



PRINCIPES

Journal of The Palm Society

April, 1962
Vol. 6, No. 2

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 Executive 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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Cover Picture

Johannesteijsmannia altifrons photographed by Dr. W. Meijer in Buko National Park, Kuching, Sarawak, Borneo. The same species in cultivation at Singapore is illustrated on page 76. See also a note in *Principes* 5:116-1961.

Mailed at Miami, Florida, April 23, 1962

LETTERS

JACKSONVILLE, FLA., Jan. 23, 1962

As a member of The Palm Society and a reader of *PRINCIPES*, it occurred to me that members of the society might be interested in a "*Cocos plumosa*" [*Arecastrum Romanzoffianum*] that four girl students at Florida Presbyterian College have been keeping in their room. I had previously heard about the palm but did not see it until I visited the College during the Christmas holidays and saw it in the lobby of the Administration Building where the palm, called "Junior," had been left for the care and attention of one of the girls in the office while the owners of the palm were away on Christmas vacation. Seeing Mr. Pierce with a camera, I requested that he take a picture of the palm and mail it to me so that I could, in turn, submit it to you. I enclose two glossy prints of the palm and a letter from Mr. Pierce to me containing interesting information with respect to the palm and its owners and temporary keeper.

Sincerely yours,
CHESTER BEDELL

ST. PETERSBURG, FLA., Jan. 11, 1962

DEAR MR. BEDELL:

I am enclosing pictures of the orphan palm tree which you saw in our lobby. The young lady watering it is Miss Alice Coyle, admissions office secretary, who helped look after "Junior" while its regular guardians were home for Christmas.

As you may recall, "Junior" showed up unexpectedly in the lobby like a lost child, decorated in Christmas streamers. The girls who had kept it in their dormitory room—Noralee Reicherts of Winter Park, Meredith Black of Evansville, Indiana, Susan Kirkpatrick of St. Augustine and Claire Franklin of Marietta, Georgia—decided it would find a good home over the holidays with the college

My name is Junior.
I live in C-2, but
my roommates left
me
Please water me. I
get thirsty every
other day
THANK YOU!



24. "Junior" vacations with college staff while its owners are away. Miss Alice Coyle was guardian. Photograph by R. Pierce.

office secretaries. When the Winter Term started in January, "Junior" went back home.

Cordially,
ROBERT N. PIERCE
Director of Public Relations

It will be very helpful if members will notify the Society of their changes in address. Each month several copies of *PRINCIPES* are returned by the Post Office because members have moved. This entails delay in receipt of the journal by those members, as well as payment of postage three times on each copy.

Helpful Hint

Mrs. Mulford Foster, Orlando, Fla., has called our attention to a very attractive notepaper: Eaton's "Palmetto." There are two fan-shaped leaves in palest gray against an ivory background. You may want to look for this paper at your stationer's.

LUCITA H. WAIT

Orania sylvicola—the Correct Name for *Orania Macrocladus*

During the preparation of a checklist of cultivated palms, it has been necessary to consider the name for the *ibul* palm of Malaya and Sumatra which for many years has been called *Orania Macrocladus* and is so listed in Ridley's *Flora of the Malay Peninsula* 5: 17. 1925.

Martius took as his epithet for this palm the generic name *Macrocladus* proposed by W. Griffith in 1845 instead of the epithet *sylvicola* used by Griffith. The present *International Code of Botanical Nomenclature* (1961) requires that the earliest epithet (*sylvicola*) be used. The appropriate transfer is made here. The correct name for *Orania Macrocladus* is *Orania sylvicola*.

Orania sylvicola (W. Griffith) H. E. Moore, *tr. nov.*

Macrocladus sylvicola W. Griffith, in *Calcutta Journal of Natural History* 5: 490. 1845.

Orania Macrocladus Martius, *Historia Naturalis Palmarum* 3: 186 [ed. 2]. 1849
HAROLD E. MOORE, JR.

Essays on the Morphology of Palms

VII. A DIGRESSION ABOUT SPINES

P. B. TOMLINSON

A tendency on the part of palms to develop sharp spinous processes is suggested by the frequent use of specific epithets like *aculeata*, *armata*, *horrida*, *hystrix*, *polyacanthos*, *spinosa* and so on. Several quite different organs in palms may become modified as spines, whilst other spines may originate as mere outgrowths of surface tissues and are not equivalent to another part. If spines, then, are not a morphologically homogeneous group it might be suggested that they are biologically homogeneous, all having the same function, whatever their mode of origin. But even this is not true because insofar as we

can be aware of the "function" of spines it is quite evident that they may have one of two contrasted purposes.

Nevertheless, although a consideration of spines in palms may involve a rather artificial lumping of quite unrelated structures, a study of their great variety reveals much of botanical interest. Also, no previous attempt has been made to assemble information on this subject, so that it is hoped that this present article will be of value, as well as of interest.

In this article I have considered any pointed or hooked structure to be a spine. The expression "spine" has no

precise botanical meaning, except that it usually refers to a rigid, pointed process. However, I have also included organs which are curved.

Three distinct morphological categories are involved. Firstly, there are spines which are obvious modifications of some pre-existing organ, as can be discovered from their position and mode of origin. Secondly, there are structures defined by the botanist as "emergences," each emergence being the outgrowth of superficial tissues and not homologous with another structure. The most familiar example is the prickle or thorn of a rose. Thirdly, there are spines which originate from hard internal tissues, being revealed only by late changes involving the loss of softer surrounding tissues. Each of these categories may be considered independently, being subdivided somewhat for convenience in description.

Organs Modified as Spines

Leaflets as spines. In some species of *Phoenix*, each leaflet ends in a rigid point and is, in itself, an effective spine. However, in all species of *Phoenix* the proximal or basal leaflets develop, not as flattened organs, but invariably as rigid, angular spines, the whole system forming a very effective protective thicket about the young leaves and bud (Fig. 25). No other palms are like *Phoenix* in this respect.

In several climbing palms, on the other hand, it is the distal or terminal leaflets which are modified. The rachis is prolonged into a long cirrus along which the pairs of leaflets are widely spaced. Each leaflet develops as a rigid, backwardly directed spine. The function of these pairs of spines is not of protection, but as grapnels which serve to attach the leaves of the palm to the surrounding foliage and branches of



25. Leaflet spines of *Phoenix reclinata* form a dense thicket around the terminal bud. Photographs by P. Tomlinson.

taller trees, so that the palm grows into the forest canopy with the support of adjacent vegetation, rather than by its own mechanical tissues. That these grapnel-spines are modified leaflets is evident from their mode of origin, as well as their position. They occur in *Desmoncus*, in a few scrambling species of *Chamaedorea* and in the scandent palms of West Africa related to *Ancistrophyllum*. It should be noted that whereas a similar anchoring cirrus is developed in certain genera of scandent palms of the Asian tropics, notably in *Daemonorops*, the grapnels in the latter palms are of a different origin (Tomlinson, 1961).

Roots as spines. Roots in palms normally originate at the base of the trunk and grow into the soil as absorbing and anchoring organs. In a few palms, however, they appear throughout the length of the trunk and differentiate as pointed spines. The most familiar example is *Cryosophila nana*, the root-spine palm. It is unfortunate that the much more descriptive name for this palm, *Acanthorhiza aculeata*, is not correct. The spines can be identified as roots because they originate from deep-seated tissues, as do normal roots, they have the internal structure of a root and whilst they are growing they possess a root cap. They may also branch in the manner of roots. Unlike roots, however, they grow erect, cease their growth early and become sclerotic. *Zombia* and some related palms show an interesting resemblance to *Cryosophila* in that erect-growing pointed roots may be formed, but only at the base of the trunk.

In addition to *Cryosophila*, root-spines grow all over the trunk in some species of *Mauritia*. These spines, however, are short and stout.

Branch roots as spines. Branch roots, that is roots which grow from existing roots, may also become modified as spines. This occurs sometimes on the stout aerial roots of *Eugeissona* and on the stilt-roots of certain of the iriartoid palms. The spinous roots of *Socratea* have been used by the Indians of South America as ready-made rasps for grating cassava.

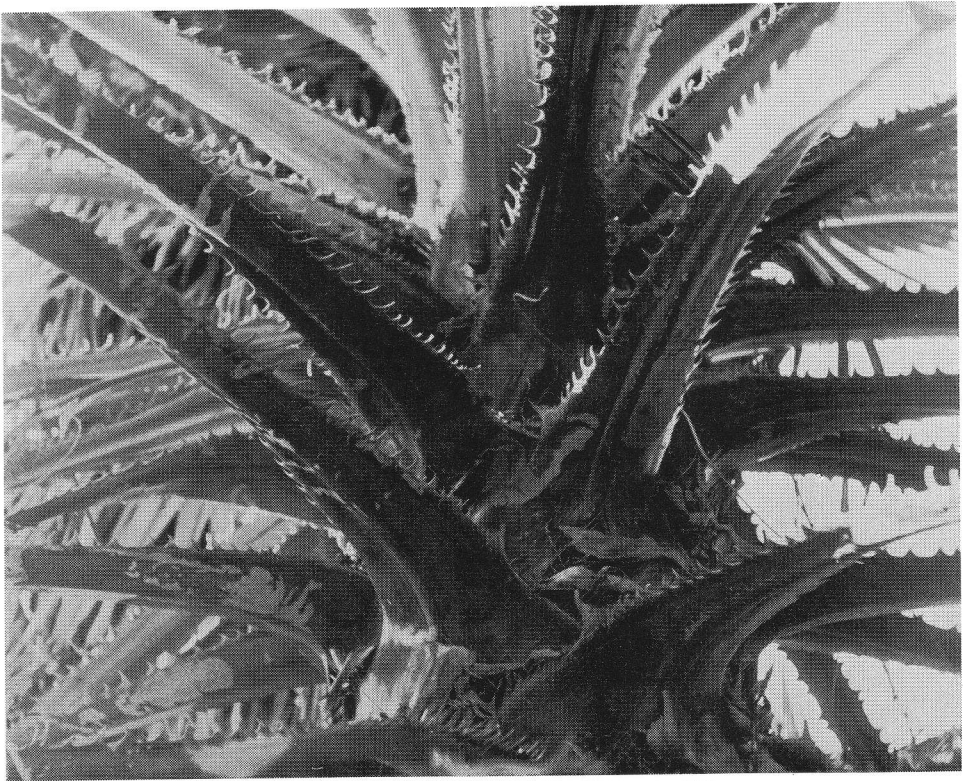
Emergences

These structures develop merely as outgrowths of superficial tissues, not being equivalent to any other organ. These prickles or spinous emergences in palms may develop on any or all of the above-ground organs and their length and size varies considerably. For

convenience the distribution of spines on each organ may be considered independently, although there seems to be no fundamental difference between spinous emergences on different organs.

