# Current Work on the Systematic Anatomy of Palms

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## *Introduction*

There is at present no up-to-date summary of the anatomy of the monocotyledons comparable to Metcalfe and Chalk's *Anatomy of the Dicotyledons* which was published in 1950. At the moment the only existing publication is Solereder and Meyer's *Systematische Anatomie der Monokotyledonen* which, besides being practically unobtainable, is incomplete because the proposed volumes on many of the larger groups, including the *Glumiflorae* and the *Liliflorae,* never appeared. However, since the completion of the *Anatomy of the Dicotyledons,* Dr. C. R. Metcalfe of the Jodrell Laboratory, Royal Botanic Gardens, Kew has been working on a comparable survey of the monocotyledons which will include all available information on the anatomy of all families within the group together with taxonomic notes and notes on economic uses. At the moment a survey of the anatomy of grasses is almost complete and the anatomy of a number of small families has been described.

The work which the present paper sets out to describe is part of this larger project and has been in progress for two years. Although this work is by no means complete it is possible at the moment to derive some tentative conclusions from the observations which have been made so far. These are presented here for the first time. The study was started at the University of Leeds on material collected from the glasshouses of the Royal Botanic Gardens, Kew. Subsequently a visit for one year to Singapore was of tremendous benefit in that some firsthand knowledge of the native palms of Southeast Asia in their natural habitats was gained and at the same time access to the large living collection in the Singapore Botanic Gardens was granted through the kindness of the Director, Mr. J. W. Purseglove. As a result a large collection of preserved material of Asian palms was assembled. At the moment West Africa is providing abundant material of its few local palms. Very little work has been done on American palms because of lack of material, but Dr. H. E. Moore, Jr. of the L. H. Bailey Hortorium is co-operating in making good this deficiency.

## *Scope and Purpose of the Work*

The object of the study is to provide a survey of the anatomy of the vegetative organs of palms which will include all existing information on the subject. The results will be presented in such a way that the relation between the anatomical findings and the taxonomy of palms will receive special emphasis. The scope of this anatomical approach to traditional systematics has already been outlined very adequately by Metcalfe in *Science Progress* 161: 42, 1953. It is therefore only necessary to re-emphasize here that the object of systematic anatomy is not to derive a classification of plants (in this instance palms) from their anatomical structure but to indicate in what way existing classification, based on traditional exomorphic vegetative and floral features, is supported by internal microscopic structures. Where evidence from both disciplines is in agreement, the conclusions arrived at have a more probable validity, but where results do not agree, the anatomist can only suggest that a re-investigation of the problem by the taxonomist may produce modifications which will lead to mutual satisfaction. Also it must be remembered that external morphology and internal anatomy are only two sources of information from which our ideas on the natural affinities of plants may be derived and that cytology, pollen morphology, and even biochemistry can supply further useful information.

It must also be remembered that taxonomy is concerned in the first place with the identification of plants, as well as determining their probable phylogenetic relations. In this respect the anatomist is much less useful than the taxonomist, although it cannot be denied that anatomical information may be very useful in identifying sterile material and in particular in identifying plant fragments.

Ultimately the structure of all vegetative organs of palms will be described, but at the present moment attention has been largely concentrated on the lamina (leaf-blade) and very little work has been done on the anatomy of stem and root. Even so it appears that the lamina will offer far more useful information, because of its greater variability, than either stem or root which are rather uniform in structure. In addition the lamina is always more easily accessible than other organs.

## *Collecting and Preserving Material for Systematic Anatomical Work*

When a survey of the anatomy of such a large family as the *Palmae* (about 2,600 species) is to be attempted, only a small sample, which must include as many groups as possible, can be studied. In addition, for plants as large as palms it is not possible to describe in detail the anatomy of all parts. For this reason certain restricted but standard regions have been selected for study. These regions are:

i) the *lamina,* either as a pinna at the median level in the feather palms, or a portion of a leaf segment at a median level in the fan palms.

ii) the *rachis,* just below the insertion of the lamina or lowest pinnae.

iii) the *leaf sheath,* at a less precise level, but usually just above its insertion on the stem.

iv) the mature *stem,* including a portion of the inner and outer regions.

v) mature *roots.*

Obviously some parts of a palm are more accessible than others. The lamina is most easily obtained. This is important because the most useful information is obtained from the lamina. The stem is least accessible since it is necessary to cut down and destroy a shoot in order to obtain it. This cannot be done with single-stemmed palms in cultivation. Roots require a little effort in excavating near the base of the stem, but they can be taken without harming the living plant.

