PRINCIPES

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THE PALM SOCIETY

A non-profit corporation primarily engaged in the study of the palm family in all its aspects throughout the world. Membership is open to all persons interested in the family. Dues are $10.00 per annum payable in May. Requests for information about membership or for general information about the Society should be addressed to the Secretary.

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

Contents for January

Cover Picture

Ravenea robustior stands majestically in the tangled forest beside a catchment basin in the reserve near Perinet, Madagascar (see page 18).

Mailed at Miami, Florida
March 27, 1965

NEWS OF THE SOCIETY

Since the first of July the Society has acquired twenty-four new members. This is almost one per week, and far below the record we made at one time of about two per week. This does not include old members who have rejoined, and whom we are always delighted to welcome back. In order to keep the Society alive and going, we must continue to enlist new members, and once more we urge you to keep on telling interested persons about the Society and sending in names of prospects.

For the first time we have a new member in Okinawa, Mr. Motohide Yamakawa, who is in the Forestry Section, Economics Department, Government of the Ryukyus. These islands have a climate similar to that in certain parts of Florida, and Mr. Yamakawa hopes to develop a fine collection of exotic palms there. Two enthusiastic palm collectors are Mr. Somphongs Lek-Aree and Mr. P. Chawanonda, of Bangkok, Thailand. We also have many fine collectors and students of palms in Japan, and in other parts of the world.

* * *

A new local group (or chapter, if you wish) of The Palm Society has been formed in central Florida. Meeting at the home of Mr. and Mrs. Billings McArthur in Winter Park, thirteen members came from a radius of about fifty miles to see the McArthurs' extensive collection of palms and other plants, and to vote on the formation of a central Florida chapter. The vote was unanimous and Mr. McArthur was nominated acting chairman. Field trips and meetings will be held at intervals.

* * *

Dr. Armando Dugand of Barranquilla, Colombia, has sent an interesting postage stamp, recently issued, showing part of the entrance avenue to the Agricultural Experiment Station at Palmira, Valle, in western Colombia, near Cali.

He writes:

"Both the tall and the small (young) palms are *Syagrus Sancona* (H. B. K.) Karsten, originally described by Humboldt, Bonpland and Kunth as *Oreodoxa Sancona* in 1816. Palmira (a very nice name for a town, don't you agree?) is not very far from the type locality (Roldanillo), in the same Cauca Valley, where Humboldt and Bonpland collected their specimens in 1801. I am trying to interest the Government to issue a stamp of the national representative tree of Colombia, the Quindio Wax Palm (*Ceroxylon quindiuense*), one of the natural wonders of the Central Cordillera."

* * *

Mr. J. D. Rowell, of Sacramento, Calif., sent a color photograph of two young *Trachycarpus Fortunei* growing out-of-doors in Lewiston, Idaho. They look very green and healthy. Mr. Rowell sent these two plants to his aunt in Lewiston about five years ago. He says:

"Actually, the plants are not much larger than they were when originally set out. The growing season in Lewiston is quite short and the trees have suffered some burning back of the leaves each winter. Still it is surprising to me that they have survived until now due to the rather severe climate and the rather modest protection the trees have had. The only protection they have ever had is some leaves around them, which have blown away on some occasions, leaving the trees completely unprotected. On one such occasion the temperature was around 0° F. Lewiston has the mild-

est climate of any city in Idaho in spite of its location in the northern part of the state. The elevation is only about 750 feet above sea level. It is jokingly referred to as the 'Banana Belt' by students at the University of Idaho in Moscow (at about 3,000 feet), but it still has a great deal of cold weather for palm growing. It gets down to −15° F. often enough that this is not considered unusual."

* * *

On the evening of January 23rd members of the Palm Society living in Greater Miami and members of Fairchild Tropical Garden had the great privilege of hearing Dr. H. E. Moore, Jr., Director of the L. H. Bailey Hortorium, Cornell University, and editor of PRINCIPES, describe, with exciting slides, his recent search in many lands for new and/or little-known palms. Visits to Madagascar, Borneo, New Guinea, northern Australia, Fiji, New Caledonia and other places yielded a number of new or "lost" palms, about which very little has been known. Now that their pictures have been taken, their pollen gathered for chromosome study, herbarium specimens made, structure studied and in some cases seeds gathered and germinated, they eventually will become better known. Dr. Moore paid dearly for these palms, with a severe leg infection and a bout of malaria. We are most grateful to him for his work, and for sharing his experiences with us.

* * *

Early numbers of PRINCIPES are either out of print or rapidly becoming so. Libraries of universities and botanical institutions, as well as individuals, often want to complete their sets, and it is distressing to have to tell them this is no longer possible. Once in a long while a precious back number or two comes in, and a need is met. I have placed a note in my complete set of PRINCIPES, asking that if anything should happen to me the set should be turned over to The Palm Society, for use by some library or qualified person. Perhaps some of you fellow-members might care to do the same.

LUCITA H. WAIT

Palm Chromosomes by Air Mail*

ROBERT W. READ

Botanist, Fairchild Tropical Garden, Miami, Florida

Chromosome numbers have previously been determined from root-tip cells, from certain other meristematic regions of the plant, from microsporogenesis, or from cells cultured in artificial media. Thus work was usually limited to the availability of seedlings or mature specimens growing in a botanical garden or arboretum collection. Because of the limited number of palm species available in cultivation (the 410-450 species of palms at the Fairchild Tropical Garren represent 17 per cent of the palm family or less), and because a technique for studying palm chromosomes at pollen tube mitosis has been successful (Read, 1964), an attempt was made to utilize pollen sent from distant parts of the world for processing in the laboratory at the Fairchild Tropical Garden. The tropical habitat of most palms and their special growth requirements have heretofore limited the study of palm chromosomes on a large scale.

The first success was achieved by us-

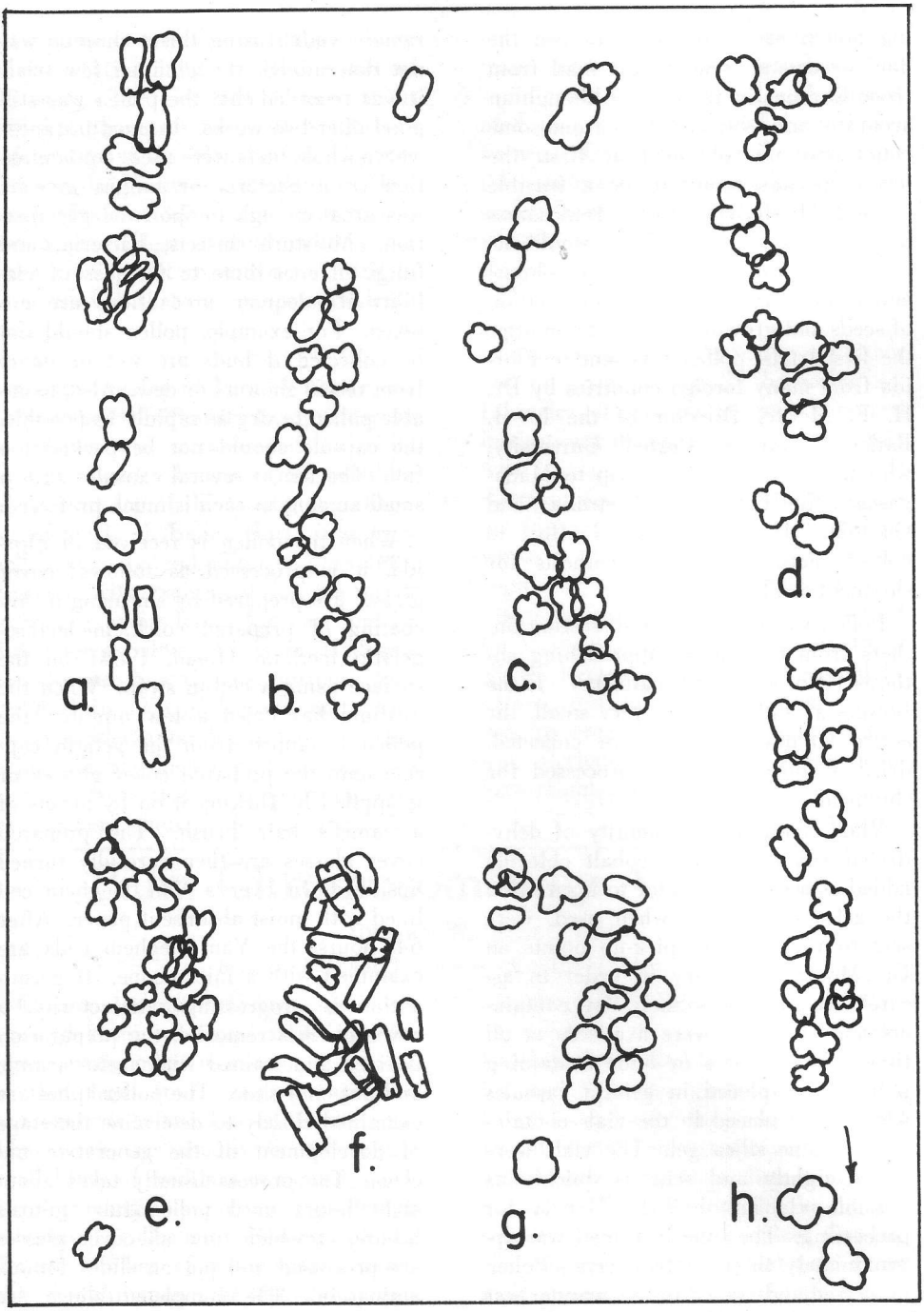
*From work related to a project supported by National Science Foundation Grant number GB-1354.

ing pollen of *Lodoicea maldivica*, the double coconut, sent by air mail from Hope Gardens in Jamaica. Although an accurate and satisfactory chromosome count was not obtained at first, the technique was found to be a feasible method of studying the chromosomes of palms growing where they would ordinarily be inaccessible to the cytologist and without waiting for the germination of seeds and growth of roots. Soon after the first trials, pollen was sent to Florida from many foreign countries by Dr. H. E. Moore, Director of the L. H. Bailey Hortorium, Cornell University, who was on a collecting trip to Madagascar, the Far East, Australia, and Oceania. He made a special effort to collect mature pollen at anthesis for shipment to Florida .

