PALM (Lat. *palma*, Gr. παλάμη), originally the flat of the hand, in which sense it is still used; from this sense the word was transferred as a name of the trees described below. The emblematic use of the word (= prize, honour) represents a further transference from the employment of the palm-leaves as symbols of victory.

The Palms (*Palmaceae*) have been termed the princes of the vegetable kingdom. Neither the anatomy of their stems nor the conformation of their flowers, however, entitles them to any such high position in the vegetable hierarchy. Their stems are not more complicated in structure than those of the common butcher's broom (*Ruscus*); their flowers are for the most part as simple as those of a rush (*Juncus*). The order Palmaceae

is characterized among monocotyledonous plants by the presence of an unbranched stem bearing a tuft of leaves at the extremity only, or with the leaves scattered; these leaves, often gigantic in size, being usually firm in texture and branching in a pinnate or palmate fashion. The flowers are borne on simple or branching spikes, very generally protected by a spathe or spathes, and each consists typically of a perianth of six greenish, somewhat inconspicuous segments in two rows, with six stamens, or pistil of 1–3 carpels, each with a single ovule and a succulent or dry fruit, never dehiscent (fig. 1, A and B). The seed consists almost exclusively of endosperm or albumen in a cavity in which is lodged the relatively very minute embryo (fig. 1, C). These are the general characteristics by which this very well-defined order may be discriminated, but, in a group containing considerably more than a thousand species, deviations from the general plan of structure occur with some frequency. As the characteristic appearances of palms depend to a large extent upon these modifications, some of the more important among them may briefly be noticed.

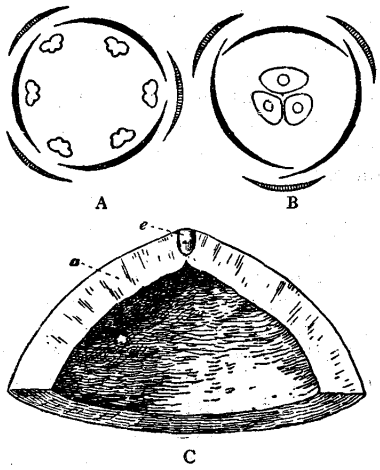
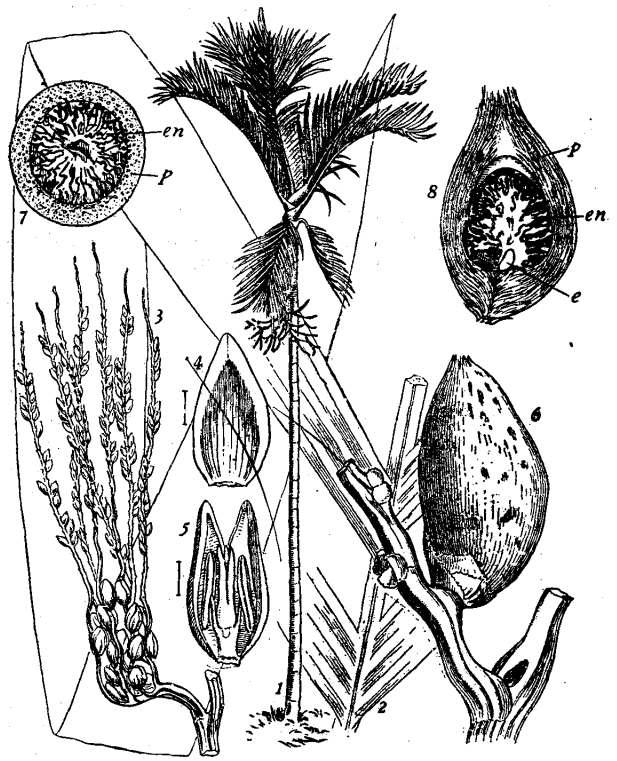


FIG. 1, A, B.—Floral diagrams of a Palm (*Chamaerops humilis*).
A, male flower. B, female-flower.
C, Upper portion of Coco-nut seed, showing *e*, embryo, embedded in *a*, endosperm.

Taking the stem first, we may mention that it is in very many palms relatively tall, erect, unbranched, regularly cylindrical,

FIG. 2.—*Daemonorops Draco* (a Rattan Palm).
1, Young shoot much reduced. 2, Part of stem bearing male inflorescence. 3, Part of female inflorescence. 4, The same bearing ripe fruits. 2, 3, 4, one-fourth nat. size.

or dilated below so as to form an elongated cone, either smooth, or covered with the projecting remnants of the former leaves, or marked with circular scars indicating the position of those leaves which have now fallen away. It varies in diameter from the thickness of a reed (as in *Chamaedorea*) to a sturdy pillar-like structure as seen in the date-palm, Palmyra palm (fig. 7) or Talipot. In other cases the very slender stem is prostrate, or



(After Bentley and Trimen, *Medicinal Plants*, by permission of Messrs J. & A. Churchill.)