After the material has been obtained from the living plant, usually with considerable effort using large knives and saws, it is carefully cut into small enough pieces to go into screwtop preserving jars and is fixed in formalin-acetic-alcohol in which it will maintain its condition more or less permanently without deterioration. In this way a very large collection of dead, preserved material has been obtained from living plants. In order to transport these rather bulky objects it has been found very convenient and affords much saving of space if the material is taken out of its jars of preservative and sealed airtight, together with a small wad of cottonwool soaked in formalin-acetic-alcohol, in polythene bags.

In addition to material derived from living plants much valuable information has been obtained from dried leaf material taken from herbarium or museum specimens. This is often the only source of information about rare and little-known plants. Through the kindness of Dr. C. X. Furtado I have had material from several of the type specimens in the Singapore Herbarium. By simple techniques it is usually possible to revive dried material adequately so that its internal structure can be examined. In one instance material in one of the Kew museums collected by Alfred Russel Wallace in the Celebes nearly one hundred years ago has proved amenable to anatomical study.

## *Preparation of Palm Leaves for Anatomical Study*

Serious technical difficulties were encountered when attempts were made to prepare thin sections of all organs of palms for microscopic study. At the moment only those relating to the lamina have been overcome and can be described.

Preparations in which the surface layers can be studied in surface view are made by laying a piece of the lamina flat upon a glass slide and scraping away as much unwanted tissue as possible. These preparations can be cleared, stained, and mounted in the same way as sections. Difficulties involved in sectioning the leaves of palms are largely due to their high silica content but soaking material in hydrofluoric acid overcomes this. In order to save as much time as possible, lengthy embedding procedures were avoided. It was found that sections could be cut as thin as 10 micra without embedding the lamina, using a Reichert sliding microtome. This made possible a much more rapid advance than might have been otherwise. Although all sections have been examined unstained and untreated, a number of permanent stained preparations have been mounted. For this a special technique was developed for rapid handling of the very delicate freehand sections produced on the sliding microtome. These permanent slides will ultimately be housed at Kew, where they will form part of the reference collection in the Jodrell Laboratory. .

## *The Anatomy of the Palm Lamina*

In order that the subsequent discussion may be fully understood a brief description of the structure of the lamina of palms may prove useful. The pinnae of feather-leaved palms and the segments of fan-leaved palms contain a system of alternating large and small veins which run parallel with each other and more or less longitudinally in the pinna or leaf segment. This system of veins is usually visible to the naked eye. In addition there is a system of short transverse veins connecting the longitudinal veins. These may or may not be visible to the naked eye. From transverse sections of the lamina the conducting tissue of these veins is seen to be sheathed by one or more layers of cells. The smaller veins are usually sheathed only by thin-walled parenchyma cells while the large veins may be sheathed either by parenchyma cells and fibres or even by fibres alone. The transverse veins contain only a few conducting elements and are sheathed either by thin-walled or by thick-walled cells. In addition to the fibres which form part of the vascular bundle sheath, the leaves of palms usually possess scattered fibres or longitudinal fibre strands which are not associated with vascular tissues.

The fibre and vascular strands are embedded in thin-walled assimilating tissue which contains most of the chlorophyll found in the lamina. This chlorenchyma may be differentiated into columnar palisade cells towards the adaxial (upper) surface and rounded, loose spongy tissue cells towards the abaxial (lower) surface, as in most dorsiventral leaves, but very often the mesophyll is uniform and is made up of cells which are all alike.

The surface layers which form the rest of the leaf tissue are often very complicated. In addition to the epidermal cells, which may or may not have thick outer walls and a well developed cuticle, there is usually one or more layers of so called "water-storage" cells below each epidermis. These hypodermal cells are usually large, colourless and thin-walled. Narrow longitudinal bands of these cells in certain precise regions of the lamina become considerably enlarged and anticlinally extended. Since these are believed to bring about the expansion of the folded lamina they have been called "expansion cells." The epidermis itself frequently bears scales, warts or hairs of various kinds which may be visible to the naked eye as small flecks on the surface of the lamina.