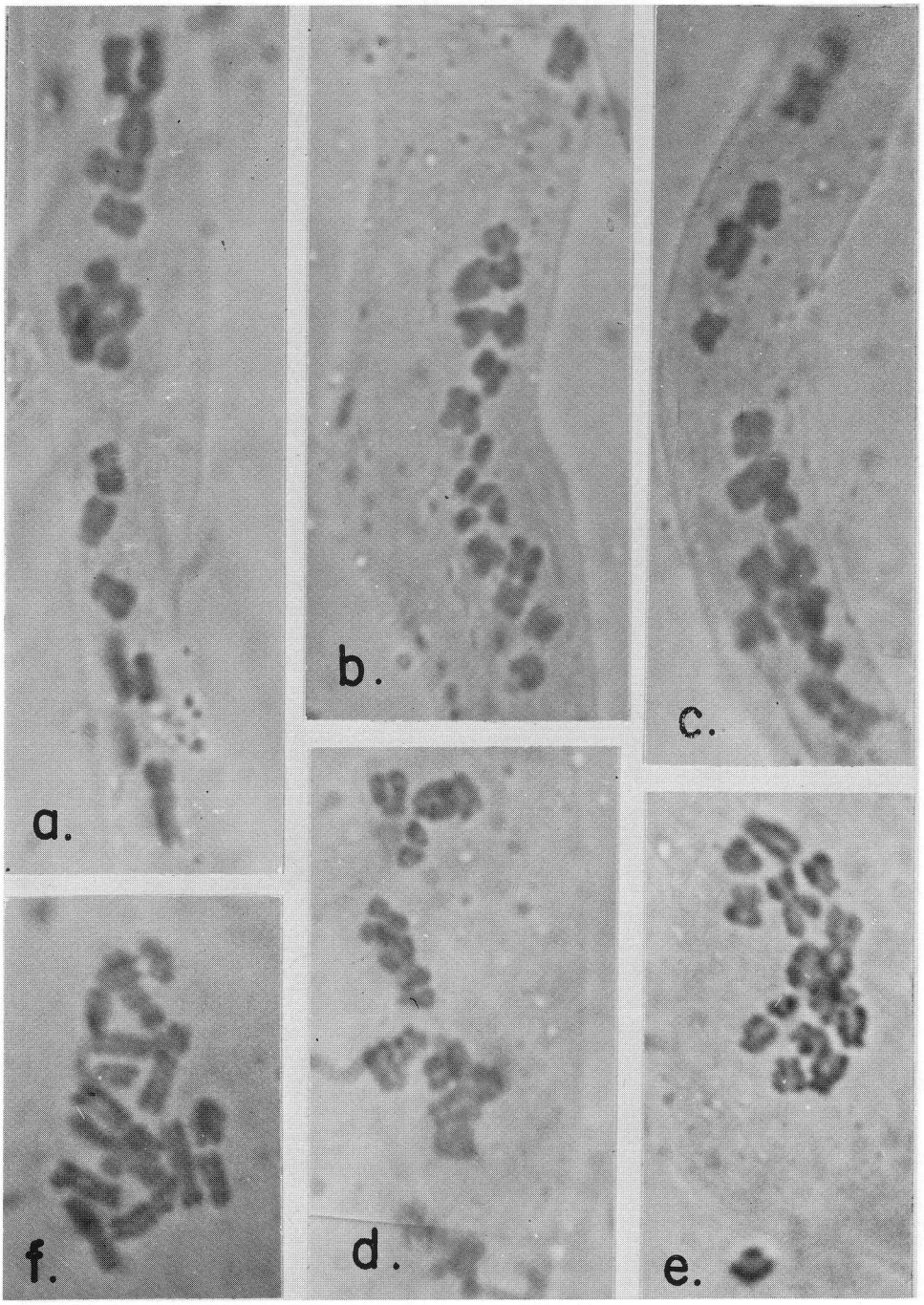
Pollen was collected by dissecting anthers from buds at or approaching anthesis (if of sufficient maturity). If the flowers at anthesis were very small, the entire staminate buds were collected, dried a short time, and processed for shipment.

Vials containing a quantity of dehydrated silica gel, with cobalt chloride added as a color indicator to insure that the gel was still dry when used, were sent to various mail pick-up points on Dr. Moore's itinerary in order to assure that fresh, absolutely dry containers and silica gel were available at all times. The anthers or buds containing pollen were placed in gelatin capsules which were placed in the vials containing the blue silica gel. The vials were sealed tightly and sent as quickly as possible via air mail to Florida for processing. The time in transit was approximately three to five days. Pollen processed and mailed in this manner was found to be viable and to germinate readily, producing excellent results. The maximum length of time that pollen will remain viable using this technique was not determined, though in a few trials it was recorded that the pollen was still good after two weeks. In most instances where whole buds were used, contamination from bacteria or fungus mycelia was great enough to spoil the germination. Moisture, insects, bacteria, and fungi all contribute to the loss of viability if adequate precautions are not taken. For example, pollen should not be collected if buds are wet or damp from recent showers or dew. Also, to enable pollen to dry as rapidly as possible, the capsule should not be packed too full. The use of several capsules with a small amount in each is much preferred.

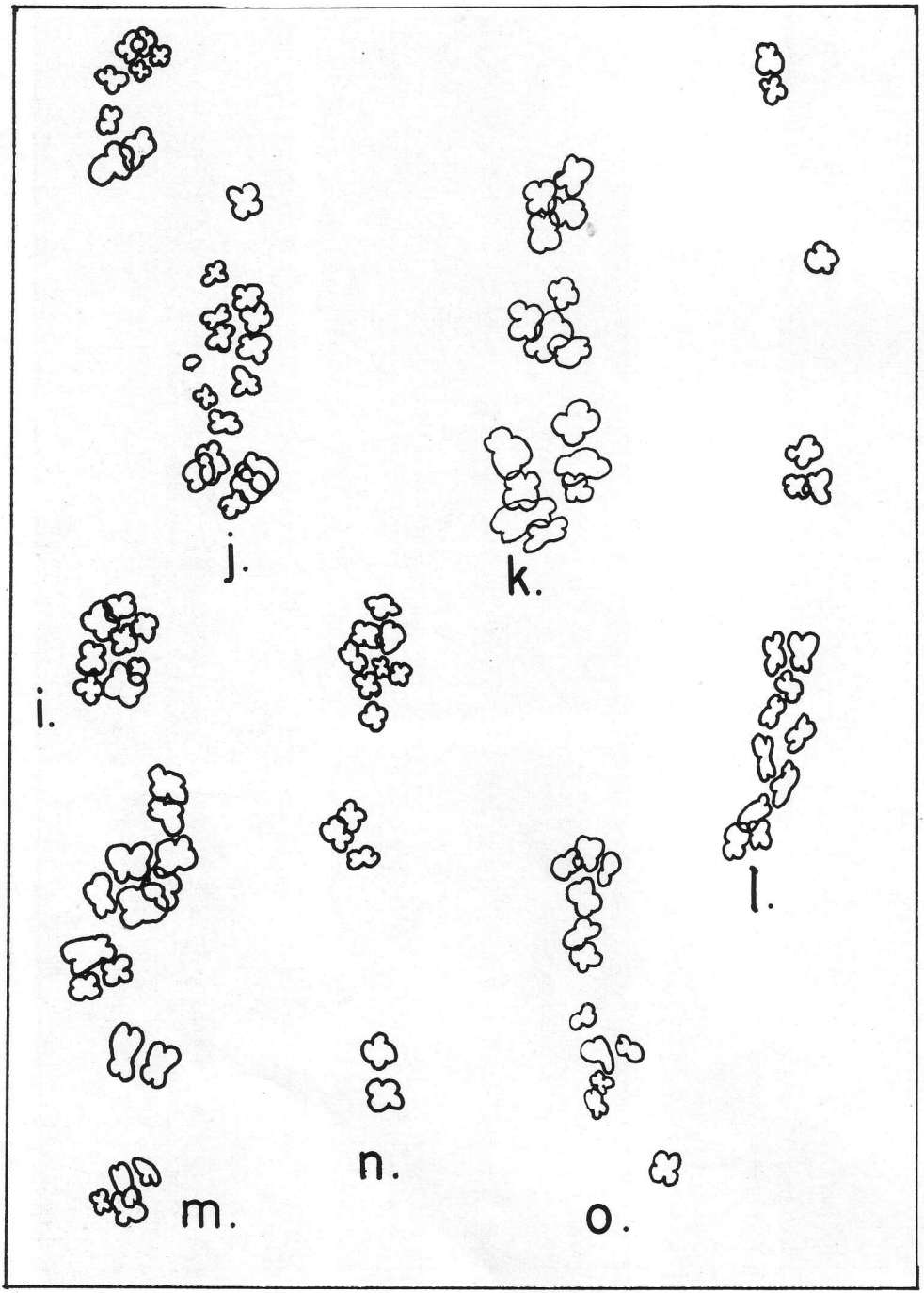
When the pollen is received in Florida, it is processed as follows: cover glasses are prepared by smearing a thin coating of prepared colchicine-lactose-gelatin medium (Read, 1964) on the surface using a cotton swab. When the medium has dried a few minutes, the pollen is tapped from the gelatin capsule onto the prepared cover glasses or is applied by flicking it on by means of a camel's hair brush. The prepared cover glasses are then carefully turned upside down over a Van Tieghem cell lined with moist absorbent paper. After 6-8 hours, the Van Tieghem cells are examined with a microscope. If germination is progressing satisfactorily, a cover glass is removed, the preparation is fixed and stained with aceto-carmine and put on a slide. The pollen tubes are examined closely to determine the stage of development of the generative nucleus. The process usually takes about eight hours until pollen tube mitosis occurs, at which time all cover glasses are processed and put on slides for examination. The completed slides are made permanent by means of a vapor transfer method described in an earlier paper (Read, 1964).



