Great height in the palms may be a phenomenon in the United States, but is not even news in the family; for, after all, one species of *Ceroxylon*, sometimes exceeding 200 feet, was believed for many years to be the tallest living thing on earth—before the immense eucalypts and sequoias were discovered.

DENT SMITH

Essays on the Morphology of Palms

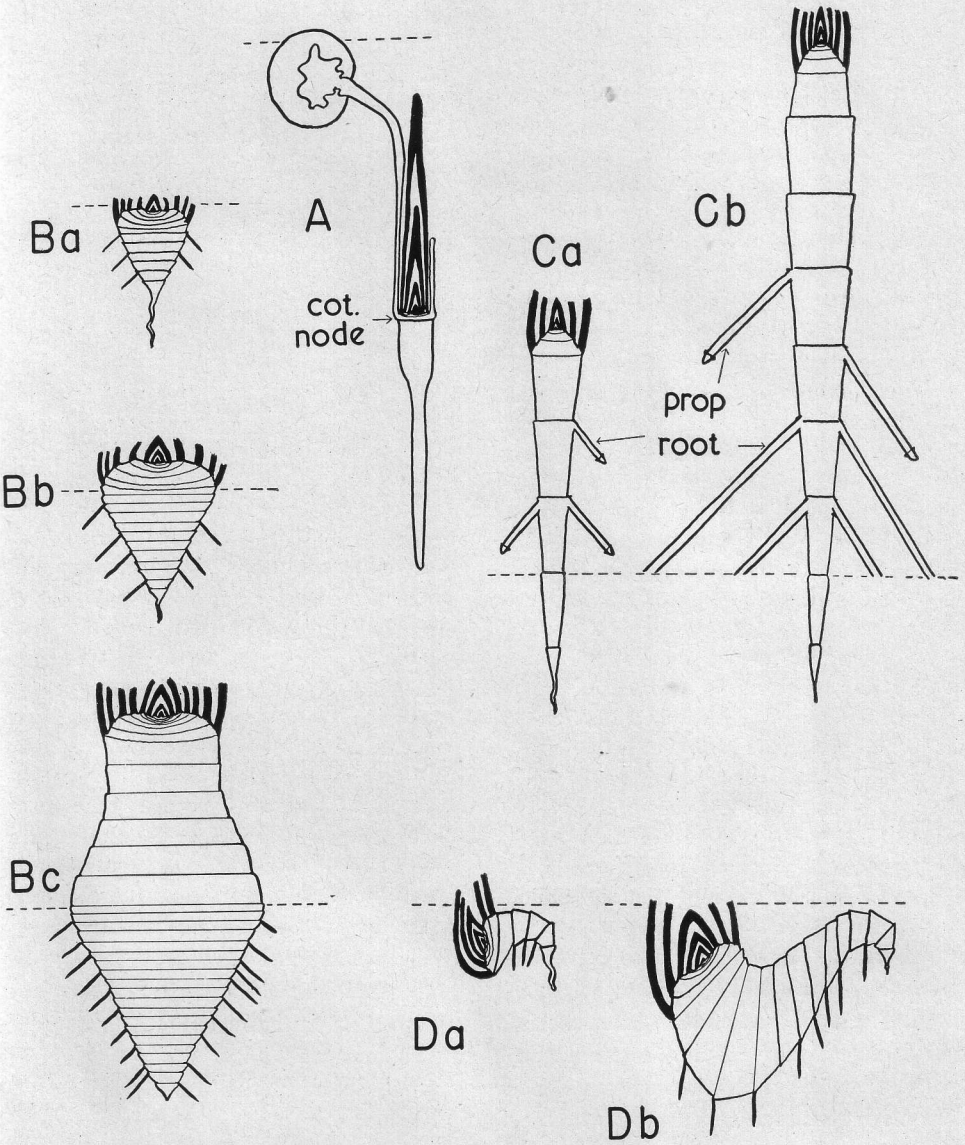
P. B. TOMLINSON

II. THE EARLY GROWTH OF THE PALM

The palm seedling develops an anchoring and absorptive root system together with an assimilating leafy crown and soon becomes independent of the seed as its source of food. The stem usually remains inconspicuous for a considerable time. Botanists familiar with the early stages of growth of the palm after the seedling stage know that its stem grows first in girth and develops a broad woody subterranean stock before the leafy crown is visibly raised above the soil surface. In this predominance of thickening over extension growth, palms contrast remarkably with woody dicotyledons as represented by our common trees. In the latter, primary (elongation) growth always precedes secondary (thickening) growth so that tall but slender saplings are characteristic of the early stages in the life of dicotyledonous trees. This difference is a direct result of the fact that the palm stem has no means of continuous growth in thickness. In contrast dicotyledonous trees have beneath the bark an actively growing region, the cambium, by means of which the trunk continues to grow in thickness throughout the life of the tree. Consequently the slender stem of the sapling is capable of becoming a wide trunk and supporting an increasingly branched crown. The palm stem, on the other hand, has no cambium.

The peculiar growth-limiting characteristics of palms and other monocotyledons are a direct consequence of this lack of thickening growth, as has recently been indicated in an interesting article by Holttum (1955). He points out that in order to support a woody trunk, which in palms may eventually be over 100 feet high, a massive foundation has first to be established. This broad, base begins to develop in the seedling (fig. 69A). The first nodes, at which the seedling leaves are inserted, are not separated from each other by long internodes (fig. 69Ba). Successive nodes are increasingly wider and equally congested so that the base of the stem comes to have the shape of an inverted cone (fig. 69 Bb). Most of this early stem growth takes place underground and all that is visible above the soil surface is the crown of leaves which often persists at this level for several years. Eventually, however, a sufficiently broad base is developed and the later internodes elongate so that the leafy crown is raised above the soil level and a woody trunk becomes visible (fig. 69 Bc). In some palms, particularly those with narrow cane-like stems, the difference in length between the early, basal internodes and the later ones which form the aerial stems may be very considerable. In other palms, such as the oil palm and the date palm, the internodes are always short and the aerial stem is developed by the superposition of a large number of short internodes.