Spines on leaflets. The distribution of spines on the leaflets seems very constant for each species in which they occur, but varies considerably for palms as a whole. Typical spinous palms are most species of *Aiphanes*, *Astrocaryum*, and *Bactris* in which spines are commonly distributed irregularly over both surfaces of each leaflet, and where they are abundant there may be a transition from large, rigid spines, through smaller prickles to pointed hairs only visible through the microscope. Spines are sometimes restricted to the leaflet margin as in some lepidocaryoid palms, or to the marginal and main ribs as in *Raphia*. The margins of the leaf segments in some fan-palms are likewise minutely prickly, as in *Lepidocaryum* and *Rhapis*, whilst in some species of *Copernicia* teeth occur on ribs as well as segment margins. It should be noted that these marginal teeth are never homologous with the teeth at the margins of many dicotyledonous leaves, as in the European holly, which are the ends of veins. In palms there is never a correspondence between spines and either longitudinal or lateral veins. In some caryotoid palms veins end freely at the leaf margin, but not as sharp spines.

Spines on the leaf axis. Where spines occur on the leaflets they may also equally be common on the leaf axis, as in the bactroid palms, in which they densely clothe the exposed part of the leaf axis, although their density is greater in some genera, e.g. *Astrocaryum* and *Bactris*, than in others, e.g. *Acrocomia* and *Aiphanes*. In many of the climbing lepidocaryoid palms the spines are most abundantly developed on the ex-



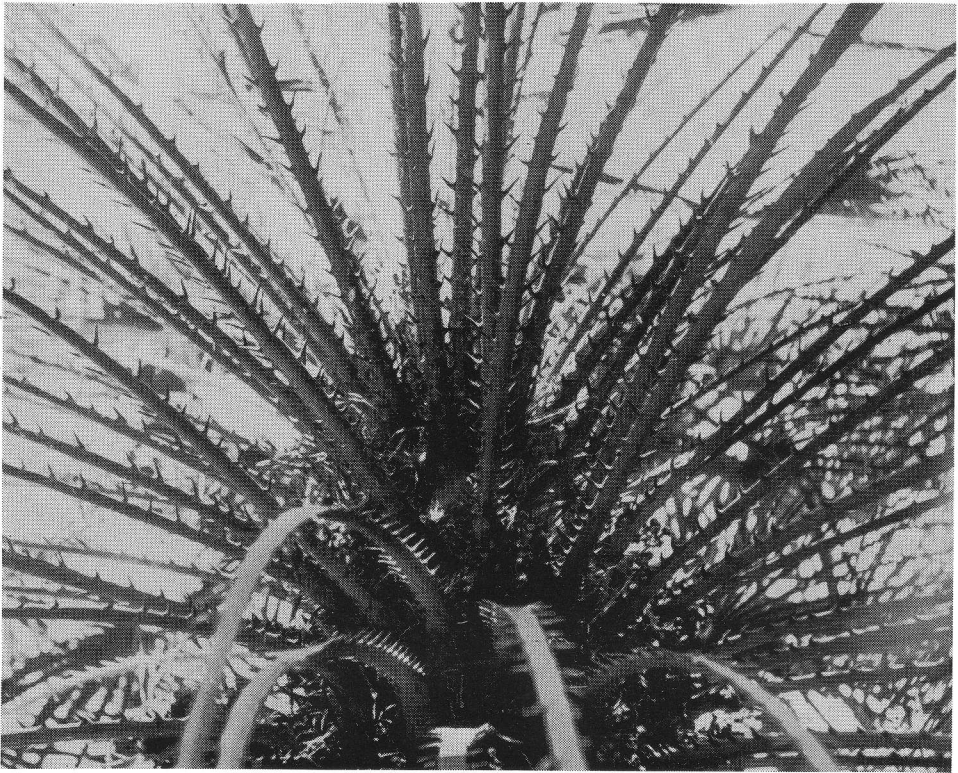
26. Short stout petiole spines of *Washingtonia filifera*.

posed part of the leaf sheath, often forming a characteristic pattern for each species, even though this pattern may differ strikingly in juvenile and adult foliage of the same species. The spines may be long and needle-like, or short and broad; they may be arranged in regular whorls, as on the petiole of *Salacca*, or the leaf sheath of some *Daemonorops* species; they may run in vertical series. In some species of *Daemonorops* the interweaving adjacent whorls of spines form galleries in which ants live.

The origin of these larger spines is of some interest. They appear early, within the palm bud, developing from superficial tissues and since they grow on surfaces tightly enclosed by other organs, they lie appressed against the leaf axis, but always pointing towards the leaf

apex. When these spiny enclosed surfaces grow beyond those of older, enclosing leaves the spines become erected by the enlargement of a basal, cushion-like hinge of cells. This hinge may move the spines through an angle of more than 90° , so that they ultimately point backwards. At maturity the hinge-cells become hard and the spine is rigid. Since each spine usually develops within a shallow recess in the surface, its original position is commonly indicated by a shallow groove.

A somewhat different arrangement of spines is common in fan palms. These are not conspicuously spiny, except for teeth which develop on both margins of the petiole (Figs. 26, 27). These may be long straight spines, as in some species of *Livistona* and there is a continuous

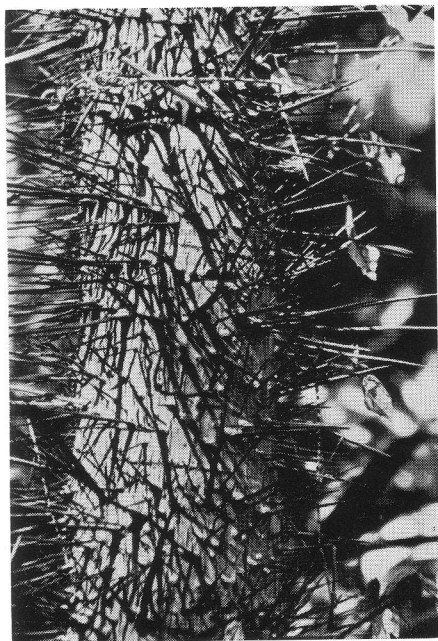


27. Long straight petiole spines of *Chamaerops humilis*.

transition to the minute teeth which occur in many of the smaller fan-palms, as in *Serenoa* and *Rhapis*. In other fan-palms, although the margins of the petiole are not obviously spinous, they are sclerotic and roughened like an irregular saw, as in *Borassus* species. Conspicuous or not, these saw-like margins can make ugly wounds and such leaves must be handled carefully. One interesting suggested homology, to which Dr. H. E. Moore has drawn my attention, is that the basal spinous leaflets of *Phoenix* and the larger spines of some fan-palms, e.g. *Chamaerops*, may be morphologically equivalent (cf. Figs. 25 and 27). This might be true if *Phoenix* and *Chamaerops* are closely related, as has been suggested. However, I have no helpful comment to make on this attrac-

tive hypothesis.

Grapnel spines. Although strictly included within the previous category, the specialized hooks of certain scandent palms deserve separate consideration. These occur on the back of the leaf axis, usually being restricted to the long terminal cirrus. The hooks occur in groups rather than singly, so that their basal cushions are fused to form a single, massive pad which together with the group of pointed digits so resembles a bared cat's-claw that the name *ungue* which is given to them seems particularly appropriate. Like the grapnel leaflets of *Desmoncus* these organs are almost offensive weapons compared with the passive nature of more orthodox spines. Or so it seems to the unwary traveller who inadvertently brushes



28. Spines on the stem of *Aiphanes* sp.

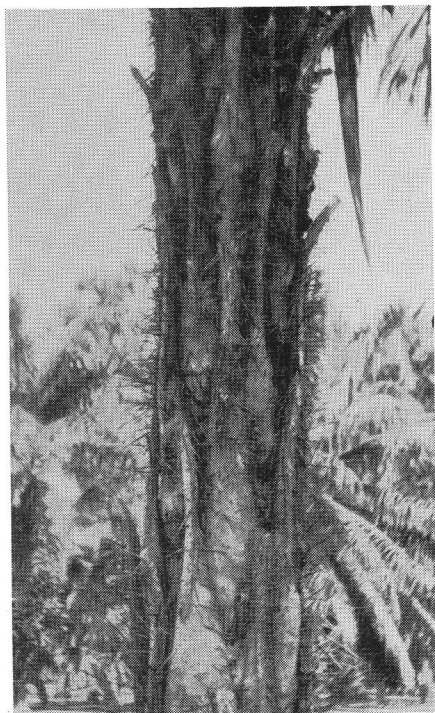
against the whip-like cirrus. The flagellae of *Calamus*, described earlier (Tomlinson, 1961), also bear these unguis.

Spines on stems. Emergences, which vary in their stoutness, also may appear on exposed stem surfaces, particularly in the bactroid and lepidocaryoid group (Fig. 28). These spines wholly resemble those of the leaf axis and may also originate in shallow grooves. One interesting feature of spines on the stem in *Acrocomia*, noted by Bailey (1941), is that in the *Sentocomia* section of the genus, spines occur on the stem, and are exposed by the early abscission of the spineless leaf bases. In the section *Tectocomia*, on the other hand, spines are absent from the stem surfaces, but are present on the outer surface of the long-persistent leaf bases (Fig. 29). This indicates, of course, how remarkably precise is leaf fall from palms and the close correlation of one morphological

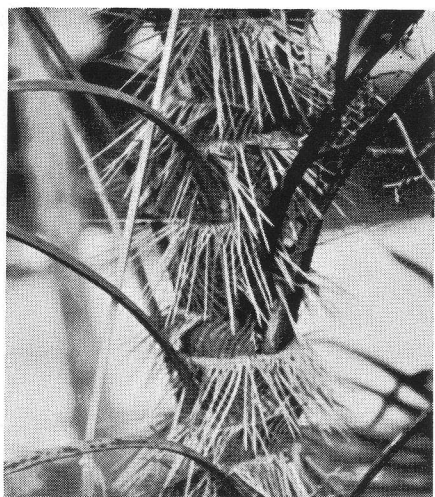
feature with another (see Tomlinson, 1962).

Spines on spathes. In the most well armed palms, spines are abundant on the spathe as well as on vegetative organs. *Bactris* and *Daemonorops* are good examples. Sometimes spines are restricted to the spathes in mature trees as in *Deckenia*.

Spines on inflorescences. Except in some bactroid palms, the inflorescence axis is not usually spinous, even though the rest of the palm may be quite spinous. One other special instance is the peculiar inflorescence in *Calamus*, often reduced entirely to a supporting organ, the flagellum, as I have indicated elsewhere (Tomlinson, 1961), and bearing the same kind of hooks as found on the cirrus of other scandent palms. These two organs flagellum and cirrus are



29. Spines on outer surface of persistent leaf bases in *Acrocomia Totai*.



30. Spines from persistent hard parts of leaf sheaths in *Zombia antillarum*.

therefore analogous, in that they both function as anchoring organs, but they are not homologous or morphologically equivalent.

Spines from Internal Structures

Spines develop in certain palms as a result of partial breakdown of leaf sheath tissues so that only rigid sclerotic tissues persist. Two different types exist.

Spines of Zombia. In *Zombia antillarum* the leaf sheaths are long-persistent, all harder tissues remaining after the softer tissues have been lost by decay (Tomlinson, 1962). In the interweaving skeletal network which persists, the distal ends of the larger vascular bundles project as stout spines which ultimately become reflexed (Fig. 30). The whole series of persistent spinous leaf bases forms the very characteristic and effective armature of this plant. The spines of *Rhapidophyllum hystrix* (Fig. 31) originate in essentially the same way but do not become reflexed. The spines of *Trithrinax acanthocoma* seem to have the same origin.