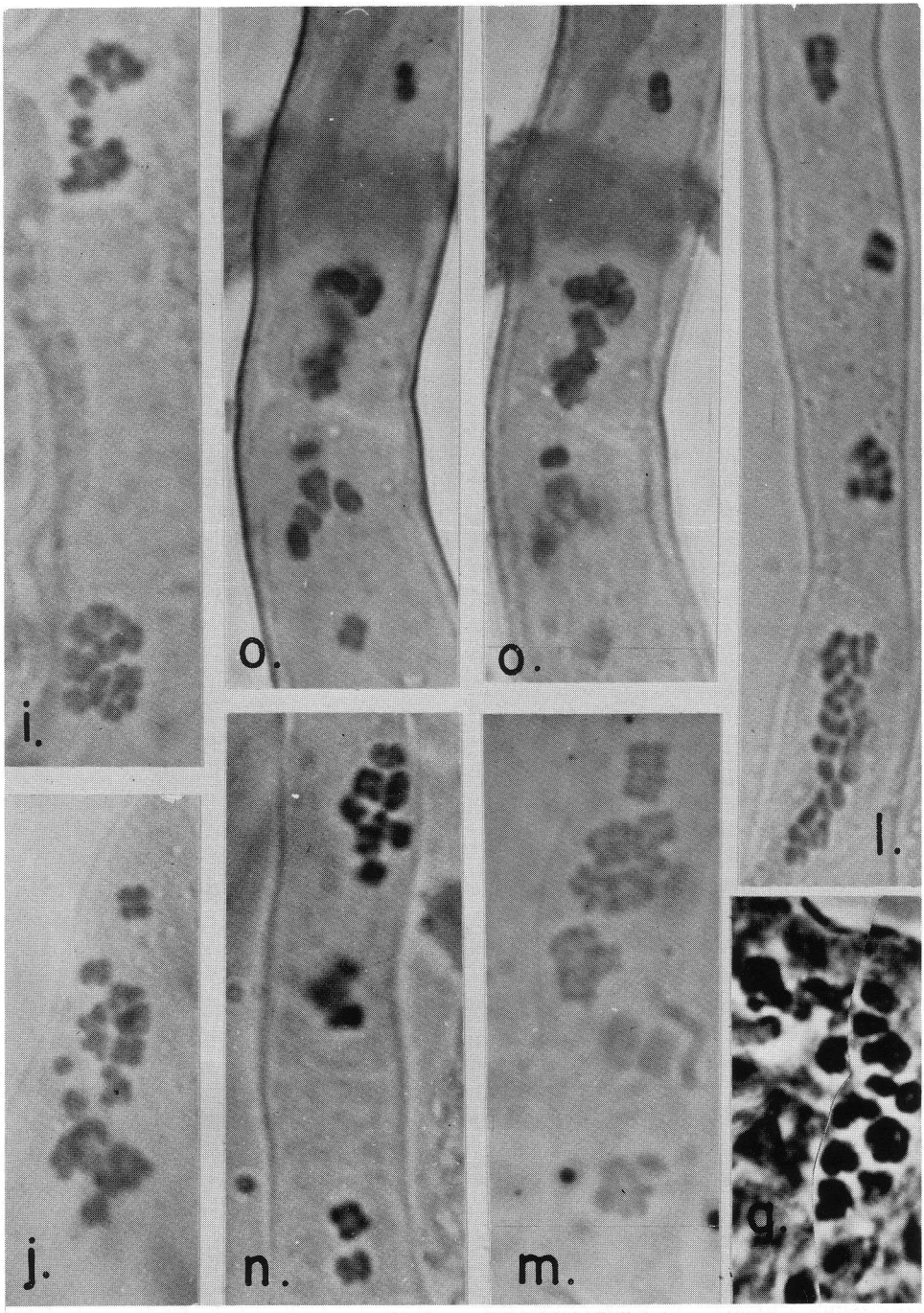
1. Camera-lucida drawings of chromosomes at pollen-tube mitosis enlarged approximately 2,700 times: a, *Rhopaloblaste ceramica*; b, *Carpentaria acuminata*; c, *Laccospadix australasica*; d, *Ptychococcus lepidotus*; e, *Archontophoenix Alexandrae*; f, *Ptychosperma elegans*; g, *Veitchia sessilifolia*; h, *Veitchia vitiensis* var. *Parhamiorum*.



2. Photomicrographs of palm chromosomes corresponding to the camera-lucida drawings in figure 1.



3. Camera-lucida drawings of chromosomes at pollen-tube mitosis enlarged approximately 2,700 times: i, *Gulubia Hombronii*: j, *Gulubia costata*: k, *Taveunia trichospadix*: l. *Heterospathe humilis ?*; m, *Wallichia densiflora*; n, *Calamus caryotoides*; o, *Calamus Muelleri.*



4. Photomicrographs of palm chromosomes corresponding to the camera-lucida drawings in figure 3: o photographed at two levels of focus: g corresponds with camera-lucida drawing in figure 1 and was photographed with phase-contrast equipment.

The Coconut Industry Board of Jamaica has been shipping pollen from distant places for their work on the hybridization of coconut varieties (Whitehead, 1962). They report that they are using a freeze-drying technique which permits long-term storage of the viable pollen in quantity. However, for the purpose outlined in the present paper, the equipment and skill needed seem unnecessary in collecting pollen from palms while in the jungle many miles from civilization. The technique described herein requires only a few small air-tight "pill" vials containing pre-dried silica gel and gelatin capsules. The results obtained from pollen sent in by Dr. Moore are tabulated in Table I and documented in figures 1-4.

Literature Cited

Read, R. W. 1964. Palm chromosome studies facilitated by pollen culture on a colchicine-lactose medium. Stain Technology 39: 99-106.

Whitehead, R. A. 1962. Room-temperature storage of coconut pollen. Nature 196: 190.

	Haploid number	place of origin	Moore voucher
Arecoideae			
a. *Rhopaloblaste ceramica*	n = 16	Cultivated at Singapore	9077
b. *Carpentaria acuminata*	n = 16	Australia	9228
c. *Laccospadix australasica*	n = 16	Australia	9240
d. *Ptychococcus lepidotus*	n = 16	New Guinea	9259
e. *Archontophoenix Alexandrae*	n = 16	Australia	9249
f. *Ptychosperma elegans*	n = 16	Australia	9245
g. *Veitchia sessilifolia*	n = 16	Fiji Islands	9348
h. *Veitchia vitiensis* var. *Parhamiorum*	n = 16	Fiji Islands	9358
i. *Gulubia Hombronii*	n = 16	Solomon Islands	9296
j. *Gulubia costata*	n = 16	New Guinea	9273
k. *Taveunia trichospadix*	n = 16	Fiji Islands	9345
l. *Heterospathe humilis ?*	n = 16	New Guinea	9289
Caryotoideae			
m. *Wallichia densiflora*	n = 16	Cultivated in Australia	9256
Lepidocaryoideae			
n. *Calamus caryotoides*	n = 13	Australia	9241
o. *Calamus Muelleri*	n = 13	Australia	9230

Table I. Chromosome counts of palms obtained from pollen-tube mitotic studies of air-mailed pollen. Voucher specimens are on deposit at the L. H. Bailey Hortorium, Cornell University, Ithaca, New York.

Ptychococcus lepidotus — A New Species from New Guinea

HAROLD E. MOORE, JR.

The genus *Ptychococcus* is related to *Ptychosperma* in the tribe Ptychospermeae of the subfamily Arecoideae. Few of the species have been adequately described. The original species, *P. paradoxus*, has been grown in botanic gardens for many years but most of the others are known only from incomplete specimens in herbaria. Two of the seven validly described species — *P. Guppy-*

anus and *P. Kraemerianus* — are known with certainty only from fruits, and another — *P. Schumannii* — appears to have been described from mixed specimens representing more than one species. Nonetheless, comparison of specimens collected in New Guinea during 1964 with descriptions and specimens of known species leaves little doubt but that they represent still another species. Seeds and seedlings have been introduced into cultivation and the chromosome number is reported elsewhere in this issue by Mr. Read (p. 10). It is advisable, therefore, to provide a name. The epithet *lepidotus* has been chosen because of the tiny scales on the petals of flowers of both sexes.*

PTYCHOCOCCUS LEPIDOTUS H. E. Moore, sp. nov. (Fig. 5)

Caulis ca. 5 m altus. Folia breviter petiolata pinnis utrinque 41-47. Inflorescentiae fusco-tomentosae, ad maturitatem glabratae, petalis florum masculorum et foemineorum dense lepidotis, staminibus 85-110, fructo rubro 4.1-5 cm. longo, 3.4-4 cm. diam., endocarpio et semine 5-lobatis, carina curvata prominente.

Trunk solitary, slender, gray, ca. 5 m. high or perhaps more, ca. 10 cm. in diameter. Leaves ca. 12, spreading or ascending; sheath ca. 6 dm. long, green with indument of dark brown membranous scales margined with appressed soft interlocking hairs forming a dense tomentum at first but the hairs deciduous in part leaving only the membranous center or the base of the scale at length, especially on marginal or unprotected areas, the margins oblique without ligules; petiole short, 5-20 cm. long, rounded and densely pale lepidote-tomentose below, more or less densely covered above with pale membranous lacerately interlocking scales when young or their darker bases when old; rachis 2.5-3 m. long, rounded centrally and channelled toward the margin below, scaly like the petiole above and below when young, the margins flattish toward the base and the upper surface channelled on each side of a median rounded ridge, becoming nearly deltoid in section at mid-leaf and to the apex where scales are often deciduous and the surface only dark punctate; pinnae 41-47 on each side of the rachis in regular, mostly alternate arrangement at intervals of 5-6 cm. near the middle, the blade nearly horizontal basally but twisting upward at about a 90° angle with the apex arcuately curved, the lower pinnae 50-65 cm. long, 2.1-4.3 cm. wide, median pinnae 68-78 cm. long, 6-9 cm. wide, apical pinnae 37-42 cm. long, 3.5-6 cm. wide, all with very oblique (basal) to nearly truncate (apical) sharply divided and toothed apex, very narrowly reduplicate at the base where densely and minutely red-brown lepidote above and paler lepidote on the prominent midnerve above, the lower surface densely and minutely red-brown or pale lepidote with a line of twisted basifixed red-brown membranous scales to ca. 13 mm. long on the midnerve, these sparser toward the apex. Inflorescences 9 (on type tree), stiff, densely clustered below the crownshaft, those in flower horizontal, those in fruit drooping; lower bract ca. 42 cm. long, 7 cm. wide in bud, densely pale lepidote-tomentose, ancipitous-margined and acute, enclosing the upper bract, the entire inflorescence red-brown tomentose in bud but the axes becoming sparsely hairy to nearly glabrate at maturity; peduncle dorso-ventrally compressed, 9.5-15 cm.

