute protuberances; pistillate flowers as long as the staminate, conic-ovoid and obtuse in bud, sepals 3, ovate, convolute-imbricate, petals 3, about as long as the sepals, convolute-imbricate with valvate apices, staminodes united in a prominent annulus, the pistil trilocular with 1 axile ovule attached the length of each locule, only one maturing, style enlarged, stigmas distinct. Fruit narrowly ovoid or ellipsoid, the exocarp thin, smooth, mesocarp of numerous slender longitudinal fibers readily separable from the endocarp, this acute at each end, very hard, thick and bony, with 3 prominent pitted vertical bands outside corresponding with 3 intruded bands alternating with 3 shining vittae within, the pores near the base in the vittae; seed irregularly 3-angled with rounded edges and sculptured impressed sides, truncate at the apex, obliquely truncate at the base to the narrow outer edge and included

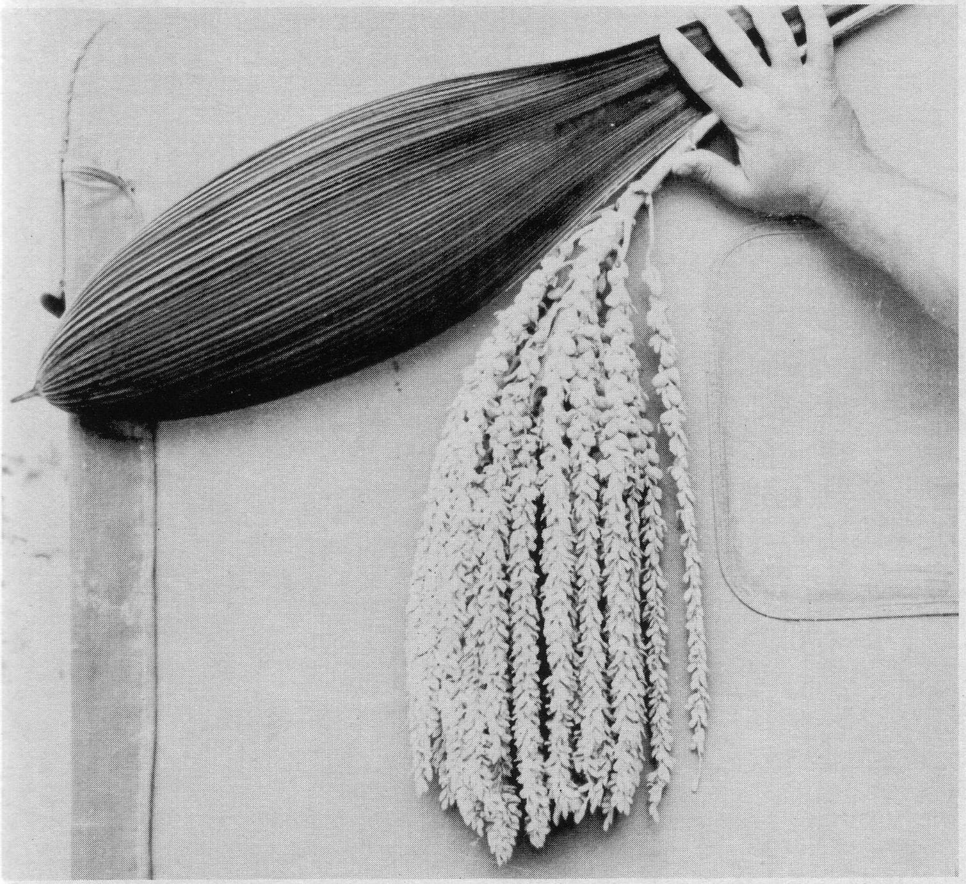
74. *Chrysallidosperma Smithii*. Dr. Smith holds an entire inflorescence, complete with bracts, collected near Yurimaguas, Peru.

basal embryo, endosperm solid or with a very narrow central cavity and ruminate marginally.

Chrysallidosperma Smithii H. E. Moore, **sp. nov.**

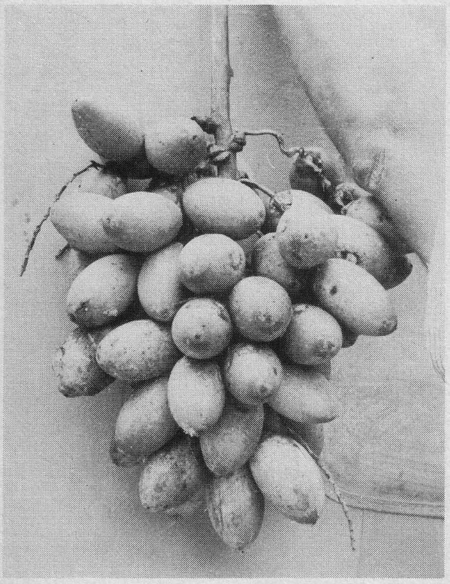
Caudex ad 10 m. altus. Folia 2-3 m. longa, pinnis utrinque 83-92 in gregibus dispositis. Inflorescentia longe pedunculata, rachillae ca. 35. Flores masculi 10-13 mm. alti, flores feminei 12 mm. alti. Fructus 6.5-7 cm. longus, 3-5 cm. in diam., semine 3.5 cm. longo, 2 cm. lato.

