

long, to  $2\frac{1}{2}$  in. wide; the lower are shorter and narrower.

Inflorescences, borne below the leaves, are encased in a single deciduous orange to yellow two-edged bract about 14 in. long, 3 in. wide. The entire inflorescence may measure nearly a foot in length and is canary yellow in flower with the lower rachillae once-branched, the upper unbranched. Flowers are

borne in spiralled clusters of two male and a central female except toward the tips of the rachillae where male flowers alone occur. The latter are about  $\frac{1}{4}$  in. long with 6 stamens. Yellow female flowers are about the same length as the male and have the sepals united at the base. These, with the petals, form a yellow cup about the base of the inch-long shining red fruit.

## Palms of Africa

P. B. TOMLINSON

Compared with the American and Eastern tropics, in which extensive speciation of palms has taken place, the palm flora of continental Africa is poor. In fact, that of Madagascar, the Seychelles and Mascarene Islands of the Indian Ocean is much richer than that of the whole of the African continent and shows a much greater degree of endemism. This is but a general reflection of the poverty of the whole African flora compared with the rich floras of tropical America and particularly of the Malay Archipelago. Plant geographers have not explained this fact satisfactorily apart from making the suggestion that the flora of tropical Africa is a relatively young one in which evolution of new plant forms has not been proceeding for as long a period as in other parts of the tropics.

Comparing the palm flora of Africa with that of the rest of the world, it is evident that it is made of outliers from richer palm floras elsewhere. The subfamily Borassoideae is the best represented group and three (*Borassus*, *Hyphaene* and *Medemia*) of its seven genera occur in Africa. Of the remaining genera *Bismarckia*, *Lodoicea* and *Lantania* are restricted to Madagascar and the nearby islands of the Indian Ocean, while *Borassodendron* is Malayan. *Medemia* is entirely African. *Borassus* in

West Africa represents the westerly limit of this genus which extends eastwards as far as New Guinea. *Hyphaene* has its maximum development in East Africa.

*Phoenix*, which is the sole member of the subfamily Phoenicoideae, has three of its twelve species in Africa, most of the others being in Asia Minor and the Indian continent. The subfamily Lepidocaryoideae has its center of development in the Eastern tropics but is represented in Africa by four genera of scandent palms and by *Raphia*. *Ancistrophyllum*, *Eremospatha* and *Oncocalamus* might be thought to represent an African offshoot from the group of scandent palms of Malaysia, but their different leaf morphology suggests that they may have had a separate origin. The fourth scandent palm, *Calamus deerratus*, is the sole African representative of the genus *Calamus* which has very many species in the Indo-Malayan region. *Raphia* is probably the largest genus of African palms and elsewhere is represented only in Madagascar, together with a single species, *R. taedigera*, in South and Central America, which forms one of the rare links between the palm floras of America and Africa.

*Elaeis* and *Jubaeopsis* are the only two African genera of the subfamily Coccoideae, although they seem but dis-

tantly related. *Elais* is rather isolated in a taxonomic sense and includes *E. guineensis* of West Africa. *Jubaeopsis* is a recently discovered palm of South-East Africa which is said to have affinities with the Chilean *Jubaea*.

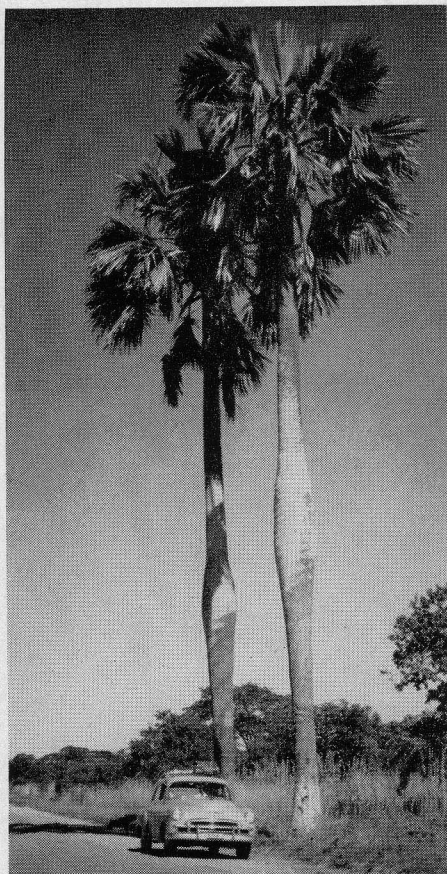
The Coryphoideae are imperfectly represented in Africa. *Chamaerops humilis* is a small Mediterranean palm which occurs on North African shores as well as in Southern Europe. *Wissmannia* is a little-collected palm of Arabia and Somaliland which was at first associated with *Hyphaene* in the Borassoideae.