In some other palms breakdown of the leaf base tissues may leave long vas-

cular strands which are not spinous but pliable. *Arenga pinnata* shows this well.

Spines of some cocoid palms. In many genera of cocoid palms, as in *Butia*, *Elaeis*, *Jubaea* and *Syagrus*, the petiole is armed with irregular marginal teeth (Fig. 32). These are neither equivalent to the leaflet spines of *Phoenix* nor are they comparable to the petiolar teeth of fan palms. They are apparently the strongly fibrous remains of the distal parts of the leaf sheath left by the loss of most of the leaf sheath tissues as the leaf matures (Tomlinson, 1962). Their origin has yet to be studied in detail before they are properly understood.

Spines as taxonomic features. Whilst it has been emphasized that the distribution of spines in many species is a valuable diagnostic feature, it is also interesting to record the distribution of spinous palms throughout the major



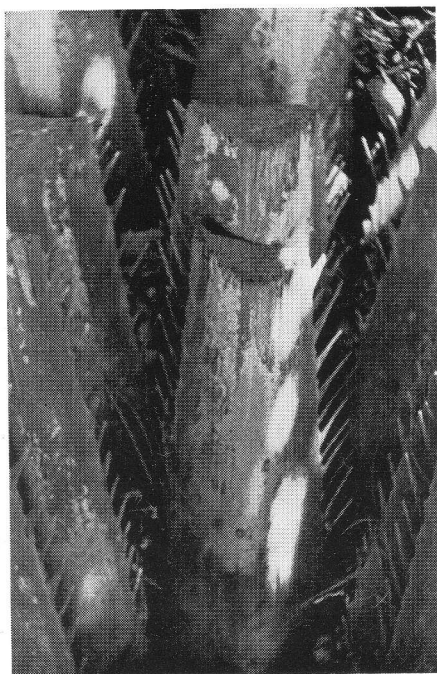
31. Projecting spines in *Rhapidophyllum hystrix* are persistent hard parts of leaf bases.

tribes. This is peculiarly uneven. Two groups, the bactroid and lepidocaryoid palms, are excessively spinous, especially those genera related to *Bactris*. In the climbing palms of the lepidocaryoid group, spines are developed for support as well as defense, whilst other genera in this group may have protective spines of one sort or another, as in *Metroxylon*, *Pigafetta*, *Raphia* and especially in *Salacca*. It should be noted that supporting spines appear in at least three distinct subfamilies and must have evolved independently in five distinct groups.

The fan-palms are, superficially, not well armed plants, but the spinous or roughened margins of their petioles are effective if not eye-catching. In addition there are miscellaneous genera within the sabaloid group of fan-palms with special spiny defenses, as in *Cryosophila*, *Rhapidophyllum*, *Trithrinax* and *Zombia*. The phoenicoid palms have a unique and well-developed protective system. The cocoid palms include many genera with spinous leaf axes.

In the remaining main groups the arecoid, caryotoid, chamaedoroid and iriartoid palms, spines are, with a few exceptions, absent. There are a few scandent species of *Chamaedorea* with poorly developed grapnel-like distal leaflets. Some iriartoid palms have aerial roots studded with spines. Amongst the great assemblage of unarmed, arecoid palms are a few with conspicuously spiny trunks, as in *Oncosperma*, or with the spines restricted to the axes of seedling leaves, as in *Stenersonia*. Others have spinous spathes, as in *Deckenia*.

The general conclusion seems, therefore, that spines commonly are developed in palms, but most prolifically in certain groups and that they have many



32. Spines on the apparent margin of the "petiole" in *Syagrus coronata* are remains of the hard parts of the margin of the leaf sheath.

different morphological sources. The function of these spines does vary, since in the climbing palms some of them obviously serve for support. Otherwise the function seems to be entirely protective. But we may pose the question—what do these spines protect against?

Spines in other plants are most pronounced in the inhabitants of deserts, where they are obvious defensive structures directed against a heavy grazing pressure from herbivores living in areas where plant food is scarce and plant growth is slow. But spininess is not a particular feature of palms which inhabit dry areas. Many species of *Bactris* and *Astrocaryum*, two of the most consistently and heavily armed genera of palms, grow in moist, shady situations.

The secret of the defensive needs of palms, on the other hand, may lie in their special mode of growth, rather

than their ecological requirements. The palm is peculiarly vulnerable because each erect axis has but one bud and many palms have but one erect axis (see Tomlinson, 1961). The individual is therefore wholly destroyed should its one apical meristem be destroyed. The situation has been described aptly by Schroeter: "Like a foolhardy gambler the palm stakes all on a single card," quoted by Richards (1952, p. 10). But even though the adoption of this growth habit has been a gamble, it seems to have been a calculated risk, since the palms are, amongst living families of flowering plants, a large and successful group, widely distributed throughout the tropics. This restriction to the tropics is probably not a consequence of their peculiar growth form so much as their continual growth without resting periods and without the mechanism to survive adverse climatic conditions. The palm bud is vulnerable because it is large, nutritious and appetizing. It is sometimes distastefully astringent because of a high tannin content, but with one possible exception it is not poisonous. The palm bud must therefore have been eaten by large herbivores long before it was eaten by man.

The protective measures devised by palms seem essentially directed towards the defense of the bud. The armature of *Phoenix*, for example, certainly suggests this. The problem in present-day biology is to recognize the large forest animals at which these defenses are directed. It requires great strength on the part of any animal to tear out the heart of a palm bud. The only example of this with which I am familiar is the Malayan forest bear, which can be destructive in plantations of introduced West African oil palm.

Otherwise, where are large herbivores sufficiently strong and tall to do this

damage? The suggestion I would like to make is that the large animals against which the spiny defensive mechanisms of palms are directed are now extinct. In the struggle for existence it is the palm which has survived and persisted, whereas gigantic vegetarian predators, possibly less successful in other directions, have perished. Apart from suggesting an age for palms which goes back at least to a period when the forests of the earth were populated by much larger animals than exist today, this hypothesis also suggests that spininess is a primitive feature in palms. More recently-evolved palms have no defensive mechanism because the need has diminished and certainly there are many small delicate palms without protective spines. Also it may be that unarmed palms of great antiquity originated in areas free from herbivorous predators, and the existence of so many genera of spineless areoid palms on isolated islands in the Pacific area might support this view. The distribution of present-day spiny palms may be a rough measure of the former distribution of large vegetarian animals which are now extinct.

Whatever the answer to these very hypothetical questions, it is certain that spines are, or have been, of adaptive significance to palms and are one reason for their present success.

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Palms at Kew

T. A. RUSSELL

Royal Botanic Gardens, Kew, England

The first collection of palms in England of which good record remains was that of Robert James, 8th Lord Petre, at Thorndon Hall in the county of Essex, some 21 miles east of London. Lord Petre and his wife took great interest in growing unusual plants, and a feature of Thorndon Hall was the "stove," or heated conservatory, which in 1736 contained ten different palms. All are not recognisable at this distance of time, but they plainly included the date-palm of North Africa, a Brazilian fan palm, the oil palm of tropical Africa, and the cabbage-palm which had been found by Sir Hans Sloane in Jamaica.

When Princess Augusta, Dowager Princess of Wales, put into effect in 1759 her plans for a botanic garden at the royal residence of Kew House, there was built a heated house for tropical plants in which palms might find a place. In 1768 this held six species; the date-palm and coconut, the talipot and palmyra palms, the European fan-palm, and a climbing palm or rattan. Additions to this number came slowly through the years, and not more than 20 species were being grown in 1823 when the palms came under the charge of a young man named John Smith.

Smith was a great gardener who combined skill and experience with an independent and purposeful mind. Born in Scotland, the son of a gardener, he had been taken from school at an early age to be apprenticed to his father, and had completed his training by working in several famous gardens. He then travelled south and in 1822, when 24 years of age, he was given employment in the Royal Gardens at Kew at a weekly wage of 12 shillings. In the next year he was

made foreman of the hothouses, and as foreman and then curator he served Kew for over forty years until advancing blindness caused him to retire from active work. He lived on in the neighborhood for many years, employing the days in dictating his memories of what had happened in the Gardens in his time, a record from which springs much of our knowledge of early palms at Kew.

In 1823 when Smith became foreman of the hothouses, he found the palms not only few in number but also badly housed. The glasshouse then used for palms was a lean-to structure, 60 feet long and rising to 15 feet at the highest wall. A central bed was filled with bark from the tanyard, whose slow fermentation provided heat, and in this the tubs and pots of palms were sunk. The finest specimens at this time were two plants of *Sabal Blackburnia* and a *Corypha*; and Smith describes how they and a *Pandanus* were continually pushing their leaves through the glass of the roof. He adds that pity was taken on them in 1828 when the roof was raised 4 feet, but the relief so provided can have been only short-lived.

The year 1841 saw great changes at Kew for in that year the Gardens ceased to be the property of the Royal Family and became instead a Government institution. Sir William Hooker was appointed Director, and, with John Smith as curator, developments were put in motion. High on the list of new works was a Great Stove or Palm House which would provide a suitable habitation for palms and other exotic plants.

The Great Palm House

A fashionable architect of that day,

Decimus Burton, was invited to submit a plan. Burton was a man of some distinction. The tenth son of an architect, he had chosen to follow his father's profession, and before passing the age of 23 had not only set up his own business but was becoming well known for his creative designs. An example of his work familiar to visitors to London is the arch and facade of Hyde Park Corner. But his chief interests were in the country, in laying out gentlemen's estates with dignity and elegance, a house in classical style, an undulating park with groups of trees, in the distance a placid lake.

In March 1844 Burton submitted his plan of the Palm House, a plan which was finally adopted after some modifications suggested by John Smith and by Richard Turner, head of the firm supplying the iron framework. The house was to be 362 feet long, the largest structure of glass which had hitherto been made. It was to have a lofty central chamber 63 feet high and 100 feet across, and a wing to north and south, each 30 feet high and 50 feet across. The structure was to be supported by a framework mainly of wrought iron, and the panes of glass were to be tinted a particular shade of green to moderate the scorching effect of bright sun (a refinement soon shown to be needless in the smoke-filled atmosphere of Greater London). A suitable temperature for tropical plants was to be maintained, even in the depth of winter, by hot-water circulation, and to do this adequately four and one-third miles of piping (later increased to nearly five miles) was reckoned necessary. Twelve boilers installed beneath the building would supply the hot water.

At some distance from the glasshouse was a shaft or ornamental tower designed to provide a chimney for the boilers

and a pressure-head of water. Connecting the two buildings was an underground passage (eventually made 7 feet high and 479 feet long) with a track along which fuel for the boilers could be delivered.