Stems solitary, grey or brown, irregularly and not prominently ringed, sometimes fissured lengthwise, to ca. 10 m. high, 8 cm. in diam. Leaves 10-15 in a spreading or ascending gracefull lacy crown, dark green and dull above; sheath short, with finely woven fibers covered with tawny tomentum when young but fraying in age; petiole 3.7-9 dm. long, rounded and deciduous red-brown and pale-brown tomentose becoming glabrate and dark waxy-lepidote below, channelled and glabrate above; rachis 2-3 m. long, rounded and dark furfuraceous toward the margins below, channelled to sharply angled above; pinnae 83-92 on each side of the rachis in groups of 1-3 (-5), spreading and borne in 2-3 planes at least toward the base, but the blade nearly flat in appearance, the lowermost pinnae long acuminate-attenuate, ca. 70 cm. long, 4 mm. wide, those at mid-leaf acute, ca. 66 cm. long, 3 cm. wide, those at apex ca. 23 cm. long, 6 mm. wide, all with midnerve prominent and keeled above, impressed below, and prominent cross-veinlets in life and when dry, glabrous except for minute pale waxy peltate scales or scale-bases below, the secondary and tertiary nerves very fine and scarcely distinct. Inflorescence white in flower, green in fruit, long-pedunculate, the thin outer bract ca. 40 cm. long, 4.2 cm. wide, minutely brown peltate-lepidote where protected, the inner bract with a slender brown tomentose or



75. *Chrysallidosperma Smithii.* Close-up of same inflorescence showing the pistillate flowers restricted to lower part of rachillae.

brown ceraceous lepidote manubrium ca. 6 dm. long and a shortly rostrate (to 6 cm.) brown furfuraceous cymba ca. 7.5 dm. long, 13.5 cm. wide; peduncle ellipsoid in section, ca. 7.5 dm. long, 1.4 cm. wide, 9 mm. thick, densely deciduous brown tomentose becoming glabrate, at least marginally and apically, the rachis ca. 2.5 dm. long with shining brown hairs and minute pale peltate scales, the rachillae ca. 35, enlarged basally, ca. 25-40 cm. long, the lower ones with a long naked base and 1-2-7 or to 28 spirally arranged triads of a central sessile pistillate flower and two lateral staminate flowers on prominent pedicels 3-5 mm. long in the lower half or less, staminate flowers sessile and paired or solitary in the upper half or more of the rachilla, the rachillae more or less flexuous between flowering nodes; staminate flowers sweet-scented, glabrous, 10-13 mm. long, creamy white, sepals, ca. 1 mm. long, petals dull, thick; pistillate flowers ca. 12 mm. high, 10 mm. diam. at base, sepals 10 mm. high, 9 mm. wide at base, petals shorter in bud, staminodes united in a dark brown annulus ca. 2 mm. high, pistil ovoid. Fruit narrowly ovoid or ellipsoid, rounded at base and apex, 6.5-7 cm. long, 3.5-4.2 cm. in diam. when dry, smooth, the



76. *Chrysallidosperma Smithii.* A fruiting cluster.

mesocarp ca. 3 mm. thick when dry, endocarp ca. 6 mm. long, 3.5 cm. in diam., ca. 5 mm. thick above the pores, ca. 9 mm. thick above the intruded and prominent bands between the pores, the pores ca. 1 cm. from the base; seed ca. 3.5 cm. long, 2 cm. wide.

PERU. Department Loreto: Province Alto Amazonas; on open wooded slopes with acid sandy clay soils (pH 4.5) between kilometers 13 and 14 on Yurimaguas-Tarapoto road, May 24, 1960. *H. E. Moore, Jr., A. Salazar C. & E. E. Smith 8516* (BH, TYPE; USM, ISOTYPE). Province Coronel Portillo; wooded slopes 6-8 kilometers beyond Aguaytía on road to San Alejandro, ca. 330 m. alt., April 29, 1960, *H. E. Moore, Jr., A. Salazar C. & E. E. Smith 8375* (BH, USM).

Socratea Salazarii

Socratea Salazarii H. E. Moore, **sp. nov.**

Caudex 2-9 m. altus. Foliarum pinnae indivisae utrinque 11-16. Fructus magnus, ovoideus, ca. 3.5 cm. longus, 3.3 cm. in diam. ad apicem irregulariter fissus.