*Support of the National Science Foundation for travel under Grant number GB-1354 is gratefully acknowledged as is that of the John Simon Guggenheim Memorial Foundation which enable the author to study types of *Ptychococcus* among Beccari's collections at the Istituto Botanico, Florence, Italy, in 1956.

long, 4 cm. wide; rachis 25-40 cm. long, angled as are the ca. 17 branches, the lower few again twice-branched with ultimate flowering axes 14-23 cm. long, those above once-branched to furcate or unbranched. Flowers in triads of a central pistillate and two lateral staminate nearly throughout the axes; staminate flowers green, drying brown, ca. 15 mm. long, 7 mm. in diam. or smaller when dry, the sepals 5-6 mm. high, 7 mm. across, keeled dorsally toward a gibbous base, ciliate marginally, petals ca. 15 mm. long, 7 mm. wide, very slightly asymmetric apically with a dense cover of minute brownish membranous scales, stamens 85-110, whitish at anthesis, the anthers emarginate to acute apically, deeply bifid basally, the lageniform pistillode as long as the stamens; pistillate buds ca. 10 mm. high, the sepals minutely brown hairy, the petals densely lepidote and pale brown when dry, the sepals in fruit ca. 7 mm. high, petals 11 mm. high, 2 cm. broad, forming a cupule ca. 2.5 cm. across, staminodes 3 and more or less united in a low semicircle in fruit. Fruit orange-red or crimson, 4.1-5 cm. long, 3.4-4 cm. in diam. when fresh, smooth and rounded, ovoid with slightly excentric apical stigmatic scar, drying 4-4.5 cm. long, 2.5-3 cm. wide without cupule, prominently angled and wrinkled, the endocarp ca. 4 cm. long, 2.6-3.2 cm. wide, with walls 2-3 mm. thick, prominently and narrowly keeled on the rapheal side with a hollow below the curved tip and the 3-ridged, 2-grooved ventral surface, laterally with a 2-ridged, 1-grooved flange on each side; seed 2-3 cm. long, 1.5-2 cm. wide, 5-lobed, shaped similarly to the endocarp; endosperm with shallow marginal ruminations on the lobes and a deep intrusion in the rapheal lobes. Seedling leaf bifid. Chromosome number: n = 16.

Territory of New Guinea. Morobe District: ridge trail southwest of Bupu Village on track to Engebu above Wampit River, alt. 2500-2800 ft., 3 March 1964, *H. E. Moore, Jr.*, & *A. Millar 9259* (BH, type; LAE, isotype); mixed forest at upper limit of *Araucaria* zone, Bulolo-Watut divide, alt. ca. 3600 ft., 11 March 1964, *H. E. Moore, Jr.* & *J. S. Womersley 9281* (BH; LAE); disturbed forest near airstrip at Wagau, alt. 3400 ft., 14 March 1964, *H. E. Moore, Jr.* & *J. S. Womersley 9293* (BH; LAE).

Vernacular names: *val* (Bupu); *wakal* (Wagau).

Trunk said to be used for spears and bows. Infrequent in the forests.

Fruits of this species vary when fresh and mature from 4.1 cm. long, 3.4 cm. in diameter. (*Moore* & *Womersley 9393*) to 5 cm. long, 4 cm. in diameter with corresponding differences in size of endocarp and seed. Only ripe fruit was collected at Wagau but a plant growing near the airstrip was clearly the same as that seen at Bupu and Bulolo and the associated palms — *Gronophyllum sp.*, *Heterospathe humilis ?*, *Calyptrocalyx* sp., *Areca* sp. — were the same as those at Bupu.

The densely scaly petals of male and female flowers readily distinguish *P. lepidotus* from *P. Archboldianus*, *P. arecinus*, *P. elatus* and *P. paradoxus*, all of which have glabrous petals. The much smaller fruit eliminates *P. Schumannii* as amended by Burret (*Repertorium Specierum Novarum* 24: 262. 1928). Two remaining species — *P. Guppyanus* and *P. Kraemerianus* — have the seed prolonged in a very narrow sharp rapheal keel and the lateral and ventral lobes are narrow.

It is perhaps worthy of note here that *Index Kewensis* lists a further species of *Ptychococcus*, *P. Albertisianus* Beccari ex Martelli, *Nuov. Giorn. Bot. Ital.* ser.

2, 42: 74, 78. 1935. The name is a *nomen nudum* since it is neither accompanied by a description nor does it refer to a description, only to a possible misidentification in some of Beccari's earlier writings of some fruits collected on the Fly River by d'Albertis. It is likely that these fruits are referable to *P. Archboldianus* Burret of the Fly River region in New Guinea.

5. The tree from which type specimens of *Ptychococcus lepidotus* were taken still may stand in the mountains of New Guinea (*Moore & Millar 9259*).

Palm Hunting Around the World

HAROLD E. MOORE, JR.

Introduction

If palms were as small as mosses and could be fitted in entirety on sheets of paper or in vials for study and preservation in museums and laboratories, there might be no need to write about hunting them through the tropics. Very many of them, however, are so large and difficult to collect for study that botanists and explorers have tended to neglect them or to collect only fragments of leaf and inflorescence. Thus, though one may examine the whole of many plants from museum specimens, there are remarkably few palms for which this is true.

For the past fifteen years and more, your guide on the journey that follows has been attempting to understand the palms. The particular trip to be described was taken to provide information and materials for a study of palm genera and materials for several colleagues who are studying the anatomy, cytology and pollen of palms. Grateful acknowledgment is made for support of this travel as part of National Science Foundation Grant number GB-1354 and for the assistance of foresters, botanists, and others wherever I went. Perhaps a word of explanation is due about photographs. Photography is not a strong point with the writer and results usually reflect this weakness. Working on the basis that a poor photograph of a palm is better than none, some have been included that ordinarily would not be reproduced.

I. Madagascar to Malaya

One flies to Madagascar by way of Paris. On September 30, 1963, then, I set off from New York by the night plane to London, thence to Paris, stopping enroute for some last-minute checking of specimens and localities at the Royal Botanic Garden, Kew, the British Museum (Natural History) in London and the Laboratoire de Phanérogamie in Paris, where Monsieur Capuron, the forest botanist for Madagascar, was finishing a period of study and making plans to return, alas, only when my own time on the island was to end. Armed with some words of advice and further letters of introduction, I boarded plane again at Orly Airport in mid-afternoon of October 4th.

The flight to Madagascar was broken by a sunset stop at Marseille, an hour under a full moon at Athens, and an hour in the warmth of Djibouti where the sky flushed with the incredible red of an African dawn as we boarded for the last stage to arrive, finally, at 9:30 on a brilliant spring morning at the international airport some miles from Tananarive, capitol of the Malagasy Republic.

Tananarive, a city of hills, stands high on the central plateau of the island where the temperature drops to uncomfortable levels in winter. With the unfailing courtesy of hotel and government personnel, and aided no little by the fleet of inexpensive taxicabs, letters of authorization to collect were obtained from forestry officials, contacts were made at the Institut de Recherche Scientifique de Madagascar*, last minute purchases of needed supplies were gathered, and I wakened very early on the morning of October 10th to breakfast continental style and dash for the narrow-gauge train that departs at 7 o'clock for the winding trip from Tananarive to Tamatave on the east coast. My destination was not so far, for the trains, ascending and descending, stop for a luncheon break at the railroad hotel and restaurant at Perinet, close to the forest of Anamalazoatra. This is a classic palm locality for the island where, at least formerly, some 19 species in nine genera had been collected. Here I threw off the train for the first time the canvas sacks that were to touch ground in so many places over seven and a half months and made my way into the confusion that always surrounds the

*Without the help of a number of persons, field work in Madagascar would have been less successful. I should like here to acknowledge the assistance of M. Georges Ramanantsoavina, Inspecteur Principal des Eaux et Forets, and his forestry staff, of M. Roederer, Director of the IRSM, of M. Bosser and Mme. Toilliez-Genoud in the botanical section of IRSM who arranged for much of the drying and shipping of specimens and other individuals mentioned by name in the text as well as Mrs. Alison Bishop Jolly and Mr. Preston Boggess for earlier preparation.

6. *Neophloga lanceolata* in the forest of Anamalazoatra (*Moore 9000*)

arrival of a train to make arrangements for a brief stay in Perinet.

The forest of Anamalazoatra is certainly much diminished over its former extent, but on inquiring for the local forest officer, I found him engaged with a group of visiting foresters to whom I was soon attached for a quick survey of the region and an introduction to that part of the forest which still persists largely untouched. Fortunately, this area is only an hour by foot from Perinet so for three days I roamed the trails and slopes of the forest. The re-

7. *Dypsis Louvelii* has velvety green leaves and bright red fruits (*Moore 9004*)

sults, admittedly, were disappointing, for despite the best predictions I had been able to make from the information of previous collectors, I found myself here, as elsewhere on the island, a month or more in advance of the best flowering season and the palms fewer than hoped for.

Nonetheless, *Neophloga lanceolata* was in flower, forming clusters of slender canes to ten feet high by a streamside, the delicate pinnate leaves and whole aspect reminiscent of some of the New World *Chamaedorea* species (Fig. 6). Slender green inflorescences emerge from among the leaves and bend abruptly at the top of the upper bract so that the top of the peduncle and the few flowering branches become pendulous. Small orange-yellow male flowers contrasted with the green branches but nowhere was there evidence of the red fruits characteristic of *Neophloga*. A second species, *N. concinna* var. *triangularis* with undivided leaves, was seen in only one location about two kilometers from the town on the slopes of the river that flows through Perinet.

More abundant than either of the foregoing, *Dypsis Louvelii* (Fig. 7) was seen with some frequency along the trails and near the stream that flows into a fish hatchery in the preserve. Its narrow, deeply bifid leaves are a lovely velvety green and the blades deeply pleated; the very few fruits seen were bright red on a creamy inflorescence. A single seedling is now still alive in Florida, hopefully to produce seed for propagation in cultivation.

