

A NEW FIJIAN SPECIES OF CALYPTOSEPALUM

I. W. BAILEY AND A. C. SMITH

With two plates

AMONG THE PHANEROGAMS collected in Fiji by the junior author in 1947¹, one specimen from upland central Viti Levu could not, upon preliminary study, be referred to any family known to occur in the region. Of the plant in question, *Smith 5339*, several duplicate herbarium specimens and a wood sample from the trunk are available. The herbarium material bears foliage and essentially mature fruits, but one sheet shows very young fruits, with the carpel scarcely developed beyond its flowering condition and with the perianth and disk intact, and also young flower buds. The plant being apparently dioecious, no staminate flowers are available, and there is no trace of stamens or staminodes in the pistillate flower.

The specimen clearly represents a genus not previously recorded from Fiji or the adjacent archipelagos. The desirability of applying a name to it has led us to consider all plausible systematic positions for this Fijian plant, and we have reached the conclusion that it is best placed as a congener of *Calyptosepalum sumatranum* S. Moore. Reasons for this conclusion and a discussion of the position of the genus follow a formal description of our new species and an analysis of its salient characters.

***Calyptosepalum pacificum* sp. nov.**

Arbor dioica ad 12 m. alta, ramulis cinereis subteretibus praeter partes novellissimas minute et fugaciter sericeas glabris valde corticeo-lenticellatis; stipulis binis basi petiolorum lateralibus deltoideis acutis circiter 1 mm. longis latisque extus minute fulvo-sericeis mox caducis, cicatricibus minutis; foliis simplicibus alternatis, petiolis nigrescentibus leviter canaliculatis in sicco rugulosis crassis (1.5–2 mm. diametro) 1–1.5 cm. longis; foliorum laminis coriaceis siccitate brunneis vel fusco-olivaceis, ovato-oblongis vel late ellipticis, (6–) 7–12 cm. longis, (3–) 3.5–7 cm. latis, basi late obtusis vel subtruncatis et saepe paullo inaequilateralibus, in petiolum subito breviter decurrentibus, apice obtusis vel subacutis, margine integris et leviter incrassatis, utrinque glabris vel interdum pilos paucos dispersos subpersistentes (eis carpelli similes) subtus nervis gerentibus, pinnatinerviis, costa valida utrinque prominente et rotundata, nervis secundariis utrinsecus 5–8 irregulariter arcuato-adscendentibus et copiose anastomosantibus utrinque valde elevatis, basalibus confertis, rete venularum copioso utrinque

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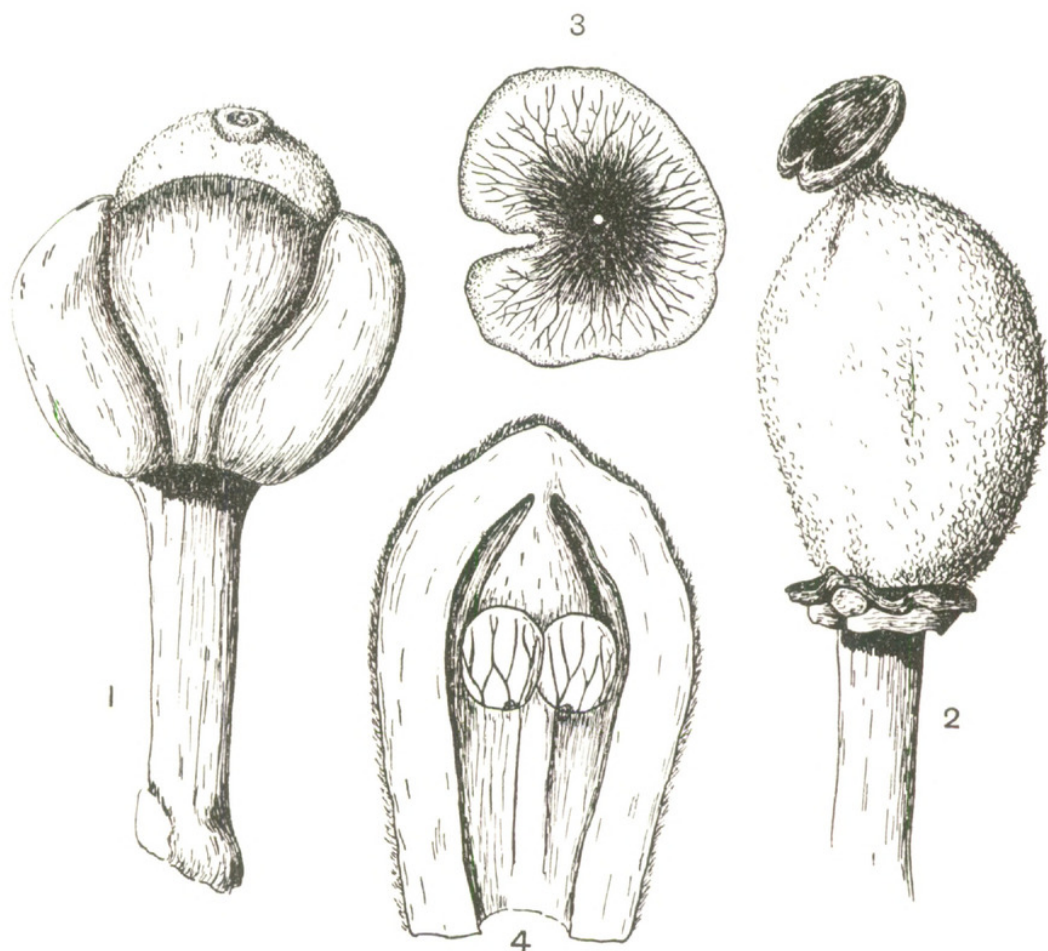
prominulo; floribus (♀ solis visis) pluribus (plerumque 2–5, interdum cum aliis abortivis), e glomerulis parvis irregularibus natis, glomerulis axillaribus vel supra cicatrices in ramulis defoliatis dispositis; bracteolis sub floribus paucis (videtur 2 basi pedicelli oppositis) late reniformibus, circiter 0.5 mm. longis, 1.5–2 mm. latis, extus obscure sericeis, margine rotundato minute ciliolatis; pedicellis rectis teretibus in sicco rugulosis paullo post anthesin 4–6 mm. longis, parce strigilloso-puberulis demum glabratiss, apice in receptaculum complanatum 2–3 mm. diametro subito incrassatis, sub fructu ad 2 mm. diametro et 8 mm. longis; perianthio tepalis 4 decussatis composito, tepalis reniformi-ovatis apice rotundatis, 2.5–3 mm. longis, 3–3.5 mm. latis, e basi plurinervatis, glabris, 2 exterioribus papyraceis, 2 interioribus membranaceis, omnino evanescentibus, cicatricibus linearibus vel transverse ellipticis inconspicuis; disco annulari carnoso glabro, primo subpatente haud 0.5 mm. alto apice truncato, demum rotato et margine irregulariter sinuato; staminibus et staminodiis nullis; ovario supero ellipsoideo vel obovoideo uniloculari, extus minute papilloso et copiose piloso (pilis pallide fuscis simplicibus pluriseptatis ad 0.5 mm. longis subadscendentibus vel subappressis, apicem ovarii versus reflexis); stigmate subsessili terminali carnoso peltato leviter infundibulari 2–3 mm. diametro, margine ventraliter inciso, mox caduco (raro subpersistente), cicatrice parva rotundata; ovarii loculo solitario, placenta ventrali superne valde incrassata, ovulis 2 collateralibus anatropis, e parte incrassata placentae pendulis; fructibus ellipsoideis vel obovoideis maturitate ad 3 cm. longis et 1.5 cm. latis, basi et apice rotundatis, raro stigmate coronatis, apice plerumque inconspicue cicatricosis, pericarpio coriaceo persistenter piloso, semine solitario (ovulo altero abortivo) in sicco valde contracto, in vivo videtur magno carnoso elongato-obovoideo apicem versus connecto, testa tenui, endospermo copioso, embryone magno.