## *Anatomical Features of the Leaf Which Are of Diagnostic Value*

Before any morphological feature, whether external or internal, can be used for purposes of classification it must first be established that the structure does not alter as the environment of the whole plant is changed. It is because the floral and reproductive organs of flowering plants are very constant in their appearance within a single species that they are most useful in taxonomic work. In the same way those anatomical features selected to aid the taxonomist must not be plastic structures which are easily altered by changes in the habitat of the plant. For instance, it is well known that the mesophyll of a single species has quite a different appearance in a leaf grown in full sunlight than one allowed to develop in shade, whilst on the other hand, the structure of hairs would not be altered by a similar environmental change. Under these circumstances, therefore, the mesophyll is much less useful as a diagnostic feature than is the type of hair.

With this proviso in mind, the following paragraphs give a very brief summary of the more important structures in the leaves of palms which are believed to be constantly present within a given species and to provide useful criteria for the identification of taxonomic groups of palms.

### *i. Symmetry of the lamina*

Most palms have dorsiventral symmetry in which upper and lower halves of the lamina are different. Stomata, for instance, are usually restricted to the lower surface. The upper mesophyll layers are sometimes differentiated into columnar palisade layers, while the cells of the lower mesophyll remain rounded and rather loose. However, there are a number of palms, such as *Phoenix, Borassus, Sabal* in which the leaves have an isobilateral symmetry with identical upper and lower surfaces and in which the structure of the mesophyll cells below each surface is the same. In other plants in which this symmetry is developed e.g. *Iris,* the leaves usually stand erect so that both surfaces are equally illuminated. Similar ecological conditions may be expected to have induced this structure in those palms with isobilateral leaves. Certainly in *Phoenix* the pinnae remain rather closely folded and might be expected to receive equal amounts of sunlight on upper and lower surfaces. However, the condition must be determined genetically in the first instance since the differentiation of tissues is complete in the folded lamina long before it becomes exposed to light. Also it is rather difficult to accept this explanation for *Sabal* leaves which normally have the lamina extended horizontally.

### *ii. The shape of the epidermal cells in surface view*

The shape may be rectangular, if the cells are extended longitudinally; or rhombohedral, if the cells are extended obliquely; or hexagonal, if the cells are extended transversely, although this last condition is rare. In any one group of palms the shape of the epidermal cells is constant. Thus in the *Sabal* tribe the cells are always rectangular (Fig. 7) whilst in the arecoid palms they are probably always rhombohedral (Fig. 5). Also the anticlinal walls of the epidermal cells in surface view may be either linear, or undulate (Fig. 6). Presence or absence of undulate walls seems to be fairly constant for any one species, so that a useful diagnostic feature is available. Thus, for example, in the *Sabaleae* it is remarkable that all American representatives have linear epidermal walls while most Asian genera have undulate walls, a fact first noted by

Pfister in 1892 (cf. Figs. 6 and 7). The epidermal cells of most members of the *Lepidocaryoideae* have anticlinal walls which are undulate.

*iii. Stomata*

Although the structure of the stomata is very uniform in the palms as a whole and corresponds in general to the alismatoid type (Fig. 8), certain genera or groups of genera have peculiarities in the construction of their stomatal apparatus by which they can be identified. For instance, all members of the small tribe *Caryoteae* have peculiar striations in the walls of the guard cells which are very conspicuous in surface view (Fig. 10). *Sabal* (Fig. 12) and *Chamaerops* are among those genera which can be recognised from the appearance of their stomata in transverse view. In this respect *Nypa* is a well known example because the stomatal pores are occluded by numerous horizontal thickenings of the wall of the guard cells.

*iv. Trichomes*

Although there are a few palms in which excrescences are limited to the midrib region (e.g. *Phoenix*) many bear peculiar appendages on the surface of the lamina the structure of which is very constant and may be diagnostic for the genus or tribe to which the palm belongs. The peculiarity of these structures is that in the still folded leaf they produce a filamentous or scalelike expanse of thin-walled cells which is sloughed off when the leaf expands. Consequently, all that remains in mature leaves are the shrivelled remains of the thin-walled cells borne upon basal thick-walled cells. The latter, however, may have a characteristic arrangement which is easily recognised (Fig. 11). In a few palms — e.g. *Arenga, Diplothemium, Ceroxylon, Latania* — the thin-walled cells persist and become filled with air, so producing a glaucous or feltlike bloom on the undersurface of the leaf. In the bactrid and calamoid palms small multicellular spines are common which show a gradual transition in size to the large spines with which these plants are so fiercely armed.