The forest surrounding the fish hatchery contains at least two other palms, *Vonitra utilis* and *Ravenea robustior*. Except for one clump planted or left in a dooryard at Perinet (Fig. 8), the *Vonitra* was seen only at the edge of a

8. This clump of *Vonitra utilis* grows in a dooryard near the station at Perinet.

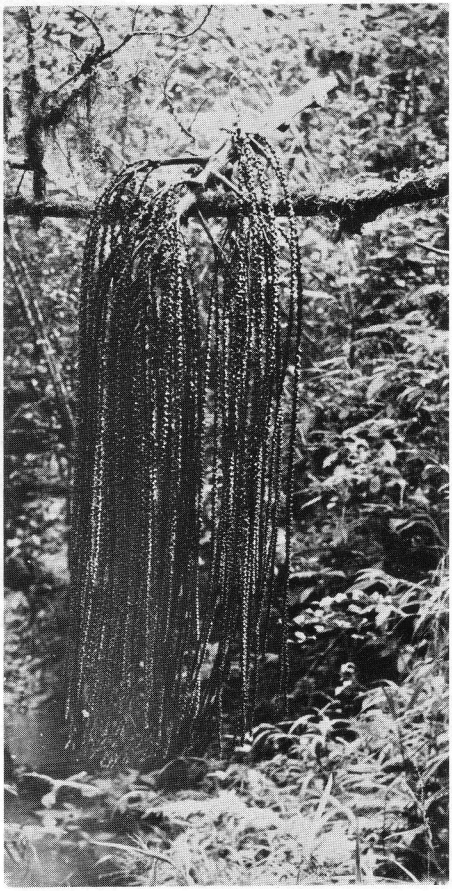
small stream, sometimes with its roots in the water, and usually with several stems in a tuft. Nor were mature specimens frequent in the forest. With all my searching, only two were located mature enough to flower and fruit. And with the finding of these came a real surprise, for in both instances the stems had branched dichotomously, as in *Hyphaene thebaica*, to produce a dense head of arched leaves which twist through an angle of 90° toward the tip to give the effect of a rooster's tail feather (Fig. 9). From among these leaves and their fibrous-margined sheaths, long-petioled inflorescences arch out to bear many pendulous ropy flowering branches (Fig. 10) which change

9. The crown of *Vonitra utilis* in the forest (*Moore 9005*).

from a beautiful coral-pink in bud to yellow-green when first expanded then deep almost blackish green as the flowers approach maturity. The only fruits seen on a second tree were unobtainable by climbing and, hanging over a stream, were swept away when knocked down with a stick.

Far more abundant, and framing the fish hatchery catchment basin, were trees of *Ravenea robustior* (cover) with great brown trunks to 60 feet high, 17-18 inches in diameter, capped by a crown of stiff ascending leaves. In October, there were neither flowers nor fruits evident on any of the many individuals I saw and at first I hoped that they might, in fact, prove to be the much desired genus *Louvelia*. It was not until a month later on November 9th that the true identity became clear for then, on the last day of active field work on the island, inflorescences had emerged from among the leaves of several trees and clearly bespoke *Ravenea*. Having arrived on a Saturday afternoon when all the labor force had dispersed and rain was falling, the obtaining of specimens had to be left to the kindness of M. Lefevre of the forest office who later was successful in forwarding material to Tananarive which verified the identification.

Returning from this delightful spot on October 13th to the usual delay of



10. Flowers of *Vonitra utilis* are borne on ropy pendulous branches.

11. *Raphia farinifera* greets the palm enthusiast at the Maroansetra airport.

processing materials, Tananarive was base again until, on October 16th, the early dawn was again broken by rude rappings at the door and it was time to depart for the 7 o'clock plane to Tamatave and transfer, after some hours, to the small plane that flies weekly up the coast to Maroansetra on the Baie d'Antongil.

The airport at Maroansetra is a grassy stretch cut into the littoral forest and almost the first view one has on climbing from the five-seated plane is a line of *Raphia farinifera* (Fig. 11) along the opposite side of the nearby river. Elsewhere in the vicinity of Maroansetra one sees this palm both wild and cultivated, chiefly in dooryards. From the airport a battered truck transports passengers over a narrow sandy road to the simple but pleasant accommodations of the Hotel d'Antongil.

Maroansetra is far enough away from centers of population to have escaped much of the destruction of forest so evident as one flies along the coast and fortunately so, as transport is expensive and not easy to obtain. On the advice of M. Vadon, a retired school teacher and entomologist by avocation, and of M. Zavah, the local representative of the forestry service, I first spent two days working in the littoral forest where palms had been evident on the ride into town. Here I made the acquaintance of *Vonitra Thouarsiana* (Figs. 12, 13) which, like *V. utilis*, often clusters but which has much more slender shorter gray trunks covered with fibers when young. The leaves are red when first produced and at maturity are nearly flat, not twisted at the tip. Flowers are produced when the plants are still young but are apparently more frequent when the trunk has forked for the first time. Its inflorescence, too, is more slender. This same species was later encountered in the Royal Botanic Garden at Peradeniya, Ceylon, where it was labelled *Dictyosperma album* var. *fibrosum*.

The most exciting event was the discovery of a tree of *Ravenea madagascariensis* in flower along a logging track. This, known locally as *anivona*, was about 20 feet high and impossible to photograph, but from a sterile plant

12. A young plant of *Vonitra Thouarsiana* near Maroansetra.

(Fig. 14) one can see the crown of arching leaves with pinnae borne at an angle of about 45° to the rachis and bent over at the tip. The inflorescences are borne among the leaves and in male plants five or six arching long peduncles are subtended by a single low bract in a leaf axil, each peduncle also sheathed by four bracts, the upper two of which are white woolly outside, yellow-orange inside, and as long as the inflorescence. The flowering branches are creamy-white and densely covered with fleshy white flowers. Several days later, in another locality on the road to Rantabe, a female plant with the inflorescences solitary in the leaf axils, was located in flower and young fruit but unhappily no fruit was ripe.

Other palms of this forest were *Neodypsis Lastelliana* (Fig. 15), what may be *Dypsis gracilis*, and *Chrysalidocarpus lutescens* (Fig. 16), all sterile. Later, however, with a rented truck and guide and accompanied by M. Zavah, we discovered both the *Neodypsis* and *Chrysalidocarpus* in forests on the road to Navana. Here *Neodypsis Lastelliana* had trunks to 40 feet high and more, 8 inches in diameter, standing out on a steep hillside. To reach, fell, make notes, select material, and see it transported to the truck was not a matter of minutes but the climb resulted in good specimens. Most striking is the dense coat of red woolly scales on the leaf sheaths accounting for the common name of *menavozona*, which translates to *col rouge* in French or "red neck" in English. The bud or cabbage of this palm is avoided as poisonous by the local people who do, however, eat the bud of *Ravenea*.

13. An older plant of *Vonitra Thouarsiana* (*Moore 9009*).

Chrysalidocarpus lutescens, or *lafaza* locally, formed much more accessible clumps near the road where the clustered stems were 10 to 12 feet high and easily seen because of the yellow-orange petioles which make this palm so desirable in cultivation. Equally at home in the sandy seaside forests or on the slopes of the low hills about the bay, it is easy to see why this palm has adapted so well to cultivation.

A stop at the forestry station along this road brought us to a few of the undergrowth palms belonging to the genus *Dypsis* which tend to resemble each other superficially but to differ in details that are still being studied.

The last day of residence in Maroansetra had been set for a trip to Nossi Mangabe, a small island rising steeply from the waters of the bay. But the best arrangements can (and only too frequently do) go wrong and much of the morning was lost in finding a replacement for the boat so faithfully promised but so faithless to its owner that no cajolling could induce it to run. By the time a larger and disproportionately more expensive craft was found, our party had grown with the addition of Mme. Zavah and the youngest of a large family who were equipped with picnic lunch and numerous bottles for the clear water that emerges from a spring near the landing place— water that was refreshing indeed after the steep climb to the summit and return. For all the fun, the palms were disappointing. Only a *Dypsis* with slender clustered stems and variable leaves was in collectable condition, though *Vonitra* and another *Dypsis* were seen here and there on the slopes.

When the plane service is weekly and the seats are five, one plans accordingly, so on October 24th at 6 a.m., botanist, baggage and formaldehyded specimens

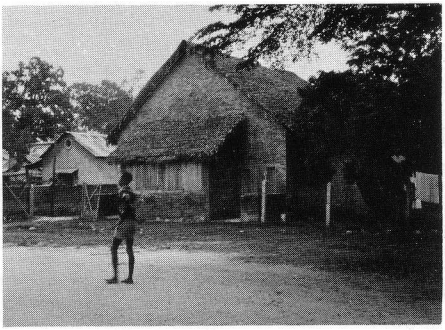
14. *Ravenea madagascariensis*, a young plant near Maroansetra (*Moore 9010*).

were flown back to Tamatave, thence to Tananarive where began the inevitable routine of packaging and mailing preserved materials, of drying specimens, and preparing for the next venture to the northwest of the island and to Nossi Bé on the 28th.

15. The red collar of *Neodypsis Lastelliana* is obscure against the dark background of the littoral forest at Maroansetra.

16. The stems of *Chrysalidocarpus lutescens* are usually clustered but here one overtops any suckers (*Moore 9012*).

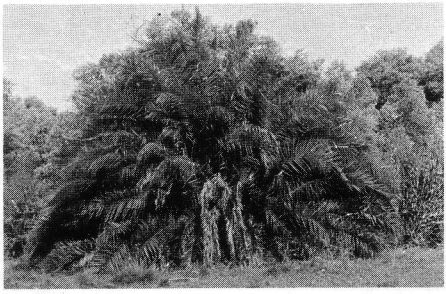
Flights to Ambanja and Nossi Bé go by way of Majunga on the west coast. On leaving Tananarive, the plane flies over the adjacent rice fields, at that time green with new rice, to the dry, barren, often eroded central plateau with only gallery forest visible along some of the streams and then the dry but palm-studded coastal zone where the pale leaves of *Bismarckia nobilis* and clusters of *Hyphaene Schatan* stand out from the plane and the *Bismarckia* is particularly abundant about the airport. North from Majunga,



17. The hotel at Ambanja provides simple but welcome accommodations.

these palms are prominent for many miles but the vegetation changes as Ambanja is approached. There, unfortunately, the forestry vehicle was in disrepair, good collecting grounds were not within ready access by foot or standard vehicle, so after an overnight stop (Fig. 17), I "hopped" by plane to the island of Nossi Bé off the coast where some original forest is retained in the Lokobe Forest Reserve.