FIJI: VITI LEVU: Mba: Valley of Nggaliwana Creek, north of the sawmill at Navai, alt. 725–850 m., July 21, 1947, *Smith 5339* (TYPE at Arnold Arboretum, 2 sheets, duplicates at U. S. National Museum, etc.) (*ndonggau*; tree 12 m. high, on edge of dense forest; tepals dull yellow; mature fruit orange).

The new species differs from *C. sumatranum* S. Moore, the type and only previously known species of *Calyptosepalum*, in several obvious characters, although the known flowers, being staminate in one case and pistillate in the other, cannot be too critically compared. The Fijian plant has comparatively long petioles and leaf-blades that are thicker in texture, proportionately broader, obtuse to subtruncate at base, and obtuse or subacute at apex. In contrast, *C. sumatranum* has its leaf-blades narrowed at base and short-acuminate at apex, with nerves and veinlets less obvious than those of *C. pacificum*. As regards floral characters which presumably are specific in nature, it may be noted that the disk in *C. sumatranum* is pilose and the ovary-rudiment (in ♂ flowers) glabrous, whereas in the new species the disk is glabrous and the ovary copiously pubescent.

THE FLOWER

The several duplicate specimens of the single collection of this Fijian tree bear mature or nearly mature fruits. The type specimen has, in addition, small immature fruits and a few flower buds in early stages of enlargement. A detailed study of the exomorphic and endomorphic characters of the flower buds and of the youngest fruits enables one to visualize the general form of the flower at anthesis. It consists of two pairs of fleshy decussate tepals, a glandular-appearing, annular disk, and a single carpel which contains two pendent anatropous ovules and terminates in a broad, funnel-shaped stigma, TEXT-FIGS. 1-4. There are no rudiments of stamens or staminodes and no structures that might be interpreted as vestiges of petals. It should be noted in this connection, however, that subsequent to anthesis and during the enlargement of the torus and of the young fruit,



TEXT-FIGURES 1-4. FIG. 1. Young fruit, showing retention of the decussate tepals at an unusually late stage of development. There is a corky scar at the apex of the carpel left by the abscission of the stigma, $\times 12$. FIG. 2. Young fruit, showing retention of the stigma, also disk and corky scars left by the abscission of the tepals, $\times 8$. FIG. 3. Cleared stigma, showing complex vasculature, $\times 12$. FIG. 4. Longitudinal section of carpel, showing two pendent anatropous ovules, $\times 10$.

the disk becomes distorted and broken and gives at times a false impression of being the bases of additional appendages. Abscission of the tepals and stigma appears to occur shortly subsequent to anthesis, leaving four corky scars at the base of the enlarging carpel and a circular embossed one at its apex. In exceptional cases only are the tepals and stigma retained for a time during subsequent stages of development, TEXT-FIGS. 1 and 2.

