out recourse to and understanding of the flowers and fruits. Therein lies the challenge to those who desire to study them as a hobby. To wish otherwise will not change their essential nature.

Certainly not all students of the palms will agree with the union of *Socratea* and *Iriartella* with *Iriartea*. These genera are abundantly distinct in the field and herbarium when inflorescences, flowers and fruits can be observed. Several errors should be noted. *Chamaedorea* and *Maximiliana* are misspelled throughout. *Morenia* does not normally have inflorescences of both sexes on the same plant as stated in the generic key. In the same place, characters of *Tessmanniodoxa*, excluded from the Peruvian flora, are attributed to *Tessmanniophoenix* which Macbride maintains as a genus distinct from *Chelyocarpus* though Burret, in 1941, considered *Tessmanniophoenix* synonymous with *Chelyocarpus*. A real understanding of these fan palms and of the Peruvian palms in general still requires much more study of them in the field.

Weber, Claude and Shirley C. Tucker. *Flowers and Botanical Subjects on Stamps*. 164 pp. American Topical Association, 3300 North 50th Street, Milwaukee 16, Wis., 1960. Price $5.00.

For the philatelist interested also in palms, pages 73-84 of this handbook contain a listing of stamps adorned with palms. Mrs. Weber wrote "Palms on Postage Stamps" in *Principes* 4: 9-16, 1960.

Predictably, the coconut, *Cocos nucifera*, the date palm, *Phoenix dactylifera*, and the African oil palm, *Elaeis guineensis*, lead the list. Others are *Areca Catechu*, *Arecastrum Romanzoffianum*, *Borassus aethiopum*, *B. flabellifer*, *Calamus* spp., *Chamaerops humilis*, *Jubaea chilensis* (as *J. spectabilis*), *Lodoicea maldivica* (as *L. callipyge*), *Maximiliana Martiana* (as *M. regia*), *Metroxylon Sagu*, *Nypa fruticans*, *Orbignya Cohune*, *Phoenix canariensis*, *Pritchardia pacifica*, *Raphia vinifera*, *Roystonea oleracea*, *R. regia*, *Sabal Palmetto* and *Washingtonia filifera*.

H. E. MOORE, JR.

Essays on the Morphology of Palms

P. B. TOMLINSON

III. SEEDLING LEAVES AND JUVENILE FOLIAGE

It is useful to consider the first leaves developed by seedling palms in some detail because they are likely to be familiar objects to nurserymen who raise palms from seed and also because they are much easier to understand than are complex adult palm leaves. Having understood seedling palm leaves it then becomes easier to comprehend adult palm leaves.

Palm leaves, like those of many other monocotyledons, consist of four main parts (Fig. 6A). There is a sheathing base which encircles the stem, a long narrow petiole which extends into the rachis bearing pinnae or segments together forming the blade or lamina. The first plumular leaves are peculiar since they have no blade (see *Principes* 4:56-61. 1960). They are reduced scale-like structures and probably have a protective function. Their number is always small but seems to be constant for each species. These scale leaves are soon suc-