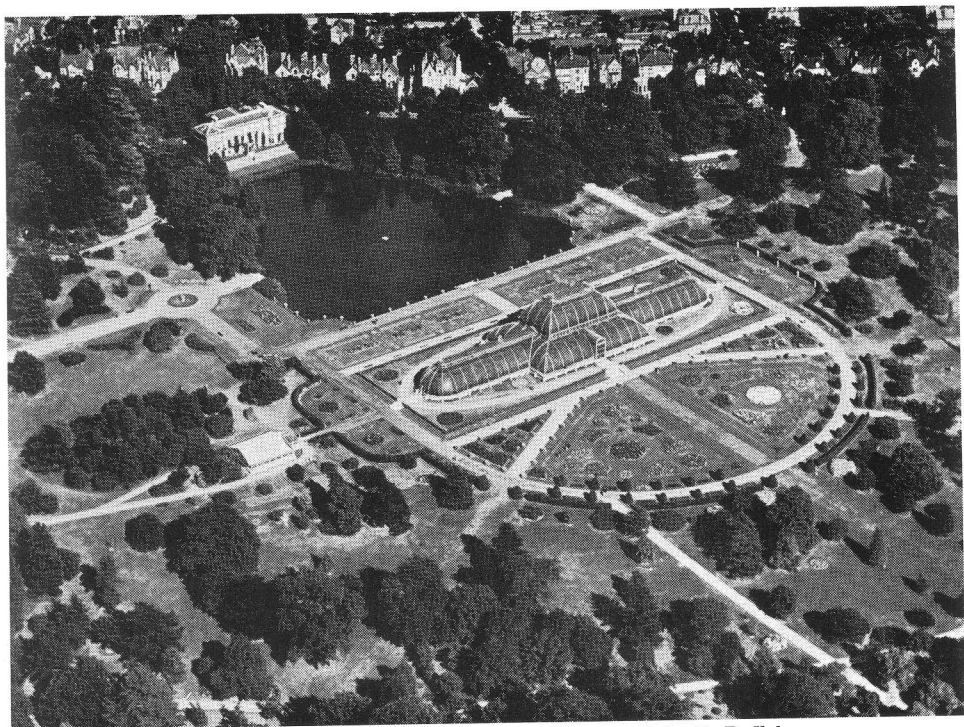
The best position for this new building had still to be decided and the site proposed by Decimus Burton aroused all John Smith's scorn and indignation — "the lowest spot in the parish" he said, "a quagmire for the greater part of the year." Smith, of course, knew what he was talking about, and we read in the *Journal* how, for some winters to come, water seeped into the boiler-room so fast that fire-engines had to be employed night and day to pump out water lest the fires should be extinguished. But this defect was made good in time, and now, as we view this building, the crystal centre piece of the present Gardens, we can see in its admirable siting, the evidence of Burton's genius and artistic vision.

Work on the foundations and boiler-room was started in 1844. Progress on the upper structure was slow and there appear to have been delays in delivery of the ironwork which was being fashioned in Dublin. The construction attracted great interest, and amongst visitors viewing its progress were Queen Victoria and her Consort whose surprise visit is described in a letter from Decimus Burton to Sir William Hooker:

6 Spring Garden,
30th June, 1848

MY DEAR SIR WILLIAM,

I trust that change of air is benefitting your health and that you will soon return in strength . . . You will have heard of the unexpected visit there yesterday of Her Majesty and Prince Albert. Mr. Smith very properly immediately offered his services, and I, who happened to be in the Palm House, was afterwards de-



33. The Palm House, Kew, from the air. Photograph by R. R. Zabeau.

sired to attend H.M. and the Prince who asked many questions and expressed much satisfaction. I took the opportunity of expressing my regret that, in consequence of a serious accident, you had been ordered by your Physicians to the seaside. I added you would be mortified on having a second time lost the opportunity of being present on the occasion of H.M. visiting the Gardens. I added that it would be some comfort if I might say to you that H.M. would again be there this summer. The Queen smiled and said *She certainly should* and I was to inform you so.

You will be glad to hear that the Palm House Flues are greatly improved as to draught.

Yours very truly,
DECS. BURTON

At last, in July 1848, the house was considered ready to receive plants, and

John Smith records for us his feelings in going into the great structure to arrange their disposal. He saw ironwork in every direction, massive girders in iron, the gallery with its two spiral iron staircases, the iron plates forming the flooring, all, he says, more like "some dockyard smithy or some iron railway station than a hothouse to grow plants in." A firm of shipwrights was employed to move the large sabals, one of which with attached soil weighed $17\frac{1}{2}$ tons and had to be manhandled over rollers from the old hothouse half a mile away.

The palm collection was soon in place and to it was added a collection of cycads and of screw pines and tropical plants of economic interest, bananas, mango, coffee and cacao. At first the plants stood in pots or tubs on the metal flooring, but in 1854 Smith was given his way and some of the iron plating

was removed to make six large beds of soil in the central room. Planted in these, the larger palms were encouraged to make much better growth and the mango tree was described as fruiting well.

The new Palm House was greeted with delight and admiration by the visiting public. The Director, in the official guide-book, described it as the glory of the Gardens, and other writers wrote its praises in all the fulsome verbiage and pride of achievement appropriate to the mid-Victorian period. "Truly this is a magnificent work, worthy of this great nation, and of the delightful science the interests of which it is so eminently calculated to advance" (Philip H. Gosse, 1856).

The tropical plants being now so satisfactorily housed, Decimus Burton was asked to design a house for plants requiring protection in the winter but no great degree of heat. The Temperate House or Winter Garden which he planned was more grandiose than the Palm House, having a spacious central hall, 216 feet long and 140 feet wide, with a large wing to the south and another to the north connected to the centre by two smaller chambers octagonal in shape. Building of the central hall and octagons was begun in 1860 and completed four years later, when part of the palm collection was transferred to beds in the central portion. The wings were not added until much later, and it was not until 1899, long after its designer's death, that the building reached its completed length of 628 feet enclosing an area of one and two-thirds acres under glass. Although to the external view this building lacks the distinction of the Palm House, internally its uncrowded spaciousness is most attractive. It has proved no less favourable a setting for palms, many of which prefer its cooler and less humid climate.

Sources of the Palm Collection

In the skilled hands of John Smith, and swelled by contributions from many parts of the world, the palm collection improved rapidly in variety and condition. From earliest days of the Royal Garden, travellers and residents abroad, whether surgeons of the Royal Navy, or Army Officers on overseas duty, colonial governors, missionaries, or traders, had been encouraged to send plants from the countries they visited. Moreover, from 1772 onwards, Kew employed its own collectors, young men trained in the Gardens and sent to distant parts to seek plants for the collection.

First among these was Francis Masson who from the Cape of Good Hope sent plants to Kew over a period of years, 400 species in all, some of which have since become popular garden-plants. A cycad or sago-palm, *Encephalartos longifolius*, which was collected by Masson and came to Kew as a young plant in 1775, still grows in the Palm House, a veteran of 186 years and a living link with this enterprise of the eighteenth century.

Two Kew men were with Captain Bligh when, following the disastrous voyage of the "Bounty," he made his second and successful voyage in H.M.S. "Providence" carrying plants of bread-fruit from the South Seas to the West Indies. One of them, Christopher Smith, collected palms in the West Indies and these were brought to Kew by Captain Bligh in 1793.

From Australia came a number of palms including the graceful *Livistona australis*. This was received in 1808 from George Caley, a man of unusual character. The son of a Yorkshire horse-dealer he had become interested in plants through their use in treating sick horses. He obtained employment as a gardener at Kew, and after three years was sent



34. A palm from New Zealand, *Rhopalostylis sapida*, in the Temperate House, Kew, (left); *Cryosophila*, a graceful fan palm at Kew (right). Photographs by R. R. Zabeau.

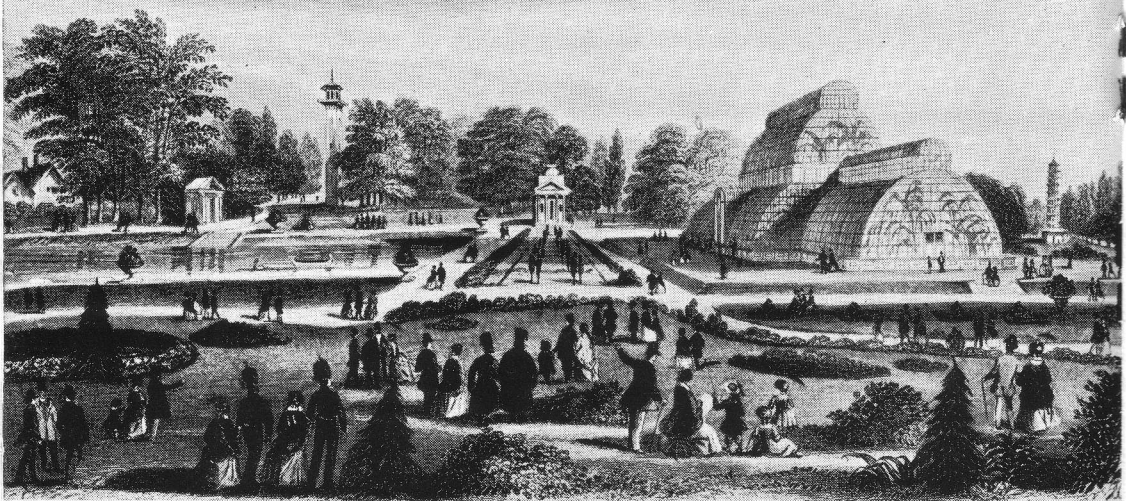
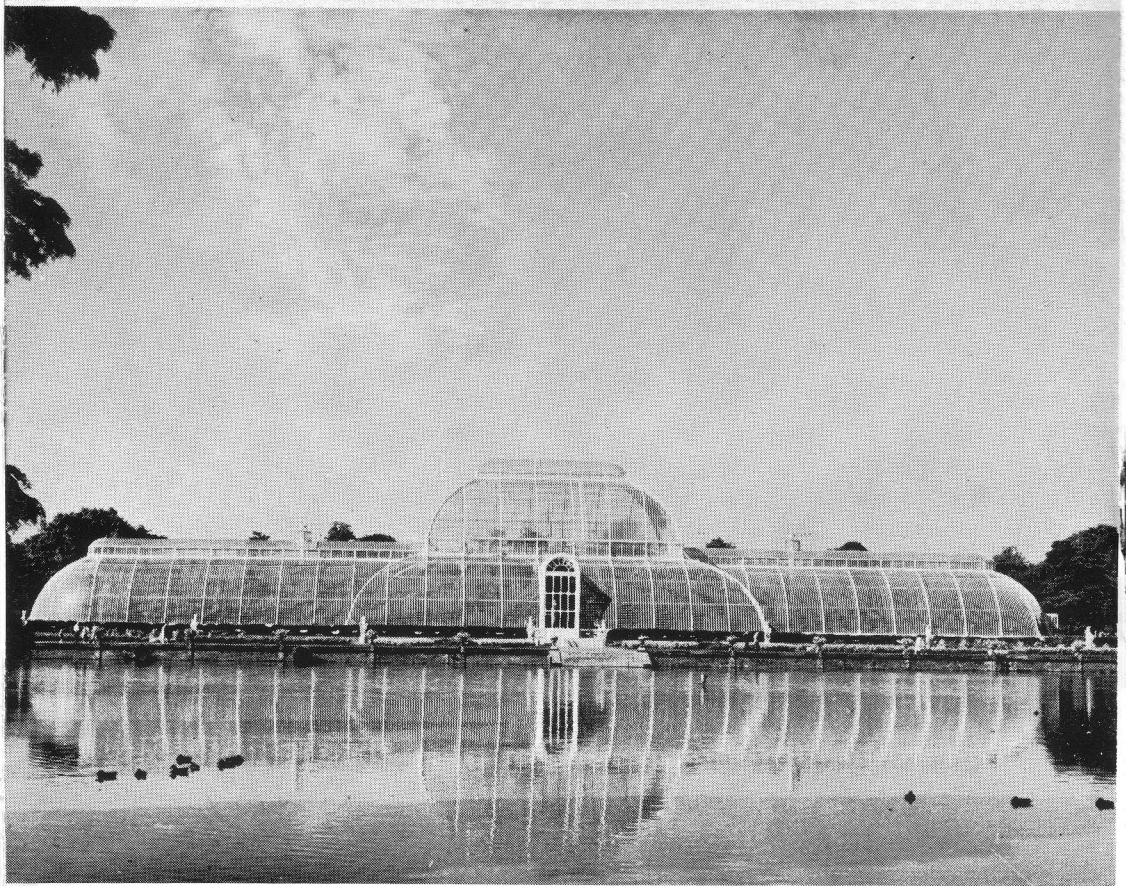
to New South Wales where he proved an industrious collector, sending many plants to England.