Each of the four decussate tepals has a branching reticulate venation derived in most cases from three principal, independent vascular strands or traces. The disk is unvascularized, but the carpel in its somewhat enlarged form in the youngest available fruits has a strikingly complex and highly specialized vasculature. In transverse sections cut at the base of such a carpel, there is an outer ring of numerous, small, precociously branching vascular strands, a small, compact, more or less centrally located eustele, and a single, large, detached bundle. The outer bundles extend upward in the wall of the carpel, branching repeatedly and forming a basket-like venation of much complexity. The central eustele is in continuity at lower levels with the eustele of the pedicel. It extends upward in the ventral side of the carpel to the level of attachment of the ovules, where it dissociates into a number of principal strands. Two of these curve abruptly downward and ramify in the integuments of the ovules, two extend upward and ramify in the stigma, and four to six curve upward and then downward in the wall of the carpel. The large detached bundle extends upward as a discrete strand in the dorsal side of the carpel. It branches at higher levels and has an extension into the stigma. Evidence from a young flower bud indicates that the differentiation of the ventral eustele and of the discrete dorsal strand is initiated during early stages of the ontogenetic development of the flower, whereas that of the peripheral bundles occurs during subsequent stages of the enlargement of the torus and carpel. There are no vestiges of a suture in the ventral side of the older carpels, but the stigma has a deep cleft in its ventral side, TEXT-FIGS. 2 and 3.

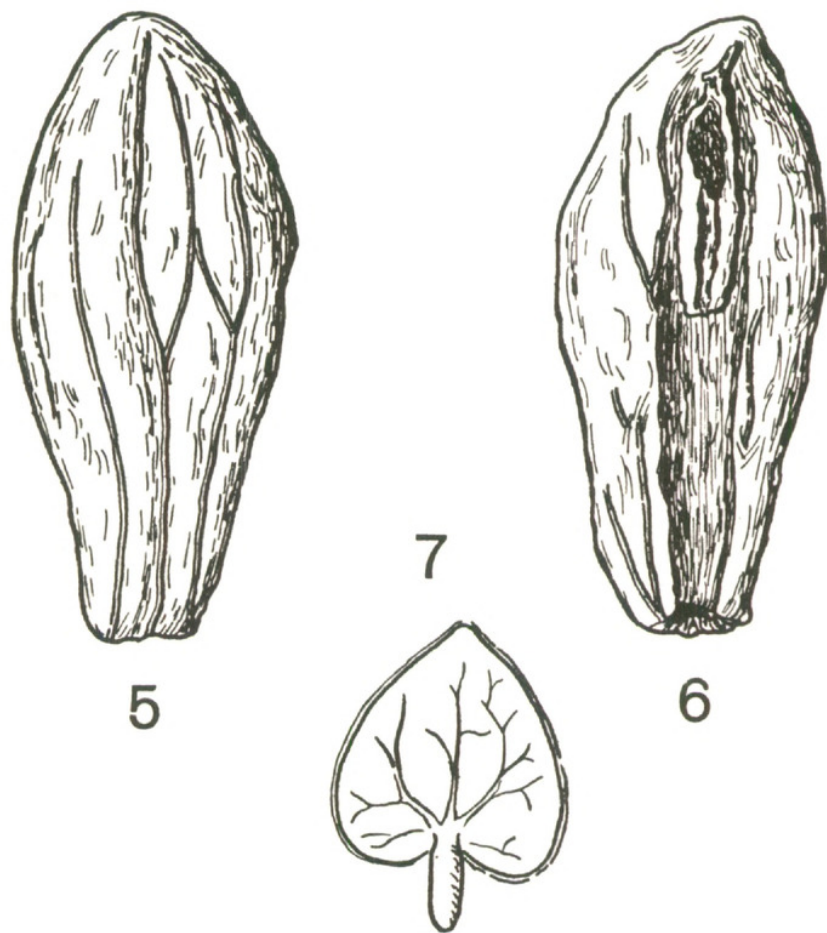
THE FRUIT

One ovule aborts, at least in a majority of cases, and the mature fruit contains a single elongated seed, TEXT-FIGS. 5 and 6.

The older fruits have no clearly defined outer epidermal layer, but instead are clothed externally by a dense mat of short, multicellular papillae. This papillose surface appears to be derived during development of the carpel and the young fruit by repeated periclinal and anticlinal divisions of all of the cells of an originally unicellular epidermal layer. Among the papillose projections are elongated hairs which become more widely spaced as the fruit matures. Both the papillae and the hairs vary considerably in size and form. Among the former are conspicuously capitate and glandular-appearing ones. The hairs are multicellular and frequently are internally septate. They may be thick-walled or thin-walled, straight or markedly undulate, or recurved parallel to the surface which bears them.

As seen in sectional view, PLATE-FIG. 1, the pericarp consists of five more

or less clearly defined layers. Passing from without toward the locule these are: (1) the papillose layer referred to in the preceding paragraph, (2) a zone of small, thin-walled parenchymatous cells, (3) a zone composed largely of stone cells, (4) a broad central zone of large, thin-walled parenchymatous cells and (5) a compact zone of thin-walled parenchyma whose cells tend to become elongated or oriented parallel to the inner surface of the pericarp. The vascular bundles are distributed within the



TEXT-FIGURES 5-7. FIG. 5. Seed, showing vasculature, $\times 3.3$. FIG. 6. Seed, showing extensive hilum, $\times 3.3$. FIG. 7. Embryo, $\times 3.3$.

broad central layer and have numerous branches which extend outward toward the sclerenchymatous zone. The proportions and the detailed configurations of these layers change during successive stages of the enlargement of the fruit. In particular, the layer of stone cells becomes broader and denser. Furthermore, the vasculature of the pericarp becomes increasingly complex and massive.