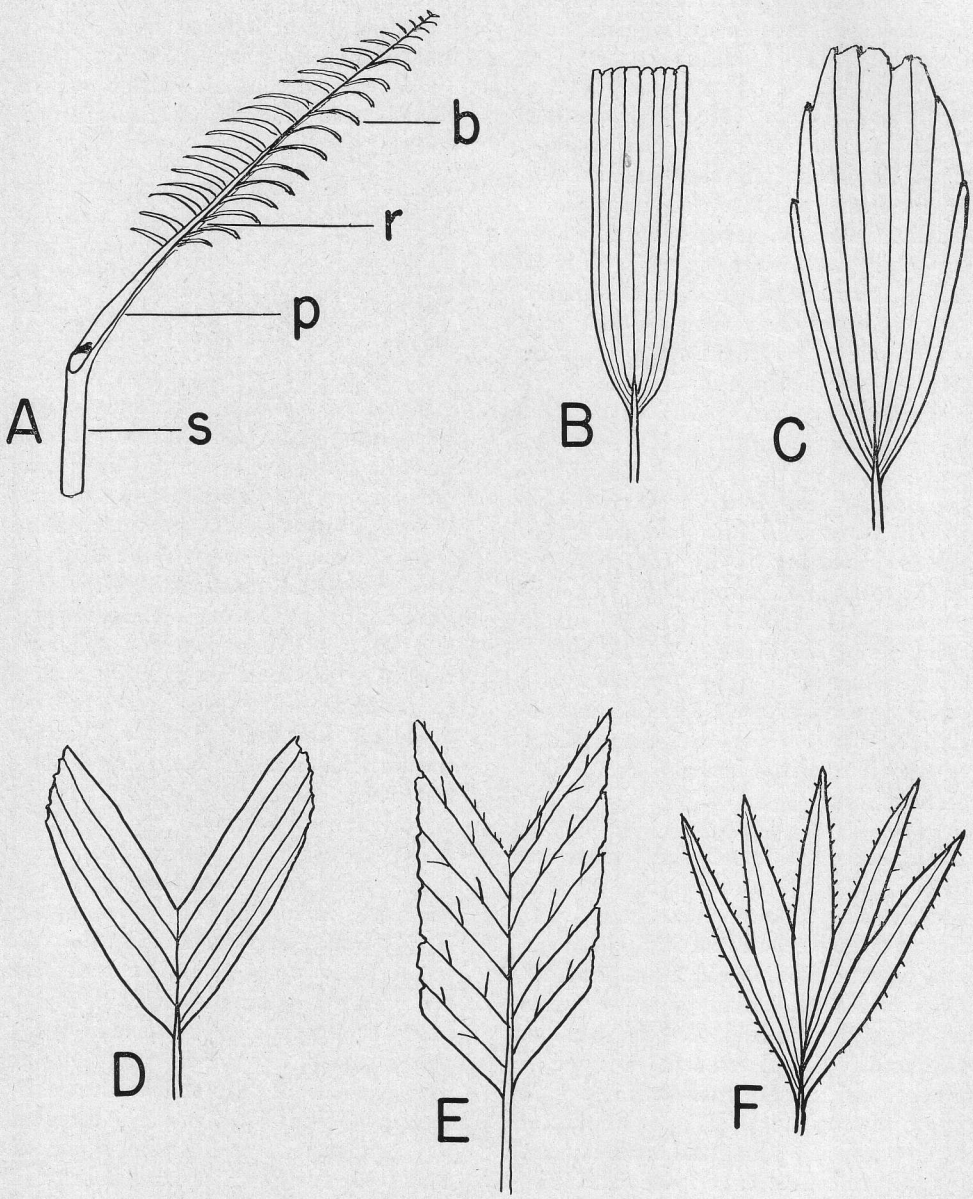
ceeded by true foliage leaves with green blades and in speaking about the latter it is necessary to refer to them as the first foliage leaves to distinguish them from the earlier, bladeless leaves.

Although there is a considerable range in blade shape of first foliage leaves in palms, it is very constant for each species. Detailed information about seedling foliage in palms is not often recorded in taxonomic writings. This is rather unfortunate, because familiarity with seedling palms soon suggests that it is possible to recognize the genus or even species to which an individual belongs from an examination of its first foliage leaves, a fact which must be well known to nurserymen. Thus the possibility arises of recognizing wrongly identified palms in their youngest stages and so preventing wastage caused by the unnecessary cultivation of valueless plants. Apart from the general shape and size of the blade, the distribution and frequency of hairs, prickles and other appendages are all useful diagnostic features. However, the general shape of the first foliage leaves is our immediate concern.