M. Abdullah of the forestry department served as guide for an inspection of the island on which *C. madagascariensis* var. *lucubensis* or *Chrysalidocarpus lucubensis* and *Phoenix reclinata* (Fig.18) are the palms one sees occasionally in second-growth forest or persisting (*Phoenix*) in pastures. The forest reserve itself occupies part of one end of the island and is entered from the Poste Forestiere at Ambalafary. To reach



18. *Phoenix reclinata* often persists in pastures on Nossi Bé (*Moore 9023*).

19. A striking association of *Ravenala madagascariensis* (left) and *Chrysalidocarpus madagascariensis* var. *lucubensis* (center) along the shores of Nossi Bé.

good palms it is necessary either to scramble along the boulder-strewn coast at low tide or to go by canoe to suitable points for climbing into the forest. After a trial of the first method, M. Abdullah arranged for a canoe which delivered us early in the morning of October 31st at a small beach where a streamlet debouched. Paddling along the coast, we had seen *Chrysalidocarpus* in abundance, often with the traveler's palm, *Ravenala madagascariensis* (Fig. 19), but in one tangled ravine a few palms of different aspect caught my attention. Field glasses showed them to be sterile, lacking the crownshaft of *Neodypsis* and possibly, I thought, *Vonitra nossibensis*. Almost at once on landing, however, we located the same palm in young fruit which immediately revealed it to be a species of *Ravenea* (Figs. 20, 21) not before reported for the island. The 40-foot stem with a crown of arcuate leaves had to be felled to obtain specimens which yet remain unidentified to species for lack of male flowers and inflorescences. The last, as later seen in very old dried state on a distant tree, appear to be solitary in the leaf axils. Better luck attended the sampling of *Chrysalidocarpus* (Figs. 22, 23) which was in good flower though not in fruit, and of *Neodypsis loucoubensis* (Figs. 24, 25) which occurs

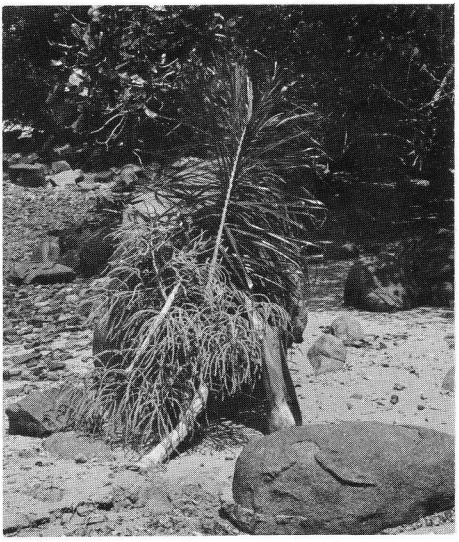
20. Early in the morning, *Ravenea* sp. is difficult to photograph on Nossi Bé.

21. *Ravenea* sp. ready for sectioning for specimens (*Moore 9024*).

high on slopes away from the sea in company with *Dypsis sambiranensis* (Fig. 26). The leaf sheath of this *Neodypsis* is a silver green, quite in contrast to the red of *N. Lastelliana* but no less handsome, and creamy male flowers were open on short fleshy branches of a spreading inflorescence borne below the leaves.

The last destination in the region of Madagascar was Grand Comore, larg-

22. Obviously a good palm for seaside planting — *Chrysalidocarpus madagascariensis* var. *lucubensis* in the Lokobe Forest on Nossi Bé (*Moore 9026*).

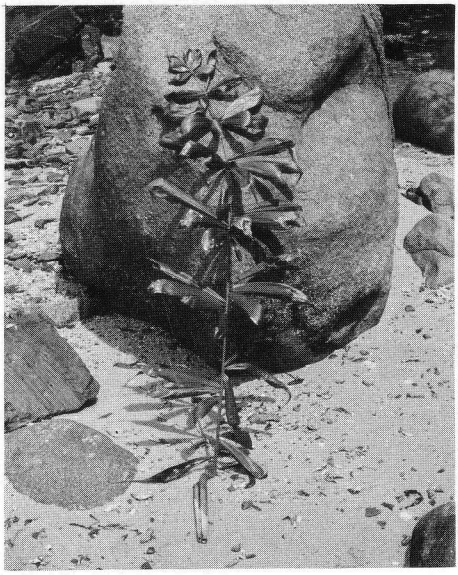


23. The tree in figure 22 reduces to workable size when specimens are made.

24. *Neodypsis loucoubensis* grows on the slopes of hills in the Lokobe Forest (*Moore 9025*).

25. *Neodypsis loucoubensis* ready for the botanist's plant press.

est and highest of the Comores Islands which lie off the coast of Mozambique. *Ravenea Hildebrandtii* is native on this island and when collected proved identical to puzzling specimens collected earlier in young fruit by Dr. Harold St. John. This *Ravenea* is a most handsome palm which grows on old lava rock at an elevation near 2,000 feet. The trunks reach 60 feet or more in height, more than 10 inches in diameter, with a crown of numerous leaves from which hang

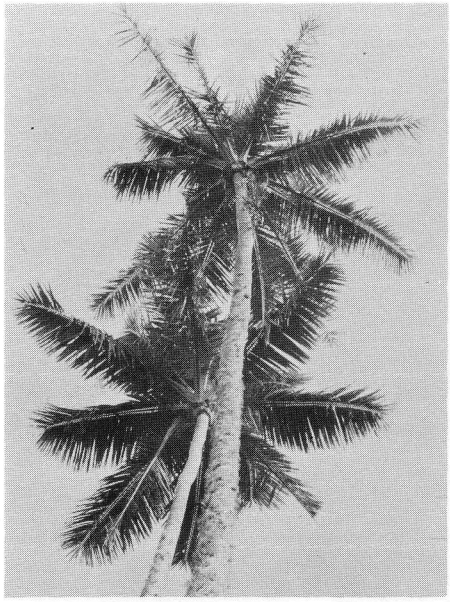


26. Only the leaf of *Dypsis sambiranensis* was taken since there were no flowers (*Moore 9027*).

long-peduncled inflorescences (Figs. 27, 28). At the time of my visit, only fruit was seen (Fig. 29). This, brilliant orange and 5/8 inch in diameter, made a striking contrast with the deep green foliage and waxy white undersurface of the leaf rachis. Abundant seed was collected so hopefully this species will again be seen in cultivation as it was during the past century.

Two other palms, *Chrysalidocarpus Humblotianus* and *C. lanceolatus*, were once native in the forest of Combani high on the volcanic cone, but today they are apparently very rare indeed. Fruit of neither is known and I had been hopeful of obtaining fruit to eliminate any question as to possible identity with *C. Cabadae* described from cultivation. Not only did I fail in this, but by an unhappy coincidence, a further question has been raised. Flying in to Grand Comore, I saw only coconuts which are cultivated everywhere, but on leaving the island, the plane flew over a large area of lava near the airport where, looking down, I saw to my anguish clumps of an unmistakable *Chrysalidocarpus* far from any reported locality and in aspect resembling *C. lutescens* or *C. Cabadae*. The former is cultivated about a house in one village near the *Ravenea* locality but has not spread beyond the planted clumps there and certainly was not much in evidence elsewhere. There is, then, the possibility that this coastal palm is an escape, but equally that it is native. For the next Palm Society member to visit Grand Comore, I have an errand — to locate and collect this palm!

With this heart-breaking farewell to the Comores and after a quick return to Perinet for flowers of *Ravenea robustior*, time and schedules called for final packing, arrangements for shipping specimens, and departure for Af-

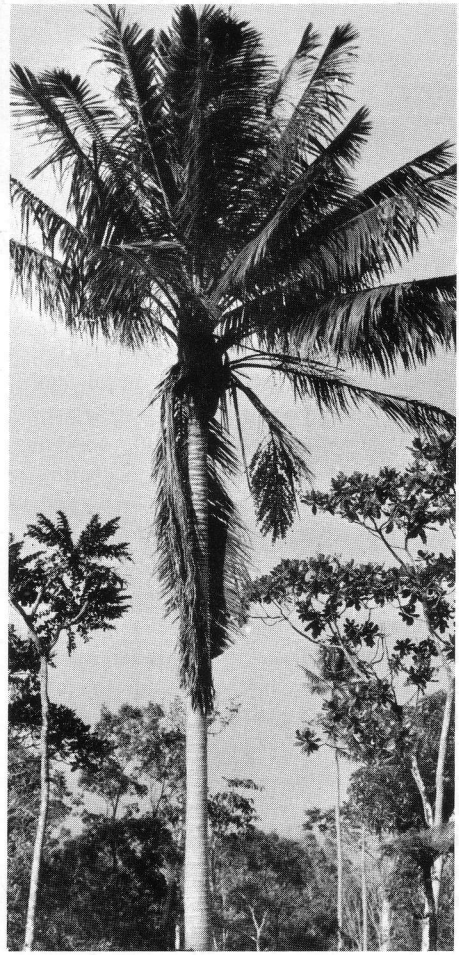


27. Looking up at the crowns of *Ravenea Hildebrandtii* on Grand Comore (*Moore 9028*).

rica, the island of Pemba and thence to Asia.

Pemba is now part of Tanzania lying beyond Zanzibar and reached from Dar-Es-Salaam by a small plane which makes a round-trip to Tanga with stops on the way. Thanks to the help of Mrs. Helen Faulkner and Mr. Selby of the Department of Agriculture on Zanzibar, arrangements had been made for a one-day visit to the Ngezi Forest which lies among the groves of clove on Pemba. The island was once noted for its "witch-doctor college" and though little evidence of such activity is to be seen today, I cannot help but feel that some malevolent spirit was at work on November 13th. Firstly, I was aroused in the dark morning hours long before scheduled departure time by an over-eager and misinformed airline driver and when the plane did depart, early enough, rain clouds were building up off the coast. After a brief stop on Zanzibar, where I had the pleasure of meeting Mrs. Faulkner at the airport, we continued on to find Pemba enveloped in a series of blinding rainstorms which required two tries on the part of the pilot before the airstrip could be located and landed on.