THE SEED

The seed, even in apparently mature fruits, contracts so extensively in drying and becomes so deformed that it appears to have aborted. However, it re-expands upon soaking and resumes its original plump, elongated form,

TEXT-FIG. 5. It contains a well-formed, normal-appearing embryo with pseudo-palmately veined, basally auriculate cotyledons, TEXT-FIG. 7. The embryo is embedded in a massive endosperm whose thin-walled cells contain no visible accumulations of starch, fat or oil. It is the excessive contraction and re-expansion of these large, delicate cells which produces the pronounced changes in volume of the seed during drying and wetting. The testa is thin and soft and contains an externally conspicuous vasculature which resembles that of the ovules in greatly expanded form, compare TEXT-FIGS. 4 and 5.

THE LEAF

The simple, entire, pinnately veined leaf is coriaceous and glabrous appearing when fully expanded. However, a few hairs tend to persist, from the early juvenile stages, upon the lower surface of the leaf and to be scattered along the principal veins. These hairs resemble the thicker-walled, recurved ones that occur on the carpel and fruit. The base of the young leaf is flanked by a pair of small, triangular, caducous stipules which leave corky scars following abscission.

The lower epidermis is composed of angular cells of relatively uniform size. The stomata have no special subsidiary cells, and the guard cells are not extensively subtended by the surrounding epidermal cells. There is a conspicuously differentiated layer of large hypodermal cells which becomes discontinuous at times. The palisade layer consists of several rows of relatively short elements, and the thin-walled spongy mesophyll contains large intercellular spaces. The venation is massive and conspicuous, even the smaller veinlets being jacketed by sclerenchyma and in turn by thin-walled crystal-bearing cells, PLATE-FIG. 4.

Three traces, related to a trilacunar node of the stem, enter the base of the petiole, where they quickly become associated in a vascular cylinder or eustele, PLATE-FIG. 2, which extends throughout the petiole and the mid-rib of the lamina. Within the pith of this vascular cylinder, in its course through the petiole, there are one to three, commonly two, amphivasal bundles. The cells of the parenchyma of the petiole, particularly many of the cortical cells and the rays of the secondary phloem, contain crystals of calcium oxalate. Small druses predominate in the phloem and large, single, rhombohedral crystals in the cells of the cortex. The vascular cylinder is jacketed by large, very thick-walled fibers.

THE STEM

The pith and the eustele in the internodal parts of the stem have a symmetrically four-lobed form as seen in transverse sections, the configuration of the tissues being correlated with an approximately one-half phyllotaxy. The median traces of the leaves are situated in two opposite lobes and the lateral traces in the two intervening lobes. The median trace of each leaf consists of two widely separated halves in the subtending

internodal part of the stem, but commonly divides forming three or four independent strands at the nodal level. Further divisions of these strands, as also of the lateral traces, occur precociously in the base of the leaf, where orientation into a foliar eustele takes place.

The pith is homogeneous and composed of relatively short cells, many of which contain single rhombohedral crystals of calcium oxalate. The secondary xylem is formed by a primitive type of cambium having elongated fusiform initials with extensively overlapping ends. The wood parenchyma is apotracheal in distribution, PLATE-FIG. 3, varying from diffuse to loosely aggregated tangentially. The relatively thin-walled, angular vessels occur singly and in small radial clusters. The long, slender vessel members have numerous scalariform perforations in their extensively overlapping ends. The intervascular pitting in the tangential facets of adjoining vessels is minute, closely crowded and multiseriate, and exhibits numerous transitions between opposite and alternating seriations. Vestiges of scalariform pitting are of not infrequent occurrence, particularly in the smaller vessels. The pitting between vessels and wood parenchyma or rays is of essentially similar size and form, with, however, numerous evidences of unconformity. The imperforate tracheary elements or "fibers" have such excessively thickened walls that the lumina are occluded and the pits are few in number with minute vestigial borders. The first-formed secondary xylem has vertically extensive uniseriate rays composed of tall erect cells. In addition, there are more or less numerous biseriate and triseriate rays composed of more nearly cubical cells or slightly procumbent ones. The wood from the outer part of old stems resembles the secondary xylem of twigs taken from herbarium specimens, but exhibits the usual increase in cell size that occurs during enlargement of stems. The rays, PLATE-FIG. 5, are lower, the multiseriate (2- to 4-seriate) ones being proportionally more numerous and composed of radially more extensive procumbent cells. Many of the parenchymatous cells of both the earlier and the later formed wood contain crystals of calcium oxalate, the rhombohedral form predominating.