Caley's plant of *Livistona australis* at Kew long outlived him, but was surpassed in size by another sent from Australia in 1824. The sender was Allan Cunningham, a botanist trained at Kew, who, in his travels after plants, became one of the pioneer explorers of that country. He pursued his journeys with great ardour and disregard for comfort, and at his early death was said to have worn himself out with his exertions. His plant of *Livistona australis*, "for many years one of the greatest ornaments of the Palm House," reached the glass roof and was felled in 1876. A large palm of this species is conspicuous in the Temperate House, but this plant came to Kew from the Royal Gardens at Windsor and has no known connection with Allan Cunningham. Other species sent by him

still represented at Kew include the elegant palm which bears his name, *Archontophoenix Cunninghamiana* in the Palm House, and *Rhopalostylis Baueri* and *R. sapida* which are handsome features of the Temperate House.

A new palm was found by the collector William Milne, who sailed in the ship "Herald" on a survey of islands in the South Pacific, in 1853. On the small island of Lord Howe was seen "a dense forest of palms." From here Milne sent the umbrella palm, *Hedyscepe Canterburyana*, which later became popular as an ornamental.

A collector given a specific assignment to seek out a palm was William Purdie, who sailed for Colombia in 1843 with instructions to find the palm yielding vegetable ivory. The nuts were already familiar in Europe as an article of trade, being valued as a substitute for ivory in the making of billiard balls, chessmen,





35. The Palm House when completed was the largest glasshouse hitherto seen (left above).
36. The Palm House, Kew, as restored in 1959 (left below). Photograph by R. R. Zabeau.
37. The Palm House, opened in 1848, was hailed with delighted admiration (above).

and buttons. But, although they were understood to be borne by a palm, its identity and appearance were not properly known. For three years Purdie travelled in Colombia covering rugged and difficult country, and collecting rare and beautiful plants. He was able to find *Phytelephas macrocarpa* growing in abundance on slopes above the River Magdalena, and to describe its short almost recumbent stem, its spreading decorative fronds, and the scent which made the countryside fragrant as inflorescences opened on the separate male and female palms. He sent over 100 viable seeds to Kew, and seedlings raised there were distributed to other botanic gardens. A female plant, flowering at Kew in 1855, attracted much notice. The plant now in the Palm House arose as an off-shoot off an old plant, perhaps a seedling of Purdie's.

Amongst other Andean palms of which he sent seeds was the remarkable wax palm, *Ceroxylon alpinum* Bonpl. (*C. andicola* Humb. & Bonpl.). It owes its name to a coating of wax covering the trunk, which, scraped from the stem and mixed with tallow, makes very good candles. At Kew this palm is reckoned to be slow-growing, and a specimen in the Palm House with trunk 23 feet tall may perhaps be from seed sent by Purdie. His task completed in Colombia, Purdie went to Trinidad as Superintendent of the Botanic Garden, whence he continued to send palms and other plants to Kew.

With the development of botanic gardens in many overseas dependencies, the exchange of plants with Kew increased greatly. A list of palms being grown at Kew, given in the Director's report for 1882, includes 420 names. In the critical light of today, many of these names would not be regarded as distinct or as representing good species. There can be

no doubt, however, that the collection at that time was one of great wealth, remarkable for its number of species and wide geographical range.

The Palm Collection Now

A list of palms growing now at Kew would include about 125 species. Only one is grown out-of-doors without protection, the windmill or Chusan palm, *Trachycarpus Fortunei*. This palm finds good use in China where its leaves are made by peasants into hats and rain-proof capes, while its fibre provides rope for Chinese junks. It was first sent to England by one of the greatest plant-collectors (though not a Kew man) Robert Fortune, and a tall plant near the Main Gate at Kew is believed to be one of six plants received from him in 1849. Other younger plants are grouped near the Temperate House. Although they grow well, flowering and fruiting abundantly, these palms look strangely out of place in an English garden, as if perhaps they had strayed out of the glass-house on an unusually hot afternoon, and had found themselves locked out at closing time.

The great central room of the Temperate House provides a spacious setting for some of the finest palms. Chief among them is the coquito nut palm of Chile, *Jubaea chilensis*, a palm whose fronds brush the roof at 55 feet, with massive trunk 34 feet tall to the base of the leaves and 8 feet 11½ inches in girth 5 feet from the ground. This great palm is thought to date back to 1843, in which year a purchase of seed was made, and, during a large part of its life, it stood under the gallery of the house about 25 feet west of its present position. In 1938 its upward growth was being checked by the sloping roof, and a decision was made to move the palm into the centre where the height of the



38. *Jubaea chilensis*, the largest palm at Kew. Photograph by R. R. Zabeau.

house is greatest. To do this, the base of the palm, including roots and accompanying soil, was enclosed in wooden casing and the whole was slowly shifted inch by inch—no mean task for the total weight was reckoned to be 43 tons. In its native land this species is valued for its edible kernels or nuts. Charles Darwin, in the account of his voyage, describes how it is felled for extraction of the sap, which is then boiled to the consistency of syrup and eaten as palm honey. Later writers comment on the continued destruction of the palm to provide this Chilean delicacy.

Mention has been made of the tall palm *Rhopalostylis sapida*, with closely ringed trunk and stiff, erect, pinnate leaves, which is conspicuous in this house. Equally tall is a species of *Phoenix*, thought to be *P. reclinata*, with

single curving stem clothed with leaf-bases and topped by graceful feathery fronds. This palm is almost a centenarian having been given to Kew as a young plant in 1866.

Lord Howe Island, though small and distant, provides three elegant palms to grace the Temperate House, the *Hedyscepe Canterburyana* to which reference has already been made, and *Howeia Belmoreana* and *H. Forsteriana*. These graceful species with green, leaf-scarred trunks, and dark-green fronds, were at one time so popular as ornamentals in the nursery trade that the sale of seed from that island made a useful source of revenue for the isolated community.

The greater part of the palm collection is to be found in the Palm House where it occupies much of the high central portion, and shares with the screw-

pinces or Pandanaceae the north wing. The southern wing is filled with cycads or sago-palms, a collection of this order which is probably without rival in its variety and range.

Of the palms, the most striking perhaps, on account of the great size of its pinnate fronds, is the sugar palm *Arenga pinnata*. Although the plant in the Palm House is relatively young, with trunk little more than 3 feet high, its great fronds rise up 30 feet and more to the gallery of the house. This is a Malayan palm of many uses, a source of fibre, of toddy, and, most importantly, of sugar. The flow of sugary sap is induced by wounding and then by tapping the stalk of the male inflorescence. The juice, when boiled down, yields a dark impure sugar, much appreciated in the Far East.

Less handsome, but of greater economic value, is the African oil palm, *Elaeis guineensis*, a slow grower in the crowded conditions of the Palm House, whose fruits are a commercial source of vegetable fat and soap.

The palm reaching highest in the house is a species of *Calamus*, a rattan or climbing palm, whose stem is less than two inches thick at the base, but whose topmost frond is more than 50 feet up, almost touching the glass roof. The grace and elegance of this palm belie its aggressive character. The stem is thickly covered with black spines; the fronds, also spiny, have mid-ribs extended to form harpoon-like whips with reflexed barbs. Armed with these, the rattan scrambles upwards through the vegetation, intent only on raising itself above its neighbors into the sunlight.

Not much less in height are some palms of more independent habit, the *Ceroxylon* to which reference was earlier made, and a species of *Cryosophila*.

Occupying the centre of the house, a position it has had since 1878, is the Indian date *Phoenix sylvestris*, now a fine specimen with trunk about 21 feet high and total height of 36 feet. This species resembles the better-known date-palm, with its stiff blue-grey foliage, but is less valued for its fruit than for its leaves used for brooms and basketwork, its fibre made into rope, and its sap which in Bengal is boiled down to sugar on an extensive scale.

Attracting the eye by their shapeliness are two fine specimens of *Pritchardia pacifica*. Claimed by some to be without rival for its ornamental effect, this fan-leaved palm was found by Seeman, the authority on palms, in the islands of Fiji, and three seedlings were sent by him to Kew in 1864. This is no ordinary palm, for Seeman notes that, in the primitive life of the Polynesian islands at that time, the ownership and use of this palm were reserved for the aristocracy.

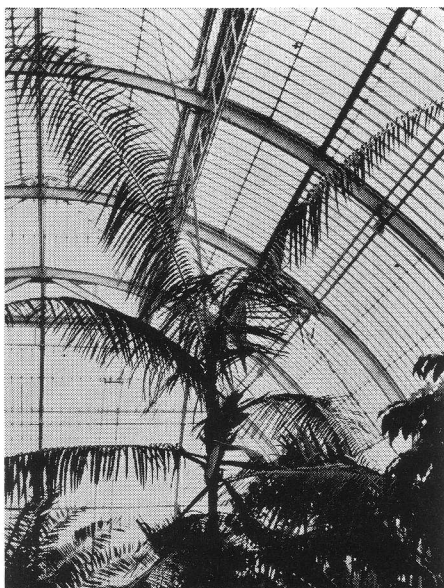
Another handsome fan-leaved palm, labelled as *Sabal Blackburniana*, recalls Lord Petre and his collection, for this name was first applied to a palm given by him to a Mr. Blackburne in 1737. The Kew specimen is indicated as coming from Bermuda (1), and is the palmetto which is so pleasing a feature of these islands. Other palms attracting attention in the Palm House include the Chinese fan-palm, *Livistona chinensis*, which grows rapidly and fruits readily in this house; the invaluable coconut, *Cocos nucifera*, of which there is a young plant; the fishtail palm, *Caryota mitis*, with its bipinnate fronds ending in wedge-shaped sections; and the Canary date, *Phoenix canariensis*, its crowded leaf-bases geometrically arranged on the stem.

The structure of the Palm House it-

¹And if so should be called *Sabal bermudana* [Ed.].

self has not remained unaffected by the passage of years. Some damage was suffered in wartime by bombs which, falling near though not on the structure itself, caused shattering of the glass. More disastrous than war-damage has been the corrosion of the iron-work fostered by a century of moist heat. This so weakened the framework that in 1952 the building was declared unsafe and was closed to the public. With dismay it was learned that the structure was considered beyond repair and would need to be replaced. Further tests indicated that repair might yet be possible and a major restoration was started in 1955. Section by section, the glass was removed, the girders strengthened by welding of steel plates, and all the iron-work cleaned from rust and treated. In replacement of the glass, longer curved panes, admitting more light, were inserted. When this was done, it was possible to see the grace and lightness of Burton's design revealed anew.