*v. Hypodermis*

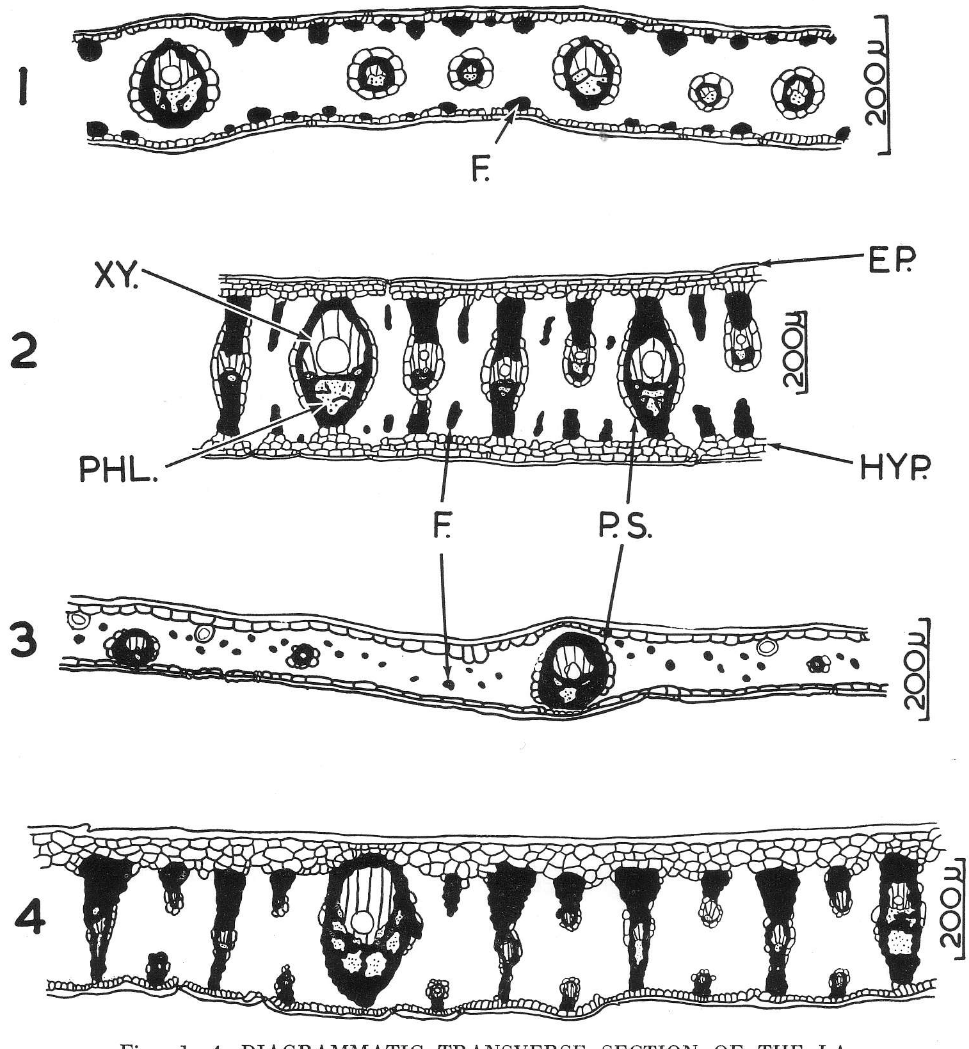
Although the number of layers of enlarged hypodermal cells varies in different parts of a single leaf, at any standard level it is always constant for each species. Usually there is one hypodermal layer beneath each surface (Figs. 1 and 3), but there may be more or there may be unequal numbers on opposite surfaces. As examples, at the standard levels studied, the arecoid palms nearly always have one hypodermal layer beneath each epidermis; *Jubaea* (Fig. 4) has 2-4 adaxial layers, one abaxial layer; *Hyphaene* (Fig. 2) has 3 layers beneath each surface. In addition the shape of the hypodermal cells as seen through the epidermis varies from group to group because the cells may be either transversely or longitudinally extended. Further, the hypodermal cells situated around the substomatal chambers usually have a very definite arrangement which in such genera as *Phoenix* (Fig. 9), *Borassus, Lodoicea,* and *Pritchardia* is very distinctive.