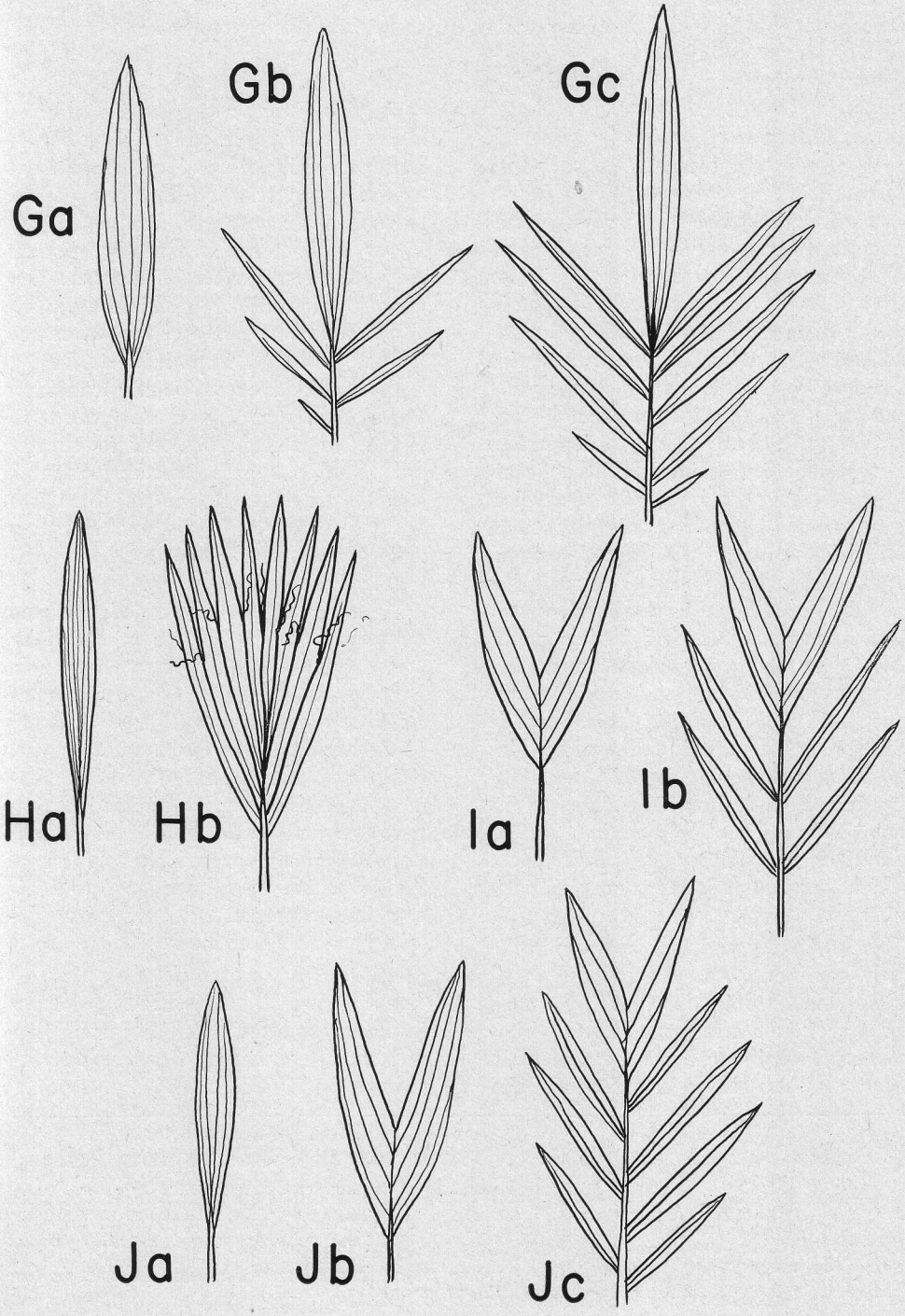
The first foliage leaf of any palm can be placed in one of a few classes. It is usually simple, rarely compound. If simple it may be either narrowly lanceolate (spear-shaped) (Fig. 6Ga), or bifid (Fig. 6Ia) i.e. having two segments separated by a deep median incision. Lanceolate blades sometimes have a notched or truncate apex, as in *Licuala* and *Livistona* (Fig. 6B); sometimes, as in the caryotoid palms, the blade is more broadly flabellate than lanceolate (Fig. 6C). In the bifid type of leaf the shape of the two segments varies enormously. Thus in many ptychospermate palms the apex of each segment is truncate instead of pointed (Fig. 6D), in *Aiphanes* the margin of the blade is notched (Fig. 6E) whilst in the iriartoid (stilt-) palms the blade is irregularly toothed and sometimes the apical incision is so shallow that the blade seems to be entire. These differences are but the earliest expression of leaflet shapes characteristic of all later leaves.

Compound first foliage leaves may have a digitately divided blade, as is not uncommon in the borassoid fan palms (Fig. 6F), whilst in the feather-palms the blade is sometimes pinnately divided as for example in *Raphia, Nephrosperma* and *Howeia Belmoreana* (Fig. 6Ib).