Prior to the initiation of cambial activity, each bundle of the eustele — as seen in transverse sections of the stem — is capped externally by thick-walled fibers. Subsequently, the entire vascular cylinder becomes enclosed in a composite ring of sclerenchyma, formed in part by the original fibers and in part by stone cells derived from tangentially intervening, thin-walled parenchyma. The secondary phloem, when first formed, is soft and is composed of parenchyma, sieve tubes and rays, no fibers being formed among the derivatives of the cambium. As the zone of phloem widens in enlarging stems more or less extensive sclerification of parenchyma occurs in its outer part. The form of these secondary changes in the older phloem varies considerably in different parts of the tree. Successive rings of sclerenchyma are formed in the bark of the main stem of the tree. These rings are comparatively widely spaced and are composed of sclereids. The soft intervening tissue contains more or less numerous patches of such sclerenchyma derived in part from phloem parenchyma and in part by the

sclerification of ray cells. At least in certain of the upper branches of the tree, all of the vertically oriented parenchyma tends to develop lignified secondary walls, whereas most of the cells of the rays do not.

The crystals of calcium oxalate differ markedly in form in different parts of the phloem. Druses occur abundantly and characteristically in the unmodified parts of the rays. On the contrary, the zones and patches of stone cells have numerous cells which contain single crystals of rhombohedral form.

DISCUSSION

The summation of reproductive and vegetative characters, in the case of this Fijian tree, is peculiar and unusual, and the problem of determining the true relationships of the plant is a difficult one. When all of its salient exomorphic and endomorphic characters are taken into consideration, it does not fit readily into any existing family of the dicotyledons. However, it closely resembles a Sumatran tree collected by H. O. Forbes in 1880-82, subsequently described and placed in the monotypic genus, *Calyptosepalum*, by S. Moore (3) in 1925.

The species, *Calyptosepalum sumatranum* S. Moore, is based upon two collections, *Forbes* 2847 and 2862. Both sets of herbarium specimens bear male flowers only, but a few detached fruits were included under *Forbes* 2862. Unfortunately, these fruits are of two entirely different kinds. Therefore, it is essential to determine which of them actually belongs to *Calyptosepalum*.

Both of the Forbes collections, 2847 (isotype) and 2862, are represented in the Gray Herbarium, and our observations are based upon these specimens, supplemented by examination of a fruit from *Forbes* 2862 at the British Museum. Sections of the stems of *Forbes* 2847 and 2862, made by Swamy (5) in connection with his anatomical investigation of the Santalaceae, were available for detailed study.

Significant similarities and differences between the vegetative parts of the Fijian and the Sumatran plants are the following:

The buds of both trees are naked with a $\frac{1}{2}$ phyllotaxy and precociously developing triangular stipules. Those of the Fijian plant are less conspicuously hairy except at their apex, and the stipules are more massive and leave more evident scars following their earlier abscission. The stems of both plants have a characteristically 4-lobed pith and eustele as seen in transverse sections, a morphological feature that is correlated with a $\frac{1}{2}$ phyllotaxy and a trilacunar nodel anatomy. The cellular structure of the pith, xylem, cambium, phloem, and cortex is fundamentally similar in both cases, the only conspicuous histological difference being the occurrence of porous, as well as of scalariform, perforation plates in the vessels of the Sumatran plant. The major patterns and the minor details of the vascularization of the petiole and lamina of the simple entire leaves are strikingly similar. The petioles of both plants have cylindrical eusteles surrounding a pith which contains from one to three vascular strands, the

medullary bundles of the Fijian plant being more extensively amphivasal than those of the Sumatran species. The venation of the lamina, as revealed in cleared specimens, is massive and conspicuous, even the smaller veins being jacketed by sclerenchyma and in turn by crystal-bearing cells. The stomata of the Sumatran plant are more extensively subtended by surrounding epidermal cells, and hairs and bases of hairs are more numerous on the under surface of fully matured leaves. In addition, there are more numerous small druses in the palisade layer.

Both plants are characterized by having hairs of a similar structural type, viz. multicellular and unbranched, but commonly recurved parallel to the surface which bears them. Furthermore, both are characterized by forming two types of crystals, viz. druses and single rhombohedral crystals.

A summation of exomorphic and endomorphic evidence from the vegetative organs indicates that the Fijian tree and the Sumatran one are closely related. Such differences as occur in the leaves and stems are of no greater magnitude than may be anticipated in related, but geographically widely separated, species. In fact, without convincing evidence from the reproductive organs, there are no valid arguments for placing the two trees even in separate genera.

It is unfortunate that the female flower of the Sumatran plant and the male flower of the Fijian tree are not available, and that one is forced at present to depend upon comparisons between flowers of different sexes.

The size, external form, and axillary distribution of the flowers are similar in both cases. Both kinds of flowers have a perianth consisting of two pairs of fleshy, deeply concave, decussate tepals. Both have a conspicuous disk whose form is determined by internal pressures and spacial relationships within the developing flower bud. At anthesis, the expanded disk of the male flower bears the imprints of the four stamens that are crowded inward and downward upon it in the closed bud. That of the female flower, being confined to the space between the base of the carpel and the tepals, expands outwardly rather than inwardly and has an undulating contour in conformity with the fleshy bases of the tepals. The disk of the male flower is pilose, whereas that of the female flower is glabrous and glandular appearing. The carpel of the female flower is conspicuously pilose during the earlier stages of its ontogeny, whereas its sterile homologue in the male flower is nearly glabrous. However, the hairs of both flowers are of a fundamentally similar structural type.