*vi. Expansion cells*

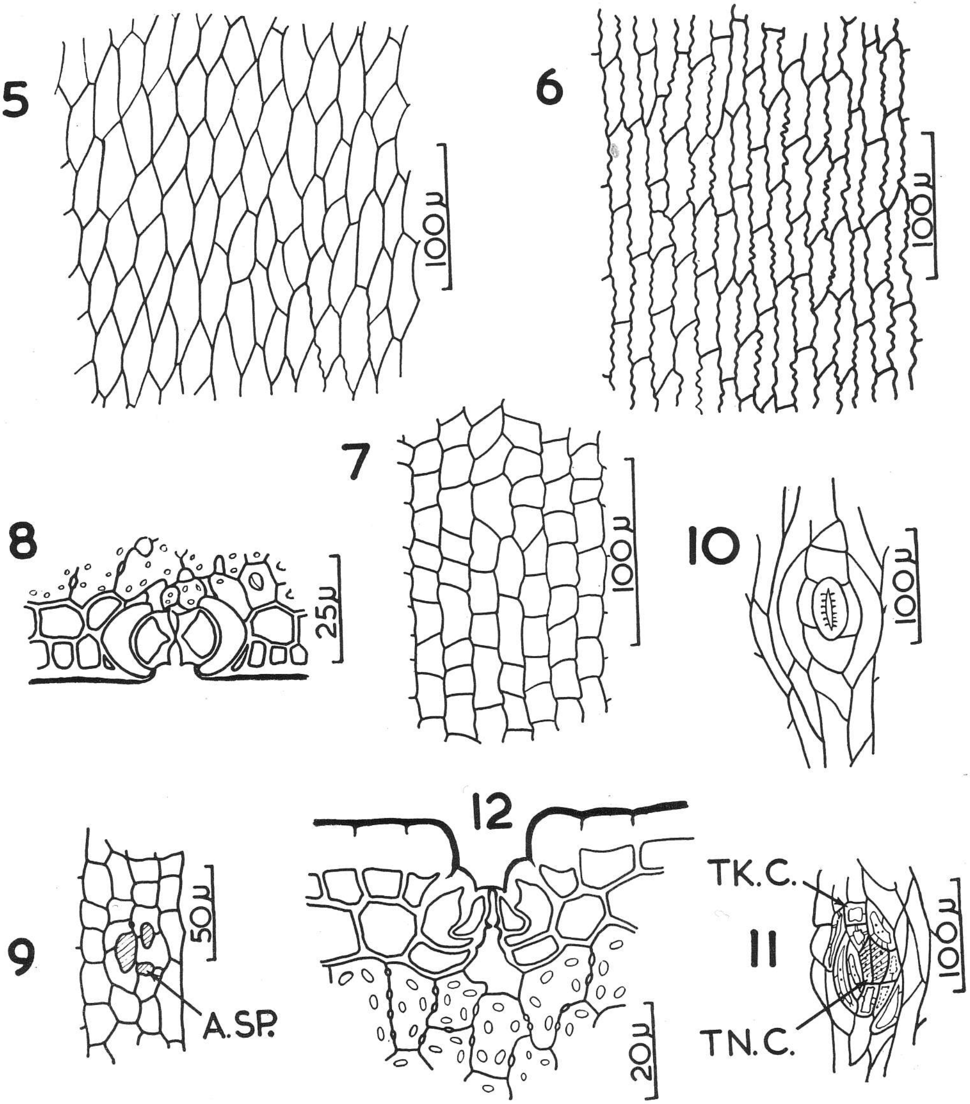
The bands of enlarged hypodermal cells which are assumed to cause the unfolding of the expanding lamina have a fairly restricted position which is constant for each species. For instance, the fan-leaved palms have a band of expansion cells within the angle of each fold of the lamina. In the feather-leaved palms the expansion cells appear to be distributed in two main ways; either there is a band of cells on each side of the midrib, or the cells are not present in the midrib region but are distributed at irregular intervals throughout the lamina.

*vii. Fibre strands*

The position of the strands of fibres which are independent of the sheathing fibres of the vascular bundles is very varied and many groups of palms have their own distinct type of arrangement.




Figs. 1—4. DIAGRAMMATIC TRANSVERSE SECTION OF THE LAMINA. 1, *Phoenix reclinata;* 2, *Hyphaene thebaica;* 3, *Didymosperma Hookerianum;* 4, *Jubaea chilensis.*—sclerotic tissue—solid black; xylem—vertical lines; phloem—stippled; ep.—epidermis; f.—fibres; hyp.—hypodermis; phl.—phloem; p.s.—parenchyma sheath of vascular bundle; xy.—xylem.