77. *Socratea Salazarii.* An entire leaf from near Yurimaguas, Peru.

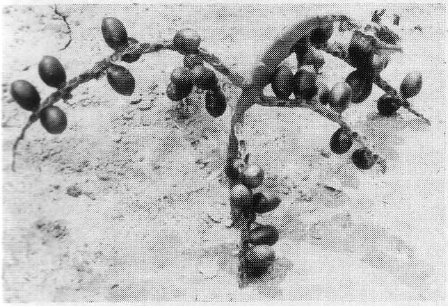
78. *Socratea Salazarii.* Pinnae from the middle of the leaf, the base to the right of photograph.

Trunk solitary, brown, ringed, 2-9 m. high, 6.5 cm. in diam. or more, from sparsely to moderately spiny separated stilt roots .7-1 m. high, 3.5-4 cm. in diam., the spines to 3 mm. long. Leaves about 7, spreading, the sheaths blue-green to dark green with a visible coat of shining red-brown predominantly medifixed hairs at least when young, 0.9-1.2 m. long; petiole ca. 4 dm. long, terete, minutely brown lepidote or brown punctulate; rachis essentially terete but alternately ridged below each pinna above, at first covered with a dense coat of appressed brown basifixed, medifixed or substellately branched hairs but soon glabrate and densely brown punctulate, at least below, 1.6-2.2 m. long; pinnae 11-16 on each side of the rachis, glossy green above, rufous below where densely and conspicuously pilose on the surface and the numerous prominent yellowish nerves, and especially so at the point of insertion, or at length becoming glabrate and densely brown punctulate, undivided, cuneate-trapezoidal in outline and arcuate-undulate or flattish in life, the lower margin longest, lacerately toothed and tapered from both margins to a more or less acute apex except the apical pinnae, those broadly truncate and subflabellate, lowermost pinnae 28-34 cm. long and narrower than the remainder, pinnae at mid-leaf ca. 72-75 cm. long, 20-23 cm. wide at widest point, the apical ca. 30 cm. long on lower margin, 14-25 cm. wide at apex, 18-21 cm. along the rachis, the primary nerves ca. 25-28 on pinnae from mid-leaf with slender intervening nerves and often with broad longitudinal bands of dense appressed brown hairs. Inflorescences as many as four, solitary at nodes below crownshaft, the peduncle 14-18 cm. long, 1-3 cm. wide at scar of outer bract, dorso-ventrally compressed, arcuately decurved;

79. *Socratea Salazarii.* Detail of the upper portion of a leaf.

bracts 4, erect, the outer ca. 10 cm. long, the innermost ca. 31 cm. long, at least the inner with medifixed hairs similar to those of the sheath; rachis 6-7 cm. long with 5-8 short stout stiff glabrous (?) rachillae 20-31 cm. long, compressed and the lowest ca. 17 mm. wide, 8 mm. thick at the base, marked with elliptic scars of pistillate flowers and fruits ca. 8 mm. long. Flowers creamy-white; staminate ca. 5 mm. high (reconstructed from damaged specimens), petals angled, stamens ca. 30 (field observations); pistillate ca. 4 mm. high in bud, in fruit the perianth more or less explanate with sepals ca. 3 mm. high, petals ca. 5 mm. high, 7 mm. wide. Fruit ellipsoid-ovoid, ca. 3.5 cm. long with perianth, 2.5 cm. in diam. when fresh, ca. 3.3 cm. long with perianth when dry, greenish-brown drying light brown and somewhat granular, with excentrically apical stigmatic remains, the fruit splitting irregularly at the apex to expose the thickish white dry pulp when completely mature; seed ca. 2.5 cm. long, 2 cm. wide, attached basally, with numerous pale anastamosing raphe branches ascending to the apical embryo. Seedling leaf (as grown at Cornell University) deeply bifid.

PERU. Department Loreto: Province Coronel Portillo; in dense woods in low areas a few kilometers southwest of Yurac on road to Boquerón del Padre Abad, alt. ca. 400 m., April 27, 1960, *H. E. Moore, Jr., A. Salazar C.* & *E. E. Smith 8366* (BH. USM); on wooded slopes 6-8 kilometers beyond Aguaytía on road to San Alejandro, alt. ca. 330 m., April 29, 1960, *H. E. Moore, Jr., A. Salazar C.* & *E. E. Smith 8381* (BH, USM). Province Alto Amazonas; on open wooded slopes with acid sandy clay soils (pH4.5) between kilometers 13 and 14 on Yurimaguas-Tarapoto road, May 24, 1960, *H. E. Moore, Jr., A. Salazar C.* & *E. E. Smith 8517* (BH, TYPE; USM, ISOTYPE).



80. *Socratea Salazarii.* An infructescence with fruits not yet split at the tips.