Despite the rain, Mr. Jabir Uki, Forest Officer, was ready to try the road to the forest, so after paying formal calls on island officials, we transferred to a landrover for a trip over a track more river than road to the edge of the forest. How often distance magnifies problems! Instead of the envisioned



28. Inflorescences of *Ravenea Hildebrandtii* appear among the leaves at right.

29. The ripe fruits of *Ravenea Hildebrandtii* are brilliant orange.

scramble through a dense and inaccessible forest to reach the *mpapindi* palm, *Chrysalidocarpus pembanus*, we easily, if wetly, walked to several handsome clumps. The green stems rise often to 20 feet, sometimes to 60 feet, and in general much resemble *C. Cabadae*. Though only immature fruit was available, I was able to collect a good series of flowers which were the most desired item and arrangements were made to have ripe seed forwarded at a later date. Preparing specimens under a partially sheltering thatch shed in the village of Kiuyu Ngezi attracted the usual onlookers and of course as soon as the job was done the rain began to let up. Thus the plane was able to land again with less difficulty. In late afternoon, passenger with specimens was on the way to Dar-Es-Salaam. Regretfully, though, no photograph of the object of this visit was made to illustrate a very handsome palm.

The palms of Africa are centered on the west coast and had to be left for a later venture. A layover in Nairobi permitted a visit to the East African herbarium and a day in the famous game park at Amboselli after which it was time to head eastward via Aden and Bombay to Colombo, Ceylon, where Mr. Jayaweera was waiting to carry me to the Royal Botanic Garden at Peradeniya of which he is superintendent.

Palms at the garden have been described earlier (*Principes* 5: 53-59. 1961). As the principal object in visiting Ceylon was to see *Loxococcus rupicola*, Mr. Jayaweera had arranged for transport. In company with Dr. Leslie Garay of Harvard, we set off for a rugged area of dwarf mossy forest at Corbet's Gap 10 miles east of Rangalla. As luck would have it, *Loxococcus* was bearing greenish-yellow ripe fruits (Fig. 30) but one plant yielded an unopened

30. *Loxococcus rupicola* deserves its name, here growing on the edge of a high cliff in Ceylon (*Moore et al. 9031*).

inflorescence with nearly mature flowers. This unusual palm well deserves its name of *rupicola*, or rock dweller, for it always occurs on or near rocks or ledges, in our locality very steep and difficult of access. By the use of ropes, however, specimens were obtained from a few reachable plants. The trees are not large, reaching a height of about 10 feet where we saw them, with stiff crowns of dark green leaves about four feet long.

Another day was spent collecting and preserving flowers of *Lodoicea maldivica* and a few other unusual palms in the garden, including *Vonitra Thoursiana* far from where I had last seen it. A second day in the field with Mr. Jayaweera and Dr. Garay brought to a close an all too short stay.

From Ceylon, the air road led via Jaffna and Madras to Calcutta, a flight not to be forgotten because in the air between Colombo and Jaffna the headlines of a newspaper brought the jolting news of President Kennedy's assassination. Everywhere in the next few days, the travelling American was greeted with words of sympathy. In India, a national day of mourning accompanied the funeral which was observed in Calcutta by a memorial service at the American Consulate.

The Botanic Garden at Calcutta is located at some distance from the city proper in the suburb of Sibpur and like Kew is set out along a river, the Hoogli. Palms are abundant in the garden but the rarer sorts for which I was looking had mostly disappeared. In recompense, the herbarium is rich in dried specimens which kept me busy until time to continue onward, stopping for a day in Bangkok where the canals are often lined with *Nypa fruticans* and thence on to Kuala Lumpur, capitol of Malaysia, where begins another chapter in the palms of Asia and Oceania.

Evidence for the African Origin Of the Oil Palm

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Although there is some disagreement as to the natural habitat of the oil palm in West Africa (Chevalier, 1910; Briey, 1922; Exell, 1944 and Waterson, 1953), it has been widely assumed that the oil palm has an African origin (Popenoe, 1934; Bailey, 1948 and Okiy, 1960). The claims of Cook (1901, 1910, 1940 and 1942) that the oil palm is American in origin are based upon arguments which are not very convincing, but his thesis that it came from the Americas, probably Brazil, is difficult to refute.

The usual practice in general works on the oil palm is to quote Cook's theory and also that of Chevalier (1934) who holds the opposing view of an African origin, and to go on to say that the oil palm is now well established in West Africa.

This account examines a little more closely than usual such evidence as is available on the distribution of the oil palm at the time of the early Portuguese voyages of discovery during the 15th and 16th centuries. No new information is presented; all the evidence has already been published elsewhere, but the historical and botanical aspects have not previously been integrated for the oil palm in the way this has been done for other crop plants.

Discoveries in the Americas

In chronological order, the Portuguese (and some Spanish) voyages of discovery and other relevant historical events were, briefly, as follows:

1492 Christopher Columbus sailed on his voyage of discovery of the New World.

1493 Papal Bulls of Demarcation of May 3rd and 4th which precluded the Portuguese from the Americas and the Spanish from Africa.

1494 Treaty of Tordesillas based on the Papal Bulls of 1493. The line demarcating Spanish and Portuguese territories was extended to 370 leagues W. of Cape Verde, and included a part of Brazil. (then called Terra de Vera Cruz) on the Portuguese side.

1498 Columbus discovered South America.

1500 Brazil discovered by Pedro Alvarez Cabral who made landfall at 17° S. Actually a Spanish landing was made by Vincente Yáñez Pinzón earlier in the same year, but this was not followed up because of the Treaty of Tordesillas. Cabral then continued his journey via the Cape of Good Hope to Calicut.

1501 The discovery of Brazil followed by an expedition with Amerigo Vespucci as pilot. There was very little further interest in Brazil until the accession of King John III in 1521.

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West African Exploration

Some of the earlier explorations of West Africa are not well documented, and there are a number of early maps, such as the Laurentian Portolano of ca. 1351, which show features which could only have been known by early voyages about which there is no written evidence available at the present day. The account in Herodotus Bk. IV, Ch. 42 suggests a voyage of the Phoenicians of the Pharoah Nechao (600 B. C.) reaching West Africa, and separate evidence for Hanno the Carthaginian's visit to West Africa, ibid. IV, 196; these are possible, but not certain (Mauny, 1956b). There is also a French claim that trade was established in 1383 at Elmina by a group of Norman merchants (Villault, 1669). It is now conceded that this claim is incapable of proof, Beazley (1906), although it is known that King Francois of France was greatly annoyed at the Treaty of Tordesillas which apportioned the newly discovered lands to Spain and Portugal by reason of prior discovery.

The relevant documented history of West African exploration is outlined briefly below:

1434 Start of Portuguese exploration when Cape Bojador was successfully doubled by Joao Diaz (Mauny, 1956b).

1441 First gold dust and slaves arrived at Lisbon.

1446 Discovery of Sierra Leone.

1461 Discovery of the Grain, Ivory and the Gold Coasts as far as Elmina.

1472 First authenticated European visitor to Nigeria. Ruy de Sequeira visited Lagos and the Kingdom of Benin.

1481 A British expedition to the Guinea coast was prevented by request of the King of Portugal John II (1481-1495) to Edward IV of England.

1481-2 Diogo d'Azambuja with Bartholomeu Diaz and possibly Christopher Columbus founded Elmina and laid claim to the whole country.

1484 Diego Cao reached the mouth of the R. Congo.

1485 Joao (John) Affonso (Alfonso) d'Aveiro established trade with Benin.

1488 Cape of Good Hope rounded by Bartholomeu Diaz.

1493 Papal Bulls of Demarcation.

1494 Treaty of Tordesillas.

1503 Visits to Benin by Duarte Pacheco Pereira.

1530 William Hawkins called at Sestos River (in Liberia) for trade.

1553 First English ships to reach Nigeria under Captain Windham (Wyndham), piloted by the Portuguese Antonio Pinteado, anchored at mouth of Benin River and traded with Benin after a journey by boat and overland.

1562 First cargo of 300 slaves carried by an Englishman (Sir John Hawkins) to Hayti [sic] from Sierra Leone.

1588 James Welsh took two ships to Benin river, and by boat to Gwato (or Ugwato, the river port of Benin) and stayed two months for trading.

1589-90 Second visit of James Welsh to Benin River in the "Richard of Arundel" (100 tons).

1642 Portuguese retired from the coast.

1650 First accurate description of oil palm by Bauhin.

Historical Records of the Oil Palm

The best unequivocal descriptions of the oil palm, palm oil and wine appear

late in the history of discovery of West Africa. Barbot (1732) describes the fruit and oil as follows,

"The oil is made of the nuts [fruit] of this tree which grow in a cluster of two or three hundred nuts together, the cluster growing out of the trunk of the tree about a man's height from the ground. The nut is of the bigness of a pigeon's egg, and the stone as big and as hard as that of a peach; and each tree commonly produces 5 or 6 clusters. The oil drawn from the nuts is of the saffron-colour smelling strong; at first extracting it looks like oil of olives, as to its consistence, which growing old, turns thick and lumpy like butter and may be transported every where . . ."

Undoubtedly this refers to the oil palm. In addition, he describes and gives illustrations of the coconut, and refers briefly to four other species of palm.

In the "Observations of William Finch, Merchant . . ." (1607) in Purchas (1905), there is a description of the palmito tree which has "boughes" . . . rather Reeds than boughes, being all pithie within . . . the leaf long and slender . . . the boughes are beset on both sides with sharp and strong prickles . . ." There is also a description of the nuts and of wine, and an account of the method of climbing palm trees for wine with a "withe," as there are "no boughes nor branches save only at the top."

There are numerous references to palms, palm oil and palm wine in "A Description of Guinea . . ." dated 1600, in Purchas (1905) (translated from the Dutch).

"They have a strong complexion or savour of their bodies, much like Oyle of Palme, wherewith they often anoint themselves."

". . . Palme trees whereof some are female which yield no wine, but bear Grapes as big as Plummes of an orange colour, at the one end being somewhat blackish: those grapes they peele to the stones and thereof they make Oile, which they call palme oile, which is verie delicate and good, which they use to dress their meate withall, and make good sawce thereof for their fish, the thickest of this Oile they use to anoint their bodies withall, to make them cleane, and the women use it to frizell their haire the veins [sic] are as great as acorns, and as hard as stone, at the end thereof having three round holes, they beate them in pieces, and within them find certaine Nuts, like little earthen pellets, much like hazell-nuts, but when you eate them they taste of the wood, and are verie drie."