Figs. 5—7. ADAXIAL EPIDERMIS, SURFACE VIEW. 5, *Ptychosperma Macarthuri*; 6, *Cyrtostachys Lakka*; 7, *Coccothrinax argentea*; 8, *Phoenix canariensis*, t.s. stoma; 9, *Phoenix canariensis*, hypodermis, surface view, with substomatal cells; 10, *Caryota mitis*, stoma, surface view; 11, *Caryota mitis*, base of epidermal hair, surface view; 12, *Sabal mexicana*, t.s. stoma. —a. sp.—intercellular air-space; tk. c.—thick-walled cells; tn. c.—thin-walled cells.

Often the fibre strands are limited to a position in contact with the surface layers (Fig. 1) while on the other hand they may be limited to the mesophyll (Fig. 3). Yet again, as in *Jubaea* (Fig. 4), the fibres may be found only as large vertical extensions of the sheath tissue of the vascular bundles. Many combinations of these types exist, e.g. *Hyphaene* (Fig. 2).

*viii. Vascular bundles*

The distribution of vascular bundles in relation to the other tissues of the leaf is very variable and imparts a characteristic appearance to the transverse section of the lamina. Often all vascular bundles are connected by fibrous extensions of their sheathing tissues to the surface layers (Figs. 2 and 4). They may be connected mostly either to the upper or lower surface. On the other hand the vascular bundles may be largely independent of the surface layers (Figs. 1 and 3). Then they may be situated either at the centre of the lamina or approach closely to one or other of the surfaces.

The structure of the individual vascular bundles may provide useful features for diagnosis. This depends on the amount of fibrous supporting tissue, the distribution of sheathing parenchyma cells, the amount of xylem, and number of phloem groups, any of which features may vary considerably and so alter the appearance of the vascular bundle in transverse section.

In addition to the longitudinal bundles the size and distribution of the transverse vascular bundles provide useful taxonomic characters. For instance, in the tribe *Attaleeae*, at the points where the two vascular systems cross, the transverse bundles always run above the longitudinal. Large transverse bundles sheathed by fibres are very common in the tribes *Sabaleae* and *Borasseae*, while in the arecoid palms small transverse bundles sheathed by parenchyma are the rule. The genus *Borassus* can be recognized easily by the massive fibre buttresses which connect the transverse bundles to both surfaces.

*ix. Stegmata*

Situated adjacent to the fibre of palm leaves are small cells, each containing a single silica body, the cells being arranged in long files or, less commonly, in small groups. The individual cells have been termed stegmata. They have been observed in all palms, although their number varies considerably from species to species. The shape of the silica body and the extent to which the walls of the cells are thickened is very distinctive for each group of palms. For example, in the *Caryota* tribe, the silica bodies are shaped like small bowler hats and the silica cell is thin-walled. In the arecoid group the silica cell is also thin-walled but the silica body is spherical, while in the *Borassus* tribe the silica bodies are spherical but the wall of the silica cell adjacent to the fibre is always thickened and more or less envelops the silica body. Consequently, in this last group, when the silica body is dissolved away by means of hydrofluoric acid an impression of its shape is left in the wall of the silica cell.

*x. Miscellaneous*

In addition to the structures described above there are many others which have not been mentioned but which may be confined to a limited number of palms and provide very reliable means of identification. Sometimes similar structures may be found in totally unrelated genera. For instance, there are a number of genera which contain fibrelike sclereids, of which *Bactris, Daemonorops* and *Licuala* are examples although these are members of very different tribes. However, because they contain sclereids while closely related members of the same tribe do not, a means of recognising them within their small group is available. In the same way there are several members of the *Sabaleae* and *Lepidocaryoideae* which have a sclereid-like extension of the individual fibres of the sheath of the transverse vascular bundles. Here the fibres run parallel with the vascular tissues for some distance and then their ends are turned away to ramify among the adjacent mesophyll cells. Stone cells have been found only in *Lodoicea*. The wax palm, *Ceroxylon andicola* can be recognized by the deep longitudinal grooves in the lower surface of the lamina to which the stomata are confined. As more material becomes available and is examined, more structures distinctive of individual palms may be brought to light.