The group *Areceae* in Drude's sense is not represented in continental Africa, which is very surprising because many of its genera are endemic to Madagascar, the Seychelles and Mascarene Islands, e.g. *Acanthophoenix*, *Deckenia*, *Dictyosperma*, *Dypsis*, *Neodypsis*, *Nephrosperma*, *Phloga*, *Roscheria*, *Stevensonia*, *Vershaeffelia* and *Vonitra*. However, there are two small palms of forest shade and swamp in the Congo Basin, *Podococcus* and *Sclerosperma*, which have some affinity with this group. Even so, they are rather isolated and the nearest relationship is probably with *Geonoma* and allied genera from South and Central America.

Apart from these indigenous palms, the coconut, *Cocos nucifera*, is cultivated and abundant on both western and eastern coasts of tropical Africa, as indeed it is on all tropical seashores. Although the true home of the coconut is in dispute, the main choice lies between American and the eastern tropics, and it is certainly not African. *Areca Catechu*, the betel-nut palm, is cultivated in East Africa.

In spite of this small palm flora, its study is not easy because its members are widely scattered, imperfectly collected and occupy a variety of habitats. The wide distribution and sparsity in

species are evidence that African palms were originally derived from the richer palm floras of America and Asia and only *Hyphaene* and *Raphia* have undergone marked speciation within tropical Africa.



56. African fan palm, *Borassus aethiopum*, near Lusaka, Rhodesia. Photograph by W. H. Hodge.

### The Ecology of African Palms

One can divide the palms of Africa, very roughly, into two groups according to their ecological preferences. One group, which includes *Borassus*, *Hyphaene*, *Jubaeopsis*, *Medemia*, *Phoenix* and *Wissmannia*, consists of those palms which are tolerant of dry, exposed situations and are never found in dense for-

est. They show various xeromorphic features, particularly in the anatomy of the leaf. The second group includes *Podococcus*, *Raphia*, *Sclerosperma* and the scandent palms which are all forest inhabitants and intolerant of exposed situations. Most of them, in fact, will only grow in the more swampy parts of lowland forest. *Phoenix reclinata* is somewhat intermediate between these groups because although it will grow in full sun it always occupies marshy places which are often inundated during the wet season. *Elaeis* is the least conservative of African palms and will occupy a wide variety of habitats. It will grow in quite dense secondary forest but on the other hand will also flourish in exposed, but not too arid, situations. Some small *Raphia* species grows outside the forest, but always beside water courses or in savanna swamps. Even so, many African palms are remarkably adaptable so that peculiar admixtures may be found. I have seen *Raphia sudanica*, *Phoenix reclinata*, *Elaeis*, *Borassus* and planted *Cocos* all growing near together in and around a small savanna swamp in northern Ghana.

### The Genera of African Palms

#### Subfamily Borassoideae

*Borassus*: This genus is represented in Africa by *B. aethiopum* (African fan palm), formerly considered to be only a variety of the Indian *B. flabellifer*. It has tall, columnar, solitary stems and large palmate leaves. It is widely distributed in Tropical Africa as far west as Mauretania, and this also represents the most westerly limit of distribution of the genus as a whole. Eastwards, *Borassus* extends as far as New Guinea where it is represented by *B. Heineana* and such a wide generic distribution is unusual amongst palms. *B. aethiopum* is common in open secondary forest and savanna, where it often forms extensive

groves. Like all members of its tribe it is dioecious and at a distance male trees can often be recognized because they mostly retain the old leaf bases. In female trees the large axillary fruiting branches possibly cause the early leaf fall. Also the timber of female trees is supposed to be much more termite-resistant than that of male trees, which is a useful property in tropical Africa. As in some other palms, the columnar stems often have a distinct swelling some distance above ground level apparently resulting from a period of vigorous vegetative growth at the stem apex. Two, or even three, successive swellings may be developed. I am told that the Asian *B. flabellifer* never shows these swellings. The African fan palm is not used so extensively by native people as is its Asian cousin. It is tapped to some extent for palm wine and its timber has limited uses. The pulpy pericarp of the fruit is sucked for its sweet sap and the fleshy hypocotyl of young seedlings is sometimes eaten. The "cabbage" is also edible. The leaves are used for thatch and the dried lamina is a raw material for plaited work.