The fibrous root system of palms, like that of other monocotyledons, develops in a way which contrasts with the tap root which is typical of dicotyledons. Holttum suggests that this difference is also related to the absence of a vascular cambium from monocotyledonous roots. The first root is incapable of growth in



69. Early growth of palms. A, diagrammatic vertical section through a seedling of the *Phoenix-type*. The cotyledonary node (cot. node) is the region of insertion of the cotyledon and therefore the first node on the stem; B-D, diagrammatic vertical sections through young palms. Nodes represented by straight lines; adventitious roots by thick single lines; only the bases of the leaves are drawn: Ba-c, three successively older stages in the development of a palm with a solitary erect stem; Ca-b, two successive stages of an *Iriartea*-type stem; Da-b, two successive stages of a *Sabal*-type stem.

thickness so that no matter how much it branches and increases its effectiveness as an absorptive organ, it is limited in its capacity to transmit absorbed water and mineral salts to the expanding stem and leafy crown above. In dicotyledons the first root has a cambium and so in-increases in thickness at a rate which permits it to transmit an adequate supply of water to the aerial parts. In monocotyledons, the first root is replaced very early by many adventitious roots, i.e. roots which grow directly from the stem. It has already been shown that in the *Archontophoenix*-type of seedling the first root is soon replaced by a more dominant adventitious root (*Principes* 4: 57, fig. 33Cc). Adventitious roots are usually only produced at the nodes, although in palms this is not obvious because the basal nodes are so congested. This basal region seems to be an unlimited source of root-producing tissue and palms apparently produce new roots throughout the whole of their lives.

The early stages of stem growth, described above, are fundamentally the same in all palms although they are most easily observed in palms with tall, columnar trunks, such as in the coconut palm. In some palms with solitary stems, such as the royal palms, the stem may be widest at the soil level since the elongated internodes of the aerial stem are somewhat narrower than those which form the broad basal swelling (fig. 69 Bc). The thickness of the stem base is, however, correlated with the final size of the stem and palms with narrow cane-like stems produce only a narrow base. It is therefore obvious that planted palms must be well nourished and cared for in early stages of growth so that a broad foundation can develop; otherwise, if starved early in life, the stem base will not be sufficiently broad to support a tall trunk.