## *Discussion and Conclusions*

Before outlining a few of the taxonomic conclusions suggested by those observations on the anatomy of palms that have so far been made, it is well to remember that these conclusions are never derived from the consideration of single characters alone, but from the sum total of similarities and differences between different groups. Were this not so it would be possible to classify palms according to some quite artificial scheme, such as placing together all those palms which have sunken stomata or spherical silica bodies or thickened epidermal cells. This would give quite a different result to the modern system which takes into account as many features as possible. As a matter of fact, palms from obviously unrelated groups often possess common structure. As examples it has already been mentioned that isobilateral leaves are found in many tribes; that sclereids are developed in several unrelated genera, and that the arrangement of cells below the stomata which is so characteristic of *Phoenix* is also found in members of the tribe *Borasseae*.

With this point in mind the following are some of the more obvious conclusions which have been deduced so far:

*i. Specific differences*

It is at once obvious that species from the same genus are not normally distinguishable from each other anatomically. This is because the anatomical differences between closely related species are largely quantitative and in any case the range of variation in structure shown by a single species grown under varied conditions may be greater than the differences between this species and another one. This is not an unexpected result since similar conclusions have been arrived at in anatomical surveys of other families. It merely means that anatomy is of most help to the taxonomist in delimiting taxa at or above the rank of genus.

*ii. Generic differences*

There are a number of palm genera which are sufficiently isolated for them to be recognized from their leaf anatomy alone. *Borassus, Ceroxylon, Cryosophila, Lodoicea, Nypa*, and *Sabal* are a few of the most obviously distinct genera.

At the other extreme very many genera are almost identical anatomically. For instance members of the tribe *Areceae* usually cannot be separated with any degree of confidence from each other on anatomical grounds and the picture will probably become even more uniform when more members of this group are examined. Similarly, recent revisions of the very large rotang genus *Calamus* have created several new genera which are morphologically very distinct. However, when I came to examine many of these in Singapore, largely through the kindness of Dr. C.X. Furtado, I was unable to find definite anatomical limits between them and the "parent" genus, which is not an unexpected result. What is a surprising result, on the other hand, is that the genera *Calamus* and *Daemonorops*, both of which are climbing rotangs of the Eastern Tropics with very similar habits and which are so closely related that they were frequently confused in early taxonomic work, are very easily distinguished by means of certain anatomical structures in the leaf.

*iii. Differences between genera within the same tribe*

Within the major groups it is often possible to pick out certain groups of genera which have close affinities. For instance, in the *Sabaleae*, the genera

*Licuala, Teysmannia* and *Pholidocarpus* show a combination of anatomical characters not found elsewhere. This sort of thing is to be expected and will probably be found to occur frequently as the range of observations is extended because within a single tribe all genera have not an equal affinity with each other.

*iv. Tribal differences*

Even after a brief examination of the anatomy of palm leaves it was fairly obvious that each of the major groups of palms has a combination of anatomical leaf characters by which it could be recognized. Thus, in just the same way as one could talk about the arecoid inflorescence, or the lepidocaryoid fruit, it is possible to conceive a sabaloid or phoenicoid or arecoid type of leaf section. As an example the following description would apply to all members of the tribe *Caryoteae*:

Leaf dorsiventral. Epidermal cells rhombohedral or spindle-shaped, walls linear. Stomata superficial, guard cells with transverse striations on the ledges conspicuous in surface view (Fig. 10). Hairs usually abundant on the abaxial surface and producing a glaucous bloom of thin-walled, air-filled cells, each group of superficial cells arising from two or three basal thin-walled cells which are surrounded by a cylinder of thick-walled, sclerotic cells (Fig. 11). Hypodermis usually one-layered below each surface. Nonvascular fibres situated in the mesophyll and rarely making contact with the surface layers (Fig. 3). Individual fibres with large, septate lumina. Longitudinal vascular bundles mostly independent of the surface layers and situated at a median depth in the lamina, or towards the abaxial surface. Phloem often sclerotic. Transverse vascular bundles small, sheathed by parenchyma only. Stegmata with a hat-shaped silica body, silica cell thin-walled.

*v. Evidence in support of recent taxonomic revision*

One very interesting aspect of this present study is that some recent modifications in the classification of palms arrived at from a study of exomorphic features have been confirmed independently by anatomical observations. This is very stimulating and is rather like a detective novel in which the reader is able to identify the criminal from a different set of clues to those provided by the author. For instance, the genus *Orania* was included in the small tribe *Caryoteae* by Drude (1889). An examination of its structure showed that there were many differences between its leaf anatomy and that of the rest of the *Caryoteae* and in addition the genus did not show any obvious affinities with any other tribe of palms. It was therefore very gratifying to discover subsequently that both Beccari and Burret had each included *Orania* in a distinct tribe in their subdivisions of the *Palmae*. Another example is equally clear-cut. When Ridley described the genus *Pholidocarpus* for the *Flora of Malaya,* it was included in the tribe *Borasseae* only to be moved subsequently into the *Sabaleae*. Anatomical evidence supports this change and also suggests that *Pholidocarpus* may be related to the genera *Teysmannia* and *Licuala*.