FIG. 3.—Areca Palm (*Areca Catechu*).
1, Tree, very much reduced.
2, Part of leaf, half nat. size.
3, Portion of inflorescence with male flowers above, female (larger) below, half nat. size.
4, Petal of a male flower.
5, Male flower opened by removal of a petal.
6, Fruit, half nat. size.
7, 8, Same cut across, and lengthwise. *p*, Fibrous pericarp; *en*, ruminated endosperm; *e*, embryo.

scandent by means of formidable hooked prickles which, by enabling the plant to support itself on the branches of neighbouring trees, also permit the stem to grow to a very great length and so to expose the foliage to the light and air above the tree-tops of the dense forests these palms grow in, as in the genus *Calamus*, the Rattan or Cane palms. In some few instances the trunk, or that portion of it which is above ground, is so short that the plant is in a loose way called " stemless " or " acaulescent," as in *Geonoma*, and as happens sometimes in the only species found in a wild state in Europe, *Chamaerops humilis*. The vegetable ivory (*Phytelephas*) of equatorial America has a very short thick stem bearing a tall cluster of leaves which appears to rise from the ground. In many species the trunk is covered with a dense network of stiff fibres, often compacted together at the free ends into spines. This fibrous material, which is so valuable for cordage, consists of the fibrous tissue of the leaf-stalk, which in these cases persists after the decay of the softer portions. It is very characteristic of some palms to produce from the base of the stem a series of adventitious roots which gradually thrust themselves into the soil and serve to steady the tree and prevent its overthrow by the wind. The underground stem of some species, *e.g.* of *Calamus*, is a rhizome, or root-stock, lengthening in a more or less horizontal manner by the development of the terminal bud, and sending up lateral branches like suckers from the root-stock, which form dense thickets of cane-like stems. The branching of the stem above ground is unusual, except in the case of the Doum palm of Egypt (*Hyphaene*), where the stem forks, often repeatedly; this is due to the development of a branch to an equal strength with the main stem. In other

cases branching, when present, is probably the result of some injury to the terminal bud at the top of the stem, in consequence of which buds sprout out from below the apex.

The internal structure of the stem does not differ fundamentally from that of a typical monocotyledonous stem, the taller, harder trunks owing their hardness not only to the fibrous or woody skeleton but also to the fact that, as growth goes on, the originally soft cellular ground tissue through which the fibres run becomes hardened by the deposit of woody matter within the cells, so that ultimately the cellular portions become as hard as the woody fibrous tissue.

The leaves of palms are either arranged at more or less distant intervals along the stem, as in the canes (*Calamus*, *Daemonorops*, fig. 2, &c.), or are approximated in tufts at the end of the stem, thus forming those noble crowns of foliage (figs. 5, 6, 7) which are so closely associated with the general idea of a palm. In the young condition, while still unfolded, these leaves, with the succulent end of the stem from which they arise, form ".the cabbage," which in some species is highly esteemed as an article of food.

The adult leaf very generally presents a sheathing base tapering upwards into the stalk or petiole, and this again bearing the lamina or blade. The sheath and the petiole very often bear stout spines, as in the rattan palms (see fig. 2); and when, in course of time, the upper parts of the leaf decay and fall off, the base of the leaf-stalk and sheath often remain, either entirely or in their fibrous portions only, which latter constitute the investment to the stem already mentioned. In size the leaves vary within very wide limits, some being only a few inches in extent, while those of the noble *Caryota* may be measured in tens of feet. In form the leaves of palms are very rarely simple; usually they are more or less divided, sometimes, as in *Caryota*, extremely so. In species of *Geonoma*, *Verschaffeltia* and some others, the leaf splits into two divisions at the apex and not elsewhere; but more usually the leaves branch regularly in a palmate fashion as in the fan-palms *Latania*, *Borassus* (fig. 7), *Chamaerops*, *Sabal*, &c., or in a pinnate fashion as in the feather-palms, *Areca* (fig. 3), *Kentia*, *Calamus*, *Daemonorops* (fig. 2), &c. The form of the segments is generally more or less linear, but a very distinct appearance is given by the broad wedge-shaped leaflets of such palms as *Caryota*, *Martinezia* or *Mauritia*. These forms run one into another by transitional gradations; and even in the same palm the form of the leaf is often very different at different stages of its growth, so that it is a difficult matter to name correctly seedling or juvenile palms in the condition in which we generally meet with them in the nurseries, or even to foresee what the future development of the plant is likely to be. Like the other parts of the plant, the leaves are sometimes invested with hairs or spines; and, in some instances, as in the magnificent *Ceroxylon andicola*, the under surface is of a glaucous white or bluish colour, from a coating of wax.