Socratea Salazarii was found in what appears to be a very restricted habitat in company with or in the same region as either a new *Iriartella (8366)* or *Chrysallidosperma Smithii (8517)*. Most species of *Socratea* have the middle pinnae much dissected. Apart from the tall and small-fruited *S. exorhiza* of Brazil which as often interpreted seems to differ significantly from the original description of Martius, only *S. gracilis* Burret from British Guiana and a taxon represented by incomplete material from the Río Kananarí, Vaupes, Colombia *(Schultes & Cabrera 10105-E,* BH) have undivided pinnae. *S. gracilis,* however, has a much smaller fruit only 18 mm. long when dry (but immature), and the pinnae at mid-leaf are often divided into two segments. The material from Colombia approaches *S. gracilis* in fruit size but in foliage, inflorescence and other characteristics seems closely related to *S. Salazarii.*

Fruit of *S. Salazarii* is the largest yet described for the genus, being approached only by that of *S. macrochlamys* Burret. When mature, it splits naturally and irregularly at the apex revealing the dry white pulp, as noted both near Yurac and Yurimaguaus where fruiting plants were collected. The description of the inflorescence at anthesis and of staminate and pistillate flowers is incomplete owing to damage incurred in drying and shipment.

The epithet recognizes the invaluable aid given by the Peruvian Forest Service as represented by Ing. Adolfo Salazar C. who, as my counterpart in a Point-Four project, facilitated the study of Peruvian palms during 1960 in every direct and indirect way.

LETTERS

It always gives me great sorrow to see a dead palm tree, and I understand quite well how distressed you must have been in your recent drive to Louisiana [seeing the winter-killed palms along the Gulf coast—L.H.W.] or Mr. Dent Smith with the terrible loss of so many of his palms. We do not have any freezes under our tropical sky, but my lot has been to witness the utter, savage destruction of thousands upon thousands of *Scheelea magdalenica, Sabal mauritiaeformis,* and *Copernicia tectorum*—some of the scheeleas and sabals over 70 feet tall—either felled or expeditiously burned alive in gigantic holocausts with the forests in which they grew. Opening of new lands for extensive pastures, cotton fields or rice fields (in the low *Copernicia* terrains) has been responsible for the loss of about 85 per cent of our forests, including tremendous numbers of the three species mentioned above without counting the bushy, spiny *Bactris minor* and *Pyrenoglyphis major,* or the climbing, vine-like *Desmoncus myriacanthos.*

The *Pinanga patula* is a success in my garden. My plants are 13 to 20 inches tall, and two of them are beginning to grow a secondary stem. *Areca Langloisiana,* seeds of which Mrs. Langlois kindly sent me last December, has germinated 33 per cent, but *Neodypsis Lastelliana,* also received from Mrs. Langlois, has been a complete failure, the embryos having rotted.

Prof. Armando Dugand
Barranquilla, Colombia

I was very much interested in the articles on *Cocos nucifera.* Some years ago when I read the Cook report in Contributions, I tried to reason why the heavy, fibrous husk of the coconut should be of desert origin. Of course Cook could have contended that the coconut originated in inland South America when the geological formation was lower and probably an inland sea. This would impose the question of survival of the species during a major geological uplift. The opinions of Beccari are more logical and the sodium chloride of the palm ashes appears to support a seashore origin. This brings a question to mind: are all of the palms halophytes? I wonder about the sodium chloride content of the California native palms and the imported date palms. Those of Palm Canyon may be growing where the geological formation provides adequate sodium chloride. It would be most interesting to run ash analyses on palm materials to see if there is a definite sodium chloride relationship.

J. G. SUTHARD
Long Beach, California

[Editor's note: the wide range of soils upon which palms may grow, both acid and alkaline, suggests that sodium chloride is not always an important factor but an understanding of the whole problem is indeed much to be desired.]

THE EDITOR'S CORNER

When Dr. W. Meijer of the Forest Department, North Borneo, visited Cornell University in February, the editor asked him if he would supplement some handsome photographs of Bornean palms with a short text which begins on page 88. It is hoped that Dr. Meijer's interest in palms can add to our knowledge of those growing in Borneo even though, as a forest botanist, his chief interest is in the timber-producing trees—the dipterocarps—of the island.

The article on palms in Russia was kindly prepared by Professor S. G. Saakov who is the author of a book published in Russian entitled "Palms and their Culture in the USSR" (319 pp, Moskow-Leningrad, 1954). One notes with interest the similarity of problems between the palm-growing areas of the USSR and those of the southern United States. The Society is indebted to both authors for bringing their experiences to us.

Few members of The Palm Society will have seen palm chromosomes yet they are of vital importance. The account given by Mr. Read is intended primarily to accompany the cover and to introduce members of the Society to some of the technical work now being done.