*vi. Concluding remarks*

Largely due to lack of material, little anatomical work has been done on a number of small groups of palms which have undergone recent taxonomic revision (see Appendix). It is hoped that when more anatomical evidence becomes available it will be allowed to contribute its weight in arguments about the affinities of the larger groups of palms. Most interesting results from this type of work are produced when the anatomist is able to work in close co-operation with his taxonomic colleague. Dr. H. E. Moore, Jr. has promised to give advice on taxonomic matters which will probably save me much muddled thinking.

Some practical value should also be obtained from the results because identification of sterile and fragmentary material may be made possible. This can be of assistance to the ecologist, the archaeologist, the economic botanist, or even the horticulturist.

One further point of general usefulness may also be a result of this survey in that the development of the leaf and other organs of the palms which has long been enigmatic to botanists, will be made more amenable to study when our knowledge of the anatomy of the mature organs is more complete. The main object at the moment is to assemble all the details in one volume.

### *Appendix. Palm Material Required for Anatomical Study*

The following is a list of the palm genera (classification of Drude) of which material is required to make the anatomical survey as complete and useful as possible. Since most of the palms required are American it is thought that members of the Palm Society may be in a position to supply me with material, particularly of the less well known genera. Of course it may be difficult to obtain all parts of each species, that is stem, leaf and root, and it is understood that members may jib at the idea of tackling a 60-foot palm to gratify the wishes of a foreign scientist. However, as is emphasized earlier, it is the lamina of the palm which is of most value for systematic anatomy and it may be a simple matter to snip off a leaflet or two. The material should be fixed in spirit or preferably, in formalin-acetic-alcohol. It can be mailed in a sealed polythen bag, enclosing a wad of damp cotton wool. If these facilities are not available the leaf in a well dried state will be extremely useful. If any member of the Society is willing to help I will be only too glad to supply further details.

TRIBE SABALEAE

*Rhapidophyllum* *Brahea*
*Nannorhops* *Cryosophila*
*Serenoa*

TRIBE MAURITIEAE

*Lepidocaryum* *Mauritia*

TRIBE GEONOMEAE

*Manicaria* *Asterogyne*
*Leopoldinia* *Calyptrogyne*
*Calyptronoma* *Welfia*
*Geonoma*

TRIBE IRIARTEAE

*Catoblastus* *Wettenia*
*Iriartea* *Juania*

TRIBE MORENIEAE

*Morenia* *Pseudophoenix*
*Kunthia* *Reinhardtia*
*Gaussia*

TRIBE ATTALEEAE

*Orbignya*

TRIBE ELAEIDEAE

*Barcella* *Corozo*

TRIBE ARECEAE

*Prestoea* *Roscheria*
*Gigliolia* *Oenocarpus*
*Linospadix* *Cyphokentia*
*Iguanura* *Hydriastele*
*Sommieria* *Loxococcus*
*Clinostigma* *Cyphophoenix*
*Jessenia*

SUBFAMILY PHYTELEPHANTOIDEAE

*Phytelephas*

# Pelagodoxa Henryana

*Pelagodoxa Henryana* is one of the most fascinating rarities among the cultivated palms. The species is rare even in its native habitat—valleys on Nuku Hiva (Nukahiva), Hiva Oa, and Tahuata, all volcanic islands in the Marquesas Islands lying some 700 miles northeast of Tahiti.

Our first published record of this unusual palm appears in a French horticultural journal, *Revue Horticole* (ser. 2, 15: 302. 1917). There, D. Bois incorporated a formal description, provided by Odoardo Beccari, with photographs of a small plant, seedlings, a drawing of fruits, and notes from Charles Henry, who discovered the palm on Nuku Hiva. According to Henry, the plants, of which he saw only twelve, grew at a low altitude in the shade of *Hibiscus tiliaceus* where they never saw the sun. In describing them, he wrote (translated) "I have rarely seen a more beautiful palm. Some individuals four to five years of age, straight of stem, have the appearance of adult specimens