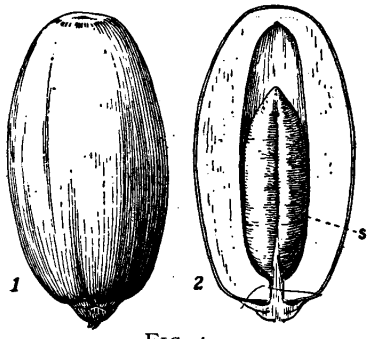


FIG. 4.
1, Fruit of date-palm (*Phoenix dactylifera*), nat. size.
2, Same cut lengthwise showing seed *s*.

The inflorescence of palms consists generally of a fleshy spike, either simple or much branched, studded with numerous, sometimes extremely numerous, flowers, and enveloped by one or more sheathing bracts called "spathes" (fig. 5). These parts may be small, or they may attain relatively enormous dimensions, hanging down from amid the crown of foliage like huge tresses, and adding greatly to the noble effect of the leaves. In some cases, as in the Talipot palm, the tree only flowers once; it grows for many years until it has become a large tree then develops a huge inflorescence, and after the fruit has ripened, dies.

The individual flowers are usually small (figs. 3, 6), greenish and insignificant; their general structure has been mentioned already. Modifications from the typical structure arise from difference of texture, and specially from suppression of parts, in consequence of which the flowers are very generally unisexual (figs. 1, 3, 6), though the flowers of the two sexes are generally produced on the same tree (monoecious), not indeed always in the same season, for a tree in

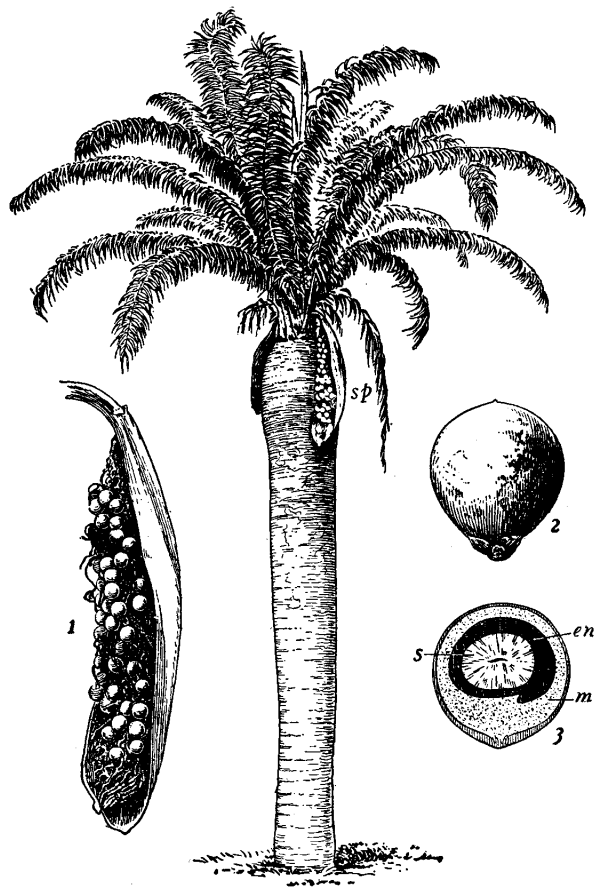


FIG. 5.—*Acrocomia sclerocarpa*, much reduced.
sp, Spathe enveloping the fruits, shown on a larger scale in 1.
2, A fruit half nat. size.
3, The same cut lengthwise. *m*, Fibrous mesocarp; *en*, hard endocarp; *s*, seed.

one year may produce all male flowers and in the next all female flowers. Sometimes the flowers are modified by an increase in the number of parts; thus the usually six stamens may be represented by 12 to 24 or even by hundreds. The carpels are usually three in number, and more or less combined; but they may be free, and their number may be reduced to two or even one. In any case each carpel contains but a single ovule.