As noted earlier, the detached fruits included under *Forbes 2862* are of two different morphological kinds. In the case of the specimen at the Gray Herbarium, the fruit obviously does not belong to *Calyptosepalum* as indicated by the character of the persistent gamosepalous calyx which subtends it. The angularities in the outer contour of the calyx demonstrate that it is composed of five concrescent members. Furthermore, the hairs on its external surface are unicellular and aggregated in clusters, in marked contrast to the multicellular (i.e. internally septate) and diffusely distributed ones of *Calyptosepalum*. The fruit is broadly ovoid, with a massive pericarp and a persistent, fleshy, 4-lobed and 4-ridged stigma. It

has four locules, each of which contains a seed with conspicuously sclerenchymatous testa.

The fruit from *Forbes 2862* at the British Museum is detached from its pedicel and has a corky scar at its apex, formed by the abscission of its stigma. It is of more ellipsoidal form and evidently is the kind of fruit that was figured and described by Moore (3). It is derived from a single enlarged carpel and contains a single seed which is attached at a relatively low level of its ventral side. As in the case of the Fijian fruits, the seed contracts and expands extraordinarily during drying and soaking. It has a thin soft testa with coarsely conspicuous vasculature, and a massive endosperm which is lobed internally. No embryo is visible.

Although the fruit and seed of *Forbes 2862* from the British Museum closely resemble those of the Fijian plant in their salient exomorphic characters and in the cellular structure of the testa and endosperm, there are obvious anatomical differences in the pericarp. The outer surface of the Sumatran fruit is glabrous, with a thick cuticle which projects inwards between the epidermal cells. Thus in surface view, the epidermis has a reticulate pattern superficially resembling that which occurs on the under side of the leaves of certain Sapotaceae. The sclerenchymatous layer is internal, instead of external, to the vasculature. The stone cells, many of which are of irregular size and form, occur in closely adjacent patches and give to the internal surface of the pericarp an appearance of being composed of a miniature mosaic.

Forbes' field notes indicate that fruits of *Calyptosepalum sumatranum* were collected. It seems likely, therefore, that the fruit from *Forbes 2862* at the British Museum is one of these, and that the fruit on the corresponding specimen at the Gray Herbarium was added to that sheet by mistake.

Evidence from the flowers, fruits, and seeds supports anatomical data from the vegetative parts and indicates that the Fijian tree is closely related to *Calyptosepalum*. The question whether the two plants should be included in the same genus or should be placed in two separate, but closely allied, genera is one that may not be finally answered until more extensive collections of the reproductive parts are made. However, on the basis of material now available, we find no valid reason to separate the two plants generically. Differences between them are of a sort to be anticipated in any angiosperm genus of reasonable circumscription, and so we refer the new Fijian species to *Calyptosepalum* with a fair degree of confidence.

Moore (3) concluded that the affinity of *Calyptosepalum* is with *Henslowia*, and therefore placed the Sumatran tree in the Osyrideae of the Santalaceae. It is listed under that family by Pilger (4) who considered it to be a genus of uncertain affinities. As shown by Swamy (5), *Calyptosepalum* cannot be included in the Santalaceae, even as a primitive and structurally less specialized representative of that family. Furthermore, the genus has a number of salient characteristics which exclude it from the Olacaceae. Indeed, a summation of evidence from both the vegetative and reproductive parts suggests that *Calyptosepalum* and its

Fijian relative do not belong in any previously described family. Should they be placed in a new family?

This raises a question of major taxonomic significance and one upon which general agreement should be attained. If *Casuarina*, *Leitneria*, *Myzodendron*, *Grubbia*, *Octoknema*, *Lactoris*, *Cercidiphyllum*, *Eupomatia*, *Gomortega*, and other isolated end-products of morphological specialization are to be segregated in independent small families, then it obviously is consistent to deal with *Amborella*, *Trimenia*, *Euptelea*, *Trochodendron*, and many other genera in a similar manner. Although such a procedure leads to a multiplication of small families—to which many systematic botanists object—it is preferable to loading truly homogeneous families with discordant elements which prove upon thorough study to be out of place. Classification should be determined not by an inherently and rigidly “conservative” or “radical” concept of families, but by the character of the plants under consideration.

In this connection, we may well remember that modern concepts of family delimitation were evolved by botanists familiar, for the most part, with the floras of the Northern Hemisphere. In the regions best known to them, the students who outlined our angiosperm families found many large and obviously closely related groups of genera. Because of the apparently natural composition of such groups as the Compositae, Rosaceae, Orchidaceae, Gramineae, etc., it is probable that the taxonomists of a century ago became inured to a concept of large and comparatively few families, and that they subconsciously acquired an aversion to “splitting” at the family level. This aversion, as is well known, persists among the curatorial staffs of modern herbaria. Every change in family delimitation and every proposal of a new family means, to the curator of a herbarium, a change in his system, accompanied by a shift of specimens, the preparation of new covers, case-labels, index-cards—in short, such a change means more work for a small and often already harassed staff. It is not surprising, therefore, that herbarium botanists with great pertinacity cling to the notion that there are already “enough” families.

However, it is not a function of systematists to decide *a priori* upon the number of families. If the plants of the southeastern Asia-Malaysian area had been as well known to the phylogenists of a century ago as were the plants of Europe and North America, can anyone believe that our traditional families would have their present circumscriptions? Workers in this area and also in tropical Africa are finding that, if they apply to their floras the criteria of family-delimitation that have served for the North Temperate floras, two courses are open to them. First, they may expand current family concepts beyond all degree of usefulness, to the point where relic genera are quite lost in a maze of vague and often contradictory characterizations, or second, they may propose distinct families for such genera. That the second course seems to be increasing in popularity may cause herbarium workers considerable anguish, but one must conclude that it offers the more legitimate solution of a difficult problem. The multiplication of families caused by the application of uniform standards of family-

criteria is "unfortunate" only in that it causes inconvenience to those in charge of our large herbaria. If such a development leads to a better comprehension of the interrelationships of genera and families, then it should be welcomed as fortunate, in spite of transient physical and psychological inconveniences.