*Hyphaene*: This is a large genus with over twenty species, most of them African but with some occurring in Arabia and India. They are known as doum or gingerbread palms. The leaves are costapalmate. The species are divided into two groups by the habit of the stem. In one group the stems remain unbranched whilst in the other the aerial stems become dichotomously branched in a very characteristic manner; in fact, such branching is not known to occur naturally in any other palms. In both groups the erect stems appear to be somewhat caespitose and may sucker at ground level. Although these palms flourish only in dry areas and never grow in dense forest, they themselves may form dense stands. The majority

of species occur in central and East Africa, Sudan and Upper Egypt, but *H. guineensis* extends westwards as far as Northwest Nigeria and it is sometimes met with farther west around villages in northern Ghana where it has been introduced, probably because of its ju-ju value. *Hyphaene* is dioecious but the fruits are much smaller than those of *Borassus*. The leaves are used for thatch and plaited into domestic ornaments and the trunk may have local uses. The hypocotyl of the seedling is edible and seeds are often earthed up in quantity to produce this vegetable. The endosperm of ripe seeds is horny and forms a local "vegetable ivory." *Hyphaene* gets its name, gingerbread palm, from the pericarp of the fruit although the similarity of this to gingerbread is one of consistency and general appearance rather than one of taste and palatability.

*Medemia*: This genus is allied to *Hyphaene* and contains two species of which *M. argun* is best known. It resembles an unbranched species of *Hyphaene* and is restricted to a few dry localities of North-east Africa.

#### Subfamily Phoenicoideae

*Phoenix*: Three species of *Phoenix* are known from the African continent and a fourth, *P. canariensis*, of the Canary Isles. *P. dactylifera*, the date palm, is extensively cultivated in North Africa. The date is important to many North African peoples (and their animals) as an article of staple food, since it will flourish in areas which are too dry for the existence of other food plants. The date palm today only exists in cultivation and although its true home is unknown it is doubtful if it originated on the African continent, but most probably it is a native of Asia Minor. It is little grown south of the Sahara although it will flourish there, since occasional plants are found, probably

having been introduced by Arab traders. I have seen at least one fine tree in Northern Ghana.

*P. reclinata* is the most common African *Phoenix* and is widely distributed in tropical Africa as far south as Natal. It is a caespitose palm whose stems rarely exceed 15 feet and it forms small thickets protected by the spinous leaflets of the leaf bases. It is most well known in swampy areas near the coast, but is equally common in similar situations inland. It is little used, although it may occasionally be tapped for palm wine and the dried leaflets are plaited into mats and baskets. *P. abyssinica* of Eritrea is considered by Drude to be a distinct species.

#### Subfamily Lepidocaryoideae

*Raphia*: Except for representatives in Madagascar and one species in South America, this large genus is entirely African. The American species, *R. taedigera*, seems to be most closely related to *R. vinifera* of West Africa. The palms form dense, almost pure stands in swampy parts of lowland forest and produce a dense carpet of erect negatively geotropic roots above the surface of the water in which they grow. The leaves of *Raphia* are the longest known to be developed by flowering plants, and those of some species have a recorded length of over fifty feet. The stems of forest species are often quite tall and may be tufted or solitary, but it is often difficult to decide the true habit of a *Raphia* because of the numerous fallen fruits which, germinating in abundance around the base of the parent stem, simulate vegetative suckers. Most forest species, e.g. *R. vinifera* and *R. gigantea*, have tall stems, although because of the long crown of leaves the length of the stem is always much less than the full height of the palm. On the other hand, a few short-stemmed raphias are known and one can quite clearly trace the evo-

lution of these "stemless" species from tall forest raphias. Outside the forest are *R. sudanica* and *R. humilis* which have very short stems so that the crown of leaves is borne almost at the soil surface. The former inhabits savanna swamps and the latter is common in southern Nigeria and the Cameroons along the sides of water-courses in areas north of the forest zone. The stemless habit seems to be an adaptation to the requirements of a new environment.