On May 29th, 1959, during the commemoration of the 200th anniversary of the Gardens at Kew, Her Majesty Queen Elizabeth visited the Palm House which her ancestor Queen Victoria had viewed with so great interest during its con-



39. Armed with hooks on its leaves, the rattan scrambles above its neighbors. Photograph by R. R. Zabeau.

struction 111 years before. In re-opening the doors to the public, the Queen at the same time opened a new chapter in the story of Burton's Palm House, and one which all concerned hope will be prosperous and make for progress in the knowledge and appreciation of the family of Palms.

Daddy of the Palm Canyons

RANDALL HENDERSON*

Within a radius of 150 miles of my home town of El Centro, California, I have tramped the length of many palm canyons—and now I have found the daddy of them all.

It is in Baja California, approximately forty miles south of the boundary established many years ago when United States and Mexico settled their dispute over the ownership of 1500

miles of rich coastal terrain along the Pacific. United States got Alta California, and Mexico retained the peninsula, designated by the Jesuit padres as Baja California.

The palm trees which grow wild in the southwestern sector of the Great American desert do not know anything about boundary lines. I have found many lovely oases on both sides of the international border.

The best known and largest forest of palms on the Alta California side of the

*Reprinted with permission of *Desert* from *The Desert Magazine*, June, 1948. Photographs by the author.

line is the famous canyon at Palm Springs where between 3,000 and 4,000 washingtonias extend along a tiny stream for seven miles. Many thousands of visitors go to Palm Springs every year to marvel at the scenic beauty of this gorgeous canyon. (*Desert Magazine*, Jan. '41).

But Baja California also has its champion palm canyon, although few visitors, even among the Mexicans, have ever been within its rocky walls despite the fact it is only 50 miles from Mexicali's 40,000 population.

The daddy of the Mexican palm canyons, as far as my explorations have gone, is Tajo—*Cañon del Tajo*. The word means cut or opening in a mountain. It is a pretty name, but it does not do full justice to the great gorge which slashes through the western slope of the Sierra Juarez range and empties its periodic storm waters onto the normally dry floor of Laguna Salada, the great inland basin just south of California's Imperial Valley. Tajo really is the *Gran Cañon de la Sierra Juarez*.

My first glimpse of this spectacular canyon was 11 years ago when Malcolm Huey and I maneuvered our jalopies far up into the rocky fan which spreads out at the mouth of the gorge. We spent a day hiking along an old cattle trail which led up into the canyon. Four miles from our parking place we came to a little stream with an occasional palm tree on its banks. Two miles above where the first palm was seen we found an old Indian cave with pictographs in a sheltered crevice. It was growing late, and there we turned back. One day was not long enough to get acquainted with this canyon.

Later I told my friend Dr. Warren Fox about those pictographs, and being an amateur archeologist, he gave me no peace until we had arranged a trip to

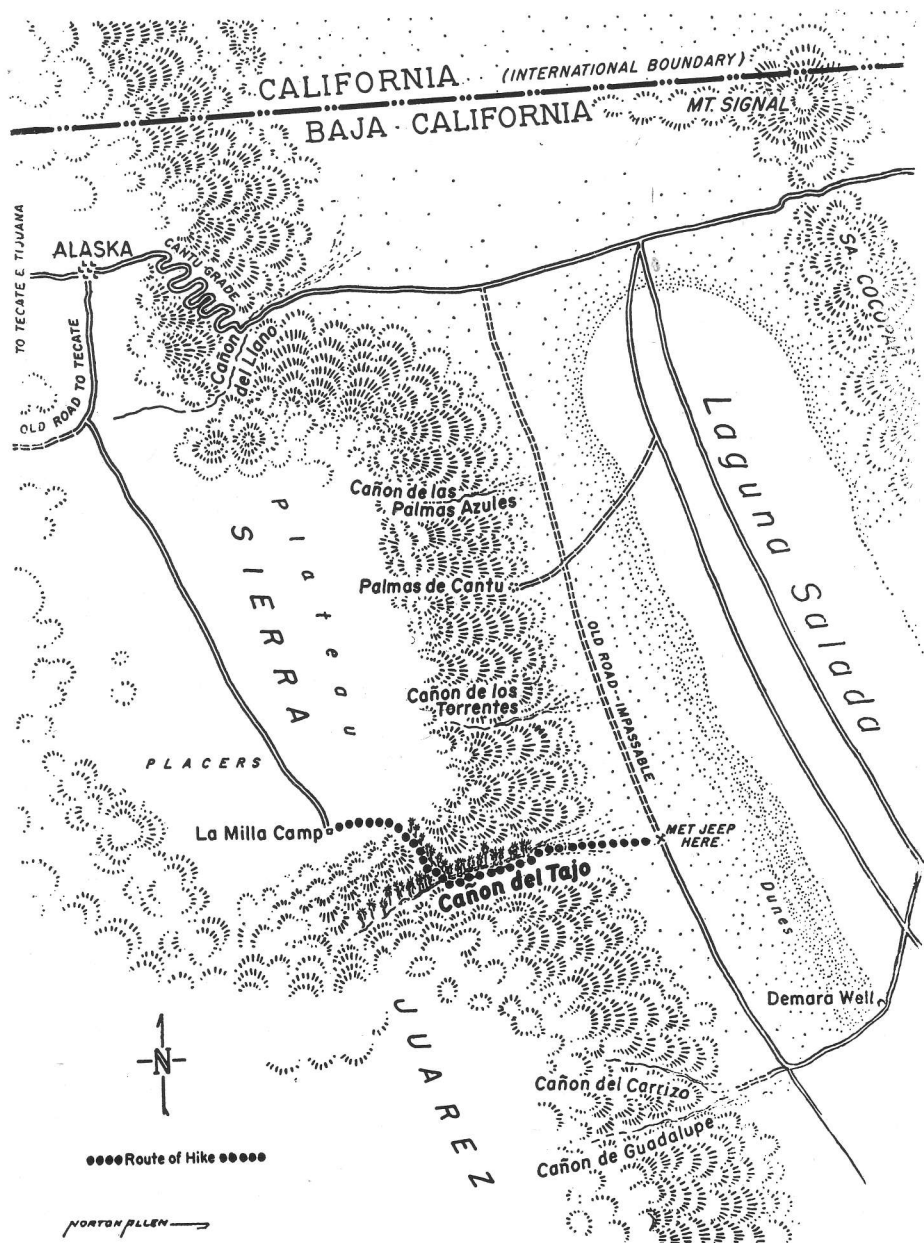
the cave. We backpacked our sleeping bags up the canyon and slept that night in the cavern. Then while he roamed over the rocky slopes looking for prehistoric campsites and artifacts, I hiked up the canyon to become better acquainted with the palm forest.

The doctor found abundant evidence of Indian occupation, but no artifacts worth bringing home. I had not gone far before I realized that most of the palms in Tajo canyon were of a different species than the *Washingtonia filifera* which grows so plentifully on the California desert to the north. The Tajo palms were of the fan type, but of shorter stature, and their fronds had a blue-white cast I had never seen on the Alta California trees. Then I came to one with a great cluster of fruit as big as marbles and about the same color as a green olive. Since the fruit of the *Washingtonia* is the size of peas, and almost black in color, I knew I had found a botanical stranger.

I brought out some of the fruit and frond stems and sent them to Don Admiral, botanist at Palm Springs. He relayed them through friends to Dr. L. H. Bailey of Cornell University, leading authority on the palm family, and in fact on all botanical subjects.

Several months later, on one of his periodic trips to the West coast, Dr. Bailey asked me to guide him to the canyon for positive identification of the trees. We made the trip on a hot May day, yet despite his 79 years the scientist hiked the eight-mile round trip into the canyon with amazing agility, and along the route entertained us with stories of botanical discoveries all over the world.

Dr. Bailey confirmed what he already had suspected—that these were the blue palm *Erythea armata*, a native of the Lower California and Sonora deserts.



40. The author's route in Tajo Canyon.

This palm has spread from its southern habitat almost to the California border—but has never jumped the line. Since then I have found them within 15 miles

of Alta California, but never have discovered a single tree in the many palm canyons I have visited north of the border.

Although I have made three trips into this canyon, my journeys had never extended beyond the lower portions of it, and I looked forward to the opportunity of exploring its full length.

Later, comparing notes with Arles Adams, I learned that he also was eager to make the trip. Arles had looked down into the canyon from the top of the Sierra Juarez range, and had seen miles of palms extending along the winding floor of the gorge. "I believe there are thousands of them," he said.

We agreed that a round trip up the canyon and back to our starting point could not be made in a day. And neither of us relished the prospect of carrying bedding and food for a two or three day backpack up along that rocky floor to the mile-high headwaters near the top of Sierra Juarez.

We solved the problem by arranging with Walter Gatlin to ferry us to the top of the range, which was accessible by a passable jeep road, and then meet us at the bottom the next day. We would make a one-day trip of it—downhill all the way.

It was April 12 last year when we crossed the international line at Calexico, port of entry for the adventure. In addition to Walter and Arles our party included Bill Sherrill and Luther Fisher of the U.S. Border Patrol.

From Mexicali we followed the old Cantu road toward Tecate and Tijuana. The first 38 miles was a fair dirt road through the cotton and grain fields of the Colorado River delta and across the floor of the desert to the base of Sierra Juarez.

When former Governor Cantu gave his engineers instructions to build this road in the early days of the present century, he evidently told them to get to the top of the mountains by the shortest pos-