The long series of leaves developed by seedling palms may be referred to as juvenile foliage in order to distinguish them from the adult foliage developed by well-grown palms. In some palms juvenile foliage may be quite different from the adult type of leaf. This is most striking in the climbing palms (rattans) and it is not unknown for a "new" species to have been described from non-flowering material which has turned out to be the juvenile foliage of a known species. Between the very first foliage leaf which is always small and usually simple and the very large, compound leaves of the adult foliage there is a long series of transitional forms of gradually increasing size and complexity. It would be impossible to describe in detail here the complete transition for even a single series but this is unnecessary because it is possible to divide palms into a few classes according to the sequence of leaf shapes shown by their juvenile foliage. If one watches the development of a young palm it is soon easy to decide to which class it belongs. One interesting observation that is likely to be made is that palms with a similar first foliage leaf have different leaf successions. Six main classes can be recognized.



6. Palm leaves, very diagrammatic and not to scale, blade only except A. A, leaf illustrating use of terms—sheathing base (s), petiole (p), rachis (r), and blade (b) which is rarely entire and may be segmented as shown. B-F, first foliage leaves of palms: B, *Licuala*; C, *Arenga*; D, *Ptychosperma*; E, *Aiphanes*; F, *Latania*. G-J, juvenile palm leaves, first foliage leaf (a) and later juvenile leaves (b,c): G, *Phoenix;* H, *Washingtonia;* I, *Chrysalidocarpus;* J, *Roystonea*.


Ga
Gb
Gc
Ha
Hb
Ia
Ib
Ja
Jb
Jc

1. In *Phoenix* the first foliage leaf is lanceolate (Fig. 6Ga). Eventually compound leaves are produced in which lateral leaflets are inserted below a terminal leaflet. (Fig. 6Gb). Later leaves have more lateral pinnae which are reduced to spines at the base (Fig. 6Gc). This type of pinnate leaf with an odd terminal leaflet is described as imparipinnate and all adult leaves of *Phoenix* are clearly imparipinnate. A similar transition is found in all the caryotoid palms, with the exception of *Caryota* itself, but it is often difficult to recognize the odd terminal leaflet in adult leaves.

2. In the borassoid and sabaloid fan-palms, which have an entire, lanceolate first foliage leaf (Fig. 6Ha), the transition series usually includes a succession of broader blades which are split into an increasing number of "fingers" or segments (Fig. 6Hb) until the broad fan of the adult foliage is produced.

3. In the majority of feather palms belonging to the arecoid, bactroid, chamaedoreoid, iriartoid and lepidocaryoid groups in which the first foliage leaf is bifid (Fig. 6Ia), it is followed by pinnate leaves with a series of lateral pinnae inserted below a pair of equal terminal pinnae (Fig. 6Ib). Such a leaf is described as paripinnate. Adult leaves which terminate this series are also paripinnate.

4. *Roystonea* and *Stevensonia* are the only representatives known of a small class which is unique in that it also ends with paripinnate leaves (Fig. 6Jc) but starts with a simple, lanceolate leaf (Fig. 6Ja). In between is a series of bifid leaves (Fig. 6Jb). Consequently this series contains a greater number of different leaf types than is found in any other series.

5. One other series begins with a lanceolate first foliage leaf. This occurs in the majority of cocoid palms, but not in the coconut itself. In this type the lanceolate leaves are succeeded by leaves which are irregularly pinnate since the arrangement of segments on opposite sides of the rachis is very inconstant and uneven and the leaves are neither pari- nor imparipinnate.

6. There still remains the transition series exhibited by those palms in which the first foliage leaf is already compound. In these, whether they belong to fan or feather palms, there is a gradual increase in size and complexity of successive leaves and no new types of leaf are involved.

Taken by itself, a knowledge of the different shapes of leaves produced by seedling palms does not mean very much. However, it is hoped that these notes will be a useful introduction to the study of the adult palm leaf which will appear in the next essay. In addition, the subject is of considerable theoretical importance and leads to a better understanding of the probable evolution of the palm leaf as I have tried to indicate in a separate and much more detailed article (Tomlinson, 1960).

Literature Cited.

Tomlinson, P. B. 1960. Seedling Leaves in Palms and their Morphological Significance. *Journal of the Arnold Arboretum 41*:414-428. 1960.

Ceroxylon alpinum, the Correct Name for the Quindío Wax Palm

The genus *Ceroxylon* is usually attributed to Humboldt and Bonpland in the first volume of their *Plantae Aequinoctiale* (1805). Bonpland, however, had anticipated this publication in the *Bulletin des Sciences, par la Société Philomathique, Paris* 3(91): 239. Sept.-Oct. 1804. Thus *Ceroxylon alpinum* Bonpland, used there, is the earlier and correct name for *C. andicola*. H. E. M., Jr.