Many species of *Raphia* undoubtedly exist, but the confusion in their identity and nomenclature is considerable. Apart from variation in overall size, leaf morphology is very uniform. Species have usually been characterized by fruit shape and general habit. However, size and shape of fruits does vary considerably on a single individual and, as already indicated, the general habit may not be easy to recognize. On the other hand, the most marked differences between species are to be found in the general appearance of the spadix and the size of its branches, and these provide the most useful diagnostic features. Unfortunately, such parts are neither well-collected nor well-preserved in herbaria, so that the taxonomic revision which the genus so badly needs would be a difficult task and impossible without access to wild palms.

The spadices of *Raphia* palms of many species are extensively tapped as a source of palm wine. This process is not destructive since *Raphia* is monocarpic and once the massive terminal raceme is developed the palm dies. In any event, untapped raphias are abundant so that as one drives through forest areas their long pendulous infructescences with loads of cone-like fruits are common objects to be seen by the wayside at the bottom of each dip in the road. In fact, the forester regards *Raphia* as little more than a weed. The leaves are used for

thatch and old leaf bases provide a coarse fibre. *Raphia farinifera* of Madagascar is the source of the commercial "raffia." This is the surface layers stripped from young leaves and dried, and is a binding material extensively used in horticulture.

The scandent palms

*Ancistrophyllum*, *Eremospatha* and *Oncocalamus* are common climbing palms of West African forests, all with narrow stems and long internodes enclosed by persistent tubular leaf bases. Although they closely resemble the scandent rattans which are abundantly developed in the Eastern tropics, the two groups may well have had an independent origin because of differences in the morphology of the long whip-like cirrus into which each leaf rachis is extended and by which the palms are supported. In the Eastern rattans each cirrus is armed only with claw-like emergencies. In the African climbing palms on the other hand, the cirrus is provided with distant pairs of grapnel-like spines which are equivalent to pairs of leaflets. In this they resemble *Desmoncus*, a genus of American scandent palms, although this is a member of the cocoideae and is not at all related. The three African genera are distinguished from each other by floral characters but are difficult to identify in the field because inflorescences only appear in the forest canopy at the ends of the long stems. *Eremospatha* is most easily recognized since its tubular leaf sheaths are unarmed and not spinous as in the other two genera. Botanists recognize several species in each genus, of which *Eremospatha* is the largest. *Oncocalamus* is said to contain two species but one of them, *O. acanthocnemis* is known only in the vegetative condition and it seems likely that it is actually the juvenile foliage of the other species, *O. Mannii*, or even of another genus. This is an



57. *Podococcus Barteri* (left), *Sclerosperma Mannii* (center), *Ancistrophyllum laeve* (upper center with terminal inflorescences,) and *Ancistrophyllum secundiflorum* (upper right) reproduced from *Transactions of the Linnaean Society of London* 24: pl. 38, 1864.

indication of the way in which juvenile and adult leaves in these scandent palms differ.

*Calamus*, which is a very large genus of the Eastern tropics, is represented in Africa by one species, *C. deerratus*, the

sole member of the subgenus *Afrocalamus*. It is easily distinguished from other scandent palms because the clawed flagellae which support the stems appear to arise from the side of the leaf sheaths and are not extensions of the rachis. Each flagellum is actually a reduced, unbranched, axillary inflorescence which is adnate to the stem internode immediately above and the leaf sheath above that.

Apart from these morphological differences the general habit and ecological requirements of all four genera are similar. Individual erect stems in all species appear to be monocarpic but they arise from underground rhizome systems and are continually replaced. They are all members of the *Raphia* association characteristic of swampy forest areas. Apart from some use of the canes they have little application.

Subfamily Coccoideae

*Elaeis*: The African oil palm (*Elaeis guineensis*) is native to and widely distributed in West tropical Africa. It has been introduced into South America and in Malaya and Indonesia. Its cultivation is practiced on extensive plantation scale. In Africa, on the other hand, the cultivation of the palm is largely in the hands of native farmers and well-ordered plantations are not common. The oil-palm is solitary-stemmed and grows to a height of about 60 feet with a symmetrical crown of long pinnate leaves whose basal margins are armed with short spines. This symmetrical crown is not seen in tended trees from which the older leaves are removed to release the axillary fruit clusters. The palm is monoecious and produces a regular succession of male and female inflorescences, each of which is enclosed within the broad base of the axillary leaf, individual fruits of the female spadices being subtended by a short spinous bract.