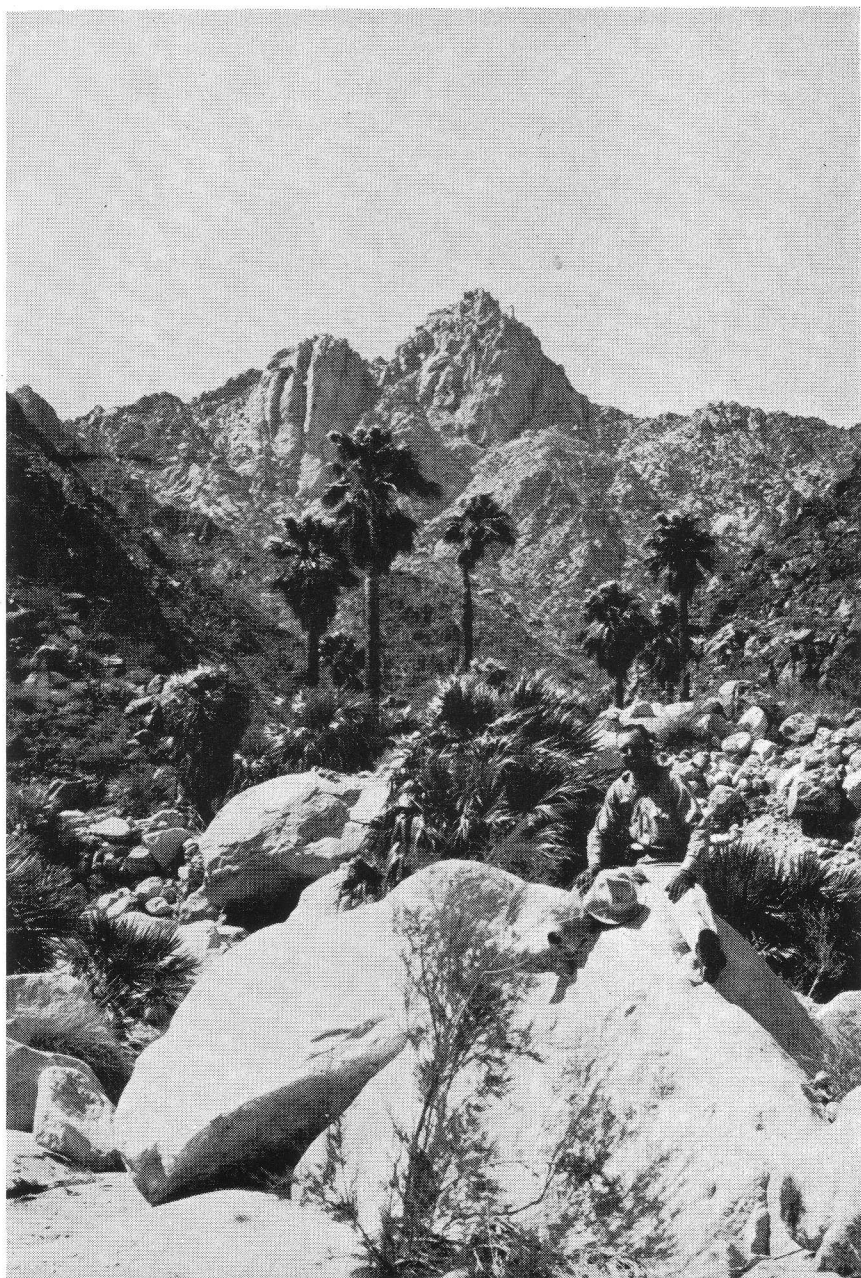
sible route. They did just that. They zig-zagged right up the face of the steepest slope they could find, and between the zigs and zags they put in hairpin turns which are easy enough for a burro, but somewhat awkward in places for a modern automobile. However, Mexican truckers and stage drivers go over the road daily, with surprisingly few casualties. It was easy for the jeep, but I would not recommend this road for tourists.

At the top of the grade is Alaska, so named by former Governor Abelardo Rodriguez who built a summer palace for his territorial government at the 4,500-foot elevation. Alaska has long since been abandoned as a summer residence for territorial officials, but there remains a little settlement of Mexicans and two tiny stores to serve passing motorists.

South of Alaska the Sierra Juarez extends for 50 miles as a great pinyon-covered plateau. In the 1880's placer gold was discovered in the decomposed granite which covers this plateau, and power equipment was later brought in to recover the gold on a big scale. The field has long since been worked out, and only an occasional prospector goes there to pan among the great piles of waste material deposited by power shovels. Driving along the road through the pinyons one passes scores of abandoned campsites and quantities of rusting equipment.

The placer area covers many square miles, and its main camp is today referred to as La Milla, the mile, or El Topo, the top. The elevation there is just a mile.

From Alaska two roads take off across the plateau, one going west to Tecate, and the other south to La Milla, a distance of 25 miles. We arrived there



41. Granite peaks tower above the palm forest in Tajo canyon.

late in the afternoon and camped that night in the shelter of a huge block of rock that stood near a little pond fed

by a spring—the headwaters of Tajo canyon. The landscape here was cluttered with the debris of a long-aban-

doned mining camp—timbering, pipe, the wrecks of automobiles of the Model T era, and before. Everything of value had been taken away, but a huge scrap-pile remained to mark the site.

That evening Arles broiled our steaks on an old stone fireplace which probably had served Mexican miners 50 years ago. And before them, the Indians had camped by this spring for in a large flat boulder which served as a windbreak for my sleeping bag were the grinding holes used by aboriginal women to prepare their meal.

Before dark we climbed a 600-foot dome near the camp to plot our route across the plateau for tomorrow's trip to the head of the canyon. There was a cairn on top the granite dome, and we left a record of our expedition in the usual tobacco can.

Walter Gatlin camped with us that night, then departed at daybreak for his return trip down Cantu grade and across the floor of Laguna Salada for the rendezvous we were to keep at the end of our canyon journey 12 hours later.

From the top of the dome we had been able to trace the shallow arroyo in which our camp spring was located to the point where it entered a cleft and then dropped down the side of the mountain to the floor of the desert beyond. This was Tajo canyon.

After Walter departed we shouldered our light backpacks containing lunch and camera equipment and set out along the watercourse. Occasionally we saw where recent prospectors had dug down through the sand to bedrock, evidently on the theory that since this arroyo drained a field once rich in placer gold, there should be some color in the drainage channel. It was a plausible theory, but the test holes evidently had

not yielded a satisfactory showing of gold for they had been abandoned.

For a while we followed a gentle grade through a luxuriant growth of mountain vegetation. Then as the streambed dropped away more rapidly granite walls rose on both sides, and soon we were in the bottom of a V formed by cliffs many hundreds of feet in height.

Then suddenly the canyon floor dropped over an almost vertical fall of 50 feet. Standing at the top of this fall we could see a series of them below, as if some prehistoric giant had hewed great steps on which to climb the side of Sierra Juarez at this point. A tiny stream of water trickled over the precipice. Around this waterfall and the others below we were able to detour without undue hazard. Working around one of these falls I saw a ledge of quartz thickly embedded with black tourmaline crystals, some of them $\frac{3}{4}$ inch in diameter. There is much of this black tourmaline in the Sierra Juarez, but it is not of gem quality, and this occurrence was at a point where we were too busy clinging to the face of the cliff to be interested in gem collecting.

We had worked our way around three of these falls—and then I saw the first palm tree. It was a healthy blue palm 30 feet high growing in a lovely setting. At its base were ferns, and on the mountainside nearby were mountain lilac in blossom, wild apricot in fruit, ribbon-wood or red shank, scrub oak, pinyon, *Rhus ovata*, agave and buckthorn cactus. My altimeter showed 4,600 feet—and this is the highest point at which I have ever found a native palm growing in the Southwest.

Then we passed a four-foot palm of the *Washingtonia* species, and below that a tree so unusual as to leave a permanent imprint in my mind. It was a blue



42. The blue palm, *Erythea armata*, produces a heavy crop of fruit, each "date" about the size of an olive. When the fruit dries the seed becomes as hard as chalcedony.

palm, a giant of the species such as I have never seen before. Slender and naked as a flagpole it stood there along with a tiny topknot of fronds at its

crown. Members of our party guessed its height to be all the way from 45 to 60 feet, and my estimate of its age would be 200 years. Because it was twice the

height of any blue palm I have ever known, it will take its place in my mental picture gallery with a few others of conspicuous charm—the Queen palm in the narrows of Andreas canyon, the Hunchback palm of the Borrego badlands (Desert Magazine cover, Dec. '37), the gnarled Old Man palm growing on the vertical sidewall at the entrance to Magnesia canyon back of Rancho Mirage, and the Sentry palm in Palomar canyon. In my notes I recorded this majestic palm as “The Chief.”

Below this there were increasing numbers of palms, but it was not until we had dropped below the 4,200-foot level that they appeared in forests. Here also was more mountain lilac wearing its lavender plumes, and wild currants with the fruit turning pink.

At 9:40 we had descended to 3475 feet, and I took a picture of three Indian grinding holes on the top surface of a great granite boulder. We passed a mesquite in bud—at just the right stage for a mesquite roast. It resembles nothing so much as a greatly enlarged asparagus head, from 1½ to two inches in diameter, projecting a foot or more above a cluster of dagger-like blades. It is a delicate procedure, going in among those daggers to gouge the bud out of the heart of the plant. The Indians used a sharpened stick three feet long or more, and then roasted it in a pit lined with hot rocks. Bill Sherrill harvested this one with his hunting knife, but when he announced he was going to take it home and roast it in the family oven I lost interest in his culinary adventure. I am sure Marshal South will share my disapproval of this unorthodox method of roasting mesquite.

At 12 o'clock my counter showed 1,554 palms, and we came to a junction where a tributary from the south brought in a large stream of water. Ac-

tually, I do not know which is the main canyon above this point. The stream coming in from the south carried a larger volume of water than the one we had been following. Perhaps we had been descending a tributary. I do not know. But looking up the other canyon I could see that its channel was lined with palms as far as the eye could follow it.

Down to this point we had seen only an occasional *Washingtonia* among the blue palms. But *W. filifera* now became more plentiful, although *E. armata* continued to predominate.

A half mile below the junction of the two canyons a great block of granite stood squarely in the middle of the gorge. There was a cave beneath it, and on a level platform of stone outside the cave were 24 grinding holes—the most I have ever seen in one boulder. We ate lunch here, and would have liked nothing better than to spend the afternoon exploring this old campsite for relics of its prehistoric dwellers. But there were miles yet to be covered before we would be out of the canyon.

At the 1,280-foot elevation we passed another conspicuous campsite—a sandy bench where the ground was covered with broken pottery. The sidewalls of the canyon at the lower elevations were sprinkled with elephant trees. I have often wondered whether the Indians ate the rather bitter fruit which grows on this tree.

Also, I am curious to know whether or not the Indians found the fruit of the blue palm palatable. If they did, then this canyon would provide a grand feast for the aborigines during March, April and May. For this palm yields a generous crop of “dates.” They grow in great clusters, some trees bearing as much as 125 pounds of them. We came through the canyon at the peak of the fruit season and saw literally thousands



43. *Washingtonia filifera* extends below the border into Tajo canyon.

of tons of fruit hanging in clusters, often so close to the ground it easily could be picked.

The fruit consists of a seed as big as a marble, covered with a thin green skin. When it matures the skin turns brown.

I brought some dried seeds home and tried them in the nut-cracker. It would not even put a dent in them. Then I tried the hammer, and it required a heavy blow to crack one open. The meat is about the color of chalcedony, and about as hard. If the Indians ate them I am sure it was only during their green stage. There is little flavor to the green nut, but the Indians who roamed this desert country ate food for nourishment, not because it pleased their palates. And their tasting apparatus had not been traduced by many generations of pie and ice cream and chocolate pudding. Perhaps these blue palm seeds were good eating—to an Indian. And I hope they were, for it would seem a pity that such a prolific crop of fruit should forever have been wasted.

At 4:30 in the afternoon we came to the place where the last trickle of water seeped into the sand, and here also we saw the last of the palms. Cattle which graze on the bajada along Laguna Salada had beaten a path up to the water—and we followed this trail another four miles before we reached Walter and the jeep. We met him just at dusk.

We estimated the hike from La Milla at 15 miles—and it had taken 12 hours to make the trip. We had counted palms along nine miles of the 15. Arles and I both carried mechanical counters, but we had seldom compared notes during the day and it was gratifying and rather surprising to both of us when we compared figures at the end of the trail. His counter showed 4,444, mine 4,518. And if you don't think that is amazingly close, you do not realize the difficulties involved in tabulating palm trees while scrambling over boulders and down waterfalls along nine miles of a canyon which loses a mile of altitude in 15.