Owing to the sexual arrangements before mentioned, the pollen has to be transported by the agency of the wind or of insects to the female flowers. This is facilitated sometimes by the elastic movements of the stamens and anthers, which liberate the pollen so freely at certain times that travellers speak of the date-palms of Egypt (*Phoenix dactylifera*) being at daybreak hidden in a mist of pollen grains. In other cases fertilization is effected by the agency of man, who removes the male flowers and scatters the pollen over the fruit-bearing trees. This practice has been followed in the case of the date from time immemorial; and it afforded one of the earliest and most irrefragable proofs by means of which the sexuality of plants was finally established. In the course of ripening of the fruit two of the carpels with their ovules may become absorbed, as in the coco-nut, the fruit of which contains only one seed though the three carpels are indicated by the three longitudinal sutures and by the presence of three germ-pores on the hard endocarp.

The fruit is various in form, size and character; sometimes, as in the common date (fig. 4) it is a berry with a fleshy rind enclosing a hard stony kernel, the true seed; the fruit of *Areca* (fig. 3) is similar; sometimes it is a kind of drupe as in *Acrocomia* (fig. 5), or the coco-nut, *Cocos nucifera*, where the fibrous central portion investing the hard shell corresponds to the fleshy portion of a plum or cherry, while the shell or nut corresponds to the stone of stone-fruits, the seed being the kernel. In *Borassus* the three seeds are each enclosed in a separate chamber formed by the stony endocarp (fig. 7). Sometimes, as in the species of *Metroxylon* (fig. 6), *Raphia*, *Daemonorops* (fig. 2), &c., the fruit is covered with hard, pointed, reflexed shining scales, which give it a very remarkable appearance.

The seeds show a corresponding variety in size and shape, but

always consist of a mass of endosperm, in which is embedded a relatively very minute embryo (figs. 1, 3, 6). The hard stone of the date is the endosperm, the white oily flesh of the coco-nut is the same substance in a softer condition; the so-called "vegetable ivory" is derived from the endosperm of *Phytelephas*. In some genera the inner seed coat becomes thickened along the course of the vascular bundles and growing into the endosperm produces the characteristic appearance in section known as *ruminate*—this is well shown in the Areca nut (fig. 3).

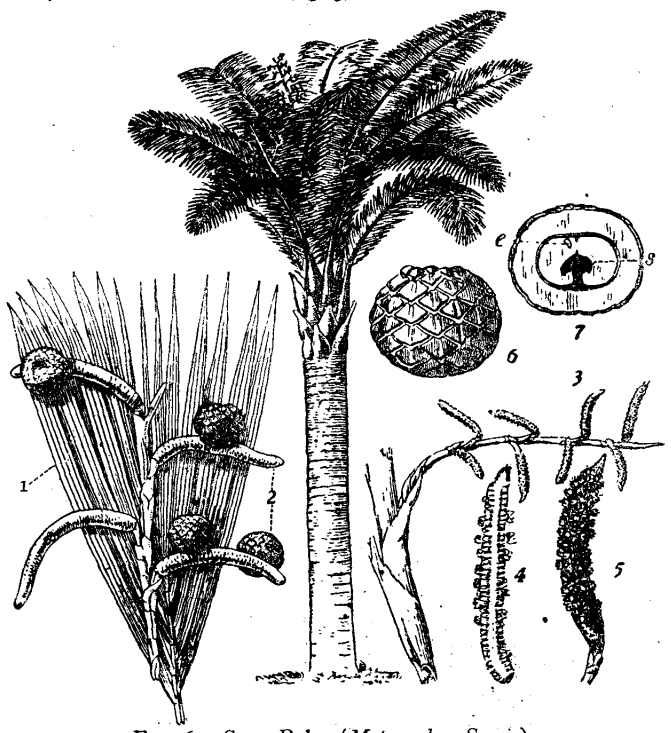


FIG. 6.—Sago Palm (*Metroxylon Sagus*).

1, Apex of leaf.
2, Branchlet of fruiting spadix.
3, Branchlet of male inflorescence.
4, Spike of male flowers.
5, Same cut lengthwise.
6, Fruit.
7, Fruit cut lengthwise, showing seed *s* and the minute embryo *e* which is embedded in a horny endosperm.

1, 2, one-sixth nat. size; 3, one-tenth nat. size; 4, 5, one-third nat. size; 6, 7, about one-half nat. size.