At the end of the 16th century, there is a description, translated by Ravenstein, of Andrew Battell in Guinea. This worthy, captured by the Portuguese, was commanded to sail to the Congo river in a pinnace called Zaire to trade for elephant's teeth, and oil of the palm tree. He describes palms in Kisama (Quicama, South of Coanza) producing edible fruit and wine. The palms are described as 6 to 7 fathoms high with leaves only at the top. The people of Nbundu in Angolia have a device for climbing these palms without using their hands, and draw wine in bottles. In the ". . . Gasas countrie (Kisama) . . . there is a great store of Palmares or Groves of Palms. For they delight greatly in the Wine, and in the fruit of the Palme, which serveth to eate and to make Oyle: and they draw this Wine contrary to the Imbondos . . ." The Gagas cut down the tree and let it lie 10 days before they draw wine after cutting a hole in the top and heart of the tree and remove one quart morning and night.

James Welsh made two voyages to Benin, the first in 1588 and the second in 1590 (Hakluyt, 1904). The cargo on the return journey of the second voyage consisted of ". . . 589 sacks Pepper, 150 Elephants teeth and 32 barrels of oile of Palme trees." The account of the first voyage refers to "pepper and Elephant's teeth, oyle of palme . . . and cloth made of the barke of palme trees." The following references to palms and palm products are made in the account of the first voyage:- "There are great store of palme trees." "They have good store of sope, and it smelleth like beaten violets."

Richard Eden's account of the voyage of John Lok to Mina in 1554-5 (Blake, 1942) describes palm wine tapping:

"Their drinke is either water or the juise that droppeth from the cut branches of the barren date trees, called palmitos. For either they hang great gourds at the said branches every evening and let them so hang all night, or else they set them on the ground under the trees that the droppes may fall therein."

There is a reference in the account of Windham's visit to the Benin river to the drinking of "the wine of the Palme trees that droppeth in the night from the cut of the branches of the same" (Blake, 1942).

An anonymous Portuguese pilot writing ca. 1540 (Blake, 1942) describes soap made of ashes and palm oil which is said to be very effective in whitening the hands.

Ryder (1959) has recently described an early Portuguese trading voyage to the Forcados river in 1522 from a book of the voyage in the Arquivo Nacional in Lisbon. Two items of accounts are of interest,

T the pilot spent 50 manillas on one pipe of oil for the cargo L x m as

T the pilot spent 106 manillas in the occasional purchase of oil for the cargo C. bj.m as

One pipe is 105 gals. as measured by the standard wine cask.

There is evidence in Duarte Pacheco Pereira's *Esmeraldo de Situ Orbis* in the recent translation by Mauny (1956) and that of Kimble (1937) of trade in palm oil before 1503, and of the existence of palm groves.

A promontory north of present-day Liberia was thickly covered with palms (grande palmar) extending two leagues or more, whilst the Isle of Palms, three leagues from the river Cestos (in present-day Liberia) was so named because of the abundance of palms. Benin is described as a city about a league wide with houses made of mud walls covered with palm leaves. In a description of the Forcados river, a trading post up the left arm of the river (probably Warri or some nearby place according to Kimble) is described with reference to slaves, cotton-stuff, leopard skins, palm oil and blue beads (palm oil = azeite de palma in the original).

The Voyages of Cadamosto . . . (Alouise de Ca'Da Mosto) in the period 1435-1460 (Crone, 1938) contain reference to ". . . a marvellous oil . . . In this country they use a certain oil in their food (the making of which I do not know). It has three properties, the scent of violets, the taste of our olive oil, and a colour which tinges the food like saffron, but is more attractive . . ."

In the same translation there is an account of "The Voyages of Diogo Gomes in 1456 or 1457 which is treated more fully in the newer translation from the Latin by Monod, Mauny and Duval (1958).

"We came to a land where, near the shore, were many palm trees, with their branches broken and such great height

that from a distance we thought they were masts or spars of negro vessels."

This cape, about one day's sailing south of C. Verde was marked on contemporary maps as Cabo de Mastos (Cabo Roxo).

Discussion

There is quite an extensive body of information on the oil palm in West Africa during the 15th and 16th centuries.

Before examining these references it is necessary to consider the negative evidence about the oil palm in South America. In "A Treatise of Brasill . . ." in Purchas (1905) it is stated: "In this Brasill there are many coco-nuts . . . more than twentie kindes of Palme trees . . ." yet there is no mention of palm wine or palm oil.

A second piece of negative evidence concerns the status of other known introductions, which are recognized as such. In "A Description of Guinea . . ." (1600) in Purchas (1905) there is a description of the pineapple: "The Annanas is also a delicate and pleasant fruit for smell . . . the Canarians called it Ananasa; the Brasilians, Nana; those of Hispaniola, Jaiana and the Spaniards in Brasilia, Pinas, because one of them found . . . the Pinas first in Brasilia . . ." There is also a mention, ca. 1540, of coconuts (Blake, 1942) "Palm trees have been brought from the coast of Ethiopia and they bear the fruit which is called cocoa-nut." The oil palm is always considered to be indigenous.

The chief difficulty in dealing with the records of early exploration is the strict identification of the product in which one is interested. In this context, reference to a palm or to palm wine is clearly too ambiguous to be applicable to one species. It is doubtful whether this ambiguity applies to "palm oil;" it is possible that *Raphia* oil may have been used for food, soap-making or cosmetic purposes, but the term 'palm oil' is used from very early days until the time of the start of large scale trade in true (*Elaeis*) palm oil, with no indication of a second source. It is most likely, therefore, that an unqualified reference to 'palm oil' refers to true *Elaeis* oil. In many cases, however, there is sufficient description of the oil or its extraction for it to be identified unmistakably. This is true in "A Description of Guinea . . ." of 1600 where the seed is also described fully enough for identification as *Elaeis*, and in Cadamosto's (ca. 1450) description of saffron-coloured oil with a scent of violets. The scent of soap made from palm oil is also described as "like beaten violets" in the account of the voyage of Welsh in 1588.

References to palm wine are in some instances referable to *Elaeis*, particularly when descriptions of wine and fruit (or oil) occur together, or when descriptions of tapping for wine are made. *Raphia* palms are never cut down for wine-making; there is no equivalent to *Elaeis* "down-wine." Because of the tangled fibrous strands of the old leaf sheaths on the stem, the *Raphia* palm cannot be climbed by the methods used for the oil palm, and a bamboo (*Oxytenanthera*) "ladder" is used to reach the apex. The palms referred to by Finch in 1607, in "A Description of Guinea . . ." (1600), by Battel in his description of tapping for "up-wine" and "down-wine", and in John Lok's voyage (1554-5) are true oil palms.

In some cases there is sufficient description of the palms themselves as opposed to wine or oil to make identification fairly certain. The observations in "A Description of Guinea . . ." (1600) of fruit, seed and kernels certainly refer

to oil palms, whilst Battell's description of the height of the palms occurs with a description of wine production that must refer to the true oil palm. The "cabo de mastos" of Gomes in 1456 or 1457 were most probably oil palms. There is a possibility that these refer to *Borassus* palms, but these palms are too ventricose to be truly mast-like, and the coconut palm had not been introduced at that time. The palms of Isle of Palms are almost certainly oil palms, as its position precludes *Borassus* palms, and the abundance of palms mitigates against the coconut.

Within the limitations of identification the evidence is conclusive for the presence of the oil palm in West Africa at the time of the early Portuguese voyages of discovery, and by inference, before Europeans arrived on the coast. If we consider only the descriptions made before 1550, the quantity of palm oil purchased in 1522 suggests that oil palms were abundant then. The Esmeraldo, referring to a period pre-1503, describes dense groves of palms and trade in palm oil, neither of which could have been produced from seed introduced from Brazil or any other part of the Americas. This conclusion is confirmed by the clear description of palm oil by Cadamosto before the discovery of the New World.

In contrast to the evidence above, the reasoning used by Cook (1942) in his thesis of an American origin for the oil palm is most unconvincing. His claim is based upon the following:

(a) the oil palm grows spontaneously on the Brazil coast,

(b) although scattered through the West Indies, the oil palm is seldom used; this forms the basis for the statement that the oil in the rancid state was met with by slaves who were therefore very averse to its use,

(c) the first unequivocal mention of the oil palm was from the Gold Coast by Bauhin (1650) after the Portuguese had been on the coast for 160 years, and

(d) palm oil is eaten largely with cassava which was introduced from Brazil.

Cook's suggestion that oil from *Raphia* palms was in extensive use is unlikely in the light of evidence for abundant oil palms. At present, although *Raphia* fruits are eaten, no oil is extracted from them, except on a very small scale, and the fruit is mentioned only in the "Plants supplying Carbohydrates" section (not fats and oils) of a recent survey of indigenous foods in Nigeria by Okiy (1960). Dalziel (1937) does refer to "raffia butter" and "piassava oil," but these are of only very local and restricted use, and do not enter trade.

The recent suggestion, Raymond (1961), that the large jar of fat found in a tomb at Abydos may have been palm oil suggests very early trade in palm oil.

Summary

The early voyages of exploration of the West African coast and of South America have been examined in relation to the fifteenth and sixteenth centuries descriptions of palm oil trade. It is concluded that the oil palm could not have been introduced from America by the Portuguese, as claimed by some authorities, but is indigenous to West Africa.

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Further Evidence on the Origin of the African Oil Palm

In the interim between the receipt of Mr. Rees' manuscript and its publication in this issue, a reprint of an article by A. C. Zeven has been received in which evidence is given for the continued presence of the oil palm in Africa for several million years (*). Pollen grains found in Niger Delta deposits believed to be of Miocene age (and thus probably over 13 million years old) have been recognized as very similar to those of the present day oil palm. Their frequency is about 0.1 per cent of the total number of spores and pollen grains, while in later Tertiary sediments and in contemporary sediments, the frequency increases to as much as 10 and 30 per cent respectively.

EDITOR

*Zeven, A. C. On the origin of the oil palm (*Elaeis guineensis Jacq.*). Grana Palynologica 5: 121-123. 1964.