Along the way we got glimpses of many palms in tributary canyons—but

there was no time to explore them on this trip. In the entire Tajo canyon system there are perhaps twice as many as we encountered along our route. We were in close agreement on another estimate—that fully 80 per cent of the trees in the canyon we traversed were *E. armata*—the blue palm.

If the commissioners who established the boundary between Baja and Alta California had moved the line a few miles further south, and left Tajo canyon on the northern side of the border, I am sure this canyon would long ago have been set aside as a national monument. Flanked in its upper reaches by colorful domes and battlements which rise 1,500 feet above the floor of the canyon, exhibiting a gorgeous botanical variation that ranges from Lower Sonoran to the Canadian zone, broken with waterfalls which make sheer drops of 10 to 50 feet, and set with lovely pools which carry the reflection of both palm and fern, this canyon with a trail to make it accessible would be a mecca for botanists and photographers and hikers.

But there are too many lovely places on this earth for all of us to see all of them, and perhaps it is just as well for the present that Tajo should enjoy the protection provided by its inaccessibility. The beauty will be there — even though human eyes seldom look upon it, and half the fun of living is in dreaming of the places we would like to go—and sensing the fact that Nature is preserving the charm of these hidden beauty spots for the day when perhaps we may have the opportunity to see them.

NEWS OF THE SOCIETY

Seed Bank

Thanks to the generosity of a new member of the Society, Mr. Donald Anderson, Superintendent of the H. L.

Lyon Arboretum, Honolulu, Hawaii, and of his volunteer helper, Mr. C. W. O'Nan, Seed Bank members and a good many others have received seeds of two heretofore little-known palms: *Calypstrocalyx spicatus* and *Pinanga patula*. Thinking that all of us would appreciate some further information regarding these palms, your secretary wrote to Mr. Anderson, requesting descriptions and photographs. He very kindly responded with quotations from the Royal Horticultural Society *Dictionary of Gardening* which have been modified by the Editor of PRINCIPES:

PINANGA, from a local name *pinang*, is a genus of 100 or more species native from India to New Guinea in the Asiatic tropics. Plants are generally of low stature with unevenly pinnate or only bifid leaves having tubular sheaths, and inflorescences borne below the leaves. A single spathe encloses a simply branched often recurved inflorescence with flowers usually in 2 to 6 vertical ranks, the males asymmetric with pointed long petals, and yellow to red ovoid or elliptic fruits. Propagation is by seed, and this has ruminant endosperm. A compost of 1 part loam, 2 parts peat and a little sand is said to suit them. They require abundant water and at least partial shade for best growth. *P. patula* from Sumatra is a low cluster palm about 9 feet high with unevenly divided leaves, red fruiting inflorescence and orange-yellow fruits 2/3 in. long.

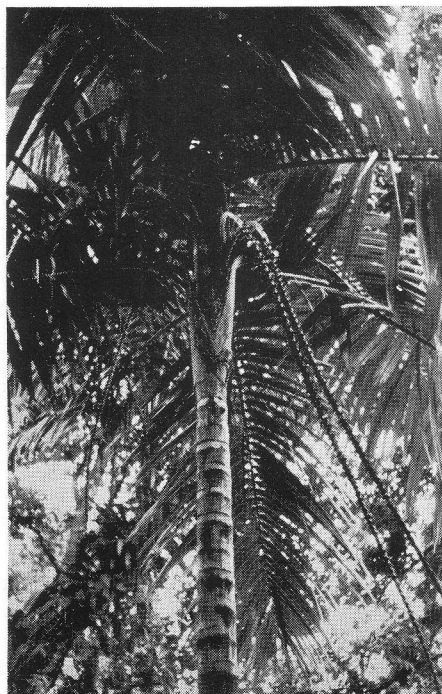
CALYPTROCALYX is a genus of perhaps 16 species native in the East Indies. The stems are usually solitary bearing a crown of pinnate leaves from among which the pendulous spicate inflorescence branches appear, each enclosed by a tubular spathe and often several together within another bract. *C. spicatus* from the island of Amboina reaches a height of about 12 feet.



44. *Pinanga patula*. Photograph courtesy T. Satake.

Regarding photographs, he writes: "Your request for pictures of these palms, in the H. L. Lyon Arboretum, will be complied with as soon as the weather permits. The pinangas are in a forest-like planting under a canopy of leaves and branches forming deep shade. The *Calypstrocalyx* is in a little more open section, but both will require a very bright sunny day, even with flash or strobe light and the use of a fast film. The Arboretum is situated at the end of Manoa Valley and partly on the slopes of Mount Tantalus, where the rainfall is well over 200 inches each year, and there is hardly a day passes that we do not have rain . . . The *Calypstrocalyx* is now about 15 ft. high and about 30 years old. The pinangas range in various heights up to about 12 ft.

"It may be of interest to you to know our experience in germinating seeds of these palms. We put down 73 seed of



45. *Calypstrocalyx spicatus*, courtesy T. Satake.

Calypstrocalyx spicatus Dec. 8, 1961; germination showed Jan. 23, 1962. Germination appears good, regular, but growth is slow. The pinangas have been very slow and irregular in germination, usually extending over a period of months. Our propagation is done in a glasshouse, with no artificial heat, but with the usual day and night temperatures, closely approximating the conditions where the palms are growing. We use a germination medium of 2/3 peat-moss and 1/3 compost, kept slightly on the wet side."

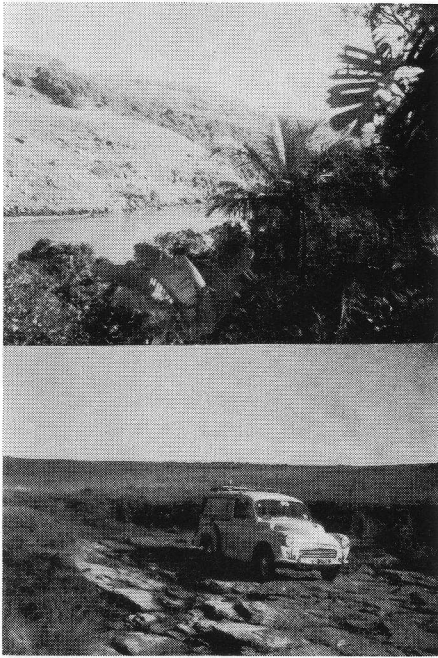
Since writing this letter, Mr. Anderson has sent the Society seven color transparencies of the pinangas, which have been placed in our lending collection of slides. Residents of and visitors to southern Florida may see a specimen of *Calypstrocalyx* at the Sub-Tropical Experiment Station, Homestead.

Mr. Hein Wicht, a member living in Durban, Natal, South Africa, made a hazardous trip to Pondoland in search of seeds of the Pondoland palm or "dwarf coconut," *Jubaeopsis caffra*. This trip was unsuccessful, as seeds were found to be immature. On 15 November, 1961, he wrote:

"I am just back from a second trip to Pondoland. This time I visited the Msikaba river, the more southerly home of the *Jubaeopsis caffra*. (You will recall that the genus is found on the banks of only two of the many Pondoland rivers). The lagoons are 5½ miles apart and very similar in appearance. The palms grow only on the north banks—probably because they seek shelter from the humid north-east wind—among rocks where water trickles down the steep cliffs. There is a large grove about half a mile upstream in the Msikaba. In the Mtenta—the northerly river—the trees are more scattered, but occupy a similar rocky situation. In both places the palms are surrounded by thick clumps of *Strelitzia augusta*, making photography difficult.

"By courtesy of the Superintendent of the Leper Station, I was able to take to the river in a dinghy rowed by two Pondo tribesmen. The grove is established on an almost vertical cliff-face, but the two "boys" scrambled ashore and returned from their climb with a hatful of fresh seed and one or two seedlings which had germinated in leaf-mould. I can spare about 5 dozen of the seeds and would like them to go to the U. S. where palms are properly appreciated . . ."

The Seed Bank spent about \$20.00 on air-freight for these seeds, which was recovered by selling the seeds for just enough to cover the costs. Members who received them were more than glad to pay extra for these very rare seeds, and



46. *Jubaeopsis caffra* on the banks of Pondoland river (above) and the "road" to Pondoland (below). Photographs H. Wicht.

we thank Mr. Wicht for sharing them with us. Those who want to read more about *Jubaeopsis caffra* are referred to PRINCIPES, Vol. 1, pp. 180-182, and Vol. 3, pp. 103-106. Smith, in Vol. 2, p. 125, lists it among the hardier palms at Daytona Beach, Florida.

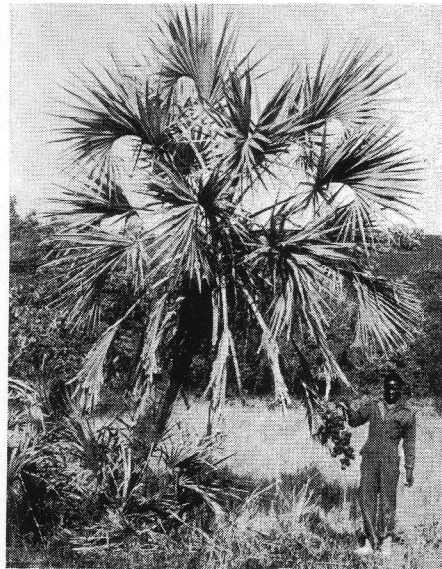
Mr. Wicht has shipped seeds of the Ilala (*Hyphaene crinita*) by surface mail, and they should have arrived by the time you read this. He states that these seeds are quite long-lived. Seed Bank members who wish some of these seeds may write to me. Mr. Wicht states that these palms are "indigenous to the South African Republic, growing on the eastern shores as far south as approximately 32 degrees S. L. This palm covers wide areas of grassy hillsides all along the coast, with strange gaps where it is not found. I have not yet decided how the seeds are distributed by nature; I

can find no animal or bird which feeds on them at any stage of their growth. In the Republic, the core of the nut is not made use of, but in Rhodesia the natives use it to make tourist trinkets. It looks much like ivory. The leaves of the palm are in great demand for basket-making, and from the sap a refreshing beverage is made, which later becomes highly intoxicating. The seeds take a long time to germinate, and the palm develops a long tap-root. I have never been able to transplant even a small specimen successfully, perhaps because I've never had the energy (or sufficient labour) to dig a large enough hole. Many of these palms actually have branches; all are multi-stemmed. The picture shows a specimen growing wild near my fishing lodge at Mtunzini, Zululand."

* * *

The Seed Bank would be very pleased to receive short reports on the success or non-success members are having in germinating seeds from the Bank.

LUCITA H. WAIT



47. *Hyphaene crinita*. Photograph H. Wicht.

THE EDITOR'S CORNER

Dr. Meijer has written that credit for the photograph of *Corypha* on page 23 of the last issue should go to Mr. L. L. Forman of the Royal Botanic Gardens, Kew. Another member of the staff at that institution, Mr. T. A. Russell, is a new contributor to PRINCIPES. He be-

came acquainted with palms during post-graduate training in Trinidad but had particular experience with *Sabal bermudana* as Director of Agriculture in Bermuda, and with *Elaeis guineensis* as an agricultural botanist in Nigeria. Mr. Russell is now an economic botanist at Kew and is interested in *Raphia*.



48. *Johannesteijsmannia altifrons* at Singapore Botanic Garden. Photograph C. X. Furtado.

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