Another alternative to the proposal of small families, in the case of phanerogams of uncertain affinities, may be the temporary assignment of aberrant genera to a special category, comparable to the Fungi Imperfecti of mycologists. In such a category might be placed plants of uncertain or obscure affinities, the inclusion of which in any existing family would cause an undue expansion of the basic family-characters. This category could also accommodate those plants as yet incompletely known, lacking, for instance, material for adequate cytological, embryological and anatomical investigations. To place such plants in a group of "Phanerogamae Imperfectae" would at least call them to the attention of regional students and would save them from the obscurity of being misplaced in some large and unsuitable family.

As previously stated, available exomorphic and endomorphic evidence makes it difficult to include *Calyptosepalum* in any existing family of the dicotyledons. As demonstrated by Swamy (5), the salient features of *Calyptosepalum* do not fall within the range of anatomical or morphological characters of the Santalaceae, and it may be excluded likewise from the Olacaceae. Furthermore, Dr. R. A. Howard concurs in our conclusion that a summation of evidence from different organs of the plants excludes *Calyptosepalum* from the Icacinaceae. Although the genus exhibits certain similarities, on the one hand, to the Olacales and, on the other hand, to the Celastrales of Hutchinson, there is no convincing summation of evidence to justify placing it with certainty in either of these orders.

We believe that *Calyptosepalum* is another relic genus which will ultimately have to be placed in an independent family. This should not be done, however, until more adequate and extensive material of its two species are available for detailed exomorphic and endomorphic investigations. For the present, it had best be placed in a special category of plants of uncertain affinities, as has been suggested (1,2) in dealing with other relic genera from Austromalayan and Indomalayan regions.

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BIOLOGICAL LABORATORIES,
HARVARD UNIVERSITY.
AND
DEPARTMENT OF BOTANY,
U. S. NATIONAL MUSEUM,
SMITHSONIAN INSTITUTION.

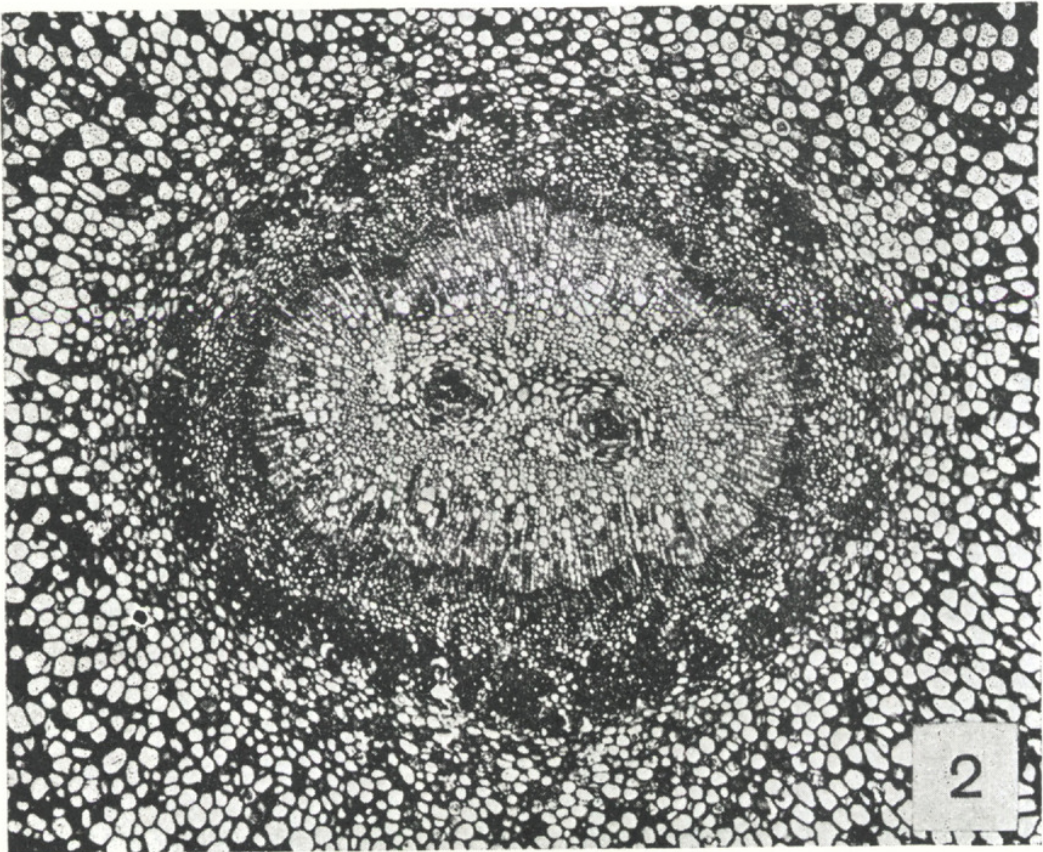
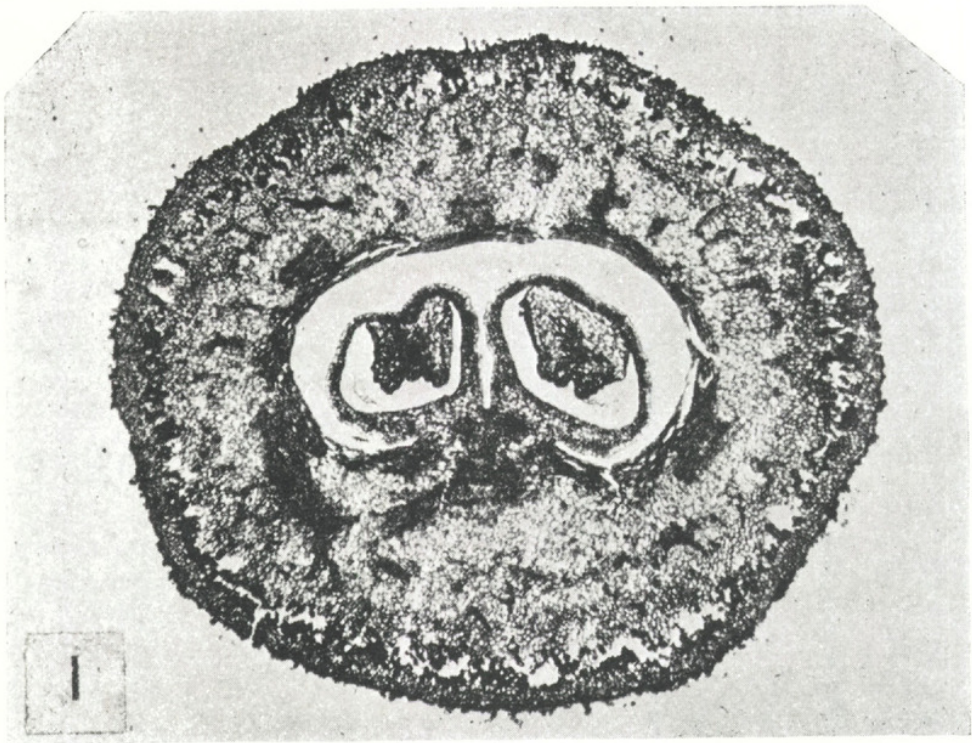
EXPLANATION OF PLATES