The order contains 132 genera with about 1100 species mainly tropical, but with some representatives in warm temperate regions. *Chamaerops humilis* is a native of the Mediterranean region, and the date-palm yields fruit in southern Europe as far north as 38° N. latitude. In eastern Asia the Palms, like other tropical families, extend along the coast reaching Korea and the south of Japan. In America a few small genera occur in the southern United States and California; and in South America the southern limit is reached in the Chilean genus *Jubaea* (the Chile coco-nut) at 37° S. latitude. The great centres of distribution are tropical America and tropical Asia; tropical Africa contains only 11 genera, though some of the species, like the Doum palm (*Hyphaene thebaica*) and the Deleb or Palmyra palm (*Borassus flabellifer*) have a wide distribution. With three exceptions Old and New World forms are distinct—the coco-nut (*Cocos nucifera*) is widely distributed on the coasts of tropical Africa, in India and the South Seas, the other species of the genus are confined to the western hemisphere. The oil palm (*Elaeis guineensis*) is a native of west tropical Africa, the other species of the genus is tropical American. *Raphia* has also species in both tropical Africa and tropical America.

The 132 genera of the order are ranged under seven tribes, distinguished by the nature of the foliage, the sexual conditions of the flower, the character of the seed, the position of the raphe, &c. Other characters serving to distinguish the minor groups are afforded by the habit, the position of the spathes, the "aestivation" of the flower, the nature of the stigma, the ovary, fruit, &c.

It is impossible to overestimate the utility of palms. They furnish food, shelter, clothing, timber, fuel, building materials, sticks, fibre, paper, starch, sugar, oil, wax, wine, tannin, dyeing materials, resin and a host of minor products, which render them most valuable to the natives and to tropical agriculturists. The Coco-nut palm, *Cocos nucifera*, and the Date palm, *Phoenix dactylifera*, have been treated under separate headings. Sugar and liquids capable of becoming fermented are produced by *Caryota urens*,

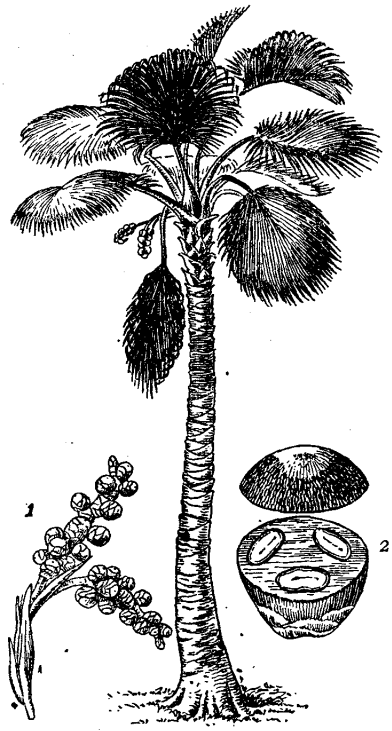


FIG. 7.—Palmyra Palm (*Borassus flabellifer*), a female tree.

1, Portion of female inflorescence showing young fruits.
2, Fruit cut across showing the three seeds, all much reduced.

Cocos nucifera, *Borassus flabellifer*, *Rhapis vinifera*, *Arenga saccharifera*, *Phoenix silvestris*, *Mauritia vinifera*, &c. Starch is procured in abundance from the stem of the Sago palm, *Metroxylon* (fig. 6) and others. The fleshy mesocarp of the fruit of *Elaeis guineensis* of western tropical Africa yields, when crushed and boiled, "palm oil." Coco-nut oil is extracted from the oily endosperm of the coco-nut. Wax is exuded from the stem of *Ceroxylon andicola* and *Copernicia cerifera*. A variety of "dragon's blood," a resin, is procured from *Daemonorops Draco* and other species. Edible fruits are yielded by the date, the staple food of some districts of northern Africa. The coco-nut is a source of wealth to its possessors; and many of the species, *e.g. Areca sapida* (Cabbage-palm and others), are valued for their "cabbage"; but, as this is the terminal bud whose removal causes the destruction of the tree, this is a wasteful article of diet unless care be taken by judicious planting to avert the annihilation of the supplies. The famous "coco de mer," or double coco-nut, whose floating nuts are the objects of so many legends and superstitions, is known to science as *Lodoicea seychellarum*. The tree is peculiar to the Seychelles, where it is used for many useful purposes. Its fruit is like a huge plum, containing a stone or nut like two coco-nuts (in their husks) united together. These illustrations must suffice to indicate the numerous economic uses of palms.

The only species that can be cultivated in the open air in England, and then only under exceptionally favourable circumstances, are the European Fan palm, *Chamaerops humilis*, the Chusan palm, *Trachycarpus Fortunei*, &c., and the Chilean *Jubaea spectabilis*. The date palm is commonly planted along the Mediterranean coast. There are several low growing palms, such as *Rhapis flabelliformis*, *Chamaerops humilis*, &c., which are suited for ordinary green-house culture, and many of which, from the thick texture of their leaves, are enabled to resist the dry and often gas-laden atmosphere of living rooms.