The natural habitat of the oil palm is not known. Although it is common in forest areas and sows itself profusely, it cannot persist in closed primary forest. In fact, the presence of old oil palms in forest is a sure indication that the forest is not virgin and that it must have been cultivated within the last 80 years, that period being the approximate life span of individual palms. Although it also grows quite well in exposed situations, it seems to require some shade, especially when young. Perhaps the original habitat was rather specialised and may have been on river banks or in the fringing forest of savanna areas.

*Elaeis* is one of the world's most important sources of vegetable oil and equals *Cocos* in this respect. Palm oil from Africa and the Malay Archipelago is widely used for the manufacture of soaps and margarine and has specialized industrial uses. Oil is extracted from both the pericarp (pericarp oil) and the endosperm (kernel oil) although the two are often mixed together. Several varieties of oil palm are recognised, differing chiefly in the thickness of the shell which surrounds the seed. Since, however, the palm is propagated by seed produced through uncontrolled pollination, populations are very mixed and varieties are not easily maintained. Apart from its commercial importance, palm oil is used locally for food and as an illuminant and medicine. The leaves are valuable for thatch and the leaf stalk is used for stakes and in palisades. The palm is often tapped for palm wine.

*Jubaeopsis*: This contains one little known species, *J. caffra*. It is the only other representative of the Coccoideae in Africa, but is only remotely connected with *Elaeis* and its spadices, according to Beccari, show it to have most affinity with *Jubaea chilensis* of Chile. It is re-

stricted to rather inaccessible areas of South East Africa and consequently is a relatively recent discovery. It is a small, rather short-stemmed palm and it may previously have been confused with *Phoenix reclinata* because Beccari suggests that the plate to illustrate the latter species in Martius' *Historia Naturalis Palmarum* actually shows *Jubacopsis*.  
Subfamily Arecoideae

*Sclerosperma*: This genus of little-known palms contains three species. All these are small, caespitose palms with short stems scarcely three feet high and having congested internodes. The leaves are small, irregularly pinnate and with broad leaflets. The spadix is simple and because of this Drude placed *Sclerosperma* near to *Geonoma* of Central America, but the relationship may not be close. All species are palms of the forest undergrowth. The best known is

*S. Mannii*, first described by Wendland and Mann from the Gaboon. I have seen it in primary forests in the Cameroons.

*Podococcus*: This resembles *Sclerosperma* in its stature and general appearance but the leaflets are narrower and the stem is more cane-like with distinct internodes and may reach a height of eight feet. The original description referred to one species, *P. Barteri*, of swampy areas in the Niger delta and a second species, *P. acaulis*, has since been described. Botanically, *Podococcus* is allied to *Sclerosperma* whose isolation it shares.

Subfamily Coryphoideae

This group of fan palms, is virtually without representation in Africa, although *Chamaerops humilis* does occur along the north African coast. A second genus, *Wissmannia*, with one species, *W. carinensis*, is known from Somaliland.

## Livistona Jenkinsiana

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*Livistona Jenkinsiana*, the only wild Indian species of the genus so far recorded, is an erect graceful palm of about 7 to 10 meters high (to over 30 feet) with an unbranched cylindrical stem and a terminal crown of fan-shaped leaves. This beautiful palm is named after Major Jenkins, whose early plant collections in Assam are well known. The reniformly flabellate leaves measure to 1.2 meters (six feet or slightly more) in diameter and the margin of the blade is toothed nearly half its radius (Fig. 58).

The young stems are covered with dry leaves or rather with the lower parts of the petioles, while the older stems are marked with the hard, black, long and

narrow scars of the fallen petioles. Consequently, the stem surface is rough, and the diameter of the stem is seldom more than a foot.

The inflorescence of this palm is interfoliar, producing many bisexual pedi-



58. Seedlings of *Livistona Jenkinsiana* grown in a shady corner near Eyo village at 400 meters altitude, Siang Frontier Division, NEFA. Photograph by R. S. Rao.

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