PLATE I

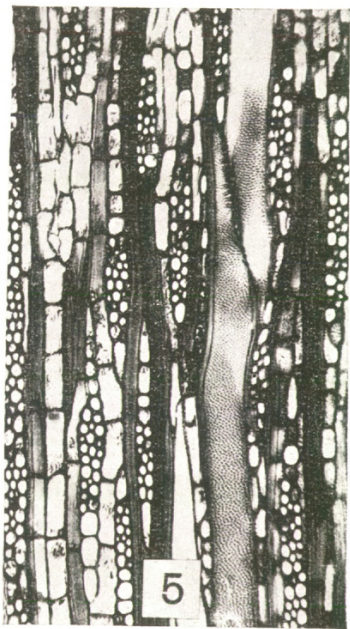
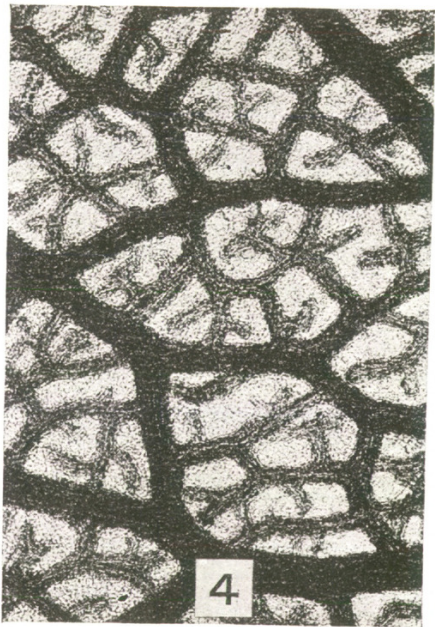
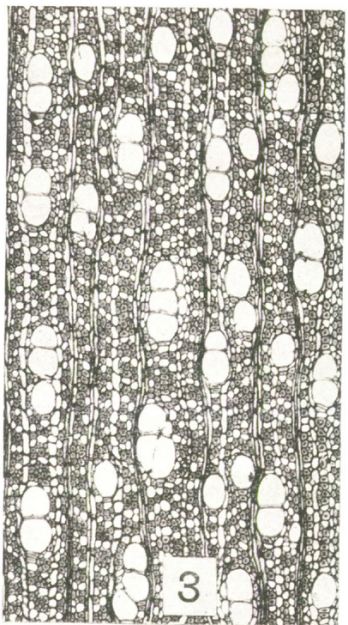
FIG. 1. Transverse section of carpel at the level of the attachment of the two ovules, $\times 24$. FIG. 2. Transverse section of the petiole, showing cylinder of vascular tissues and two included amphivasal bundles, $\times 50$.

PLATE II

FIG. 3. Transverse section of the secondary xylem, $\times 50$. FIG. 4. Cleared leaf, showing characteristic pattern of venation, $\times 50$. FIG. 5. Tangential longitudinal section of the secondary xylem, showing extensively overlapping vessel members and heterogeneous rays, $\times 107$.



BAILEY & SMITH, CALYPTOSEPALUM



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