There are a number of exceptional types which, although they have the same fundamental palm construction, are superficially dissimilar. The most striking is that found in the iriartoid palms, the stilt-palms of Central and South America. In these palms, elongation of the first internodes is marked, unlike other palms (fig. 69 Ca), but successive internodes are increasingly wider in the normal way. Consequently the adult stem has a base which tapers gradually to a point at its base (fig. 69 Cb). This type of stem is unstable but it is supported by thick prop roots which arise in an adventitious manner from the lower nodes on the stem (fig. 69 Cb). These roots are very thick. They grow obliquely downwards and normally do not branch until they reach the soil surface. They form very efficient buttresses since they grow out all round the stem.

Sabal is also conspicuously different from most other palms. Here the stem at first grows obliquely downwards instead of erect, so that a short oblique rhizome is first produced (fig. 69 Da). Eventually, however, the stem apex turns erect (fig. 69 Db) and a thick woody trunk is formed in the normal way, as in *Sabal Palmetto*. In *Sabal Etonia* and most plants of *S. minor*, on the other hand, the stem remains as a persistent horizontal woody rhizome. This last growth-habit is not very different from that shown by palms in which the erect stem apex soon grows horizontally so that a subterranean rhizome is developed, as in *Serenoa*. The leaves of these rhizomatous palms always grow erect because of unequal growth of the leaf base, the lower part

of the leaf base growing more than the upper.

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WHAT'S IN A NAME?

Bismarckia (biz már key a), a generic name established by Hildebrand and Wendland, honors the eminent Prussian statesman whose full and resounding name was Prince Otto Eduard Leopold von Bismarck-Schönhausen. It was Prince Bismarck (1815-1898), the "Iron Chancellor", who molded the conflicting kingdoms and principalities of 19th century Germany into a united nation and one of the world's great powers —which accomplishment was destined to provide a goodly measure of color and excitement for the 20th century, to say the least. The genus *Bismarckia* as now interpreted consists of only one species, the *B. nobilis*, a massive fan palm native to Madagascar.

Euterpe (you túr pee), one of the nine Muses of Greek mythology, was the goddess who presided over lyric song and poetry. Her Greek name is made up of the combination *eu* (well) plus *terpein* (to delight). Traditionally, the Muses were the daughters of Zeus, father of the gods, by Mnemosyne, goddess of memory. *Euterpe* is a genus comprising more than forty species of exceedingly graceful, unarmed, tropical American feather palms first described by Joseph Gaertner in 1788. Most of the euterpe palms have edible buds which taste like raw cabbage, and have come to be known rather commonly as cabbage palms.

Geonoma (gee o nó ma) is a genus whose members are typically smallish, graceful, moisture-loving slender palms abounding in the dense shade of tropical American forest floors. The technical name, originated by Willdenow, derives from the Greek prefix *geo* (earth, ground) plus *nomos* (district, province), which combination gives *geonomos* (colonist, in the sense of "one who is a member or an inhabitant of a colony"). The species constituting *Geonoma*, like those of *Bactris* and *Chamaedorea* also of the Western Hemisphere, are very numerous. Well over one hundred fifty species range from Mexico far into South America with a particularly copious representation being found in Costa Rica, Colombia, and Brazil.

Jessenia (jess én ee a), a genus of tropical American pinnate palms with long, erect leaves and drooping leaflets, was established by Karsten to honor Dr. Carl Jessen, a professor of botany at Eldena, Prussia. A total of five species are currently known to science, four in South America and one from the island of Trinidad (*J. oligocarpa*).

Nannorrhops (nán o rawps), a generic name established by Hermann Wendland, is composed of the two Greek words *nannos* (dwarf) and *rhops* (bush, shrub) in allusion to the fact that these fan palms with their prostrate branching stems are commonly low in stature. The double r of *-rrhops* in such compounds is classically proper because of the single vowel which precedes. As now understood, the genus is composed of three species native to lofty, arid, cold regions of northern India. One of these, the *N. Ritchieana*, ranges westward into Afghanistan. Inasmuch as these palms are indigenous to regions